

INUIT QAUJIMAJATUQANGIT OF GULF OF BOOTHIA POLAR BEARS

FINAL REPORT

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Spence Bay Hunters and Trappers Organization, Taloyoak
Kurtairojuark Hunters and Trappers Organization, Kugaaruk
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Igloodik Hunters and Trappers Organization, Igloodik
Hall Beach Hunters and Trappers Organization, Hall Beach

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1. Summary

In Nunavut, both science and Inuit *Qaujimajatuqangit* (IQ) support co-management decision-making. To complement their recent scientific assessment of the Gulf of Boothia polar bear subpopulation, the Government of Nunavut Department of Environment contracted Trailmark Systems Inc. consultants to conduct an IQ study led by Inuit communities who harvest polar bears from Gulf of Boothia. From May to August 2020, we interviewed active hunters and elders from Gjoa Haven, Taloyoak, Kugaaruk, Nauyasat, Igloodik, and Sanirajak remotely to document their knowledge of polar bear ecology, population changes (including relationships to humans), and management perspectives and considerations. In-person interviews were not possible due to social distancing and travel restrictions resulting from the COVID-19 pandemic. Interview participants reported increasing bear numbers, females and young bears, and bear encounters. Interviewees also described how they make inferences on population changes. Interviewees were concerned about harvest regulations that fail to take into account increasing bear numbers and human relationships to bears, from a cultural perspective. An appreciation and better inclusion of IQ is needed in bear management, which will inform how decision-making impacts animals, as well as the livelihood of the communities who co-exist with them.

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2. Introduction

Accurate and reliable information on polar bear population status and trends are necessary for decision-making in polar bear management. Collaborative polar bear management among the Nunavut Wildlife Management Board, Government of Nunavut, Department of Environment (GN DOE), Nunavut Tunngavik Inc., Regional Wildlife Organizations, and Hunters and Trappers Organizations (HTOs) in Nunavut focuses on ensuring populations are viable so that Inuit can continue to harvest polar bears, in part through harvest regulations (e.g., Total Allowable Harvests [TAH] and non-quota limitations). Both conventional science and Inuit *Qaujimaqatugangit* (IQ) contribute to this process.

IQ includes knowledge of wildlife trends, as well as the values, opinions, concerns, traditional management practices, and perceived impacts to harvesting and livelihood that are held by Inuit (Wenzel, 2004). This unique characteristic of IQ differentiates it from conventional science, which tends to focus on wildlife data at the exclusion of human relationships and values. Incorporating IQ in polar bear management supports “Inuit harvesting rights and priorities and recognizes Inuit systems of wildlife management that contribute to the conservation of wildlife and protection of wildlife habitat” (Nunavut Agreement, Article 5). Documenting and using IQ require the direct inclusion and guidance of IQ holders in formulating research questions, analysing and validating results, and interpreting and presenting data (Wenzel, 2004). Culturally appropriate research methods are systematic yet informal and based on respectful communication, narrative discourses, subjective and personal engagement, and unhurried meeting styles (Ferrazzi et al., 2019).

GN DOE recently completed a biological survey and data analysis of the Gulf of Boothia polar bear subpopulation (GB; Fig. 1; Dyck et al., 2020). To complement this study, GN DOE sought to obtain IQ information, and contracted Trailmark Systems Inc. (Trailmark) Consultants to conduct an independent IQ study for the Gulf of Boothia, as well as M’Clintock Channel (Ekaluktutiak et al., 2020) polar bear subpopulations. The results from both scientific and IQ research may inform harvest recommendations to the Nunavut Wildlife Management Board—Nunavut’s main instrument of wildlife co-management. These data have the potential to guide TAH and management objectives for the two subpopulations. Here, we report on polar bear IQ documented from communities that harvest Gulf of Boothia polar bears.

3. Methods

We followed a grounded theory approach to guide this work, where hypotheses and patterns in information emerged inductively, without any pre-existing theory (Strauss & Corbin, 1994). This contrasts the deductive approach (Lewis, 1988) that is used in conventional wildlife science, where hypotheses are established and tested (Johnson, 2002).

Initially community visits were planned to conduct interviews with selected local knowledge holders. However, as the COVID-19 pandemic spread across Canada, we decided on an alternative and mutually agreed upon approach. A Trailmark consultant met remotely with Gjoa Haven, Spence Bay (Taloyoak), Kurtairojuark (Kugaaruk), Aivilik (Naujaat/Repulse Bay), Igloolik, and Hall Beach HTOs. HTOs suggested public community meetings be held in each community in March and April 2020 to document IQ. Trailmark staff drafted a list of guiding interview questions focusing on hunting experience, perceived population changes, knowledge of polar bear ecology, and management perspectives. This interview guide was circulated to each HTO and the GN before being finalized.

In March 2020, the COVID-19 pandemic restricted travel and community meetings were not possible. HTO staff suggested remote interviews over telephone and videoconferencing so that IQ research could continue. Because interviews occurred remotely and mostly through telephone, participatory mapping and GIS data collection was not possible; however, interview questions probed for place names to identify geographic locations when they were relevant for the discussion. HTO staff recruited all interview participants for their hunting experience, breadth of knowledge, and familiarity with polar bears, bear hunting, and hunting areas (i.e., purposeful sampling [Marshall, 1996]).

We interviewed participants in a semi-directive manner (Huntington, 1998; Huntington, 2000) remotely from May 21 to August 10, 2020. We interviewed five Taloyoak participants individually over Zoom videoconferencing. We interviewed all other participants over telephone: five as a group and one from Gjoa Haven; three from Naujaat; three from Igloolik; and five from Sanirajak (Hall Beach). Because interviews occurred as a group discussion in Gjoa Haven, the resulting information was interpreted as perspectives of the entire group, rather than individuals. It was not always possible to distinguish who was speaking over the telephone, so we identified individual interviewee's quotations where possible, and otherwise denoted quotations with "unidentifiable Elder". We replaced identifying names with alphanumeric codes ("GH", "T", "K", "N", "I", and "HB" to denote Gjoa Haven, Taloyoak, Kugaaruk, Naujaat, Igloolik, and Hall Beach home communities, respectively) to protect participant confidentiality.

We conducted interviews in English, and interpreters provided translation between English and Inuktitut for four Taloyoak interviews, the group interview in Gjoa Haven, two interviews in Nauyasat, and one in Hall Beach. We audio recorded and auto-transcribed interviews using Sonix transcription software (<http://sonix.ai>). We manually edited transcripts and analysed them using conventional content analysis, where common themes and categories were determined from the data (Hsieh & Shannon, 2005). We identified quotations that represented common themes and reported on them. Additional quotations are listed in Appendix 1.

We sent community interview summaries (English and Inuktitut) through email to each HTO. Because of travel restrictions and the limited time available for this work, HTO board members validated the results remotely instead of the participants for accuracy and representativeness for their community. In-person validations with each participant would have strengthened engagement and data analysis. Results need to be interpreted with this consideration in mind and any uses or applications of these results need to be approved by HTOs and/or interview participants.

4. Results and discussion

4.1. Participant hunting experience

Participant experience provided context to and reliability of interview data. In Gjoa Haven, one participant was an active polar bear hunter (had been polar bear hunting in the area this year) and the other four participants were elders (no longer actively hunting due to old age). These elders had harvested an innumerable number of bears over their lifetime before quotas were implemented; since then, they reported having been able to harvest only up to five bears due to limited access. In Taloyoak, three interviewees were active polar bear hunters. Two interviewees were elders and had not visited polar bear areas in the last 20 years.

In Nauyasat and Igloodik, all interviewees were active hunters who had visited the Gulf of Boothia area (Appendix 2) in the last 3 years. In Hall Beach, three interviewees were active polar bear hunters; one interviewee recently stopped hunting but had been to hunting areas earlier this year; and the other interviewee was still actively polar bear hunting but had not harvested from Gulf of Boothia since 1999. HTOs recommended non-active hunters and elders for inclusion in this project because of their unique experiences, wisdom and/or historical knowledge of geographic areas.

4.2. IQ of polar bear ecology

Remote interviews occurred in the spring and summer and recruitment was challenging due to limited in-person coordination (HTO staff were on annual leave) and hunter availability. It is possible some interview participants did not feel comfortable sharing information openly over telephone. Some interviewees expressed a preference for face-to-face meetings, where additional contextual information could have been gathered (e.g., through participant observation).

Gjoa Haven and Taloyoak interviews also contributed to a M'Clintock Channel IQ study (Ekaluktutiak et al., 2020) and interviewees shared knowledge of both M'Clintock Channel and Gulf of Boothia subpopulations. Where possible, we distinguished the populations that interviewees referred to by geographic area. Gjoa Haven interviewees did not consider Gulf of Boothia their traditional hunting area and, as a result, focused most of their interview discussions on M'Clintock Channel (reported in Ekaluktutiak HTO et al. [2020]). Taloyoak interviewees harvest most of their polar bears from the Gulf of Boothia area and, conversely, focused most of their discussions on Gulf of Boothia bears. However, interviewees referred to polar bear characteristics broadly across both populations.

The polar bears and animals don't have any boundaries. For example, on the map you set up a boundary or a line, and the hunters not supposed to pass that line. Well, the polar bear has no lines to cross. (Interpreter translating for unidentifiable Gjoa Haven elder, 3 June 2020; Ekaluktutiak HTO et al., 2020)

The government sets boundaries right. Polar bears don't have boundaries. They go anywhere. (GH1, 3 June 2020; Ekaluktutiak HTO et al., 2020)

Inuit believe that the Boothia Channel or Boothia population and the M'Clintock polar bear populations are the same. (GH2, 16 June 2020; Ekaluktutiak et al., 2020)

Interviewees indicated polar bears are curious animals and their behaviour varies from individual to individual.

Mostly bears seem more personality than other animals. We know, we know other animals have different personalities. But the polar bears seem to have more, almost like in tune with human. (T1, 21 May 2020; Ekaluktutiak et al., 2020)

The polar bears has its own inclinations, it's like some of them run away from the disturbance, some of them don't run away from the disturbance. (K1, 26 May 2020)

They are different. Some very mean polar bears, some are not mean polar bears. Some polar bears are friendly, some polar bears are not friendly. I don't know why, just like a human being. (HB1, 23 July 2020)

They indicated younger bears are generally more curious and tend to be encountered on the mainland (versus open water).

It's the younger ones that are coming more closer to town, like the younger ones, anything, any animal. Caribou, wolf, polar bear, they're more curious to see. And coming closer to town. But the older, older ones, there they know. They know more...like they're going to be hunted if they come closer, or they're going to be shot. But the younger ones, they're more curious. (Interpreter translating for N1, 16 June 2020)

It's usually the older ones that always running away. It's the juveniles that are curious like human beings, they'll do stupid things as well. And they would come into camps wandering on and also to look at what's happening, like whether it's a dangerous area to go to or not. Like any humans, the young people would take chances to go into certain areas. Most of the bears that do come through the community are juveniles. Inside the ages of one year old to three or four years old. Those are the ones that are most nuisance. But the older ones always stay away from the communities. (I1, 13 July 2020)

Tulajuittuq, that's extra-large polar bear, live in the ocean. They hardly go to the land...big bears *tulajuittuq* harder to go around here, because I think there's too many polar bears...usually mother with the young cubs around mainland, people see them a lot and they hardly see big ones now because they protection is not to go to the main ocean because they were eaten by bigger bears. (I2, 10 August 2020)

Interviewees indicated polar bears prefer rough ice, where seals are more easily accessible.

In rough areas, the packed areas, they tend to be in that area. And when seals are giving birth it's pretty much all over you can see them. In that area where there's seal holes, breathing holes and that will usually be in April, May. (HB2, 23 July 2020)

They used to be more in the more rough ice...maybe there's more seal, because there's more snow back in the more ice, and the rough ice. So, the snow builds up on the rough ice. (HB3, 23 July 2020)

Interviewees also reported polar bears prey on a range of species, including other polar bears.

They go after bearded seals and other sea mammals but when they're hunting for them, when they see other polar bears, cannibalism comes into play to due to hunger. (Interpreter translating for HB4, 29 July 2020)

Interviewees indicated polar bears can be encountered all year round.

Mostly summertime, when we're boating, they're on our shore. And in the fall too, they're on the shore, and some in the water. Sometimes we hear [about] them miles from land, swimming. And fall time there's quite a bit near our hometown now. Wintertime, there's less to see, and early spring, you can see them on the sea ice. I mean the sea ice, yes, and there is more [captured] on the sea ice near where I go. And they, all winter, I think they stop moving, I don't know, maybe they go down to the ice, moving ice, pack ice. (N2, 15 June 2020)

Some interviewees described seasonal patterns in feeding, distribution, and denning.

In the summertime, when they're swimming along, they get fatter, they eat more. I know that they eat more, refuelling. And in the wintertime they're mostly in the den, some of them, and they get fat mostly in summertime 'cause there's more prey, their prey is ringed seal. And they would also need, I've seen some bears eating grass in the summertime, or even in the winter they dig the grass. (K2, 13 May 2020)

Polar bears are mostly noticed in maybe the open area, like open water area. Most polar bears go after seal in the water or on the ice for seal, make a hole in the ice all winter long. Polar bears, they tend to come in the area [south of] community in the fall time. Not so much in the springtime. They're more out north of us in the springtime hunting seal. (Interpreter translating for K3, 19 May 2020)

Normally polar bears den in the fall time through October, beginning of October, that's for the pregnant female. But the males tend to den through in November, which is a bit

later than the female. But there are a lot of people that don't bother denning all through their winter. (Interpreter translating for K3, 19 May 2020)

Even though bears are known to travel across population boundaries (Ekaluktutiak et al., 2020), some interviewees described differences between M'Clintock Channel and Gulf of Boothia populations.

In M'Clintock Channel where we studied, before the bears over there are mostly always skinny and the bears on Gulf of Boothia are fatter bears, healthy bears, and they're more yellow because they're healthy and over on the other side of the ocean is because they're more skinnier. They're fur is more white. (K2, 13 May 2020)

I've always noticed the M'Clintock Channel's bears are not as aggressive as the bears in Boothia. But that may be due to the size of the populations because the bears I get from the M'Clintock Channel have a lot less scars. They don't look as beat up and they're healthier...whereas the bears in Boothia, they tend to have a lot more scars. I guess there's too much competition for food or they seem to be a beat up a bit more in Boothia. (GH2, 17 June 2020; Ekaluktutiak et al., 2020)

Bears on M'Clintock Channel area seems to be more slender, less fat. And it's always been that way, they always heard of it. And it's still like that today. And for Gulf of Boothia, you have the open floe edge area behind Astronomical Islands. The ice would close up, freeze, and then through the cycle of the strong current following the moon, the ice would open up. And there's many seals. And wherever you have a floe edge or open water, there's known to be more seals and more bears in those areas. And that is the difference and we've known it for a long, long time. (Interpreter translating for T2, 21 May 2020; Ekaluktutiak et al., 2020)

Hall Beach and Igloodik interviewees also distinguished Gulf of Boothia from Foxe Basin polar bears by their migration patterns, body size, and how avoidant they are of humans.

I think the Gulf of Boothia I see more bull, bigger bears, male bears than here in Foxe Basin. That's the only thing I could really discuss, the difference between Gulf of Boothia and Foxe Basin. I see more bigger bears over at the Gulf of Boothia. (HB2, 23 July 2020)

The one around there, they are a bit more scared. And on this side, the Foxe Basin, they don't get scared much. (HB3, 23 July 2020)

Gulf of Boothia they only migrate once a year and they go back up again to the Gulf of Boothia once they are down here, and there's a big difference between the Gulf of Boothia polar bear and the Foxe Basin polar bear, so polar bear from the Gulf of Boothia they migrate down to Foxe Basin, they migrate back when it by the fall time. But these Foxe Basin polar bears are just on the Foxe Basin area. (HB5, 27 July 2020)

Interviewees indicated bears travel between Gulf of Boothia and Foxe Basin management boundaries.

The ones that come from Foxe Basin and Gulf of Boothia, they change places. Like the one from Gulf of Boothia goes to Foxe Basin and the one from Foxe Basin goes to Gulf of Boothia. Yes he can tell that the one from Gulf of Boothia who's been there for a long time, you can tell it's been there for a while because of the back of the palm of his hand and (running) out of skin from hunting too much. But he can, all he can see is that he sees them same. From Gulf of Boothia and Foxe Basin. (Interpreter translating for N1, 16 June 2020)

Information on polar bear ecology and behaviour, as well as patterns, is learned through hunting experience and travelling and living on the land. This knowledge is important for hunting success, as well as hunting shared prey.

How I know there's seal is if I can find polar bear tracks on the ice. They're hunting there. If I want to catch seals, I will try to look for polar bear tracks. They are the ones that know seals more than we do. (I3, 27 July 2020)

4.3. Description of hunting

Interviewees described polar bear hunting using tags (Appendix 3). Other animals such as caribou, wolverine, wolves and fish are harvested in polar bear hunting areas. In the past, polar bears were harvested using dog teams.

The dog teams be using to hunt harvest polar bear besides snowmobile because they know the polar bear then and they have a little bit of like not a sound at all, not like a machine. (Interpreter translating for HB4, 29 July 2020)

Today, polar bears continue to serve as an important source of accessible food, as well as clothing and income from their hide.

Polar bears are very important because in those days, the polar bears were everything to us. The fur itself would be used for clothing or you know, as well as the meat which was never wasted. It is very important to us to this current time. (K4, 26 May 2020)

Currently, with the polar bears, how important to people, it's like when we catch a polar bear, it's very important about the meat, where there's meat. And in those days, they were always important and still today, still important because we Inuit eat lots of country food and meat, and so because of polar bears' meat that's how important it is. And with the hide, with the polar bear hide, the skin, we used them too in those days, but usually we kept them...today, with the hide, we try and make everything with the polar bear hide and that's how important it is to us. (Interpreter translating for K5, 26 May 2020)

Polar bears are used as a mattress or they can use them for a wind pants because the fur will never, ever absorb moisture. It just never absorbs moisture. So, it's the best thing for to use is as a mattress or a wind pants, for Inuit style wind pants. And the meat we eat, it's like baby pork ribs. (Interpreter translating for N3, 4 July 2020)

In this manner, hunters are knowledgeable of and select for certain bear characteristics depending on what they harvest them for.

I prefer younger than older. I didn't believe my parents when they were alive, now that I'm older, I prefer younger bears, because the meat is more tender, but they mostly go for bigger polar bear so some people today...most of them always look for bigger bear. Like sport, lots of people, the hunters I call sport hunter, they want bigger ones and some people, most of the people they sometimes, when they see a bear, they don't mind them if it's sow [female] with cubs even though if they're same size, they just leave them and look for bigger ones. (K2, 13 May 2020)

Polar bears or any animals, the meat, they taste better in the winter season than in the springtime and that is why nobody really wants to catch polar bear around the springtime season. (K4, 26 May 2020)

If I want to go polar bear hunting, male or female, I'm going to shoot the fat one and the very clean fur. That's what I'm always after, I don't kill skinny ones and bad furs. So, I shoot, more like that, I shoot for food, young and clean. Not very often, sometimes, if I see a polar bear, I'll just shoot it and sometimes if I go to Gulf of Boothia, I have to choose what I want. One time I was going polar bear hunting to Gulf of Boothia I saw many polar bears and I never get one, I go back empty handed. (HB1, 23 July 2020)

Older, more experienced polar bear hunters are able to discern polar bear characteristics.

There's two different hunters now, the older one that's been hunting for polar bears for long period of time, they learn about how polar bears move. They have different movements, male and female. So, they watch and learn about the bear to see if it's a male or female. But these younger one now too that are starting to just hunt. When they go hunt, they as soon as you see a bear, there's a bear, so they just shoot it without noticing or learning about the bear. There's two types, I would say. But the older hunters, they can for sure tell if it's a female, or a male...the young hunters, all they know is if it's a big one that must be a big male. But if it's a female size, it's really hard to tell. (Interpreter translating for N1, 16 June 2020)

Uses of polar bears have shifted and, as a result, so have hunting practices. Hunting for the sale of hides encourages hunters to select for bigger bears.

We catch a polar bear by a big size. The bigger size it is, the height will add more money into it. The meat we keep but due to the fact of fundamentally speaking, like even *qablunaaq*, the white people likes to have a bigger—they like to have a big polar bear skin around their home so we do the same thing, you know, we try catch a bigger

polar bear just because of the size of the hide that will you know, benefit. (Interpreter translating for K1, 26 May 2020)

In more old bears, the polar bear skins are important for their pants, for the mitts, or kamiks. But now, only for few people use them now. So not much polar skin goes there now. (HB3, 23 July 2020)

However, fewer community members harvest bears for their hide today, due to their lower economic value.

The polar bear hide is not very pricey around this time. Not too many people outside of Nunavut want to buy the hides of polar bear. Actually, there is a place where people sell down south for the polar bear hides and today's market is down. There's no interest in selling the polar bear hides to many people. (Interpreter translating for K3, 19 May 2020)

Nobody wants the polar bear hide anymore, it's very cheap, that's why in Gulf of Boothia nobody goes hunting, maybe five years, nobody goes hunting so we got right now lots of credit in Gulf of Boothia, nobody goes hunting because of highest risk route and the gas is so expensive, the food is expensive, nobody wants to go spend the money for nothing. I mean last spring, three hunters went polar bear hunting from Hall Beach to Gulf of Boothia, they got three more polar bears. And so that's the first in maybe 5 years someone go hunting polar bears to Gulf of Boothia. (HB1, 23 July 2020)

Income generated from selling hides is usually reinvested into hunting. Today, the lower market prices for hides can no longer support increasingly expensive hunting supplies.

When it's fat, they were eaten by the people and the fur, the pelt, was sold to the Hudson's Bay, I believe was the only place they sold furs anyway and it didn't cost very much. The last time I remember my mom, let's say my father caught one in early spring, and my mom did the fur, and she said, I remember she sold it for \$40 at Hudson's Bay company. Later on, when I was a teenager, there were more bears. And people would sell the pelts and a good polar bear, a good size one would cost enough to buy a machine, like the early Bombardier machine. But those were really kind of small bills and one bear, let's say a small bill, were about \$700, \$800 for a machine, when I was a teenager. And people would buy a machine right away from the Co-op store or in order by the Hudson's Bay. Now, in the 90s, bears became more and in 2000, there were quite a bit around. So, I think the price went down a bit and then it grew, but I think the folks know about it. It was just a fraction of what you earned from the bear skin to buy a machine, that's around \$18,000 worth now. (N2, 15 June 2020)

Expensive hunting equipment and supplies can limit access to hunting.

Not all of them have snowmobiles, all the equipment. Not a whole lot of people have the opportunity to go and catch a polar bear. (HB5, 27 July 2020)

Oh my goodness, for my trip this past May it costs me just over \$2000 out of my own pocket. You know, the gas is getting expensive, the grubbs is getting expensive. All the bullets and whatnot are pretty much expensive. So, it's quite an expensive, would be an expensive hunting trip nowadays. That's what I experienced in May. It's quite far so you need other snowmobiles, like other guys that you need to go with too. So, it's a costly hunting. (HB5, 27 July 2020)

Hunting is also limited by employment.

Most that are not working hunt polar bear either in fall or winter or like around this time, springtime. But whenever a person working, who has a full-time job just get a chance to maybe stay around on the weekend, they would go after that opportunity. (Interpreter translating for K3, 19 May 2020)

The practice of polar bear hunting alone is demanding and requires a lot of work to prepare and distribute meat.

To be honest, catching a polar bear, a big game, is a lot of work and butchering the skin and preparing the meat and cutting up all the pieces into pieces. Make sure it's grabable for people to just grab without, you know, cutting themselves a piece of meat. (HB5, 27 July 2020)

Polar bears can be harvested on the sea ice or land, depending on season and location.

During the winter season we wouldn't have polar bears out on the sea ice. But during early fall about October November, we would catch polar bears, the ones that are mostly on the land. (Interpreter translating for K5, 26 May 2020)

Everybody knows that bears can be in the ice or on the land, it's more like where you go hunting...on the ice is the best time because bears like to be on the ice most. But that [I have] hunted bears on the land. (N2, 15 June 2020)

During summertime, you can catch a polar bear sooner than winter. During winter you're going to have to search for the polar bear. It depends on the season and it depends on the polar bear. (Interpreter translating for N3, 4 July 2020)

For Gjoa Haven (Ekaluktutiak et al., 2020), Nauyasat, Hall Beach, and Igloodik communities, Gulf of Boothia bears are farther away than the other polar bear populations that they can access. Hunting in Gulf of Boothia areas requires considerable time, experience, safety precautions, and fuel.

It's pretty far away from Hall Beach. Maybe the hunter is just going out for the weekend or spending the whole week over there. They really decide, oh well, they get first bear they see, or any bear that they see or if they're spending more time over, they will pick and choose which bear really like and really try to get the fatter ones. (HB2, 23 July 2020)

They want to go polar bear hunting on the other side it usually lots of food and lots of gas. So not much people go up there. (HB3, 23 July 2020)

The polar bears skin is too low now to sell the polar bear hide. That's the point and the point is the Gulf of Boothia is kind of far from our community. (Interpreter translating for HB4, 29 July 2020)

However, some community members prefer to make the trip.

I prefer hunting in the Committee Bay region [Gulf of Boothia] because it's quite a trip and also hunting caribou at the same time and taking my time and that's what my father used to hunt as well, so I think that's one of the reasons why I enjoy hunting more on Committee Bay area. Or the west coast of Melville Peninsula. And also, around Frederik Island and in that area. Normally there's a lot of bears there and I could choose what type of bear that I would want and mostly males, and also there is all kinds of bears around there. (I1, 13 July 2020)

The considerations and risks involved with polar bear hunting shed light on the deep relationships between Inuit and polar bears. Barriers to accessing Gulf of Boothia bears might explain why the quota for the population has rarely been filled (Dyck et al., 2020). However, polar bears continue to play an important role for community members from a cultural, ecological, and economic standpoint. This importance is an incentive to preserve traditions, gather knowledge, and learn how to hunt. Being able to access harvesting also permits younger hunters to learn how to hunt and, through selection, distinguish polar bear characteristics.

4.4. Changes in abundance

Interviewees reported an increase in the polar bear population in the last two decades. This change was noted in comparison to the distant past, when bear encounters were rare and more time and effort were required to pursue them.

When I was a child, polar bears were very scarce in the area. They've been scarce, not too many polar bears are spotted 50, 60, 70 miles around the area. One polar bear may have been spotted maybe [few times], once. Maybe four or five years at a time. Back then that was 1950s, 1960s. But today, there are polar bears being spotted in the area five miles, 10 miles 20 miles, something like that. (Interpreter translating for K3, 19 May 2020)

When I was a kid 'till when I was a teenager, there was almost no bears. We couldn't see one for a whole year. And I do a lot of traveling, I did a lot of traveling with my parents anywhere on the winter and summertime. We didn't get any bears in summertime, fall time, winter when we travelled. Now, you will see them everywhere in the summertime. Summertime, fall time, even near town. And when I was a small,

small kid I could walk around anywhere without a gun and my parents wouldn't even worry about me for the whole day I used to go out hunting. And like, talking [about] hunting, bear hunting. And my parents wouldn't even get worried about me and right now, you cannot even go camping without a dog or something or a tent. You have to have a cabin now if you go about, so many are out going camping...you can't get enough sleep because there will be bears when you're sleeping. There's bears all over right now. (N2, 15 June 2020)

When she was growing up, she didn't really mind about polar bears or be concerned of them. But these days, these early 2020s, right now, polar bears are so many that she is scared for her grandkids now. That's her concern, is that there's too many polar bears now. Because when she was growing up, there was hardly polar bears that you can see, but now there are so many polar bears to be concerned of that because they're just coming to town. (Interpreter translating for N3, 4 July 2020)

The increase in bear numbers can be noticed when they gather during mating season. Hunters are also aware of these changes while traveling on the land over years.

When we travel we see more bears. And nowadays we can see much bears when we are traveling, today we see them everywhere when we are traveling. (HB3, 23 July 2020)

They gather more on the shorelines. And during mating seasons, pretty much in May, April, May, females are out more and so I would say that when it comes to mating season, they gather and once they gather, after that, they hunt and so once the solid ice is gone, they just go on the shore of the beaches, and you know not be solitary anymore and be with other polar bears. I guess that's also, perhaps something to do with the population increase too. (HB5, 27 July 2020)

Interviewees attributed the population increase to harvesting limitations.

Due to the fact of the tags being placed after the tags being placed, that's how we see increasement of polar bears, now, more polar bears now because of the tags being in place. Now we cannot even catch a female polar bear with cubs because of the tags....hardly anyone is catching them nowadays and than in the past. (Interpreter translating for K1, 26 May 2020)

They're like human beings. And in the past, back in the 1960s, the population of Inuit was very low and because of a better health system and also better food and welfare coming in, there's a lot more people. And exactly the same with polar bears. They're now being looked after and they're well looked after. There's not as many in the past, but now there's more. And that could be part of it. And the purpose of the quota system was to bring more bears in. And now we have more bears. (I1, 13 July 2020)

In the old days, they don't have a quota and there is no law in the old days, if they see a polar bear with a cub, they kill it right away and use them for food or dog food, the skin, use it for clothing, and back in the 1970's, we got the quota system, we have a

quota in 1960's or the 70's so we are not allowed to shoot the cubs anymore so we never shot a cub, with a cub before. If we have to we shoot sometime for safety and now, they don't kill them anymore so the population is growing up. (HB1, 23 July 2020)

Interviewees also indicated that bears are aware of how human relationships to them are changing.

The change is that's the bear seems to know that the females with cubs are not to be shot. So, they're coming, they're more coming to town. 'Cause they know they're not supposed to shoot the female and the cubs. But the big one, male one, they don't really come closer to town. The female ones are getting more. (Interpreter translating for N1, 16 June 2020)

These days, there's more female polar bears with the cubs that's going to town because they're just being scared with loud bullets or being scared with guns not being killed. So, I think the females are used to getting to town because they're not getting killed when they go to town. But just being scared, so I think they're used to it now. Because polar bears in Naujaat goes right to our house under the steps. That's how bear is in Naujaat, like they go right under the steps. Or they're just four feet away... her concern is that there's too many females now that are just being shot at, not killed, but being scared with those bullets that just crack bullet. So, they're used to being to town now and then they go, and then about a year later, they come back. With female cubs, with baby cubs. And the polar bears are very hungry when they get to town. (Interpreter translating for N3, 4 July 2020)

More females are being encountered on the land versus male bears.

I seem to notice that there are a whole lot of females, more female than male. (Interpreter translating for K3, 19 May 2020)

I think I see some little bit of changes here on polar bears regarding the genders. I like to say that there's more female polar bears now than male polar bears. That's what I see. (K4, 26 May 2020)

Some interviewees added they can distinguish gender by observing tracks, body shape, and behaviour, as well as taste.

We're not allowed to get bears with small cubs anymore. I see more females; I can tell by the tracks 'cause I can tell by the track now. I don't like calling myself an elder, but I know just by looking at the tracks. I could even tell these boys that's a female and male. Young male, female, so I've seen more female tracks than young male bear so I think there's more female than male these days. (K2, 13 May 2020)

It's really easy to tell when there's a female or a male because of the feet, you know their feet, and the female polar bear has longer neck. (K4, 26 May 2020)

The female polar bears' meat, it's tender than the male polar bears' meat. The meat of the male polar bears'...after you cook the meat, it tends to be stone hard. With the female polar bear, when you boil the meat, it's more tender, and it tastes more better. (K4, 26 May 2020)

Males are more skinnier now, and females I guess they save their energy and the males tend to be more aggressive than females. And that's how we recognize them. (HB5, 27 July 2020)

Interviewees reported seeing more young bears.

There seems to be more younger polar bear than older polar bears in the area...hunters go for more big male bears than the younger bears. But nowadays, people seem to go for the younger polar bear for their meat, for they're tender, like the meat that's from a younger polar bear. (Interpreter translating for K3, 19 May 2020)

Seems like the smaller, younger bears are very many and easy to see. (Interpreter translating for T3, 21 May 2020; Ekaluktutiak et al., 2020)

The younger ones seem to have increased due to the fact that we don't have to hunt them with their mother and so they're leaving their mother even on a very young age, like two years old, when they're supposed to be still with the mother, and I see them more often rather than the adults one. (HB4, 29 July 2020)

Females with more cubs are being observed, as an indicator that the population is increasing.

We always see a sow [female] with three cubs instead of just two or one. These days we see more sow with three cubs...every year...every summer. When I was boating, we see sow with—we see four polar bear, mother with three cubs...it was more than one day and different bears. We saw about 10 bears in one day. And about two of them had three cubs and the others had two...in the late 90s we start seeing them, summertime, every summer when we're boating, we see polar bears down there at the bay. (K2, 13 May 2020)

In summer, I notice there's more mother bears with a family. And more younger, younger bears around. I see quite a bit of a young bears in summertime now. (N2, 15 June 2020)

In my late teens I would see a mother with two cubs mostly. But now, three years ago, I saw mostly, two or three years ago now, I see some with three cubs. Three cubs now. I think that there's more—I never saw a bear with three cubs when I was a teenager. (N2, 15 June 2020)

Interviewees reported polar bears going into meat caches is indicative of a population increase, as this behaviour was rarely observed in the past.

In the summertime, people may have caches in the area like 30, 20 miles out of the community and polar bears will smell that animal buried there and they'll find where it is. That's one of the reasons that polar bears are coming, come near the community area, and other times they might be smelling the garbage dump. That's never often that go into the garbage but once in a while. (Interpreter translating for K3, 19 May 2020)

The way I found out the polar bears are increasing is by like, when we cache the meat every year, and when we go out to go get our meat that our cache we can, in those days, those cached meat would be still there and when we get them. But in recent time, recent years, when we go get our cache meat, they're all been eaten by polar bears because the polar bears are increasing and that's where we find out that there are more polar bears now. (K4, 26 May 2020)

We don't bury, leave the meat, get it after because there are so many polar bears now. So, before that, when we get here, we used to cover with all the rocks and then get it in wintertime. We can't go that way nowadays, Igloolik area, too many polar bears nowadays. (I2, 10 August 2020)

Hunting success was considered an indicator that the population is increasing.

I'm a bear hunter and when I was young, we would be out for more than a week and sometimes we'd go home with no bear. But these days hunters go out, look for bear, and come same day. Hardly anybody ever overnight out there anymore. Only mostly me, when I'm out, I like to be out on the land. (K2, 13 May 2020)

When the quota system opened and people were told that so many bears had to be caught once a year, so many of them, they put a number. And then people would be out hunting, and they would not find any. Keep looking for one until end of the season. I think we've been quite lucky for us to finish all the quotas. Now there's too many that actually comes to the community, which we hardly ever heard of before. We definitely know that there's more bears along the shorelines than ever before. And in the past, there was hardly any. (I1, 13 July 2020)

Interviewees expressed that shared observations among hunters confirm validity.

He can say that the bears are coming more to, closer to town, and we look at the radio so other from this community to different community, he talks with a lot of people. So that's the same thing that they're saying, that we can see bears more, closer to town, and everybody is noticing that there are more populating. (Interpreter translating for N1, 16 June 2020)

Interviewees from all communities were in agreement that numbers of polar bears are increasing. Hunters shared unique observations that they have made over time to make inferences on population trends. These indicators provided insight into Inuit knowledge formation. Interviewees also shared information on polar bear population changes within the

context of impacts to hunting and land use; population changes are inseparable from human relationships.

4.5. Changes in distribution and behaviour

All interviewees reported polar bears are more frequently encountered in and around communities in recent years.

Some years are bad for bears coming into the community, and some years are okay. And she know that, they will come into the community again. Especially the young juvenile bears, the young cubs. They are very plentiful. (Interpreter translating for T4, 21 May 2020)

To my knowledge about polar bears coming into the community, 20 years ago, today, there are more polar bears now coming into the community, maybe because of the scent of seal of the community garbage dump, they might smell some kind of an animal or a carcass around town [I think]. There's more polar bears now coming into the community than before so that's how I see the changes. (Interpreter translating for K5, 26 May 2020)

Bears used to be around the floe edge all the time 'cause that's where there are good seals and hunting area. But now they're more spotting dead animals or unfinished harvest. So, they're used to be more at the floe edge, that was their environment. But now they're everywhere. They're on land near the community. (Interpreter translating for N1, 16 June 2020)

Interviewees were particularly concerned about human safety while camping on the land.

I have concerns about polar bears, especially around time of the year they start to come around closer to the community...specific to people they're very dangerous because they sometimes can destroy or kill a human. (K4, 26 May 2020, Kugaaruk)

If I were to go out camping near town or just out there on the land, currently it's more riskier now to camp inside an igloo or a tent because there is so many polar bears that always migrates from one place to another. To me, right now, I think to be in the camp, it's more appropriate to have a cabin, sleep in a cabin, than a tent or an igloo. Because of the population increasing that dramatically. (Interpreter translating for K5, 26 May 2020)

It changed right now. Even though if I go to caribou hunting, I have to bring my own bag for safety or take some safety stuff for polar bear. Right now, it's very uncomfortable on the tent right now, even though not too far from here. Every year, I don't know how many years, I've been traveling towards the Repulse Bay area to hunt narwhal or polar bear. Every time in the 1980's, 1990's and 2000's, every time I go travelling, polar bears everywhere on the shoreline. They are growing up right now, lots of polar bears right now. (HB1, 23 July 2020)

In the past, dog teams could keep bears away.

There's barely any more dogs, like traditional dog sleds, so that's something that there's no more dog watch for polar bears. And the dumps are so close to the community that polar bears now by dumpsters and that's her reason why she's thinking polar bears are coming to town. (Interpreter translating for N3, 4 July 2020)

Today, polar bears are more aggressive and no longer afraid of human activity.

Our polar bears are not so afraid anymore in the community. There's some kind of an interaction with the environment, the polar bears are not really afraid to come into the community anymore, although there is so much traffic or so much activity happening in the community, when they hear any kind of noise in the community, the polar bears aren't afraid to come to town no more. (Interpreter translating for K5, 26 May 2020)

They used to run away from people when I was a young person. Like walking along and a bear can see you, they run right away. They're scared of people. Now, they're more curious. They see people, they won't, most of them won't run away now. They stick around or try to figure out what you are. And they go to tents and they're not scared of tents anymore. (N2, 15 June 2020)

Polar bears are just as human as they can show off. You know when humans are teenagers, they're active, very active and strong. And they can show or show off their muscles. Inuit, like humans, can do that, right. Polar bears are just like humans when they're young teenage polar bears, their super white, clean fur. The more white fur they have, that aggressive they are. When you see a polar bear, young polar bear going to town. They're just going to be as a young teenager who's showing off. 'I'm scary, I'm tough, I'm good looking. I'm bigger than you, I'm more powerful than you are.' That's how polar bears are when they're as young teenagers. They'll go to town and not be scared but show off everything with all their power. (Interpreter translating for N3, 4 July 2020)

Some interviewees indicated polar bears are more aggressive when there is a higher density of them.

All polar bears vary, some of them are very vicious. Some of them aren't vicious. Some of them are, but yeah some of them are scary...to my knowledge I think they are more vicious now than in the past because of the population of the polar bears are increasing. There is more polar bears that are more. They've become more vicious. (K4, 26 May 2020)

Interviewees cautioned the increase in aggression is due to the lack of respect for bears by humans; interacting with bears without harvesting them is not considered respectful.

Back then before the quotas, people, their rule was, if you're shoot a bear, don't just lose it, leave it, wound it. If you can catch it, kill it there. And before going out hunting,

elders would tell the young ones, don't talk about bears, don't tease them, don't wound them and leave it. And that was their rule, so elders would tell the young ones not to tease anything about bears, so any animal. So, don't make fun of it, don't get it wounded. If you do, kill it here. And there was a lot of use for it. But now, if they would see it, trying to scare off a bear back then, the elders would see that, they'd be so angry about the person that you're just getting angry, that you're trying to anger the bear. Don't do that. Don't throw rocks or don't use bear bangers or things like that. (Interpreter translating for N1, 16 June 2020)

Interviewees described the impacts of bear research on polar bears.

As soon as they started using those tranquilizers, and when they started using the quotas, that's when he started, two years. It's roughly there, in between there, the population for the bears were getting more. (Interpreter translating for N1, 16 June 2020)

They make them go to sleep, that's when they seem to lost their mind. Like Inuit, we used to be good friend, don't steal, things like that, we used to listen to law. Until white guys come around, start drinking booze, start smoking marijuana, we lost our mind. We seem to be so crazy today. That's how the polar bears are too. So well, the quota comes, you are to kill one bear. So, if we see two, we kill the other one, and the other one is mad. They've always not do anything, start breaking cabins, rip the tents. There's so much today. It's so dangerous today. (N1, 16 June 2020)

Interviewees indicated polar bears are learning from and responding to changes in human behaviour towards them. Human-bear relationships are no longer in balance.

Polar bears know that they are protected by something. They know. They are intelligent animals, no matter what animal you are. They, as if, know what people are doing. What guidelines, what policies and procedures, as if they know what's going on with the tagging system. (Interpreter translating for T1, 21 May 2020; Ekaluktutiak et al., 2020)

We have a traditional old belief that polar bear can hear when we talk about them. (I3, 27 July 2020)

Long years ago, polar bear were so afraid to people who were from the community, want the people, want anything, human belonging, like igloos or we don't like too close right now, so I will turn into a different person. In my view, polar bears are polluted. Their brain is no good now. They could come up to you and usually they will smell you because ocean is polluted and filth and poison. What they eat is brain damage them, so it's very much different right now, years ago. Sometimes, few times, when I see polar bears...I always say, 'oh that's a good polar bear'...because nowadays, they see you, they likely to come to you, smell you around, that's different. So, I can say their brain is not same anymore. (I2, 10 August 2020)

Interviewees also indicated individual bears are distinguishable and the same bears tend to come into town.

You can recognize polar bears. The polar bears keep coming back and forth. Once you let them run away, try and scare them, they're going to come back for sure. They will come back. They really come back and there's no other way that they're just going to come back. You have no other choice but to say they're going to come back because there's some meat there. And that's the only way. The only way. You can recognize polar bears as human beings; you can recognize them by their skin colour or they have a scar or how fat they are or how small they are. They are just recognizable. (Interpreter translating for N3, 4 July 2020)

Interviewees indicated the changes in polar bear distribution and behaviour is largely due to changes in how humans perceive, relate to, and interact with polar bears. Relationships with polar bears have shifted from harvest-based ones to research interactions and scare tactics. Increasing aggression and distributions close to communities are a result of polar bears learning from and responding to these shifts.

4.6. Polar bear health

Interviewees reported polar bears over the last 10 years have been generally healthy.

This winter all the bears they caught were very healthy bears they got. Like fatty bears all of them...I never really used to see an unhealthy bear. To tell you the truth, all the bears. (K2, 13 May 2020)

There's not much really changes in the health of polar bears. It's just like us, like a human being, we get sick and [here and there]. But I don't see a lot of, you know, big concerns in this area because they get sick and you know, they get healthy. (K4, 26 May 2020)

You never will ever see an unhealthy polar because all of the polar bears are healthy. The only time they will see an unhealthy polar bear is when they age and they can't do hunting anymore. That's the only polar bear that you would see that would not be healthy or not normal because of their age. Because all polar bears are all healthy and very well hunters. You'll never see an unhealthy polar bear until they're aged like they can't do hunting no more. (Interpreter translating for N3, 4 July 2020)

Sick bears are rarely encountered, and interviewees can distinguish them by their body fat and fur colour.

The only thing I can tell is when a polar bear might be look sick is when the polar bear haven't had anything to consume or to eat or hunt. It's when the polar bears like famine or something like that. That's the only time when he had seen skinny polar bear that looks sick. (K4, 26 May 2020)

The way I can tell when the animal is sick is when the polar bear is really, really doesn't look a natural bear. The fur, it's skin or the fur itself may not look that usual, really

skinny, no fat. You know, that's how I would tell when a polar bear is sick...recently or currently I myself haven't seen the one like so many polar bears like that. (Interpreter translating for K5, 26 May 2020)

Interviewees indicated skinniness reflects poor hunting ability.

Came back to my late grandfather, like some hunters are skilful and lucky, and the others some hunters are not very lucky. He said it's the same thing with bears. The bears that are not very good hunters, they die of starvation, but it's rarely happened, he said, if you know what I'm saying. Those bears are not very good hunter...rarely get skinny polar bear. And I think just when the scientist see something skinny and they say the bears are starving it's not like that. It's been like that for thousands of years here 'cause the bear is not a very good hunter, the polar bear they die of starvation. (K2, 13 May 2020)

Back then when they open up the polar bear hunt for Gulf of Boothia, they used to catch polar bears that are very fat and healthy, but now they're just mostly skinny now, cause they're poorly hunting now, the bears are poorly hunting. (Interpreter translating for N1, 16 June 2020)

Bears that had been previously handled for research are considered unhealthy.

They have a second thought of eating the bear, cooking it and eating it. And the colour of the bear doesn't look as good as another bear that never been tranquilized or doesn't have a lip tattoo. On any given day, they'd rather have a hunt a bear without a lip tattoo or anything. (Interpreter translating for T2, 21 May 2020; Ekaluktutiak et al., 2020)

Most of the ones that were caught were nice and fat and they seem healthy. But the ones that have tattoo and that, they tend to be skinnier. It's usually the older bears that have the tattoo and that, so could be because of age or that. But our elders that passed down were reluctant to have what was studied by scientists. They have tattoos and ear tags and that. And what, if they don't have tags or ear tags, or tattoos or ear tags; they a lot happier and know that they're healthier and they're less reluctant to consume it. (T5, 21 May 2020; Ekaluktutiak et al., 2020)

Polar bears have become drug addicts because once you're tranquilize them they're nice and high and even though you put them away, about 20 miles away, they always come back to the dumpster because get another fix. So, they become drug addicts. And also, with the meat that we consume, there is absolutely no taste and a strange taste to the bear meat. We would throw those away right away because they had been tranquilized. The ones that had been tranquilized had very different taste, quite unique. And even though, I don't know for how many years they have been in their system, they stay in their system for so many years, we don't know. But in the past, we would throw away the meat. The meat is already spoiled. And it's been tranquilized. (I1, 13 July 2020)

One interviewee indicated radio collaring for polar bear research interferes with the bears' ability to hunt.

The ones that have radar collars, they're usually not healthy, very skinny, and under the collar, people who have actually caught bears with collars, we don't take the meat, the meat just behind the head on the neck part where the radio transmitter is. It's usually very rotten and spoiled. Doesn't smell good. (I1, 13 July 2020)

Aggressive bears that enter communities were considered atypical and unhealthy to eat.

He knows the meat is really different today. He think it's mostly from the fast food or [all the] food [that] we're eating from the dumps and stuff like that. The quality of the meat is more different from a long time ago. And he knows like some meat are still good, a lot of polar bears are still good. But he notice some of them, they're not as good as they used to be. (Interpreter translating for T1, 21 May 2020; Ekaluktutiak et al., 2020)

When you have polar bear is aggressive more, it doesn't taste as much good, but when you spot a bear and it's not running away. And if you should shoot it there and kill it. That's when it tastes better. He notice, I mean, he can tell the bear hasn't been running, that's when it tastes better. If it's been running away and you have to chase it for a while, it doesn't taste too good. (Interpreter translating for N1, 16 June 2020)

While interviewees described indicators of poor health, they emphasized that polar bears are generally healthy. Unhealthy polar bears are rarely encountered. When they are observed, poor health is attributed to poor hunting or human handling for research.

4.7. Disturbances to polar bears

Interviewees reported pollution and noises (helicopters, snowmobiles, shipping traffic, and seismic testing) are the main disturbances to polar bears.

Mostly people will disturb polar bears. And aircraft, helicopters. Helicopters will disturb the polar bear during the February season, hunters will disturb the polar bear...the sounds of the snowmobile and sound of the helicopter. (Interpreter translating for K3, 19 May 2020)

The ships or vessels using the passage of the sea ice and how polar bears could be affected by some kind of a traffic through vessels are going through the sea ice. (Interpreter translating for K1, 26 May 2020)

Probably main thing is the transportation. They are very aware of the sounds they're surrounded with I guess; I would say it's more of the transportational sounds or any human presence. (HB2, 23 July 2020)

Interviewees indicated these disturbances make bears more aggressive toward humans.

They become more vicious because of there's traffic, vessels, air crafts flying over. Because so many traffics around these areas know where there's polar bears and [when they're] being interrupted with this kind of traffic [they have] become more vicious. And that's how I understand them. (Interpreter translating for K1, 26 May 2020)

Interviewees described changes in sea ice formation, thickness and consistency.

Like in my younger years, I don't hear elders talking about the changing or the condition of the weather, you know, the condition of the sea ice. I haven't heard people talking about that very much, back then. But there was a few of them that already knew what will be happening in the future. And up to today that forecast has happened and it's already happened. And I don't know how elders would know the future of the world coming. (Interpreter translating for K3, 19 May 2020)

I've noticed big time throughout my entire life that back then when the snow was melting, we used to get a lot of water on the ice. But nowadays snow melted just like that and it's supposed to get solid, but it just floats up and then starts to disappear. And it's a lot thinner nowadays. (Interpreter translating for HB4, 29 July 2020)

I know Repulse Bay every year. So, there was ice floe edge, it's been down about 30 miles from here when I was young guy, and it used to be like every year about 30 miles everywhere...now it's about 15 miles, about half of the Repulse Bay, only 15 miles every year now. So, it's less sea ice. I think it's less sea ice now. But on the fast ice. (N2, 15 June 2020)

Interviewees indicated these changes contribute to increasing bear encounters, as polar bears are more frequently gathering along shorelines.

The ice moves away a lot sooner and they usually end up on the lands. And they just following the shorelines to look for food. I think that's why we encounter them more. (HB2, 23 July 2020)

The solid ice is disappearing easier sooner than we anticipate. And, you know, by the time they're hunting seal pups, the solid ice is disappearing, and I think that is also a factor too. (HB5, 27 July 2020)

Interviewees felt these changes are very unlikely to impact population sizes.

With the ice changing and all that, I don't see any big changes to polar bears, you know, information 'cause they move from, they migrate and they move from, they can swim, they can be on the ice and they can be on the land. With the ice being a factor, the ice condition, it is what it is but I wouldn't really see any changes on how polar bears could be affected by the condition of the icing. (K4, 26 May 2020)

Polar bears would never be affected by the climate or no matter how the weather is changing, the universe is different. Polar bears will never be affected by the weather

or no nothing. Because they can walk through a really thin, thin ice, they can be on the water for a long time. I don't think polar bears climate will never ever be affected with this weather. They're very wise and smart...white people are concerned that the ice is thinning, there is little thin ice now and polar bears can't survive in the ice, weather, because there is no more ice. She wants the white people to know that even if the ice is melting, the polar bears can survive in the ocean where there's water. And she's saying polar bears are super, super smart...they are good at everything. (Interpreter translating for N3, 4 July 2020)

Interviewees disagreed with reports on bears being impacted by changing sea ice; polar bears can hunt in open water for long periods of time.

There seem to be a lot of concern about polar bears declining or being endangered or a risk of bears declining due to ice being thinner and that. Climate change is a big talk, and it's concerning some people, that talk about polar bears from the south. But polar bears are like sea mammals. They can swim for miles. They can catch seals. In the water even, even when there's no ice. There was a polar bear survey, and it wasn't talked about but one of the guys that was the helper was on the chopper or the plane, and they saw a bear right in the middle of the ocean between that area where Igloodik is and Gulf of Boothia. They saw a bear right in the middle of the ocean, holding a seal and eating it, like no ice close by to be seen. And some biologists and scientists think because there's no more ice, they'll have hard time harvesting seals, that's not so. Because seals do sleep in the water while they're floating, and they sleep. Anybody can walk up or go right close to a seal by boat while the seal is sleeping, floating, and same thing with the bear can catch up to, I mean [get] the seal while the seal is still sleeping in the water, it's floating, sleeping. So, some people don't know about that. They think that polar bear needs ice in order to catch a seal. They catch seal even if there's no ice to be seen for miles and miles. They're predators. They know what to do. (T5, 21 May 2020)

When there's no ice I've seen bears, some bears [food] like seals on the shore. Eating seals on the shore that I'm pretty sure they caught, because there is no hunters around [miles] from here. And bears eating seals on pack ice. So, I don't know, what I'm thinking is even if the ice is gone, they'll be hunting on the shore for seals. Catching them in open water...on the shore we saw bears with freshly caught seals and baby seals in the summertime, when there is no ice and somebody said they saw a bear hunting a caribou on the island, that they caught up to and ate. And also, I seen them with beluga whales, I'm pretty sure they caught on an island, too, and I've seen them eating seals and bearded seals on the ice too, summertime. (N2, 15 June 2020)

Believe it or not, in the Foxe Basin or Gulf of Boothia, the polar bear stay on the water for a month. They can stay on the water for a month, maybe two months. We got somewhere of August 'til, I mean of open water August 'til July, 'til October, late October, there's the freezing of the water, November. Right now, it's coming late and freezing water. So, they can stay on the water for two or three months without go in the land. (HB1, 23 July 2020)

Interviewees emphasized polar bears are persistent; they are intelligent animals and can respond to environmental and human impacts.

They always said if the arctic doesn't, when the ice was melted, the polar bears are going to be died. I don't agree with them. I know the polar bears, they hunt even though if there is no ice, they always go hunting. They can swim, any kind of weather. (HB1, 23 July 2020)

You would never ever decrease polar bears because they're very, very, very, very smart. And very independent, they're very wise. That's going to swim miles and miles and miles, and the elderly people always will say, or our culture, or our ancestors say that the polar bears are very wise, very smart. They can swim days after days on the ocean. They can dive under the water. They can live in the sea. And you still going to see polar bears that's gonna survive the hardest weather that you can imagine. So, she's saying that you'll never, ever see polar bears decrease. It's been like that since our ancestors as though they say polar bears have the power over anything. So yeah, you can't beat, or you can't decrease polar bears. No way. (Interpreter translating for N3, 4 July 2020)

Interviewees were not concerned about population declines. When asked about disturbances, transportation vehicles were considered threats, but only through impacts to presence/absence in an area or how polar bears behave toward humans.

4.8. Comparisons with scientific research

Community members shared their knowledge of polar bear behaviour and ecology. This information is important not only for hunting success, but also for safety and maintaining balanced human-bear relationships. Community members described the importance of polar bear hunting and how it has changed over time, as well as the challenges hunters must face today to achieve access to hunting and traditional practices. These contexts shed light on the impacts of harvest regulations on community members.

Community members indicated polar bears travel across management boundaries, which has been suggested through scientific research (Paetkau et al., 1999; Thiemann et al., 2008; Dyck et al., 2020). Community members also reported an increase in abundance, evidenced through unique indicators of population change. These observations are consistent with the recent scientific survey that reported Gulf of Boothia population as stable (Dyck et al., 2020). Increasing bear numbers was largely attributed to harvesting limitations, which has also contributed to more frequent bear encounters and aggression. Community members also reported increasing proportions of females and young bears, as well as encounters with larger family sizes due to harvest regulations; these observations are supported by empirical

reports of high reproductive indices for the population (Dyck et al., 2020) and scientific predictions under sex-selective harvesting (McLoughlin et al., 2005; Taylor et al., 2008).

Community members considered polar bears healthy (in agreement with [Dyck et al., 2020]) and described threats as impacts to distribution and behaviour. Community members also reported sea ice changes that are consistent with empirical data (Barber & Iacozza, 2004; Stern & Laidre, 2016; Environment and Climate Change Canada, 2018; Dyck et al., 2020). Community members indicated sea ice changes have contributed to increasing bear numbers and encounters. Although the long-term impacts of climate change and reduced sea ice on Gulf of Boothia polar bears cannot be predicted with certainty (Dyck et al., 2020), community members emphasized the unlikelihood that populations would decline as a result. Community members cautioned polar bears are intelligent and adaptable animals and perceive changes to populations and behaviours as a result of how humans relate to them. In addition, communities voiced their concerns, considerations and recommendations for polar bear management and research, summarized below.

4.9. Management considerations

Harvest limitations have shifted how polar bears are valued (appreciated) by community members. Management decisions impact human relationships to polar bears.

In those days before the politics and regulations were placed in, the polar bears were so very important to us and but after the policy, the regulations, like to catch a polar bear, it requires tags now. In those days they were so more important, although right now they're important, but with the policy the regulation placed in I like to think it was that they're not more important as much as before. Because of the tags. (Interpreter translating for K1, 26 May 2020)

Even without harvest limitations, Inuit historically practiced their own traditional forms of management; animals should not suffer, nor should they be overharvested; meat is shared and not to be wasted.

Traditionally speaking, custom law about harvesting animals, our traditional speaking of custom that we have is, if you were to try to kill an animal and if you injure or shoot at an animal and you just injured it without killing it, there was a policy, Inuit law that we have. We have to make sure that we Inuit destroy the animal effectively. Make sure it's not going to suffer. You don't just shoot, or you don't just shoot at an animal, putting a wound, people just shooting it. If you wound an animal, no matter what we're doing, don't let it suffer. We have to kill that animal. That's kind of a system that we have. (Interpreter translating for K5, 26 May 2020)

When you catch an animal and of course we open the meat, we treat the meat, but we try not to also overharvest animals because we don't want to waste all that meat. So, we have indications as well to hunt for food. Of course, he said earlier too as well that we have to feed dogs and feed the family members. But we try not to overharvest as well. That was another custom law that he would add. (Interpreter translating for K5, 26 May 2020)

I hate wasting you know, I don't like to waste what I caught, so after my both parents deceased pretty much, what, five years ago, I said to myself, I'm not going to hunt big games like polar bears due to you know, the meat will be just wasted nowadays. (HB5, 27 July 2020)

Harvest quotas should be increased to reflect increasing bear numbers and encounters.

More quotas will also support hunters who rely on hunting as a source of income.

We need more quotas. I always need more quotas so if we get more quotas for Gulf of Boothia, it's alright because the sport hunters, they got lots of money and today only one sport hunter comes to Hall Beach. They gave us more money than if I go hunting a polar bear down to Gulf of Boothia, if I get one, I lost quite a bit of money for hunting. I know I'm not gonna get my money back for that polar bear. So, if we have one polar bear sport hunter, they pay a guide 3000, or if two guides \$6000. And the dog team owner only gets more, and the big business probably get more money. So, it's a lot of money for the polar bear sport hunting. We need more quota for sport hunters. (HB1, 23 July 2020)

My thought is we need more polar bear tags so there can be less polar bears...whoever out camping they get disturbance by polar bear more. (HB3, 23 July 2020)

I would like to see the number of tags we are given, I would like to see included being allowed to catch a few more each year to control the population a little bit more. There are way more polar bears than when I was young. (I3, 27 July 2020)

Some hunters expressed a desire to hunt male and female polar bears throughout the year, for safety reasons and their own preferences.

When the polar bear hunting season opens, and when it closes in the month of May, and after all polar bear tags are used up, and then there's no more tags, more polar bears come close by community or comes right into the community. And they come into the community at the wrong timing because polar bear hunting season is closed, no more tags and when polar bears are always vicious in the community nearby...polar bears don't have borders and they you know, they come near town, or they come right into town and when they come into town and when there's no tags placed anymore it would be nice to [get] that polar bear be destroyed because they're vicious, they're vicious animals when they come into town. That's the only area that I like to see improved. (Interpreter translating for K1, 26 May 2020)

If they would open up the hunt, polar bear hunt season sooner before they start hibernating. November, December is when they start hibernating. And it would be a lot more fair if any bear that comes close to town that they can shoot the bear, even if it's a female. Male or female. Any bear that comes close to town. It'd be better if they can be able to hunt. (Interpreter translating for N1, 16 June 2020)

I would like to see us being able to hunt them the whole year. At some point while I'm still alive, I would like to see that, not have particular dates. Our elders tell us that they taste good in fall, like late August, September. But we are only hunting that one date, polar bear hunting March, April, especially the male. Not so much the female but the male bears. (I3, 27 July 2020)

Hunters stressed that certain polar bears are aware of whether or not harvesting is a threat. Traditionally, bear characteristics were selected for during harvest as a form of population control. Current regulations do not take this practice into account.

Once in a while when they get into town, even if they have cubs, even when they keep them in my town, they always destroy them right away. That's why there's hardly any threats here in Kugaaruk. 'Cause I know in the late 90s, my late uncle used to get mauled by a bear so after that, not very often but when they do come in town, we just destroy them, hunters destroy them and get tags for them. (K2, 13 May 2020)

You are to kill that many males and that many females. That's really that's female, and more males to be killed. So, these big males don't bother much coming into town or wrecking things, are the ones that we are killing. (Interpreter translating for N1, 16 June 2020)

They just go to town because they've done it before, so they're just used to it now. And males are killed, and they don't go to town. So only females and mother cubs go to town or communities. (Interpreter translating for N3, 4 July 2020)

Community members were concerned that management focuses too much on polar bear protection and not enough on human safety and livelihood.

I have been to my cabin, they break in, break things, wreck the camps and all that. I've talked to HTO, they'll talk to wildlife somewhere, but nobody never paid for all those wrecked things...seems like it's okay for a person if they wreck my boat, or sometimes when you break down and you have to leave your boat behind, they get at it. Your tent, not by accident, you have to leave it. They wrecked it. Then you have to buy another tent...the government maybe cares about the polar bear that want to have more polar bears. Not to kill the polar bears, don't seem to care about people. You know, kill the person. Eat the person, it's okay. It seems like they're doing that...I'm not too happy about the law and the polar bears. Since the government put up a law and they can't do nothing about them breaking things. All they care about is not shooting them or trying to scare them away. These polar bears that have been scared away are so mad. So, we have lots of polar bears that are so mad. Make them go to sleep. Trying to

scare them away. Banging them, or tricks like that, it seems like we're trying to get them more mad, so they are so mad today. (N1, 16 June 2020)

Community members disagreed with species at risk listings.

They say polar bears are some kind of endangered species, but I do not. I would say, again, I disagree on that. If they need the proper information, they just tell them to come experience in the community and see it for yourself. That's the only concern that I have, I mean, I would say they're not on endangered species list. (HB5, 27 July 2020)

Narratives concerning polar bears and the management decisions they influence need to take into account and include Inuit knowledge and wisdom gleaned from experience. Inuit should play a larger role in managing the resources they have interacted with for millenia.

The Inuit *Qaujimajatuqangit* knowledge that they've left, that their wisdom from the elders, and like I mentioned, that I grew up within elders. And so, my father used to say that even though scientists say that in the future they might say that polar bears will be endangered due to the fact for climate change, pollutions, and multi-year ice are disappearing. But there are also multiyear ice that aren't pretty much seen. And that's where the polar bears are also not counted too. And so that is also I would say, an unknown factor by the scientists. That elders have knowledge, even though they say that multi-year ice is disappearing, polar bears are very adaptable animals and so my father used to say that they're just like humans. But they walk on their four feet and we walk on with our two feet and they're pretty much like humans and they adapt very fast and so they know the currents they know their environment very well. And so, my father used to say, well, I guess there's a word that when it comes to something, don't just jump into a conclusion or what not. So that's what I'm sticking by with my old man's old words. These are the traditions that were let on and passed on to me and to you, the younger generation. (HB5, 27 July 2020)

Looking at the law control by Inuit people, not from Ottawa, not from government. I think we should control more by the people who hunt, hunting people. But right now, it would be very difficult because the...system is too high, Inuit don't really like that, what white man is doing, just because it's white man it is true, but some of us Eskimo people, really some of them Inuit nowadays thinking we should control more animals than before, because we got rot bananas and apples from the store and can't get bears. Before that we didn't have anything, only we were given animals, so Eskimo, Inuit people, still trying to fight the law. I think it was fighting the white people most of the time, in my what I hear when I listen...before that, it was very different, the law, Inuit law, Inuit control, they were very different. Properly they were doing it, proper more than we doing right now. Without control by Ottawa, from Ottawa. So, if animal needs to control, I think those hunting, Inuit hunters should be running more. Inuit to Inuit, Eskimo to Eskimo. (I2, 10 August 2020)

Polar bear research should include IQ and Inuit participation. For example, surveys could be guided by Inuit knowledge of when and where bears are likely to be detected to reflect more accurate counts.

Up on the Gulf of Boothia area he have noticed that when the sea ice, the solid ice, when it's disappearing, when it disappeared in the summertime polar bear swim more often. And by the time they're on the shoreline, I guess when their feet are cold, that's the time when they go on the shoreline and he have seen more polar bears on the shoreline, due to the fact that the solid ice has disappearing faster than expected. So, he'd like to probably make a recommendation that sea ice is disappearing fast, polar bears are on the shoreline more. And so, if there is any polar bear counting at this time of the year, whoever is dealing with counting to take off on the shoreline and take it from there. (Interpreter translating for HB4, 29 July 2020)

Community members criticized past surveys for not including local people and affecting meat quality and bear behaviour. This has contributed to a lack of trust in scientific methods and resulting management decisions.

When biologists are in town, and you know, when they're counting the polar bears. They're not really hiring local peoples where locations are. You know, all these, all these knowledge are not associated with the communities since they know, they experience the land and the oceans and the sea ice where they are. Not just elders, but I have grown up in elders. And so, I pretty much know where the good hunting areas are thanks to my late father that I've been given this knowledge. And so, these can be, you know, worked on due to the fact that when they're tranquilize a polar bear it stays in the meat for quite a while. And so that was the concern that was given to me, and the meat becomes different. It becomes soft, all the way to the blubber. And so that was also a concern that they're not getting any fatter. Their population is decreasing. But there's community, more community sightings. And these are the only polar bears coming to town are the same polar bears. And so, the older polar bears are more, I would say, decreasing and young ones are more in the communities. And that's a concern to me nowadays too. Due to that the scientists say the ice is shrinking every year. And so that is also a concern to other hunters, elders. So, if they say they're endangered species I would disagree on that. They're not. The way Inuit culture it's not really familiarized by southerners. (HB5, 27 July 2020)

When it comes to polar bear, I have not seen anyone going up to the helicopter. I mean, perhaps they have hired some kind of wildlife monitor, but I have not seen anyone who has that knowledge of polar bear migration routes, polar bear hunting areas and polar bear harvesting areas. All these matters are have to come in play when it comes to community, knowledgeable people. (H5, 27 July 2020, Hall Beach 2020)

All those polar bears that researchers trying to figure out the weight, the height, the length, but they shoot it with the little needle, those are the main polar bears...they don't get scared at all to anything when the researchers shoot with that needle. (Interpreter translating for HB4, 29 July 2020)

Interviewees were concerned about losing access to hunting and with it, their traditional hunting practices.

There is more people going out and they're not as observant as they were in the past. Because in the past, during my father's time, they were actually living off the land and observing, knowing the behaviour of animals, especially the polar bears. And the dogs were trained to look after them from bears and this is not a reality any longer. Since we have motorized vehicles like boats, snowmobiles, four wheelers, hunt with them and it's now totally different. And it is now harder for us to teach the younger generation how to observe animals, especially bears. The movement of animals and to show respect to the animals. There have been quite a few unnecessary kills of animals because of a lack of knowledge. And these knowledges have hardly been recorded...it is important for individuals to actually learn the behaviours of animals once they go out on the land. A lot of the hunters are complaining like myself, for instance, it's cost too much money now to go on a caribou hunt or a bear hunt. It's not worth it. So, a lot of these things are—we're in the transition period where a lot of these are disappearing and dying off. (I1, 13 July 2020)

Management decisions need to take into account the ecological *and* cultural relationships between Inuit and polar bears, which include hunting and land use practices. For Inuit, polar bears are viewed as intelligent, adaptable, and responsive beings. These considerations may shape how community members share information and/or approach management.

If we speak of polar bears, we have to speak respectful of them, even though they cannot hear us, we're not with any polar bears anywhere. It's as if they know what we are saying, what we're talking about. We cannot say hopefully a polar bear can come so we can hunt a bear, they know their well-being, they're as if they know true spirit that what we are saying. (Interpreter translating for T4, 21 May 2020; Ekaluktutiak et al., 2020)

The animals in Nunavut or our land are going to be wrecked or ruined by the government if we get so much rules from the government and we try and follow them. That's not how we used to deal with it, because the elders know how goes it is. If the government gets too much rules, the animals and the land are going to get ruined. (Interpreter translating for N3, 4 July 2020)

We have to be scared of any animal that we are around. That's a big, big belief. Often, we would never make fun of any animal, and how much respect we have for each animal and so much for the bears, how powerful they are. We will never make fun of them and never ask to see one. Because we have a big superstition that if we do ask to see one, we might come across one when we are not in a safe situation. There's a few men I know that have been attacked and are still alive telling us that they are very, very powerful animals. We fear them all the time. There's big respect for them. (I3, 27 July 2020)

Still, some interviewees praised co-management efforts and decisions.

The HTO and in the Environmental Department are doing a great job in doing the polar bear population. Maintaining the proper bear population in Nunavut. (Interpreter translating for K3, 19 May 2020)

Having this tagging system as well as policies, procedures, laws in place. They are there for a reason. Management, no matter what it may be, in life, we have to abide by the rules. Because if there weren't...you know, things can deteriorate right away if they [weren't] in place. (Interpreter translating for T3, 21 May 2020; Ekaluktutiak et al., 2020)

The numbers of tags for males and females are kind of consistent now, so he likes that area. (Interpreter translating for K5, 26 May 2020)

The concerns and considerations that community members expressed suggest Inuit engagement and involvement in polar bear research and decision-making processes have been inadequate. The cultural and traditional interactions between Inuit and animals need to be recognized and considered in management objectives. Management decisions impact polar bear populations, and—through their relationships with them—Inuit livelihood. These relationships can also guide scientific methodologies toward approaches that are respectful, yet effective in data collection. In addition, IQ can include unique indicators of population changes that could inform scientific models. A deeper appreciation and understanding of IQ through relationship-building and improved communication strategies with communities can also support collaborative knowledge co-production. Community engagement in this process should be guided and led by Inuit and their knowledge.

5. Summary

This study provided a rare opportunity for community members to share their knowledge and voice their concerns on the Gulf of Boothia polar bear subpopulation. Inuit have coexisted with polar bears for millennia; the knowledge that they have gathered across generations includes important information on polar bear ecology, which is important for human survival, as well as hunting success. Hunting practices traditionally included methods of selecting for bear characteristics and forms of population management; these practices have shifted over time as a result of contemporary forms of management in Nunavut. Community members reported increasing population numbers and encounters, which are a safety concern. Current harvest regulations fail to take these changes into account. Community members also criticized management and scientific practices for not including Inuit knowledge and perspectives, including important human-bear relationships, which has impacted how polar bears respond and interact with communities. However, the observations of population changes and activity reported here are consistent with scientific data. Better engagement and communications with communities within the context of bear research and management will cultivate more trusting relationships toward collaborative management.

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Appendices

Appendix 1. Additional quotations

Importance of polar bears

Their foots, they're the best—one of best source of meat for the people and some people they use them for their wind pants and they're very useful for the people, and mitts. (K2, 13 May)

Around April perhaps they have good hair. The hair is thick, and it's a good quality for selling. Seems like that's when, is good time. Even though fall is a good time, but their hair is not as thick. (Interpreter translating for T4, 21 May; Ekaluktutiak et al., 2020)

They're important 'cause they're our regular diet. And [Inuit] of course, we have polar bear meat, we pray for them when the season's over to have that dietary. They're important to us too, they're part of our diet, so, regular diet, annually it's, we do pray for them...we also make the hide into our clothing as well so it's quite important to our community [and the people]. (T5, 21 May; Ekaluktutiak et al., 2020)

Some elders prefer to catch younger ones because they're more tender, smaller bears. Some people prefer possibly more people prefer the large male bears. Of course, it's hard to find work up here and they do have some price in them, to sell them. (T5, 21 May; Ekaluktutiak et al., 2020)

At this time today, it's pretty hard to sell a polar bear hide...we are not allowed to sell any hides anymore to the States. And to certain areas like the parts of the world, so that's why it's a lot harder to sell the hides. And if that, you know, if you can't sell the hides to the States, even the auction where we send it first down, they don't even be bought anymore. I sent a hide two years ago I have not seen nothing yet 'cause it hasn't been bought yet. (T5, 21 May; Ekaluktutiak et al., 2020)

Many years ago, they used the fur, the hide for clothing as well as the meat for food. It is very important for our way of life and even for today, we still enjoy the meat. We share the meat as well as the hide. We still use it for clothing today. And we can also sell the polar bear hide and make money off of the polar bear hide to sell. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

Today, polar bears are very useful to the people. The meat, of course, that we don't waste. We take the meat and with the hide today, we have to survive, you know, financially. And so therefore we sell the hide to be financed. And that's how we deal with, that's how we know about polar bears. (Interpreter translating for K1, 26 May)

The best time of the year to go out for harvesting for polar bears is probably about October or November...because of the meat...the meat is more tender. (Interpreter translating for K5, 26 May)

Before I hunted bears, they weren't too important because for any person, there wasn't much bears around. We didn't see them anywhere, sometimes for a whole year. And somebody caught one or that one time, my father caught one. The meat was eaten if it was fat, if it was skinny, you just use it for dog food. (N2, 15 June)

There's a lot of ways, use for polar bear. Let's say I catch a polar bear, if that bear is fat, the whole community wants. They share it to the whole community, and the hide, since it doesn't cost a lot much more, they use it for clothing now. I mean, they've been using it for clothing, but since it doesn't cost a lot to bring it now, they also use it for clothing. (Interpreter translating for N1, 16 June)

It's to maintain traditional ways. Store bought food, that is pretty expensive, and it can last longer than the store-bought items and it is shared with the community and provides a little bit of income for their pelt. So, I see those two that's an important part of the community. (HB2, 23 July)

I was taught to hunt smaller bears. That's what I want, for bear are taking food and each year it's in the skin and some men prefer to hunt bigger bears to sell their hide for a higher price. (I3, 27 July)

Description of hunting

A lot of young people are very interested in harvesting polar bear. Whenever they get a chance. Or whenever their dad would allow that person to harvesting polar bear, depends on their dad or parents for the young person to go after the polar bear. (Interpreter translating for K3, 19 May)

March, April, that's one of the good times too but on the first day of opening day, October or November, it's more people like to go out. (N2, 15 June 2020, Naujaat)

Going up to Gulf of Boothia is further. But going down to Foxe Basin is not that far from here. (Interpreter translating for N1, 16 June)

Gulf of Boothia, the trail is not the best going one up there. So, they usually don't go there until the trail is much better. But when it opens up in Foxe Basin, that's when they finish all the tags right away. (Interpreter translating for N1, 16 June)

The best part for the polar bear skins are November and September. But the government gave us by-law to follow, so we just follow the by-laws of HTO or the government policy. What they gave us for quota. So, they're good all year round. They're a good. It doesn't matter what date they are, just the furs are the best on September and November. (Interpreter translating for N3, 4 July)

Sometimes I go caribou hunting and I've been in the rangers for a long time now. We have to check the unmanned radar site in the Gulf of Boothia area, so we've been traveling a lot to Gulf of Boothia. (HB1, 23 July)

All day. We start driving in the morning and we get there at 9. By skidoo. Yeah, first time when I went up there but that was dog team, so we took four days to get up there by dog team. (HB3, 23 July)

We have to travel to the other side of another peninsula. It's about, if you take your time, it's about six-hour ride. But if you pretty much all by yourself, it's a four-hour trip pretty much nonstop. And so, and it's quite far, but you've got to know the routes from here...to the coast of Gulf of Boothia. You've got to know the route and it's quite a distance. (HB5, 27 July)

Changes in abundance and impacts of harvest regulations

There's more polar bears after we start that tag thing, what what how you say it and we're and we're not allowed to catch too many bears I mean, after we start that tag system we get more bears now. (K2, 13 May)

Right back in the 70s, when polar bears are very scarce. The government made bylaw or a policy that hunting polar bear, [that] we can only solely by tag using a [death] tag for polar bears. That's what raised the population of polar bears...after the people started using tags, polar bear tags for hunting, the polar bear population increased. And I have so far, I have not seen any decrease after people started using tags to hunt polar bear. (Interpreter translating for K3, 19 May)

They're go out perhaps within the few hours. Getting a hold of a tag and taking off within a few hours there, they harvest their polar bears, if not, the next day. Due to the fact that the numbers of polar bears are so many now. They're so protected, you're unable to hunt the cubs or anything like that. And you're only to harvest so many a year. And that is the reason why he knows for a fact that there's many, many bears today. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

Today there are too many bears. Especially in the summertime camping out, boating, when you're camping or at your outpost camp [they are] guaranteed for a bear to come into your camp. Because they are too plentiful and we Inuit like to do our hunting and we cache our meat we bury it. We ferment it. And you're guaranteed if you try and pick it up in the fall time in the winter, it's gone. You're guaranteed you'll lose that fermented or buried seal that they're trying to save for the winter. It will never be there. The bears will get to it regardless. No matter where we cache our meat. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

They're would be in areas where there was polar bears, like there was polar bears, but they're not as plenty as now. They used to use dog team, once in a while they see the bear out in the outpost camp or out on the sea and they'd get a polar bear every so often. But it seems like there is a lot more polar bears within the last years, like starting around '90s up to today, even though we have snowmobiles. Seems like they're easier to see. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

Before the white people came around, before the tagging system, they were able to harvest whatever they want. Anything that you see, even the cubs because they're

very good eating like a delicacy. As now, starting sometime in the 70s, you get the tagging system and you're not allowed to hunt any of the cubs. And he knows for a fact that is how they know that there's a lot of polar bears now. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

If I'm not going to choose what kind of polar bear I'm going to catch, I could catch a polar bear in the same day and come back home. (Interpreter translating for K1, 26 May)

After, you know, the NWMB or the GN put the policies and regulations on polar bears about, you know, total harvest of the year for polar bears. After they put policies on...didn't want us catching more females. So therefore, [there are] actually there are more females now. Because, you know, of the regulations and policies that we have to follow and the policies that we have now is that not to catch so much females than in the past and that's why I see more female now. (K4, 26 May)

Reason why I think they're increasing is because much more harvesters hunting for polar bears no more, and some polar bears they migrate from one location to another. And you know that's that's how I see the increasement of polar bears. Because you know not much in the year hardly any people capturing polar bears now than back in the day. (K4, 26 May)

The way I see this of concerning increasing the polar bear numbers, is by after the polar bear tags were placed in. And the tags are telling harvester to catch only limited of female polar bears and so much of male polar bears I believe, following those tag numbers because of those tag numbers or tags the polar bears are increasingly more now, because there are polar bear tags and, the government and they're saying that we only, we're only allowed to harvest only so much number female polar bear. And so some, maybe all the female polar bears would have cubs, and even in those days female polar bear has cubs, they still won't to catch it in those days but today with the policies changing, that's how I see the numbers increasing polar bears. (Interpreter translating for K5, 26 May)

As of today, someone can go out polar bear hunting and come back with a polar bear in the same day. (Interpreter translating for K5, 26 May)

In the past 20 years they feel like looking for a bear for a week, sometimes come back without a bear. But now once you go out, you can see a bear right away. (Interpreter translating for N1, 16 June)

I was born in 1952. Right there there was no law, Inuit ways. Any bear they see, or any game that they see, if they needed, they'd kill it. If it's even polar bears, even when they have a cubs they shoot them anyways. They can use the cubs for something. And they say little cubs are more, taste more better than the full grown. So that's what they were hunting, any bear. If there were three bears, you see, you hunt them all. But when they put up the 'you're not allowed to shoot', 'shoot the mother with a cub'. We listen, that's when it start, when the bears start coming. Well, getting more. And they put up a quota, that's when it start raising up. (N1, 16 June)

In the Boothia peninsula I used to go out polar bear hunting and you wouldn't see polar bears at all. (GH2, 17 June)

Early 1960's there was no polar bear in the Gulf of Boothia and Foxe Basin, but in the Gulf of Boothia not too many polar bears in that time, my uncle and my uncle's hunting buddy, my uncle was pass away a long time ago, so they went for polar bear hunting by dog team. But there was no polar bear. I mean there is some, not very many. They ran out of food and they ran out of dog food. They finally went to open area, to open water, that floe edge. There under a really rough time to go down there, they have to walk to the floe edge so they shot a seal that, before maybe three days or maybe two days because they have two dog teams. On the way home, believe it or not, still down in Gulf of Boothia they saw a polar bear with a cub...they shot that with a cub and in that time there was not much of polar bears. Today it's a big difference. Last year around, I took a sport hunter, polar bear hunter I took last year. The tracks everywhere, everywhere and new ones and old ones, right now you cannot believe it's lots of polar bears. And my friend went polar bear hunting last April he said polar bears everywhere, he said lots of polar bears this year. (HB1, 23 July)

I grew up with elderly people and that like to go camping during summertime. We never see any encounter of polar bear while you are out camping, caribou hunting grounds. You never encountered any polar bears. But over the years, over the last 15 years or so we've been encountering more bears on the land, having to deal with them more. (HB2, 23 July)

When I was young, there used to be hardly any polar bears. And now today you can see them everywhere...because in the old days they didn't have a tag, polar bear tag. So they would just get them whenever they see them. Today, we only can hunt them with the tags. Unless they are a threat. (HB3, 23 July)

When we are hunting them up in Gulf of Boothia, we are seeing a lot of mother with cubs, but I don't think it's that much different than when I was younger, there are just everywhere, mother with cubs. Adults we see them both, male or mother with cubs. (I3, 27 July)

Changes in distribution and behaviour

Today, there are more polar bears near, you know, coming into town more every year. To me they seem to be more vicious now because they're not afraid to go right into the community or come by the community. That's how I see the big changes. (Interpreter translating for K1, 26 May)

The only time that we notice that when we get polar bears nearby or going to town is ['cause they're] especially around the fall season, especially around September, October, November. (Interpreter translating for K1, 26 May)

They're concern about their getting too many out there, is that they start attacking. Like they're getting too many. The population is for polar bears, is getting too much so that's,

they start attacking. I mean, they're more aggressive. (Interpreter translating for N1, 16 June)

In the old days they shoot a polar bear they have to be very careful taking care to get the polar bear. If the polar bear notice that there's a man or a human, the polar bears right away they go get away and they don't go to community or a campsite or something like that. Right now, it's different they don't scare much anymore. (HB1, 23 July)

The only difference from many years up to today. Seems like they're more aggressive towards humans. Many years ago, they, as if like see people they would run away right away. Today it seems like it's not that way anymore. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

He has a big concern in this area because starting in the 1980s with the tagging system, if you're out camping at your outpost camp, don't matter what time of the year, you don't have a tag and you're trying to follow the rules of the HTO as well as the government. And if a bear were to get into the camp or the outpost camp and you don't have a tag and you have children with you and you're out on your outing, enjoying your time out on a land camping, it's you know, what are you really to do? You don't have a tag and you're told not to hunt. That is a very big concern for him today. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

Before there was a polar bear regulation, policy and procedure, they could catch the polar bear any time, even though it had cubs. Today there's so many polar bears and nobody, like we cannot catch them unless, you know, they're [totally] attacking. Trying to camp in the summer, spring and summer with your family and polar bear policy in place. He's afraid for his family, especially children, because the polar bear can attack any time, he's got no law or anything. The polar bear can attack the children any time he wants, the family any time he wants. But us, we've got a law that you know from that he's afraid, the polar bears keep coming into the camps nowadays. Destroying cabins nowadays. There's so many that he think it was, it's not, he knows that they will come into camps and all we have to do is try to scare them away. But if they're determined to come in, they will come in. (Interpreter translating for T1, 21 May; Ekaluktutiak et al., 2020)

It seems like the younger ones are more aggressive now, because even as mother bears with cubs too, a lot of time we're camping, hunting a few miles from Naujaat, from my hometown and we notice cubs that weren't get mothers or family, weren't sort of [tense] anymore. Last time I went out, when I woke up there was a mother bear with cubs, we had some meat, raw meat with blood fat on it and the meat like at night ate up, a mother or cubs ate up the fat with the cubs, and of course she tried going under my tent ropes, so we never woke up, but seems like there's more, not scared of people anymore. (N2, 15 June)

Even though it's not just polar bears there's also other concerns that we have to deal with is like, you know, the climate change, the sea ice...the way I see it impact on all animals, not just polar bears, it could be any animal including the people the human

beings. The way that I see this, concerns me is the climate change. It's that the climate change is affecting everything. (Interpreter translating for K1, 26 May)

Disturbances to polar bears

Today we have many planes flying over, jets, prospecting helicopters, planes flying over and hunters using snowmobiles with that sound of machinery. He thinks that they're a lot used to hearing that. Once, many years ago, once they hear something, they would run away right away. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

Due to machinery with the snowmobiles, jets flying over, planes and all this because polar bears have a very keen ear. They can hear from many miles, they hear machinery and they get spooked and it's as if harder to find [them] in a way, because of the machinery, the sound and smell. (Interpreter translating for T4, 21 May; Ekaluktutiak et al., 2020)

If that had gone through, the seismic, seismic testing perhaps that would have impacted our polar bear, polar bears numbers and statistics. (Interpreter translating for K1, 26 May)

As soon as they hear any type of machinery, snowmobiles, for example, they'd start to run. Even before you see them, once they hear you they'll run. (GH2, 16 June)

Changes in sea ice

Over these last few years, we get thinner ice, but we're still get lots of ice when it the floe edge is still the same spot where it is, if not a little bit further. There's not much change in the ice, the sea ice...it gets easier for them to get their prey. (K2, 13 May)

The ice condition has changed. It's not too long ago, I think that started back in the 2002, 2004, somewhere in that area. Before that ice condition was...normal. Like, when I say normal, it tends to freeze earlier in the fall time. And tends to melt later in the springtime. Today, ice condition will melt very quickly in the springtime. It will be gone like without you knowing it's going. And tends to freeze up later in the fall time like October, November. (Interpreter translating for K3, 19 May)

Unable to see icebergs up in Gulf of Boothia area many years ago. But seems like you see icebergs every so often after a few years, it might got to do with maybe the sea ice getting thinner that we started to see some icebergs up in Gulf of Boothia area. That might be a fact that true, the ice conditions and changes, that might be the reason why we see icebergs every so often in Gulf of Boothia. (Interpreter translating for T3, 21 May)

The sea ice right now is different I think everywhere in the Arctic. In the old days, back in 1960s, we have very cold weather. And there was no warm weather, and I don't know why the oceans right now the ocean, the whole ocean from south to north it's a lot warmer now that's why the broken ice melted very fast. Because of the ocean's a lot warmer than the past 40 years or more. (HB1, 23 July)

It's a lot more thinner than it used to be. Some areas you normally have an idea where the floe edge would be but it's for some reason it's not consistent these days. It's not the same edge where the floe edge used to be. It gets there but it's broken off usually now. And it's a lot thinner the way I see it. (HB2, 23 July)

And our summer is more longer. And sea ice is not forming fast enough these days. Our weather has changed I guess due to climate change, they say. Warmer weather, sea ice not forming, well by the time it's usually hard enough by December, back then, but it's not like that anymore. Sea ice, solid ice disappearing fast, early July. And so these are the factors. (HB5, 27 July)

Impacts of sea ice changes

I don't any very much effect on polar bear of sea ice change because polar bears will adapt to any season, just like we'll will adapt their home summer, fall or winter or spring. They'll adapt to any changes in the sea ice or anywhere. (Interpreter translating for K3, 19 May)

Us hunters don't have a concern about the bears of this ice condition changing. Bears are known to be great swimmers, divers. They're known to be good on ice. They're known to be on the land in the wintertime. They go denning up on the land. They're able. It's really not a big concern because they're adaptable, they adapt to the climate, whatever it may be, in the ocean, water, on land, on ice or snow. It's not much of a concern. They're very adaptable, unique creatures. (Interpreter translating for T2, 21 May; Ekaluktutiak et al., 2020)

Polar bears easy [to adapt to] environment. Whether there's lots of sea ice and whatnot, or if you don't have much sea ice, of course they go on the land. They just adapt to their environment. It's like a weather pattern they're following. (Interpreter translating for T3, 21 May; Ekaluktutiak et al., 2020)

I cannot say that polar bears being affected by sea ice changes because the polar bears can be on the sea ice, they can swim, and they can be on the land. I don't see any major issues. (Interpreter translating for K1, 26 May)

I don't think it's a big concern to me about how polar bears with their environment. Whether there you know traffic here or there by sea ice, water or by air. That area is very important to me because after the tags were placed in, that's where my concern was, is that when the tags were placed in, after the tags were placed in, then we start following those policies. There are more polar bears now, numbers of polar bears now, there are more polar bears now. With traffic and this environment around the polar bears, I don't have a big concern whether even if the ice is melted, even if there is no more ice, I don't think that's really a concern to me. That's how I, you know [that's what] I think about that area. (Interpreter translating for K5, 26 May)

They think the bears are going to become extinct or what not. But then for us living in the north, they're not. Where we live here. Well, I do. I've been following bears

population for when I was a kid, so I have no concern about them vanishing or getting extinct. And people down south think they won't survive because of global warming. The ice that has warmed, they are going to become extinct. I don't believe that. So to me there's no concern about bears getting extinct. (N2, 15 June)

Management considerations

More polar bear tags increase because of the population of polar bears that you know has increased dramatically. Most harvesters would like to see tags increase because 20, you're only allowed 25 tags in a year. It would be nice, like a lot of harvesters out there like he's not a regular polar bear hunter but he would like to see more tags. Tags given. (Interpreter translating for K5, 26 May)

There are so many bears now that it doesn't matter. You catch one now, the fur pelt is so small now, it's very cheap now...I like to go camping in springtime with my family. And they're so many bears now...our hometown that dangerous to stay in a tent or a cabin, even a cabin is dangerous. I wish there would be more tags given out to the HTO or to the people. (N2, 15 June)

I never heard of any surveys in Gulf of Boothia and I don't think Hall Beach ever been part of it. There have been discussion in QWB—Qikiqtaaluk Wildlife Board annual meetings with NWMB before about the surveys being done in Gulf of Boothia but it was mainly focused on Kitikmeot regions communities. We didn't really get to be a part of it. (HB2, 23 July)

Appendix 2. Map of the Gulf of Boothia polar bear subpopulation

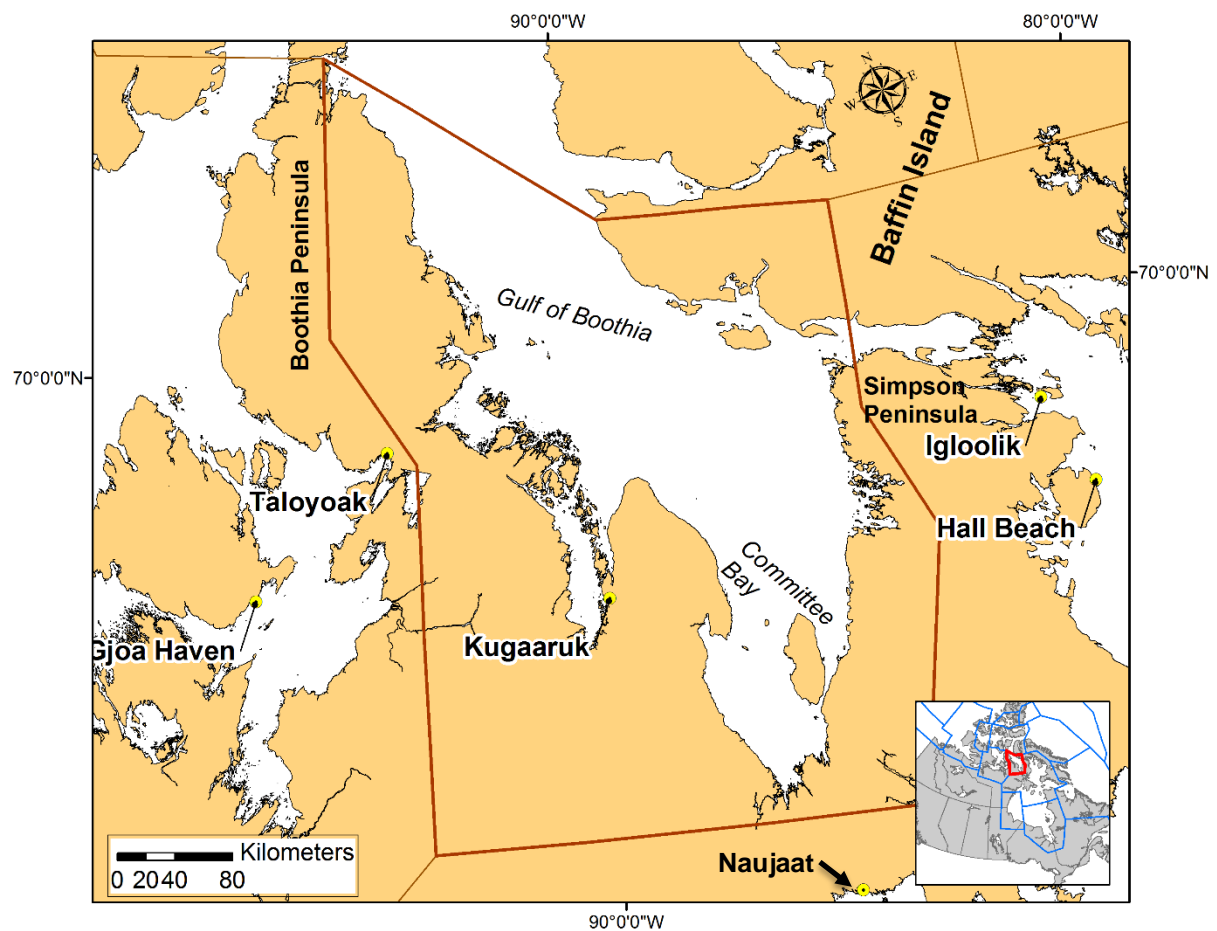


Fig. 1. Gulf of Boothia polar bear subpopulation (red border in bold) in Nunavut and the communities that harvest from there. The M'Clintock Channel subpopulation is located directly to the west.

Appendix 3. Description of polar bear management

Gjoa Haven and Taloyoak communities harvest both M'Clintock Channel and Gulf of Boothia polar bears. Gjoa Haven community members began harvesting from Gulf of Boothia after harvesting opportunities for M'Clintock Channel were limited. This year, Gjoa Haven received five tags for Gulf of Boothia. Once a hunter receives a tag, they are given up to five days in the community to prepare before going out on the land, where there is no time limit to harvest.

Usually, the HTO would give us about five days to pack up and get ready. But once you're actually hunting out there, there's really no time limit until you come back home with or without a bear. And then when you do get back, usually we pull another name from the draw. (GH2, 16 June)

Interviewees indicated that overharvesting results in a reduction in the number of tags for subsequent years.

When we overharvest—for defence kill or something, around the community—one tag is taken out from our quota. You know, if it's a female that's been caught in the community it might cost us two tags. So, we can't overharvest what is given to the community in terms of quotas. Today that's the only way we could hunt polar bears using quotas from the government (GH1, 3 June; Ekaluktutiak et al., 2020)

Taloyoak community members received 25 tags for Gulf of Boothia. To avoid overharvesting, the HTO allocates portions of tags at a time. There are usually more interested hunters than the number of tags that are available.

The HTO open five tags at a time because they don't want to overharvest. They're trying to manage in a way that they don't overharvest so the next year won't be, some years they don't even have enough tags. There are a lot of people like to go polar bear hunt and once the five tags that are introduced, five polar bears were caught and then they'd introduce another five to open. And there are many people that like to go polar bear hunting, even though they have these many tags. Hunters are waiting in line to get a bear tag and other years, there is just never enough polar bear tags. There are a lot of people. These communities are growing. Especially today. We have a lot of people that like to have the opportunity to go out polar bear hunt and catch their first bear. But they're unable to do that because of the tagging system. (Interpreter translating for T2, 21 May)

Kugaaruk received 24 tags this year. The HTO distributes tags to hunters after their harvest and are distributed through a lottery system when tags are running low.

Early in the season in October anyone may want to go out after polar bear to hunt. Do not required a draw to be done in the community but whoever want to go polar bear hunting will get a tag. That's how it goes all through the winter, spring. But when a tag is two, three tags left, the industry tag, then that's when the draws will start being done. (Interpreter translating for K3, 19 May)

Naujaat, Hall Beach, and Igloolik harvest from the Foxe Basin population in addition to Gulf of Boothia. These communities received 5, 4, and 11 tags for Gulf of Boothia, respectively. Gulf of Boothia bears are usually harvested on the west side of Melville Peninsula in Committee Bay. Interviewees indicated they usually receive a tag after the bear is harvested.

They would announce on the local radio that there's about so many tags for Foxe Basin and Committee Bay (Gulf of Boothia). And they would announce how many there are. And people just go out on the first opening day and catch some bears. It doesn't matter who, you can just go out and catch them without getting the tags I think, and then if you catch one, you can just go get the tag from the HTO...later on when the tags are not many in spring, the HTO would announce there's so many tags to go. (N2, 15 June)

The Hunters and Trappers host a annual general meeting with polar bear tags in October and we decide when to open it. It's usually open in October but you can't go up in early fall or some days too dark, so usually March is people start traveling over there. And it's open, like whenever they, community members, approve of the opening date. It's open for public. Anyone can go up there, we don't usually get a tag for it, it's after we get a polar bear we will, anyone can go up to the conservation officer and pay him the tag. (HB2, 23 July)

Going up to Gulf of Boothia it's usually straight out to Committee Bay area. Come around the island, Committee Bay area, and around that. Once I gone...towards the south and up the Gulf of Boothia...usually takes me about five to six, seven hours, depending on the speed I'm travelling and the snow, how smooth it is. (HB2, 23 July)

There is always rules for polar bears. You can't just catch polar bears [if] you want to catch one, unless you have a quota or a tag. You can catch it or unless they tell you you can catch a female, they'll pick one. Or there is one thing that you can just go and kill the polar bear is when it goes to town and you have no choice to kill it. So, there is three options, and we can't use any option we want. It has to be by the government quota to use, how to kill it. They tell us to do it, we did it. So, we can't just shoot one if we want one. But if we can get it, we share. (Interpreter translating for N3, 4 July)