Davis Strait Polar Bear Subpopulation Status Report

Prepared by the Davis Strait Polar Bear Technical Working Group

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Executive Summary

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

The Davis Strait (DS) polar bear subpopulation includes much of the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer within Canada, and a portion of southwest Greenland. Management authority for the DS subpopulation is a shared responsibility of federal, provincial, and territorial governments within Canada, Wildlife Management Boards (WMBs) and similar entities, and land claims organizations that represent Indigenous rights holders.

Status and Abundance

The most recent scientific estimate of abundance for the DS subpopulation was 2,015 polar bears (95% CI: 1,603–2,588) for 2017-2018. The Canadian Polar Bear Technical Committee's (PBTC) 2022 assessment of the subpopulation was:

Status and Trend Assessment Type	Short Definition	Assessment Result	Primary Rationale
Historic Trend (scientific)	Change in abundance since the signing of the *Agreement on the Conservation of Polar Bears* (1973), according to western science methods	Likely increased	Comparison of most recent estimate of abundance to information collected in the 1970s.
Indigenous Knowledge (IK) Trend	The abundance trend in a specific area over a defined period of time based on available IK holders' experiences and observations	Increased	Interviews and consultations with Indigenous peoples describing changes over time in the number of polar bears observed, polar bear behavior, and other factors, for wherever indigenous peoples have observed polar bear across the subpopulation's area for several generations.
Most Recent Trend (scientific)	Changes in abundance over the last 15 years, according to western science methods	Likely declined	Comparison of the most recent estimate of abundance (2017-2018) to the previous estimate collected from 2005-2007. It is important to note that the population was managed for a population reduction in Nunavut.

Harvest Limits

In Nunavut, harvest in DS was managed according to the Flexible Quota System (FQS) until the 2019/2020 harvest year, which operated on a 2:1 male to female sex ratio. However, changes to the polar bear harvest administration were introduced in 2019/2020 based on community feedback. The sex ratio was changed where communities could harvest up to 1 female for every male. The base annual

limit for Nunavummiut increased from 34 to 46 bears in 2004/2005. It was again changed to 61 bears in 2012/2013 with the aim to slightly reduce the DS subpopulation, per the management objective for a slight reduction. Although, the average annual removal from 2012/2013 to 2020/2021 harvest years has not increased with a higher annual limit.

The Labrador Inuit right to harvest polar bears in Nunatsiavut was increased from an annual limit of four to six bears in 1998/1999, and then increased from six to twelve bears in 2012/2013. The harvest season in Nunatsiavut occurs from February 1st to June 30th. There are no restrictions in the ratio of males to females that can be harvested each year. However, there are prohibitions on the harvest of females with cubs, and polar bear dens cannot be disturbed, which likely contributes to a larger proportion of males taken compared to females. Between 1989 and 2021, the provincial harvest was 76% male in Nunatsiavut.

Although there is no legal requirement for beneficiaries of the James Bay and Northern Québec Agreement to report human-caused polar bear mortalities in Québec, the Québec Government has been compiling harvest reports and issuing tags since 1985 to allow hunters to sell and export their polar bear hides. The proportion of the actual harvest being reported is currently unknown in Québec; however, there is likely a link between the probability of reporting a harvest and a harvester's interest in selling the hide. Although there are no regulations that impose a sex selective harvest ratio in Nunavik, the male to female ratio reported for the DS harvest in Nunavik for the 1994/1995 to 2021/2022 period has been approximately 2 males:1 female.

Overall harvest levels have usually been less than the annual limit (in Nunavut, Labrador, and Greenland) since the previous survey was conducted from 2005-2007. The following table reports the annual limits that have been in place and the harvest levels (H) reported to wildlife management officials, since the last survey conducted from 2005-2007:

Hunting Season	**Nunavut†**		**Newfoundland and Labrador‡**		**Québec ***		**Greenland**	
	Annual Limit	**H**	**Annual Limit**	**H**	**Annual Limit**	**H**	**Annual Limit**	**H**
2007/2008	46	47	6	4	None	13	Unk§	Unk
2008/2009	46	44	6	6	None	22	Unk	Unk
2009/2010	46	42	6	8	None	24	Unk	Unk
2010/2011	56	55	6	2	None	24	Unk	Unk
2011/2012	39	37	6	13	None	54	Unk	Unk
2012/2013	61	60	12	14	None	51	Unk	Unk
2013/2014	56	52	12	9	None	61	2	Unk
2014/2015	61	50	12	12	None	33	2	3
2015/2016	54	32	12	11	None	18	3	0
2016/2017	61	43	12	13	None	19	3	0

2017/2018	53	38	12	12	None	12	3	0
2018/2019	53	31	12	10	None	21	3	0
2019/2020	97	50	12	12	None	17	3	3
2020/2021	92	38	12	7	None	4	3	5
2021/2022	61	33	12	12	None	10	3	1

† In Nunavut, the annual limit reflects the annual harvest limit after all reductions or additions to limit have been made; the annual limit fluctuates to account for harvest that exceeds the base allocation and credit usage.
‡ In Newfoundland and Labrador, the annual limit reflects the annual take limit after all reductions and additions to the limit.
* In Québec, there is no annual limit for Nunavik Inuit harvesting polar bears within DS. Reporting of harvest remains voluntary.
§ Unk means unknown.
See full report for details about harvest limits, as well as areas where limits have been in place.

User-to-user Meetings

In 2010, a user-to-user workshop was held in Kuujjuaq, Québec. Participants at this meeting included representatives from all concerned provinces and territories, WMBs, Indigenous organizations/governments, and Inuit users from Nunavut, Nunatsiavut, and Nunavik. Some key outcomes from the meeting included the following: (1) a management objective should be established that meets Inuit subsistence needs and addresses human safety concerns, (2) population modelling suggested that an increase of 12 bears in the annual removal, at a subpopulation level, should not have a notable impact on the subpopulation, and (3) it was recommended that any increase in the harvest limit should be allocated to Nunatsiavut Inuit first, as their current share does not reflect an equitable allocation of harvest taking into account the population of hunters in Labrador.

In 2015, a user-to-user meeting was held in Montréal, Québec. Participants included Inuit representatives and hunters from Nunavut, Nunatsiavut, and Nunavik, as well as representatives from the governments of Canada, Nunavut, Newfoundland and Labrador, Québec, and Land Claims organizations. Some key outcomes from the meeting include the following: (1) management objective to reduce the number of polar bears in Davis Strait because of the high population size and density, (2) users agreed to a total removal of 116 polar bears at a subpopulation level to fulfill the management objective, and (3) participants agreed to the following allocations:

- Nunavut: 61 bears
- Nunavik: 35 bears
- Nunatsiavut: 20 bears

Indigenous Knowledge

In 2015, the Torngat Secretariat published a report that summarized current and past Inuit knowledge of polar bears. Knowledge was gathered from coastal communities throughout Nunatsiavut in 2012. Despite recently observed changes in environmental conditions, including reduced duration and amount of sea ice and prey availability, participants reported no change in body condition of polar bears suggesting that they are adapting to the changes. Polar bears did not show evidence of fidelity to any

particular feeding area, but participants noted the diet of polar bears has changed to a diet absent of cod and an increased utilization of garbage from human settlements. Participants noted an increase in polar bears not only near communities, but throughout Labrador since the 1990s.

In 2019, the Nunavik Marine Region Wildlife Board published a report with the aim to record and document comprehensive Inuit knowledge and values related to polar bears across Nunavik communities within the Davis Strait subpopulation. Key findings included: (1) an increase in abundance of polar bears since the 1970s with bear condition described as healthy, (2) tangible benefits of polar bears (food – polar bear meat is shared amongst community members and resources – sale of polar bear hides provides an important source of income), (3) public safety concerns with the increased abundance and frequency of human-bear interactions, and (4) participants shared Inuit stewardship practices that are sufficient for conservation and suggest that the introduction of a quota can be counterproductive.

In 2022, the Nunavut Davis Strait Inuit Qaujimajatuqangit (IQ) report was published with the aim to document IQ on the health of the Davis Strait polar bear population in Nunavut. Knowledge summarized in the report resulted from a series of interviews (inclusive of participatory exercises and validation sessions) performed in 2019 in Kimmirut and Pangnirtung with a total of 35 Inuit polar bear experts (elders, hunters, and women). Interview results identified a substantial increase in polar bear abundance within the Nunavut portion of the DS polar bear population –polar bear abundance had approximately increased four-fold (or 73% [range: 70-75]) since the 1970s in the Kimmirut area. At the time interviews were conducted, polar bears appeared in good overall health, with high proportions of individuals in good body condition status, no change in cub productivity and survival over time, and only a few reports of abnormalities and non-hunting related mortality. However, subtle changes in polar bear health were observed over time, including a slight decrease in body condition status and occasional reports of a hair loss syndrome. Experts interviewed also reported substantial changes in polar bear habitat and ringed seal availability (main polar bear prey in the Pangnirtung and Kimmirut areas) – with an 80% decline in ringed seal abundance observed since the 1960s around Kimmirut. Participants described a progressive increase in human-polar bear interactions and unanimously voiced public safety concerns, which must be prioritized in management to find shared solutions for mitigation of potential negative impacts.

Scientific Assessment

Polar bear abundance in DS steadily increased from the 1970s through to 2005. The Government of Nunavut conducted a population survey from 2005-2007, resulting in an abundance estimate of 2,158 (95% CI: 1833-3442) bears. A two-year genetic mark-recapture study was conducted from 2017-2018, which involved all implicated jurisdictions and WMBs. Subsequently, the previous 2005-2007 data was re-estimated using live capture data, harvest recovery data, and recent genetic samples. This resulted in an estimate of 2,250 bears (95% CI: 1,989-2,512). The estimated abundance for the 2017-2018 study was 2,015 bears (95% CI: 1,603-2,588).

In addition to studies assessing polar bear abundance, research has been conducted to evaluate changes in polar bear survival, reproduction, body condition, and movement. Survival was found to be slightly lower in the most recent abundance estimate study compared to previous studies. However, this could

be due to methodological differences between the 2005-2007 and 2017-2018 studies. The switch from a physical mark-recapture to a genetic mark-recapture loses resolution for age-specific survival estimates, since no tooth is obtained for aging the individual. The grouping of senescent bears (>20 years) with prime age bears (5-20 years old) likely reduced the overall estimate of adult survival but should be considered when interpreting results. The recruitment rates in the 2017-2018 study were lower than in previous studies and lower than adjacent subpopulations. As of 2017-2018, recruitment rates seem to be sufficient to sustain the subpopulation, although continued monitoring with changing environmental conditions is warranted, including the use of Inuit knowledge. Sea ice in DS has declined in both duration and summer sea ice area over the 1979-2014 period. However, net effects of changing environmental conditions on survival, reproduction, and distribution were not detected as of 2017-2018. Polar bears showed signs of improved body condition in the 2017-2018 study compared to 2005-2007. There has been no telemetry work since the 1990s within the DS subpopulation, although recovery data provided by harvesters has suggested that the current boundaries for DS are reflective of polar bear movement. Monitoring of these aspects of polar bear population ecology via science and Inuit knowledge could be informative going forward.

1 Background

1.1 Davis Strait Polar Bear Subpopulation Boundary

Based on the recapture or harvest of previously tagged animals and tracking adult female polar bears with satellite collars, the Davis Strait (DS) 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 (Figure 1; Stirling and Kiliaan 1980, Stirling et al. 1980, Taylor and Lee 1995, Taylor et al. 2001).

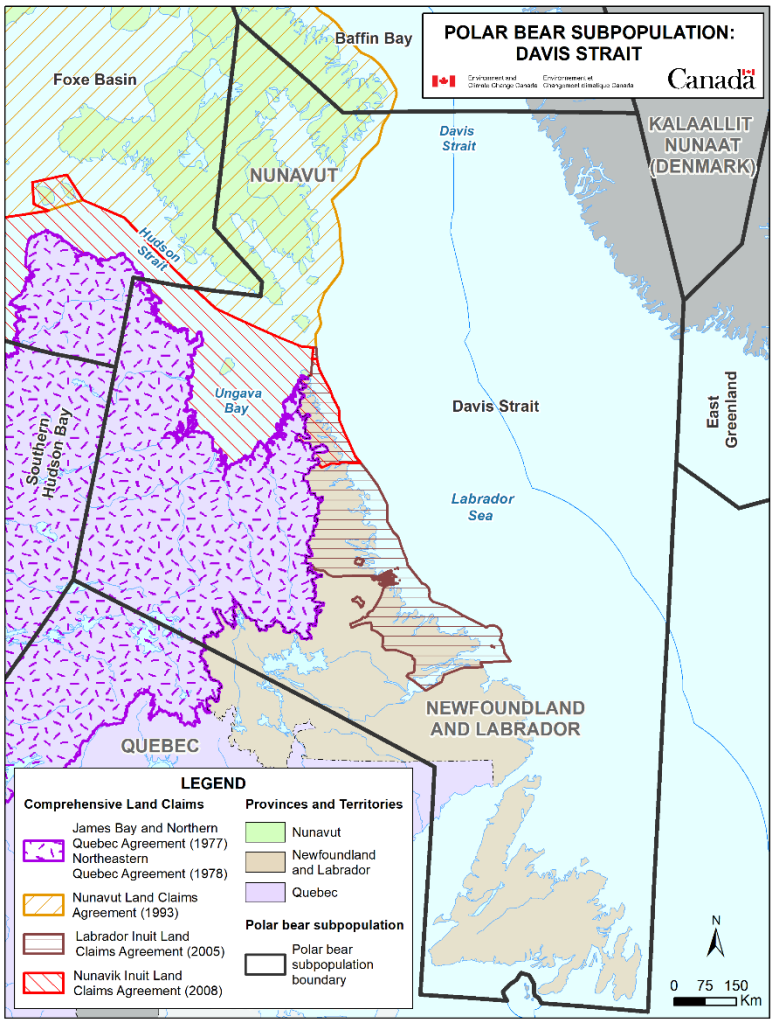

Figure 1. Davis Strait subpopulation and management unit map.

Several studies have examined the genetic structure of DS bears compared to adjacent subpopulations and examined gene flow patterns to determine if genetic variability across individual polar bears corresponds to the currently recognized subpopulation boundaries (see Paetkau et al. 1999, Crompton et al. 2008, 2014, Peacock et al. 2013). While genetic data indicate gene flow occurs, Paetkau et al. (1999) concluded that definition of a Management Unit (MU) was met in DS. Peacock et al. (2013) identified marked genetic differences between northern and southern DS bears and suggested that continued climate warming may increase that separation between those two groups of bears due to Hudson Strait ice dynamics. To date, the DS subpopulation boundary and management unit has been established based on western scientific studies and may not reflect Inuit knowledge related to polar bear distribution and seasonal movements.

1.2 Management Authority

The DS subpopulation is shared between Greenland, Nunavut, Nunatsiavut (Newfoundland and Labrador), and Nunavik (Québec) (Figure 1). Table 1 lists the organizations with management responsibility in DS, as well as the treaties/land claims agreements from which mandates are derived. In Nunavut, Nunatsiavut and the Nunavik Marine Region, Wildlife Management Boards (WMB) forward Total Allowable Take (TAT) / Total Allowable Harvest (TAH) decisions to applicable government Ministers for final decisions. The Hunting, Fishing and Trapping Coordinating Committee (HFTCC) in Québec is not a decisional body for polar bear but can recommend a TAT to the Québec government Minister, who has the discretion to act upon such recommendation, in accordance with the required consultations.

***Table 1**. Canadian management partners involved in polar bear harvest decision-making for the Davis Strait polar bear subpopulation and their current decision-making relationships.*

Agreement or Treaty	Area of Application	Wildlife Management Board or Similar Entity	Government Authority	Indigenous Government or Land Claims Organization
Nunavut Agreement	Nunavut Settlement Area	Nunavut Wildlife Management Board (NWMB)	Nunavut	Nunavut Tunngavik Inc.
Labrador Inuit Land Claims Agreement (LILCA)	Labrador Inuit Settlement Area	Torngat Wildlife and Plants Co-Management Board (TWPCB)	Newfoundland and Labrador	Nunatsiavut Government
Nunavik Inuit Land Claims Agreement (NILCA)	Nunavik Marine Region	Nunavik Marine Region Wildlife Management Board (NMRWB)	Canada (offshore) Nunavut (islands)	Makivik Corporation
James Bay and Northern Québec Agreement (JBNQA)	Mainland of Québec	Hunting, Fishing and Trapping Coordinating Committee (HFTCC)	Québec	Makivik Corporation

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

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

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

2.1 Most Recent PBTC Status Assessment (2022/2023)

The 'Historic Trend' is an assessment of change in abundance that a subpopulation may have experienced since the signing of the 1973 *Agreement on the Conservation of Polar Bears* (1973) to the present estimate. This trend led to current management practices and research. The PBTC scientific assessment of the subpopulation is 'likely increased' and the Indigenous knowledge assessment of the subpopulation is 'increased'.

In 2022, the 'Most Recent Trend (Scientific)' status for Davis Strait was reassessed based on the completed and public scientific survey conducted from 2017-2018. The Most Recent Trend status is an assessment of directionality of abundance according to the most recent estimates available. Ideally, a direct comparison of the previous abundance estimate with the most recent population abundance estimate is used to make the assessment. For Davis Strait, the 2017-2018 abundance estimate was comparable to the previous estimate derived from survey data collected 2005-2007. The PBTC assessed Davis Strait abundance as 'likely declined' relative to the previous study given that there was a 0.896 probability that subpopulation growth was <1 and thus the subpopulation most likely declined over this period (see section 6.1 subpopulation abundance for more details).

In 2023, the 'Trend (Indigenous Knowledge)' status for Davis Strait was assessed as 'increased'. In addition to the 2017-2018 scientific study, IK studies occurred in Nunavut (Tomaselli et al. 2022), Nunavik (NMRWB 2019), and Nunatsiavut (York et al. 2015). In all studies, participants noted an increase in polar bear abundance since the 1970s (across Nunavik communities as well as hunting, camping, and traveling areas of Inuit from Kimmirut and Pangnirtung in Nunavut) and since the 1990s throughout Labrador.

2.2 Previous PBTC Assessments

Prior to the scientific study in 2017-2018 being completed, the Most Recent Trend assessment was 'likely increased' using a date range of 1980-2007 because there were no other comparable scientific abundance estimates from before the 2005-2007 abundance estimate. This assessment was based on

multiple lines of evidence. 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 and Kiliaan 1980, Stirling et al. 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 traditional knowledge suggested that more bears were being seen over the previous 20 years. In addition, the abundance of harp seals (*Pagophilus groenlandicus*) in the Northwest Atlantic, an important prey species for this population, had increased dramatically over the same period (Stenson et al. 2010), providing a much-enhanced potential prey base for polar bears. Because of the uncertainties surrounding the subpopulation 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). Those results appeared to support an important growth of the DS subpopulation between the 1980s and 2007. At the time of the 2005-2007 survey, the subpopulation was however 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 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 (Rode et al. 2012, Peacock et al. 2013).

3 Harvest Levels

3.1 Current Harvest Levels

Current harvest regulations and levels are summarized in Table 2.

***Table 2**. Summary of current management of polar bear harvest (2021-2022 hunting seasons) by area within the Davis Strait subpopulation and management unit.*

	Area				
Management consideration	**Nunavut Settlement Area**	**Nunavik Marine Region†**	**Québec (onshore region)**	**Newfoundland and Labrador**	**Greenland**
Hunting season	July 1 – June 30	July 1 – June 30 [6]	September 1 – May 31 [5]	February 1 – June 30	N/A[7]
Who can hunt	Nunavut Inuit with a tag [1]	Nunavik Inuit	Nunavik Inuit	Nunatsiavut Inuit	Greenland Inuit
Harvest limit (2021-2022)	61 [2]	None	None	12	3
Protection for females and cubs	Yes [3]	Yes [5]	Yes [5]	Yes [6]	N/A[7]
Protection for bears in dens	Yes [4]	Yes [5]	Yes [5]	Yes [6]	N/A[7]

[1] *Nunavut Wildlife Act*, s.18(1); [2] *Nunavut Wildlife Act,* s.120; [3] *Nunavut Wildlife Act*, s.195, r. 9(2) - Regulatory provisions on harvesting; [4] *Nunavut Wildlife Act*, s.195, r. 9(3) - Regulatory provisions on harvesting; [5] Hunting season, protection of mothers and cubs and protection of bears in dens is not legally mandated, but is regulated in accordance with a voluntary agreement between the Government du Québec and the Inuit (Anguvigak - Nunavik Hunters, Fishers and Trappers' Association, 1984); [6] Government of NL, in consultation with Nunatsiavut Government and the Torngat Wildlife and Plants Co-Management Board, are in the process of preparing a polar bear management plan that will provide a framework for harvest management implementation in accordance with the Labrador Inuit Land Claim Agreement (LILCA). Currently, the annual limit for Nunatsiavut is 12 bears of either sex, with no harvest of denning bears or females with young of the year permitted. For all bears harvested by Nunatsiavut beneficiaries, there is mandatory reporting.
[7]N/A: Information is either not available or not applicable.

3.2 Previous Harvest Levels and Reported Harvest

Table 3 summarizes harvest limits and reported harvest levels since 1994/1995 in Nunavut, Newfoundland and Labrador, and Québec and since 2013/2014 in Greenland. Additional information about harvest is provided for the respective Canadian jurisdictions in sections that follow.

***Table 3**. Polar bear harvest according to jurisdiction for the Davis Strait (DS) polar bear subpopulation from the 1994/1995 to the 2021/2022 hunting seasons. H denotes all human-caused removals, including the total number of polar bears reported as having been harvested or killed in defense of life and property situations each year. See Table 2 for details on hunting season for jurisdictions.*

Hunting Season	Nunavut†		Newfoundland and Labrador‡		Québec *		Greenland		Subpopulation-level
	Annual Limit	H	Annual Limit	H	Annual Limit	H	Annual Limit	H	H
1994/1995	34	34	4	6	None	9	None	Unk§	49
1995/1996	34	34	4	8	None	14	None	Unk	56
1996/1997	34	34	4	2	None	20	None	Unk	56
1997/1998	34	24	4	7	None	23	None	Unk	54
1998/1999	34	34	6	11	None	20	None	Unk	65
1999/2000	34	34	6	7	None	27	None	Unk	68
2000/2001	32	33	6	8	None	28	None	Unk	69
2001/2002	34	34	6	5	None	11	None	Unk	50
2002/2003	34	36	6	6	None	9	None	Unk	51
2003/2004	34	42	6	8	None	19	None	Unk	69
2004/2005	46	43	6	8	None	10	None	Unk	61
2005/2006	42	37	6	5	None	7	Unk	Unk	49
2006/2007	41	37	6	4	None	15	Unk	Unk	56
2007/2008	46	47	6	4	None	13	Unk	Unk	64
2008/2009	46	44	6	6	None	22	Unk	Unk	72
2009/2010	46	42	6	8	None	24	Unk	Unk	74
2010/2011	56	55	6	2	None	24	Unk	Unk	81
2011/2012	39	37	6	13	None	54	Unk	Unk	104
2012/2013	61	60	12	14	None	51	Unk	Unk	125
2013/2014	56	52	12	9	None	61	2	Unk	122
2014/2015	61	50	12	12	None	33	2	3	98
2015/2016	54	32	12	11	None	18	3	0	61
2016/2017	61	43	12	13	None	19	3	0	75
2017/2018	53	38	12	12	None	12	3	0	53

2018/2019	53	31	12	10	None	21	3	0	62
2019/2020	97	50	12	12	None	17	3	3	82
2020/2021	92	38	12	7	None	4	3	5	54
2021/2022	61	33	12	12	None	10	3	1	56

† In Nunavut, the annual limit reflects the annual harvest limit after all reductions or additions to the limit have been made; the annual limit fluctuates to account for harvest that exceeds the base allocation and credit usage. See 3.2.1 Nunavut for details regarding changes in the annual limits.
‡ In Newfoundland and Labrador, the annual limit reflects the annual take limit after all reductions and additions to the limit. See section 3.2.2 Nunatsiavut for details.
* In Québec, there has not been an annual limit in place for Nunavik Inuit harvesting within DS during the 1994/1995-2021/2022 period. Reporting of harvest by Nunavik Inuit is done on a voluntary basis. See section 3.2.3 Nunavik for details.
§ Unk means unknown.

3.2.1 Nunavut

Nunavut, previously Northwest Territories, 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 TAH is the base allocation for number of bears harvested which is decided by the NWMB. Whereas the annual limit is an adjusted base allocation to account for credit use. Each community within, or near, the DS subpopulation boundary receives a share of the maximum sustainable harvest of bears allocated for DS as an annual baseline allocation from the Qikiqtaaluk Wildlife Board (QWB), which is the Regional Wildlife Organization responsible for the DS area. In Nunavut, three communities, Iqaluit, Kimmirut, and Pangnirtung harvest bears from the Davis Strait subpopulation. Locally, the Hunters and Trappers Organizations (HTO) manage and allocate the community harvest and quota among their members. Not every community will harvest their full allocation every year. Any unused portion is accumulated as credits — bears that were available to be harvested but were not taken. Credits may be used in subsequent years. An HTO may apply to the QWB for approval to use available credits for any type of legal harvest. If the numbers killed in a given harvest year exceed that year's annual quota for a given community, additional tags are issued based on any credits that the community's HTO may have available, or credits exchanged with another community's HTO that may also harvest DS bears. Tags from the annual limit may also be exchanged between the three HTOs, subject to QWB approval. When and if there is an excess harvest and no credits or exchanges are available, the excess will be deducted from the community's allocated portion of the annual limit in the following year (Government of Nunavut 2019). Credits are zeroed when a new subpopulation estimate is produced and a new TAH decision is made (Government of Nunavut 2019).

Harvest in DS was managed according to the Flexible Quota System (FQS) until the 2019/2020 harvest year. The FQS operated on a 2:1 male to female harvest sex ratio and 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 territorial Minister of Environment and the NWMB, the harvest sex ratio was changed where communities could harvest up to 1 female for every male. This ratio refers to the maximum number of females that may be killed, not the minimum. Up to 100% of the TAH could be males. Due to the protections that are in place for denning bears and females with offspring (family groups), the potential

that this management change could cause a decline of the DS subpopulation is relatively low. Adult female polar bears are the most important contributors to population growth and continued monitoring of the harvest in Nunavut is a high priority.

The annual limit was increased from 34 to 46 bears in 2004/2005 and from 46 to 61 in 2012/2013. The aim was to slightly reduce the DS subpopulation due to concerns of Inuit for perceived public safety issues and perceived impacts of DS polar bears on the ecosystem. The average annual removal for the 2012/2013 – 2020/2021 period did not increase with the higher TAH. The harvest averaged 42.7 bears/year over the past 10 years.

Harvesters in Nunavut strictly followed the management quota system and rarely exceeded quota limits in any given year. Under the flexible quota system, credits accumulated for any unused portion of the harvest allocation and these credits would automatically be applied in an overharvest situation. If the female allocation was exceeded and no credits are available to apply, the reductions would be applied to the following year's harvest allocation. Thus, HTOs and their members often stopped harvesting bears when the female allocation was met. Since approximately 2015/2016, the harvest for DS in Nunavut has been well below the quota, mostly due to declines in harvesting by Inuit in Kimmirut and Iqaluit. Kimmirut has harvested four (4) out of the 63 allocated bears (6% harvest rate) from 2015/2016 to 2021/2022. Iqaluit, over the same time period had a harvest rate of 52% of their allocation (119 bears/231 quota). During the previous seven years (2008/2009 to 2014/2015), Inuit in Iqaluit and Kimmirut also harvested less than their allocations, taking 91% and 80% of their annual allocations, respectively. While it is unclear why harvesting dynamics have changed in recent years for these communities, some harvesters from Kimmirut and Pangnirtung have reported that the recent decline in the market value of polar bear hides created a disincentive to harvest polar bears (Tomaselli et al. 2022). The market for polar bear hides crashed in 2014 leading to an overall decline in the number of hides exported in the following years across Canada (Cooper 2022). Inuit in the three Nunavut communities continue to harvest DS polar bears for food, teaching youth about polar bears, local and personal use of skins, and other traditional Inuit values, despite the reduced commercial value of skins.

3.2.2 Nunatsiavut

The Labrador Inuit right to harvest polar bear was initially limited to four bears as a result of the abandonment of Port Burwell (Killiniq) in 1978 and the division of that community's quota of eight polar bears equally between Québec and Newfoundland and Labrador (Urquhart and Schweinsburg 1984). This initial Newfoundland and Labrador quota of four polar bears was later increased to six in 1998, and then to 12 in 2012.

The provincial Minister issues the 12 polar bear hunting licenses to the Nunatsiavut Government which then allocates the licenses to Inuit hunters. All bears have to be harvested within the Labrador Inuit Settlement Area. Three licences are allocated to Nain, three to Hopedale and two each to Makkovik, Postville, and Rigolet. The season starts on February 1st and continues until June 30th.

The Nunatsiavut Government Ministerial Directive identifies a number of conditions that Labrador Inuit must follow when hunting polar bear. Polar bears with cubs are not permitted to be taken and polar bear dens cannot be disturbed in any way. Bears of either sex may be harvested and successful hunters are required to ensure that the meat does not spoil and that care is taken to make sure the quality of the hide is maintained. Successful hunters are required to wait two years before they can re-apply for a polar bear licence and only one licence is permitted per household. This helps to ensure that the licences are distributed in a fair manner and are shared in the community as much as possible.

When a bear is harvested, the hunter is required to fill out a kill return form and submit it to the Nunatsiavut Government, along with the skull and biological samples from the animal. The location, date, condition, and sex of the bear are also recorded on the kill return form. The skull, tissue samples, and measurements are then provided to NL Wildlife Division which arranges for analyses on age determination and genetic markers and collates this information. The cleaned skulls are then returned to the hunters. This aspect of the program has proven helpful in garnering a near 100% level of reporting and submission of samples.

Harvest in Labrador is only partially managed by sex, with prohibitions on the harvest of females with cubs. At the same time, females that are still caring for cubs are not considered part of the breeding pool, and hence a smaller proportion of females than males are available for mating in a given year. Between 1989 and 2021, the provincial harvest was 76% male, calculated from 216 known-sex harvest records in Nunatsiavut.

3.2.3 Nunavik

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

The proportion of the actual harvest being reported is currently unknown in Québec. It is however likely that there is a link between the probability of reporting polar bear harvest and the harvester's interest to sell the hide, which is in turn influenced by the market price of polar bear hides. We can observe a strong increase in reported harvest from 2011/2012 to 2013/2014 when the average price for polar bear hides sold at auctions was at its highest. Following the strong reduction of market price of polar bear hides in 2014, we can notice a strong reduction of reported polar bears harvested in Nunavik, particularly within DS. It remains, however, difficult to establish how many of those changes in reported harvest are linked to a change in harvest levels versus a change in harvest reporting rate.

The distribution of polar bear harvest among Nunavik communities located within the boundaries of DS is far from being uniform. Most of the reported harvest in Nunavik is conducted within the Hudson Strait area by residents of Quaqtaq and Kangiqsujuaq, whose harvest represents approximately 60% and 15% respectively of the total reported harvest between 1994/1995 and 2021/2022. Another 15% of the reported DS harvest is conducted by residents of Kangiqsualujjuaq on the eastern side of Ungava bay.

Despite the absence of any regulations imposing a sex selective harvest ratio in Nunavik, the male to female ratio in the reported DS harvest in Nunavik for the 1994/1995 to 2021/2022 period is approximately 1.9 males : 1 female.

4. User-to-User Meetings and Agreements

4.1 2010 Interjurisdictional Meeting and User-to-User Workshop

In early 2010, polar bear co-management organizations in Newfoundland and Labrador (Government of Newfoundland and Labrador, Nunatsiavut Government, and Torngat Wildlife and Plants Co-Management Board) determined that harvest in DS was, from their perspective, disproportionately allocated across jurisdictions and that the needs of Nunatsiavut Inuit were not being met. Recognizing that formal mechanisms for joint management did not exist, a request was made that Environment and Climate Change Canada (then Environment Canada) assist in the establishment of a cooperative framework.

Representatives of all concerned Provinces and Territories, WMBs, and Indigenous organizations/governments formed the Interjurisdictional Davis Strait Committee (IDSC). The IDSC met in Montreal on February 3, 2010 to initiate a process. It was decided that a first step should be the determination of a management objective, so that harvest levels could be set in accordance with this objective. It was acknowledged that the management objective should take into account concerns relating to conservation and human safety, and that advice regarding harvest levels should be based on the best available western science and Indigenous knowledge.

A user-to-user workshop was subsequently convened in Kuujjuaq, Québec from September 13-16, 2010. At this meeting, participants representing the IDSC and Inuit users from the three Canadian jurisdictions heard presentations relating to the management system in each jurisdiction, as well as the most recent scientific and Indigenous knowledge information. Summary conclusions included:

- Polar bears from the DS subpopulation are abundant and, as of 2008, the population was probably stable. Population surveys conducted in the 1970s likely underestimated abundance and the available evidence suggested that the subpopulation had increased since that time.

- Inuit users have witnessed an increase in the number of polar bears and local communities and hunters were experiencing an unacceptable amount of negative impact from interactions with polar bears.

- Concerns were raised by users about the delineation of polar bears into subpopulations in general, and the current delineation of the DS subpopulation in particular. The advice of scientific advisors was that while fidelity to sub-regions is not absolute, there is regional variation in survival and recruitment and the current boundaries represent an appropriate, if imperfect, grouping for harvest management decision-making purposes.

- Some users noted that quota systems can create a perverse incentive to maximize harvest, whereas harvest management better aligned with traditional Inuit values may lead to lower overall harvest. Where quotas are used, the importance of flexibility, including the carry-over of unused harvest credits from one year to the next, was emphasized.

- Consensus was not achieved on the proposal that harvest be reduced in Nunavut and Nunavik to accommodate higher harvest in Nunatsiavut.

- It was agreed that a management objective should be established that meets Inuit subsistence needs and addresses human safety concerns.

- Population modelling suggested that an increase in TAH of 12 for the DS subpopulation should not have a notable impact on the subpopulation.

- It was recommended that any increase be allocated to Nunatsiavut Inuit first, as their current share does not reflect an equitable allocation of harvest taking into account the population of hunters in Labrador. An increase by six bears for a new TAH of 12 in Nunatsiavut could be supported by participants from Nunavut, Nunavik, and Nunatsiavut.

4.2 2015 User-to-User Meeting

From May 26-28, 2015, Inuit representatives from Nunavut, Nunatsiavut, and Nunavik met in Montréal to discuss the management of polar bears for the Davis Strait subpopulation. Representatives from the governments of Canada, Nunavut, Newfoundland and Labrador, and Québec participated in the first day of the meeting. Other participants included Inuit hunters, other government representatives, and Land Claims Organization representatives.

Inuit representatives agreed on consensus recommendations for management objectives, a total allowable level of harvest, the allocation of harvest among indigenous groups in the three jurisdictions, and numerous non-quota limitations. They recommended that the management measures and allocations determined by meeting participants should remain in effect until updated information about subpopulation status was available, noting that government representatives had informed them that a new subpopulation survey was scheduled to begin in 2017.

Key outcomes, which are described below, were forwarded by the Inuit representatives to the government Ministers, as well as the NWMB, the TWPCB, and the NMRWB to support Board decision-making.

- *Management objective*: Reduce the number of polar bears in the Davis Strait polar bear subpopulation because of the high population size and high population density.
- *Harvest reporting*: All jurisdictions should report all bears harvested, whether these bears are to be used solely for subsistence purposes or if the bears or any of their parts are ultimately destined to enter into international trade.
- *Defense of Life and Property Kills*: Should be deducted from any quotas or harvest limitations established or recommended by the respective Wildlife Boards.
- *Non-quota limitations*: Continued prohibition on harvesting of cubs and females accompanied by cubs; management practices should include a sex-selective harvest of polar bears based on the ratio of two males to one female; and females and cubs in dens should not be disturbed.
- *Research methods:* The prohibition on the use of chemical immobilization should remain.
- *Subpopulation name*: Should be changed to the original and historically accurate Inuktitut term.
- *Total allowable harvest*: Users agreed to a total removal of 116 polar bears at a subpopulation level, in order to reach the management objective to reduce the number of bears in the management unit. This value is based in part upon a Population Viability Analysis (PVA). Based upon western science, local knowledge, and Inuit traditional knowledge, participants agreed that maintaining high numbers is not only detrimental to polar bears and other species but also a safety concern.
- *Allocation:* Participants agreed to the following allocation:
    - Nunavut: 61 bears
    - Nunavik: 35 bears

    - Nunatsiavut: 20 bears
- *Meeting participants present for this agreement:*
    - Makivik Corporation
    - Nunavut Tunngavik Inc.
    - Qikiqtaaluk Wildlife Board
    - Nunavut hunters from Pangnirtung, Iqaluit, Kimmirut
    - Nunavik RNUK
    - Nunavik LNUKS from Kangiqsuallujjuaq, Kuujjuaq, Tasiujaq, Aupaluk, Kangirsuk, Quaqtaq, Kangiqsujuaq
    - Nunatsiavut Government
    - Nunatsiavut Hunters

Although the agreement was accepted at the user-to-user meeting, Nunavik communities never fully recognized it, and the voluntary harvest limit was never fully implemented. However, Nunavik's reported harvest for Davis Strait subpopulation has never exceeded 35 bears since 2015.

5. Indigenous Knowledge

5.1 Labrador Polar Bear Traditional Ecological Knowledge (2015)

Overview

This report summarizes current and past Inuit traditional ecological knowledge (TEK) relevant to polar bears collected from coastal communities throughout Nunatsiavut in 2012. This study, undertaken by the Torngat Secretariat, was the first comprehensive TEK study conducted on polar bears in Labrador. The survey data was analyzed by Lakehead University's Department of Geography and the report was written in collaboration between Lakehead University and the Torngat Secretariat. It was reviewed and approved by the Nunatsiavut Research Review Board and the Memorial University's Interdisciplinary Committee on Ethics in Human Research.

The TEK gathered provides insight on polar bear hunting practices, management perspectives, polar bear condition, behaviour, abundance, and distribution, as well as changes to climate and sea ice in Labrador from both short-term (recent decades) and long-term (elder knowledge) perspectives. The TEK was gathered in a verbal interview format consisting primarily of open-ended questions. Fifteen Labrador Inuit hunters from four communities (Nain, Postville, Hopedale, and Rigolet) were interviewed.

Key Findings

Polar bear health and physical condition – Interview participants did not report any changes in body condition despite recent changes to sea ice, climate, and the availability of prey species. TEK explanations for the apparent lack of effect from increased density or sea ice decline included a dramatic increase in harp seals (prey), continued seal hunting success in spite of sea ice decline, increased feeding on alternative (non-seal) food sources, and increased feeding during the open water season when most polar bears are onshore.

Polar bear range, distribution, and abundance – Interview participants generally agreed that the number of polar bears had increased in Labrador. Participants also noted an increase in general signs of polar

bears everywhere, not only near communities. Recent recollections of hunting activities indicated an increase in the number of bear sightings since the 1990s.

Polar bear denning – Few dens were observed and reported by the interview participants and only a slight majority of participants had ever seen a polar bear den. However, interview participants shared knowledge on polar bear dens and the general location of denning areas in Labrador. They reported that denning was restricted to land and often occurred in areas of high snow accumulation such as hills and cliffs occurring on islands or capes along the coastline. Participants also associated northern Labrador as a general denning area.

Polar bear diet – Participants agreed that the main source of food for Labrador polar bears was seals of all types. There were however conflicting views about the condition of the seal populations. These views were influenced by an event that caused high mortality in harp seals from 2010-2011, but in 2013 continued monitoring efforts confirmed that harp seals are at their highest numbers since monitoring began. The mapping exercise for identifying polar bear feeding areas did not suggest any fidelity to specific locations as feeding areas were identified along most of the Labrador coastline. Interview participants reported that the only changes that they had noticed in the bears' diet were the absence of cod and the utilization of garbage from human settlements and dump sites, which has grown in recent decades.

Physical environment, weather, and climate – Weather was reported to have affected Labrador polar bears by reducing the amount and duration of sea ice and influencing changes in the location of prey species. The reductions in sea ice extent and availability were reported to have been caused by consistently warmer temperatures and strong winds. Despite this, most participants reported that the bears have been adapting to the changes in their environment. They reported that the number of seals being consumed was sufficient for their long-term viability and that the bears were able to consume alternative food sources or catch seals on land or in the water to make up for the shorter hunting season. The participants also reported that the bears were changing their travel routes because of recent changes in sea ice conditions.

Hunting, conservation, and elder hunting knowledge - Current Labrador Inuit polar bear hunters showed a strong interest in sharing their hunting knowledge with Inuit youth and relatives, stating that elders taught them the knowledge that they wished to pass down to the next generation. Most interview participants reported that they hunt less often than in the past and suggested this may be due to other employment, the costs of hunting (e.g., gear, gas, access to equipment), hunting regulations, and a lack of interest. Interview participants reported harvest restrictions to be the largest limiting factor for polar bear hunting, regardless of the recent quota increase. Several participants noted that Inuit had managed the harvest of polar bears in the past and that the quota system was unnecessary. Participants also noted that the bears were being immobilized more often than in the past and that tranquilizing bears causes sickness, impairs the bears' ability to hunt, and can sometimes cause death.

Labrador Inuit hunters indicated a general satisfaction for the relatively new co-management system for polar bears.

5.2 Nunavik Inuit Knowledge and Observations of Polar Bears: Polar Bears of the Davis Strait Sub-Population (2019)

Overview

The Nunavik Polar Bear Inuit knowledge study aimed to record and document comprehensive knowledge and values related to polar bears across all 14 Nunavik communities (Nunavik Marine Region Wildlife Board 2019). The project was split into subsections corresponding with the three polar bear subpopulations found in the Nunavik Marine Region (Southern Hudson Bay, Foxe Basin, and Davis Strait). For Davis Strait, a total of 76 participants from seven communities were engaged in interviews and mapping activities for this project. Local hunter/trapper organizations (Local Nunavimmi Umajulirijiit Katujjiqatigiinninga, or LNUKs) in each community helped identify local polar bear experts for interviews and mapping sessions. Participants spanned a range of ages, and years of experience. When applicable, participants were asked to specify the seasons and time periods within which the information they shared was relevant. Participants shared information on the ecology and biology of polar bears, including abundance, distribution, habitat, feeding, health, mating, and denning. Participants also spoke about the importance of polar bears, both to themselves and to Nunavimmiut in general, as well as about hunting practices, management, and stewardship of polar bears.

Key Findings

Biological – By far one of the most common pieces of ecological data reported by participants was the increase in abundance of polar bears over the last half century. In almost every interview, participants reported noticeable increases in polar bears since the 1970s, and before the 2000s, with many participants first noticing an increased bear population in the 1990s. Polar bears also seem to have widened their distribution, with some participants reporting seeing bears in areas that they did not occupy in the past. Participants also reported the use of inland areas, including the movement of some bears from the Ungava area, across Nunavik to the Hudson coast. Similar movements were reported from the Nunatsiavut coast towards Ungava, across the Québec-Labrador Peninsula. Most participants that had experience seeing polar bear dens indicated they were in deep snow drifts created by large hills and mountains, usually close to the coast, though they generally did not discount the possibility of bears denning inland. Participants indicated that bears prefer to eat ringed seals, but alternative food sources were common, with bird eggs and beluga being especially frequent alternatives in the polar bear diet. Overall, participants indicated bears seem very healthy; bears are fatter in the winter and skinnier in the summer, but rarely skinny enough for participants to be concerned about the bear's health.

Importance of polar bears to Nunavimmiut – Polar bears were reported to be important to Inuit in regards to culture and mental health, safety, sustenance, and economy. Participants described a sense of emotional wellbeing and excitement when seeing polar bears in their environment. They are seen as a symbol of the fortitude and strength of the people who live alongside them. As a tertiary consumer and apex predator, polar bears are often considered more similar to humans than any other animal and regarded as one of the most intelligent species. Participants also expressed safety concerns resulting from the increased abundance and frequency of interactions with polar bears. Hunting a polar bear remains an important rite of passage into manhood for young Inuit, and participants reported a sense of pride associated with every successful hunt. Hunting provides two of the most tangible benefits of polar bears: food and resources. Polar bear meat is eaten in each community, especially by elders, and usually shared amongst community members. However, when hunters have discovered that a kill was previously tranquilized and tattooed for research, the meat is deemed unsafe for consumption and left

behind. The sale of polar bear hides is an important source of income for hunters and enables the purchase of materials such as ammunition, gasoline, rifles and snowmobiles, required to continue a subsistence hunting lifestyle. The importance of polar bear hunting has changed over time, as economic opportunities have changed, though the economic benefits have existed for many decades. Polar bear hides were traditionally used to make mattresses, snow pants, and mitts, or as important gifts (e.g., a first hide is often gifted to the hunter's sanijik, godparent) which still occurs today.

Management and stewardship – A very common sentiment among participants was that traditional stewardship practices were sufficient for conservation and that the introduction of a quota to limit polar bear hunting was unnecessary and possibly dangerous or counterproductive. Participants shared several stewardship practices that were common across the region. Without exception, hunting was based on need. While many participants expressed great enjoyment associated with being out on the land, their hunting activities were based on subsistence, not sport. Even when a hunter's own needs were met (and sometimes even before), hunting supplemented the needs of family, or the greater community. Some hunters mentioned prioritizing elders, who could no longer hunt, when distributing polar bear meat. More specifically, participants spoke about limiting their hunting to fully grown polar bears without small cubs. Participants also generally limited their hunting to winter, as well as late fall and early spring when bears have the best coat and the best meat. In some cases, especially in the past, a small amount of hunting outside of this season was done to sustain people on long expeditions (be it on the land, or on boat trips). Otherwise, virtually all kills during the warmer, ice-free seasons were due to safety concerns. Participants cautioned that the implementation of quotas can create a sense of competition between hunters or communities, and that this would likely increase the number of bears hunted: with a quota, hunters would rush to get their bears before the quota is filled. The competition created from a quota system could also inhibit traditional management practices, where hunters wait until prime hunting season to take bears. Participants suggested several ways that the detrimental effects of a quota could be mitigated, including considering seasons, and having quotas that are locally managed.

5.3 Nunavut Inuit Qaujimajatuqangit on the Health of the Davis Strait Polar Bear Population (2022)

Overview

This study aimed at gathering and documenting Inuit Qaujimajatuqangit (IQ) on polar bear health around the communities of Kimmirut, Pangnirtung and Iqaluit, Nunavut, to support management decisions and strategies for the Davis Strait polar bear subpopulation (Tomaselli et al. 2022). This collaborative research project was conducted as a partnership between the Government of Canada (Environment and Climate Change Canada and Polar Knowledge Canada), the Government of Nunavut (Government of Nunavut, Department of Environment), and local Hunters and Trappers Organizations (HTOs) from the communities of Pangnirtung and Kimmirut in the Qikiqtani region of Nunavut, with support from the Amarok Hunters and Trappers Organization (Iqaluit). The research team documenting, analyzing and interpreting information included: a veterinarian (wildlife health and participatory epidemiology specialist), a social scientist, community-based researchers, and polar bear biologists. The study explored the detailed historic and contemporary knowledge held by Inuit experts about polar bear ecology and health, as well as the importance of *nanuq* to Nunavut Inuit, and Inuit perspectives on polar bear management and stewardship. Polar bear health was considered broadly and holistically at the individual, population, and ecosystem levels; polar bear health was assessed considering multiple parameters, such as abundance and demography, habitat condition and distribution, diet and prey

availability, body condition, and other Inuit-identified health indicators and metrics, in addition to mortality and disease.

Inuit Qaujimajatuqangit related to polar bear cultural importance, harvesting practices, health, ecology, and management was documented through a series of individual and group interviews (inclusive of participatory exercises) conducted in 2019 with a total of 35 Inuit contributors from Pangnirtung (n=14) and Kimmirut (n=21). Group interviews (n=4) were performed in Kimmirut only (with a total of 15 participants) and allowed obtaining quantitative information, as well as corroborating early findings. Group interviews planned in Pangnirtung were cancelled due to the COVID-19 pandemic. Overall, project contributors included 24 men and 11 women ranging in age from their early 40s to early 80s. Polar bear experts interviewed included Kimmirutmiut and Pangnirtungmiut who had experience harvesting and butchering polar bears (generally men), processing and cleaning polar bear hides (generally women), or otherwise significant experience on the land. Direct ecological observations reported by participants were made within approximately 420 kilometers from their community, and the earliest direct observations reported dated back to the 1940s. Before finalizing research results, analyzed information was presented to study contributors during feedback or validation sessions which occurred in 2021 in both communities. This key step ensured increased accuracy and confidence in results. Project results were also shared with board members from the Kimmirut and Pangnirtung HTOs prior to final report publication, providing additional community-based peer-review of research findings.

Key Findings

Importance of polar bears to Nunavut Inuit – Interview contributors shared a strong sense of the importance of *nanuq* (polar bear) to Inuit culture, identity, traditions, and well-being, and discussed their past and ongoing relationships with polar bears. *Nanuq* was described as a mighty, intelligent, and resilient animal that must be both respected and feared. Participants explained that IQ emphasizes the importance of harvesting only what one needs, not playing with bears, sharing polar bear meat, and avoiding waste. Today, polar bears are harvested in Kimmirut and Pangnirtung mainly for their meat and hide. Polar bears are a source of country food and a source of income through the selling of hides and guided sport hunts. In both communities, polar bear hides are generally sold or used for clothing, mattresses, and blankets. However, many participants commented that the economic value of polar bear hides has declined in recent years, which has created a disincentive to harvest polar bears. Importantly, contributors from both communities commented on the importance of maintaining polar bear harvest into the future to preserve Inuit ways of life and foster community well-being.

Polar bear health and ecology – Overall, interview contributors from Pangnirtung and Kimmirut reported that, within their area of observation, the local polar bear population is today generally healthy. Observations suggestive of a healthy polar bear population included: an increase in polar bear sightings systematically reported by participants over their lifetime suggestive of increased abundance; females with two cubs-of-the-year and females with two yearlings being most frequently observed suggestive of no change in cub productivity and survival over time; a high proportion of polar bears observed in good body condition and overall health; and rare reports of polar bear disease, abnormalities or non-hunting related mortality.

In both Kimmirut and Pangnirtung, all interview contributors (n=35) reported a substantial increase in polar bear abundance observed across their area of observation over their lifetime. In Kimmirut, group interview participants indicated that the polar bear population had increased by an average of

approximately 73% (range: 70-75, n=3[1]) since the 1970s and 14% (range: 2-34, n=3) since 2005 within their area of observation. Contributors also shared detailed observations on the evolution of polar bear distribution over time within their area of observation; polar bear distribution appeared to have remained stable (Kimmirut area) or expanded (Pangnirtung area), with a progressive increase of sightings of polar bears closer to both communities starting from around the 2000s. Nearly all interview contributors from Pangnirtung and Kimmirut reported observing more cubs and juveniles, females, and/or females with cubs (family groups) over time. In addition, participants from both communities did not report any notable changes in cub productivity and survival and/or family group size over time. For example, in Kimmirut the relative proportion of cubs-of-the-year (COY) and yearlings per female had been constant from the 1990s onward, with two COYs/female and two yearlings/female most frequently observed (83% [range: 74-99, n=3] and 75% [range: 45-95, n=3] of the time, respectively). Collectively, this information coupled with targeted mapping exercises confirmed that the increase in polar bear sightings reported by all contributors corresponds indeed to a 'true' increase in the local abundance of polar bears rather than an 'apparent' increase driven by a shift in polar bear distribution or by changes in participant travel areas over time. In general, contributors from both Kimmirut and Pangnirtung reported that polar bears are in good body condition and good overall health. For example, in Kimmirut 94% (range: 92-96, n=3) of polar bears observed by group interview contributors over the 2016-2019 period exhibited healthy fat levels and 91% (range: 85-95, n=3) of polar bears observed over the same time period were described as overall healthy. Moreover, results indicated that these proportions have either remained stable or slightly declined since the 1990s. However, in recent years, Inuit contributors pointed to some subtle changes in polar bear health, including a slight decline in polar bear fatness and overall health noted by some participants and occasional reports of hair loss (alopecia) –which was also observed in some seals. In addition, participants had observed recent changes in polar bear prey availability and habitat condition over time, including changes in sea ice quality and quantity and a major decline in the abundance of ringed seals (main polar bear prey present throughout the year around Kimmirut and Pangnirtung) observed around both communities. In Pangnirtung and Kimmirut, all participants who commented on ringed seal abundance reported a major decline occurring over the last few decades. For example, contributors reported an 80% (range: 80-80, n=2[2]) decline in ringed seal abundance in the Kimmirut area occurring between the 1960 and 2019. Over the same timeframe, sightings of harp seal (only seasonally present) had increased by approximately 60% (range: 43-75, n=2), while the number of bearded seals had remained constant around Kimmirut. Contributors from both communities also noted that polar bears feeding on anthropogenic waste and other man-made items was a recent phenomenon. At the time interviews were conducted, changes in habitat condition and ringed seal availability were not reflected in observations related to cub productivity, which has remained stable according to contributors from both communities.

Management and stewardship – Contributors emphasized that *nanuq* is a resilient and opportunistic predator that is highly adaptable to changes in prey availability and habitat conditions. In addition, study results highlighted public safety concerns arising from increased human-polar bear interactions and encounters and suggested that polar bear management today must find ways to address public safety concerns while ensuring that polar bears persist into the future and remain available for future generations.

[1] Here n=3 refers to three group interviews organized in Kimmirut with male polar bear harvesters in which a total of eight harvesters participated.

[2] Here n=2 refers to two group interviews organized in Kimmirut with male polar bear harvesters in which a total of six harvesters participated.

5.4 Other Inuit Knowledge Studies

Overview

A recent literature review gathered 23 sources that include Inuit Knowledge (IK) of the DS polar bear subpopulation (Hicks et al. 2022). These sources were published between 1976 and 2022 and included peer-reviewed articles, government and co-management board reports, academic theses, books, and film. They covered all three Inuit regions within the DS subpopulation (with 18 sources from Nunavut, six from Nunatsiavut, four from Nunavik, and one from Greenland).

Five regional IK reports specific to the DS subpopulation −including the three reports described in sections 5.1, 5.2 and 5.3 above − were the most comprehensive sources within the compiled documents (Kotierk 2010a, 2010b, York et al. 2015, NMRWB 2019, Tomaselli et al. 2022). Those five regional reports were reviewed, analyzed, and synthesized by the Polynya Consulting Group as part of the Nanuk Knowledge and Dialogue Project, which aimed to develop a shared understanding about the DS polar bear subpopulation amongst Inuit regions, and to mobilize this knowledge to strengthen polar bear co-management (Hicks et al. 2022). The Nanuk Knowledge and Dialogue Project is collectively led by the TWPCB in Nunatsiavut, the NMRWB in Nunavik, and the NWMB in Nunavut, in partnership with Nunavut Tunngavik Inc. (NTI) and the Nunatsiavut Government.

Key Findings

All five regional IK reports documented an overall increase in polar bear abundance observed by Inuit since the 1970s (within areas of travel around communities) and indicated that DS polar bears are generally healthy (Kotierk 2010a, 2010b, York et al. 2015, NMRWB 2019, Tomaselli et al. 2022). Impacts of increased abundance were noted across the three Inuit regions primarily through safety concerns associated with increased human-polar bear interactions (Hicks et al. 2022). In addition, changes in polar bear habitat and prey availability were reported across these regions, including: a decrease in sea ice quality and quantity observed in Nunavut, Nunavik and Nunatsiavut; an increase in harp seal abundance reported in Nunavut and Nunatsiavut; and a decline in ringed seal abundance observed in Nunavut (Hicks et al. 2022). Inuit participants also explained that polar bears are resilient and opportunistic predators highly adaptable to environmental change (Hicks et al. 2022). Importantly, Inuit participants reported that IK is key to understanding polar bear health and managing human-bear relationships; and some participants expressed a desire to have more control in decision-making related to the management of the DS polar bear subpopulation (Hicks et al. 2022).

Finally, one regional report assessed the social carrying capacity for polar bears within Nunavut communities harvesting from the DS subpopulation (Kotierk 2010b). Social carrying capacity can be defined as the level of human/wildlife interactions that meets social and cultural demands for positive interactions, such as harvesting of food and other resources, but does not exceed social tolerance of negative interactions, such as property damage (Peyton et al. 2001). Amongst Nunavut Inuit harvesters (n=33) who participated in a survey in 2007-08, 54 % thought that the DS polar bear subpopulation was above their preferred abundance level and 37% expressed the view that abundance was at their preferred level (Kotierk 2010b).

6. Scientific Assessment

6.1 Subpopulation Abundance

According to mark-recapture studies conducted between 1974 and 1979 on sea ice in the spring, 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 and Kiliaan 1980, Stirling et al. 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 Indigenous knowledge suggested that more bears were being seen over the last 20 years.

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 – 3442) bears (Peacock et al. 2013).

A two-year genetic-mark-recapture (biopsy) study was conducted in 2017 and 2018 involving all of the DS management jurisdictions and Boards (Dyck et al. 2021a). The 2017-2018 study design resembled the 2005-2007 study in terms of coverage and timing to allow comparison to the earlier study to establish a population trend. In addition, the 2005-2007 study data was reanalyzed with the 2017-2018 study data and harvest data to improve accuracy of estimates.

The analysis included the previous 2005-2007 live-capture data, harvest recovery data from 2005 to 2018 and the genetic samples collected in 2017 and 2018. Using this larger dataset, DS abundance was re-estimated for the 2005-2007 at 2,250 bears [95% CRI 1,989 - 2,512], which falls within the confidence interval of the estimated abundance published by Peacock et al. (2013). Estimated abundance for the 2017-2018 period was 2,015 bears [95% CRI 1,603 - 2,588]. Geometric mean subpopulation growth between 2006 and 2018 was 0.989 [95% CRI 0.974 – 1.010] which corresponds to a 0.896 probability that subpopulation growth was <1, and thus the subpopulation most likely declined over this period.

Mean annual reported harvest from all jurisdictions combined increased from 64.1 ± 10.1 (SD) bears/year between 1999 and 2008 to 86.8 ± 23.6 between 2009 and 2019. Given the lack of complete harvest reporting within the DS subpopulation area, it is not possible to determine an exact number of the potential, annual allowable removal from the subpopulation. The increased harvest within the DS subpopulation area may be a factor explaining the lower abundance estimate in 2017-2018.

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

Survival

The 2017-2018 genetic mark-recapture study estimated survival for the entire DS subpopulation area (Dyck et al. 2021a). This contrasts with Peacock et al. (2013) which included a geographic component model variation in survival and reproduction based on a bear's initial capture location (e.g., north, central, and south Davis Strait). However, Dyck et al. (2021a) found there was not sufficient evidence to warrant the inclusion of three distinct geographic subpopulations within the DS boundary and did not want to reduce the samples size of the 2017-2018 study.

In the most recent abundance estimate report (Dyck et al. 2021a), survival rates estimated for all segments of the population were slightly lower than those calculated by Peacock et al. 2013, but fell within their confidence intervals. Potential causes for the lower survival reported from the recent study include the grouping of senescent bears (>20 years old) with prime age adults. Senescent bears typically have lower survival rates compared to prime age adults. Methodologically, genetic capture-mark-recapture allows estimation of survival for age class bears but loses resolution for age-specific survival estimates because no tooth is obtained for aging. Thus, including the senescent bears with prime age adults likely reduced the overall estimate of adult survival. This increases the variability in the survival estimates and must be considered when evaluating the results. Inclusion of auxiliary information including satellite telemetry and harvest data with individuals aged and identified through genetic analysis can help overcome the weaknesses of genetic capture-mark-recapture.

Reproduction

Over the two comparable study periods (2005-2007 and 2017-2018), mean cub-of-the-year (COY) recruitment (number of COYs per adult females) ranged from 0.23 to 0.45 and mean yearling recruitment (number of yearlings per adult females) ranged from 0.23 to 0.41. The rates for COYs are notably lower than the adjacent Baffin Bay subpopulation where values were between 0.55 and 0.83 (Laidre et al. 2020a). Additionally, COY litter sizes were lower than other subpopulations including Baffin Bay (Laidre et al. 2020a), but did not differ from the previous study period in 2005-2007. The recruitment rates for yearlings were closer to reported recruitment of yearlings in Baffin Bay (Laidre et al. 2020a) and fall within a range that is generally considered adequate for population persistence (Regehr et al. 2017). While the mean values are low compared to other subpopulations, they appear to be sufficient to sustain the DS subpopulation. The relatively low reproductive rates have been noted as an area for continued monitoring in the face of ongoing climate change as impacts to recruitment remain unknown.

Body Condition

Body condition decreased based on data from 2005-2007 compared to earlier 1990s data. However, bears were less likely to be in poor body condition during the 2017-18 study period when compared to the 2005-07 study. Similar improvements in body condition for polar bear subpopulations have been noted in other studies in the last 10 years (e.g., 2011-2018), including Kane Basin (Laidre et al. 2020b), Gulf of Boothia (Dyck et al. 2022), and M'Clintock Channel (Dyck et al. 2021b). These subpopulations represent a range of ecosystems, though all have some amount of ice that persists through the summer and fall, whereas DS experiences a mostly ice-free summer (Stern and Laidre 2016).

Movement

Bears were fitted with telemetry sensors in the early and late 1990s (1991-1994 and 1997-1999) in the DS area. No telemetry work has been done since the 1990s in response to Inuit concerns with physical handling and telemetry of polar bears. There appears to be high fidelity to geographic location based on capture and recapture locations from fall on-shore survey data within the DS area (GN unpublished data). Telemetry data from other subpopulations (e.g., Baffin Bay and Kane Basin, Laidre et al. 2018, 2020a) indicated changes in range and distribution of polar bear subpopulations in the past 20 years that is correlated with sea ice changes. The telemetry work from Baffin Bay supported the northern boundary of the DS area, and the dead recovery data provided by harvesters in Nunavut indicates that over 85% of recovered bears were within the DS subpopulation boundary. These data indicate that the current boundaries for DS have remained generally relevant. However, any changes in movements,

distributions, or fidelity that may have occurred in Davis Strait in relation to the ongoing sea-ice declines and other environmental change have remained unclear, except through insights that have been available through IK.

6.3 Environmental Conditions

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

In the 2017-2018 scientific study, environmental factors such as sea-ice duration were examined to evaluate if effects on interannual survival were present. Covariates investigated include the relationships between polar bear survival and 1) sea-ice decay rate following Lunn et al. (2016), 2) the number of ice-free days, and 3) the winter indices of the North Atlantic Oscillation (NAO) and Arctic Oscillation (AO; Dyck et al. 2021a). The NAO and AO are strong indicators of sea-ice extent during the spring to summer period as they influence regional climate (Stern and Heide-Jørgensen 2003, Heide-Jørgensen et al. 2007). The study used data during the 2005-2018 period and found no link between survivorship and the sea-ice parameters that were examined. Sea ice in Davis Strait has decreased both in duration and summer sea ice area (Table 5). Peacock et al. (2013) found that total survival increased when the mean summer sea-ice concentration was between 17% and 29% using their 2005-2007 study data and decreased below 17%. Mean summer sea-ice concentration did not exceed 8% during the last study period of 2017-2018.

In Davis Strait, harp seals, an important prey species for DS polar bear subpopulation (Iverson et al. 2006; Peacock et al. 2013), increased dramatically from the 1970s to 1990s, and appears to have remained relatively stable since the mid-1990s, with an increasing population in recent years (Stenson et al. 2010, Hammill et al. 2021). This abundance of harp seals probably provided a much-enhanced potential prey base for DS polar bears and was one potential mechanism behind Peacock et al.'s (2013) findings by which polar bear survival remained high since the 2000s. Similarly in the 2017-2018 scientific study, harp seal abundance was included as an environmental covariate to evaluate the effect on survival; however, the study found no relationship between harp seal abundance and survival. Since the initial increase in harp seal abundance between 2005 and 2018, the harp seal abundance has remained consistently high (> 5 million seals, Hammill et al. 2021). Dyck et al. (2021a) suggest that the increase of harp seal abundance over time may have contributed to an increase in polar bear survival in DS; however, as harp seal abundance has stabilized, and the likelihood of detecting an influence of harp seal abundance on polar bear survival has decreased.

***Table 5**. Trends in sea ice metrics according to global polar bear subpopulations (PBSG 2018).*

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

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

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