Iñupiaq Knowledge of Nanuq in the Southern Beaufort Sea

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Funded by the National Fish and Wildlife Foundation and North Pacific Research Board

This study represents the words of local experts from Wainwright, Utqiaġvik, Nuiqsut, and Kaktovik, including Robert Sarren, Kirby Sage, Max Adams, Yves Brower, Jonas M. Ahsoak Sr., Gordon Brower, Edward Nukapigak, Robert Lampe Jr., Steve Leavitt, Bruce Inglangasak, Joe Sepilu and James Killbear Jr. Many others participated but chose to be anonymous. The author is grateful for these individuals' willingness to share their observations and oral heritage. The project would not have been possible without the generous guidance of tribal and North Slope Borough Staff in each of the communities.

The author would like to acknowledge Geoffrey York (Polar Bears International), Karyn Rode (US Geological Survey) and Henry Huntington (Huntington Consulting) as advisors on this study. Susi Miller (US Fish and Wildlife Service) informed project logistics, and Jessika Hopson Driggs provided her insights during research and writing. Marcus Geist created maps for the report. Finally, the author is grateful for guidance from local research assistants and the North Slope Borough Department of Wildlife Management.

Please cite as: Voorhees, H. 2019. Iñupiaq Knowledge of Nanuq in the Southern Beaufort Sea. Polar Bears International.

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Executive Summary

Polar bears were listed as threatened under the U.S. Endangered Species Act in 2008 due to ongoing and anticipated loss of sea ice habitat. Alaska's two polar bear subpopulations in the Chukchi and southern Beaufort Seas have experienced some of the most significant declines in summer sea ice of any polar bears in the circumpolar Arctic.

Indigenous knowledge provides insights on the responses of polar bears to sea ice loss. However, Traditional Ecological Knowledge (TEK) for the southern Beaufort Sea subpopulation has not been documented systematically since the 1990s. TEK is a dynamic body of knowledge that quickly responds to new conditions presented by climate change. Gaps in documentation have prevented TEK from entering fully into scientific research shaping management policies. This study seeks to close this gap, providing an updated account of Iñupiaq knowledge about polar bears on the North Slope of Alaska.

Local and traditional knowledge of polar bears was documented through semi-structured interviews in the communities of Wainwright (n =10), Utqiaġvik (n =13), Nuiqsut (n =12), and Kaktovik (n = 12) in 2017 and 2018. Interviews centered on maps of each community's region and on individual life histories of observing bears while hunting on the land and ice. Participants included both experienced Elders and active subsistence hunters. Follow-up visits were conducted with participants in 2019[1] to verify initial findings.

Themes covered in interviews included: changes in sea ice, wind, and weather; the impact of these changes on polar bears; polar bear body condition; local abundance; behavior; feeding; seasonal movement; habitat use; dens; cubs; and ice seals. Additional themes included aspects of human-polar bear relationships such as subsistence traditions and interactions between people and bears during whaling. Interviews focused on knowledge of polar bears within the last fifteen years, seeking current observations as well as comparative assessments of change over time.

In the full report, the findings of the study are presented by community in order to reflect the specific and detailed information documented from each place. Here, the findings are presented by theme for ease of comparison. Where no specific community is mentioned, the findings are common for all communities.

Sea Ice, Weather, and Polar Bears

Sea ice and weather have changed dramatically over the past decades, notably in the disappearance of multiyear ice and the greater tendency of shorefast ice to break up or be blown offshore. The seasonal patterns of polar bear presence near the communities has shifted as a result of changing sea ice. Overall, fewer bears are seen, but they may now be seen at any time during the year rather than only when sea ice is present. Bears are more commonly seen on shorelines and barrier islands. There are also occasions when many bears are seen together, such as near whaling camps or bone piles.

[1] Follow-up was completed through mail correspondence with Nuiqsut participants.

Body Condition and Behavior

Reported trends in physical condition of polar bears varied by community. In all communities, hunters stated that the condition of bears has historically varied from year to year—often correlating with ice conditions. Variability in condition also occurs across the seasonal cycle and between individual bears, making generalization difficult. In Wainwright Elders reported an increase in skinny bears, but younger hunters disagreed. In Utqiaġvik bears are described as "fat" and in good condition. In both Utqiaġvik and Nuiqsut skinny bears continue to be considered anomalous. However, some Nuiqsut and Kaktovik residents reported that they now see more thin bears in late summer and early fall, especially at coastal scavenging sites where humans and bears come into contact. Participants in Kaktovik and Nuiqsut noted that scavenging opportunities may be bringing skinny bears close to villages and whaling camps, where they are observed disproportionately. In Nuiqsut and Utqiaġvik local experts suggested that bears have become smaller in size overall, a point emphasized by Elders who were alive in the 1950s and 1960s.

The topic of "tired bears" was an emergent theme during interviews in Utqiaġvik, Nuiqsut, and Kaktovik. Bears that arrive back on the shore and barrier islands near Utqiaġvik in September and October are often observed to be tired, and spend time resting on the beaches. Nuiqsut residents described noticing that bears arriving at Cross Island and other barrier islands in the fall appear to be tired. Kaktovik participants have observed bears behaving in a "lethargic" manner. According to interviewees across these three communities, tired behavior is a relatively new and noticeable trend within the last five years and is also influencing the way in which bears react within human-polar bear interactions.

Local Abundance

Observations of trends in local abundance over time varied by community. Variability in local polar bear abundance from year to year appears to be a prominent feature reported across the communities. Wainwright and Kaktovik reported a long-term decline in local abundance, while local experts in Nuiqsut noted significant increases in the size of polar bear gatherings on Cross Island during fall whaling (during the rest of the year, Nuiqsut residents have limited opportunities to observe polar bears). Local experts in Wainwright agreed that the number of polar bears in the region and village has decreased over time, a phenomenon which they attribute to longer periods of open water. However, local residents also observe larger gatherings of bears during certain ice-free periods.

Some local experts in Utqiaġvik reported an increased abundance of polar bears in subsistence use areas near Utqiaġvik, but these reports were counter-balanced by other observations of reduced local abundance closer to town. When there is no ice present along the coast in the fall and winter Utqiaġvik sees few bears, although there are always some bears at Nuvuk Point. This general reduction is punctuated by concentrations of bears on the coast and at the bone pile during ice-free times. Kaktovik participants reported seeing fewer bears in the region compared to 10-15 years prior. There was a consensus that the number of polar bears seen at the bone pile

at Kaktovik between the months of August and October has declined compared to 10 or 15 years ago.

Feeding

Polar bears eat ringed, spotted, and bearded seals. Polar bears feed on marine mammal carcasses on the sea ice (i.e., during whaling season) and on the beach. In summer, polar bears catch arctic char in rivers or river mouths near Nuiqsut and Kaktovik. Across the four communities participating in this study, there were few reports of observations of novel feeding behavior by polar bears. However, there were indications of possible shifts towards greater relative dependence on certain extant food sources. For example, local experts in Utqiaġvik noted that scavenging opportunities—and behavior—have increased in the summer at Nuvuk Point due to a greater number of beached marine mammal carcasses. Brown bears are known to hunt for caribou, but this is not a behavior that has been observed for polar bears. Participants emphasized that they believe polar bears are relying more on whalers for food in the fall.

Habitat Use

The most significant change in the timing of polar bear presence in Wainwright, Utqiaġvik, and Kaktovik is that they can now be seen near the coast and communities in the summer as well as during the "regular" polar bear season in the fall, winter, and spring. Overall, bears appear to be spending more time on shore and barrier islands. In Wainwright, bears may be spending more time inland than they did in the past and are encountered along waterways. In Utqiaġvik, there are more bears at Nuvuk Point in the summer now compared to the past. However, according to Utqiaġvik interviewees, there are not more bears coming directly into town during this time in comparison to past decades. There was no indication that patterns of inland habitat use by polar bears have changed for Utqiaġvik. The occasional lone polar bear is encountered inland around Nuiqsut, especially during caribou hunting season in the fall, but this phenomenon does not appear to have changed in frequency over time.

Dens and Cubs

Residents of Wainwright, Utqiaġvik, and Kaktovik do not commonly encounter polar bear dens. Elders stated that intimate and regular knowledge of the land is required to be familiar with denning sites, which shift from year to year within areas where snow accumulates. In Wainwright, occasional denning has been observed in snow banks surrounding the community. Nuiqsut and Kaktovik hunters have seen slightly more denning on barrier islands and inland in their region, which they attribute to reduced sea ice habitat. Denning bears have been seen on Cross Island, but this is unusual. Some Nuiqsut interviewees indicated that denning is beginning later than in prior decades. Across the communities, polar bears typically have two cubs, though are sometimes seen with one cub and less frequently with three cubs. This pattern has not changed over time. Participants from all communities described cubs as being in "good" condition.

Ice Seals

In Wainwright and Utqiaġvik ice seals are reported to be abundant and in good condition. Numbers have remained the same in Wainwright, and may have increased around Utqiaġvik overall, with variation across species. Spotted seals have become more abundant in the Utqiaġvik area in the last 10 years, and fur seals have moved into that same area more recently. Bearded seals have been observed with missing fur within the last eight years, but this phenomenon has been less noticeable in the last two to three years. Participants stated that seal denning—which depends on snow cover—has been insulated from the effects of warming because snow cover conditions on ice remain adequate throughout the seal pupping season. Lack of sea ice is associated with absence of ice seals in coastal areas north of the village; however, seals may also gather on barrier islands during ice-free times, in turn attracting polar bears. There are fewer ice seals in the vicinity of Kaktovik today, which participants attributed to the reduced sea ice. However, those seals that are observed are reported to be in healthy, "fat" condition.

Human-Polar Bear Interactions

Whaling brings humans and bears into close proximity. Bears may initially be attracted by food cooking at whaling camp, and then to the whale carcass itself. Once a whale is harvested, communities work to butcher it quickly, before the smell attracts too many polar bears. A patroller is assigned to keep the crews safe from bears, particularly at nighttime.

During spring whaling by Wainwright crews, bears are said to be so intent on scavenging the whale carcasses that they ignore deterrence. Bears occasionally follow people hauling whale meat back to Wainwright. However, the number of bears coming directly into Wainwright appears to have decreased within the last twenty years. Individual young bears around six to eight feet in length are those most likely to be encountered in the village of Wainwright, most often in winter.

The number of bears coming directly into Utqiaġvik has remained constant over time within living memory, as has the behavior of bears coming into town. Whale bone piles at Nuvuk are maintained partly in order to deter bears from coming into town, and bears scavenge in this area in small numbers year-round. As is commonly reported in other North Slope communities, Utqiaġvik residents say that the curiosity and inexperience of younger bears pulls them into areas of human activity. Local experts did not report an increase in the number or proportion of skinny bears coming directly into town.

Utqiaġvik crews go whaling in both spring and fall. There has been no change in human-polar bear conflict during whaling for this community. Bears behave in the same way that they always have, scavenging but preferring to maintain a distance from humans. There was no mention of increased numbers of bears being attracted to whaling by Utqiaġvik crews.

In Nuiqsut, fall whaling at Cross Island is the main time of interactions with polar bears. Whalers here report an increase in the number of polar bears at Cross Island, and an intensification of human-bear interactions during and after whale butchering. Fewer people are willing to serve as bear patrollers, given the difficulty of the task including close encounters. Some bears appear to

increasingly unaffected by deterrents such as explosions or gunshots. Bears are not often seen in the community itself, but some bears may follow the whalers—and the whale meat—back from Cross Island to the vicinity of the community, a pattern that may be increasing. Whalers keep clean camps to avoid attracting bears, including using bleach to remove or cover up smells that might appeal to polar bears.

In Kaktovik, the whale bone pile draws humans and polar bears together. Bears now arrive before whaling season starts. The number of bears coming to the bone pile has been decreasing over the last 10-15 years, though the reasons for this decrease are unknown. Although late summer to fall is the peak time for polar bear presence around Kaktovik, individual bears can now be observed "scouting out" the bone pile almost any time of year. Bear-proof meat lockers have been tried as a means of reducing the incentives for bears to come into the community, but the lockers are difficult to access in winter so have not been used consistently.

Introduction

Across the North Slope of Alaska, *nanuq* (polar bears; *Ursus maritimus*) and Iñupiaq people are interconnected through histories of co-existence, subsistence practice, and spiritual traditions. Indigenous people in the North have long recognized *nanuq* as an "uncanny double" (e.g. D'Anglure 1990, Voorhees 2015). *Nanuq* and humans share a niche as top hunters of marine mammals in the Arctic, with their survival depending on patience, resourcefulness, and skill.

Today, polar bears and Alaska Native fates continue to be intertwined. Both are living in an environment of rapidly changing and unpredictable sea ice, wind, and weather, the ramifications of which are still unfolding. These anthropogenic phenomena in turn have created a need to study, understand, manage, and limit the impacts of climate change on *nanuq*.

Polar bears were listed as threatened under the U.S. Endangered Species Act in 2008 due to ongoing and anticipated loss of sea ice habitat. Alaska's two polar bear subpopulations, the Chukchi (CS) and southern Beaufort Sea (SB) subpopulations, have experienced some of the most significant declines in summer sea ice of any populations in the circumpolar Arctic (Stroeve et al. 2014). Recent studies of the SB subpopulation that ranges across the North Slope of Alaska and northwestern Canada documented declines in body condition, cub and adult survival, and abundance associated with sea ice loss (Regehr et al. 2010; Rode et al. 2010; Bromaghin et al 2015).

Indigenous knowledge provides insights on the responses of polar bears to sea ice loss. However, Traditional Ecological Knowledge (TEK) for the SB subpopulation has not been comprehensively documented since 1997 (Kalxdorff), before climate change was recognized as the primary threat to polar bears. Gaps in documentation have prevented TEK from entering fully into scientific research shaping management policies. This study seeks to partially close this gap, providing an updated account of Iñupiaq knowledge about polar bears in and around the communities of Wainwright, Utqiaġvik, Nuiqsut (Cross Island) and Kaktovik.

Alaska Native village tribal councils, regional governments, and organizations including the North Slope Borough (party to the Inupiaq-Inuvialuit Agreement for the Southern Beaufort Sea) and the Alaska Nanuuq Commission[2] have advocated for greater inclusion of TEK within wildlife management for decades. Similarly, polar bear scientists have issued a call for increased incorporation of TEK both on the national level (U.S. Fish and Wildlife Service Conservation Monitoring Plan 2015) and through a comprehensive circumpolar monitoring plan (Vongraven et al. 2012).

TEK is usually defined as "a cumulative body of knowledge and beliefs, handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes 2000:1252). Because accurate observations of the environment are essential for human safety and successful subsistence hunting, TEK is a dynamic body of knowledge that quickly responds to the new conditions in weather and animals presented by climate change. Residents of North Slope villages in Alaska

[2] Now the Alaska Nannut Co-management Commission

are able to contextualize trends in local polar bear abundance, behavior, and condition within the historical depth of their first-hand experience and cumulative oral traditions.

In the context of sea ice changes, this study focuses on current patterns of polar bear condition, behavior, and local abundance, as well the degree to which these patterns are continuous with—or depart from—the past. Emphasis is also placed on the status of ice seals, polar bears' most important prey. Finally, this work documents human use of and interaction with polar bears in the context of subsistence hunting traditions.

The observations documented here contribute to fine-grained knowledge about the SB polar bear subpopulation, enabling more targeted and effective mitigation of both long-term and short-term threats. Learning about polar bears' current status directly from subsistence communities builds trust, partnerships, and communication so that place-based management can flourish. While the primary threat to polar bears is global climate change, international efforts have so far been insufficient to reverse or slow dramatic loss of sea ice habitat. Therefore, places where humans and polar bears come together in coastal communities, as on the North Slope of Alaska, have become the de facto primary context of both federal and community-based polar bear conservation. Given current limits on our ability to reverse climate change's impacts on sea ice habitat, local partnership and cooperation between hunters, scientists, and managers will be more critical than ever if polar bear conservation is to succeed.

The Southern Beaufort Sea Polar Bear Subpopulation

Across the Arctic there are nineteen relatively discrete subpopulations of polar bears. In this report, polar bear subpopulation boundaries are based on those defined by the Polar Bear Specialist Group of the International Union for Conservation of Nature. Two subpopulation ranges cover northern Alaska: the Chukchi Sea and southern Beaufort Sea subpopulations. The communities included in this study (Wainwright, Utqiaġvik, Nuiqsut, and Kaktovik)— fall within the boundaries of the southern Beaufort Sea (SB) subpopulation. The most recent scientific population estimate for SB bears, based on work in 2010, was 907 (95% CI = 548 – 1,270) (Bromaghin *et al*. 2015).

The SB population spans two nations: the United States and Canada (**Figure 1**). The Iñupiaq-Inuvialuit Southern Beaufort Sea Agreement, established in 1988 and renewed in 2011, extends across this international boundary, linking management through an indigenous-to-indigenous agreement that has prioritized inclusion of TEK in management decision-making.

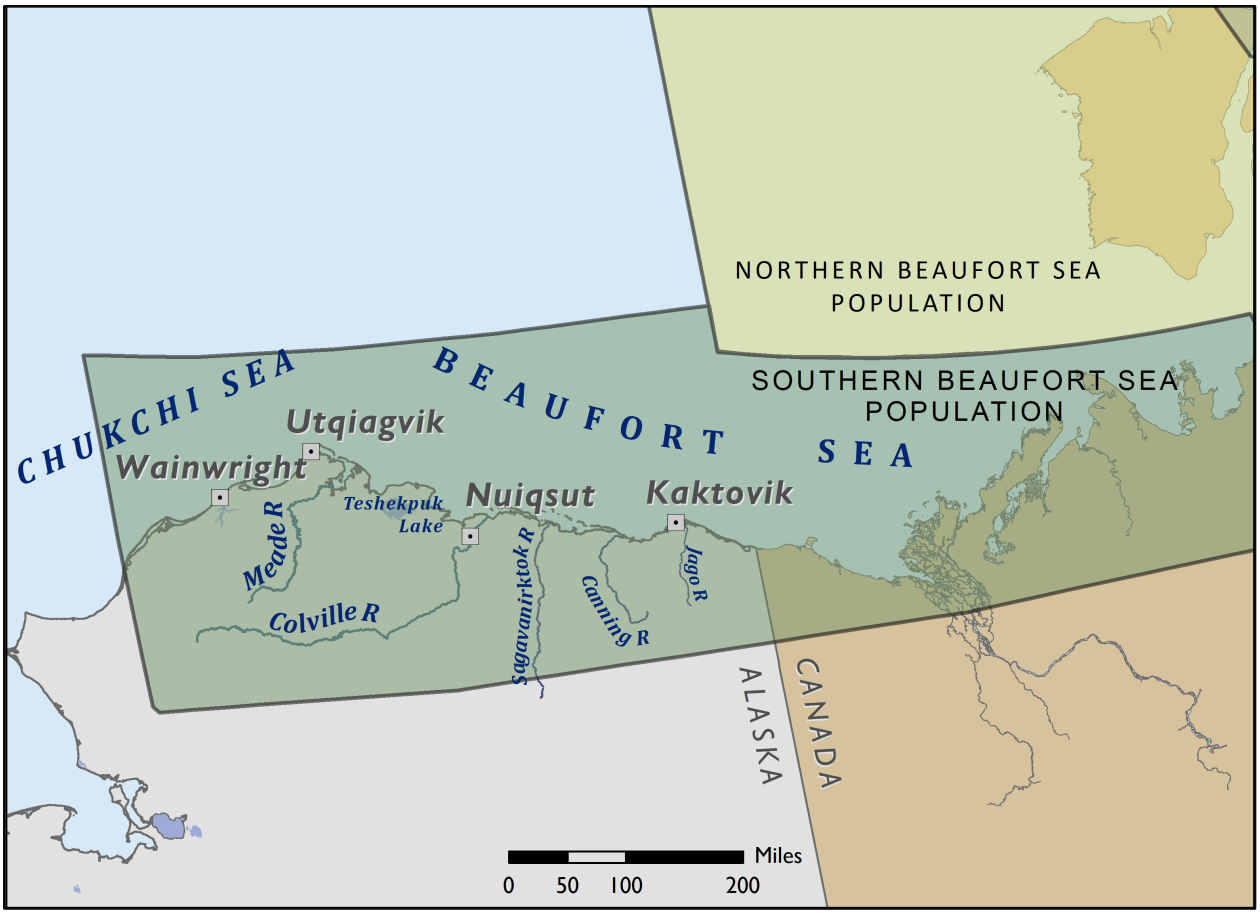

Figure 1: Map of the range of the southern Beaufort Sea polar bear subpopulation with locations of communities included in this study. The range is depicted as defined by the Polar Bear Specialist Group of the International Union for Conservation of Nature. Map generated by Marcus Geist.

Previous Traditional Ecological Knowledge Research on Polar Bears

Previous polar bear TEK studies have been concerned with two interrelated projects. The first of these has entailed documenting the historical and symbolic depth of indigenous co-existence with polar bears in the Arctic, an approach which can strengthen communities' claims to roles in present-day management (e.g. Kochneva 2007). The second goal has been to apply indigenous histories of co-existence with polar bears to the work of systematically documenting the current status of *nanuq* amid rapidly changing sea ice conditions. This work has sought to contextualize the current ecology of polar bears within community memory and oral traditions regarding polar bears in Canada (Keith 2005; Kotierk 2010a and 2010b; Kakespan et al. 2010; Slavik 2010; York et al. 2015; Joint Secretariat 2015; Laforest et al. 2018; Nunavik Marine Regional Wildlife Board 2018), Alaska (Kalxdorff 1997; Voorhees et al. 2014), and Greenland (Laidre et al. 2018).

For the North Slope region of Alaska, Kalxdorff (1997) conducted local knowledge research with polar bear hunters in twelve Alaska Native communities in the Bering, Chukchi, and southern Beaufort Sea, including the villages included in the present study. This baseline work mapped areas of polar bear feeding, denning, and seasonal movements. In 2018, Braund *et al*. conducted a

pilot study of polar bear TEK for the Chukchi Sea to inform polar bear management models. Two communities included in the present study were also included in Braund *et al.*'s (2018) work: Wainwright and Utqiaġvik. The study's initial, broadest findings indicated that although polar bears are reliant on sea ice features which have been declining, polar bear abundance has increased or remained stable, and bears remain in good condition.

Two studies in the last 10 years have specifically documented TEK for the southern Beaufort Sea on the Canadian side of the subpopulation's range. Slavik's (2010) work focused on traditional knowledge and use of polar bears, as well as community rules governing that use. Slavik found that loss of shorefast ice and changes in wind patterns beginning in the 1980s actually reshaped the terrain over which people could hunt for polar bears, changing ecology and hunting-based knowledge simultaneously.

In 2015, a TEK study for the Inuvialuit Settlement Region was released by the Joint Secretariat (Joint Secretariat 2015). This work incorporated the communities of Aklavik, Inuvik, Paulatuk, Sachs Harbour, Tuktoyaktuk, and Uluhkaktok. Based on semi-structured interviews with seventy hunters, the authors identify the 1980s as a turning point after which sea ice conditions became unpredictable. Inuvialuit polar bear hunters have historically concentrated their efforts along floe cracks, pressure ridges, and other features that support ice seal habitat. These features used to occur in approximately the same place year to year but are now variable.

This Canadian study on southern Beaufort Sea polar bears concluded that "the general health and abundance of polar bears in the Beaufort Sea region remains stable but variable, annually and across the region" (Joint Secretariat 2015:x). Despite overall stable condition in polar bears, Inuvialuit hunters had noticed fewer extremely big, fat bears since the 1980s. In addition, there have been some changes in seasonal and spatial distribution of polar bears, related to the timing of freeze-up.

Methodology[3]

In this study, local and traditional knowledge of polar bears was documented through semi-structured interviews in the communities of Wainwright, Kaktovik, Nuiqsut, and Utqiaġvik in 2017 and 2018. Interviews focused on maps of each community's region and on individual life histories of traveling, hunting, and living on the land and ice. Follow-up visits with the communities to verify findings from the interviews were conducted in 2019, with the exception of Nuiqsut.[4]

Following initial correspondence with tribal council and North Slope Borough representatives in each village, the project was launched with a community planning meeting in March 2017 in Anchorage, Alaska. Local polar bear experts and Elders from Kaktovik, Utqiaġvik, and Wainwright attended, as well as polar bear scientists and key project advisors.

[3] A detailed methodology is included because transparent communication of methods used for documenting Traditional Ecological Knowledge increases the likelihood that results will be incorporated into arenas of management and scientific decision-making.
[4] A follow-up visit to Nuiqsut was prevented by logistical challenges. Follow-up was completed through mail correspondence with participants for this village.

Along with leaders from the North Slope Borough Department of Wildlife Management, community representatives advised the principal investigator on the best approach to interviews in the villages (for example, suggesting times of year that did not conflict with the subsistence calendar or social events in each community). Community advisors noted that interviews needed to be responsive to the life history and experience of each local polar bear expert. In conversation with polar bear scientists, advisors also identified the topics that should receive special the focus in interviews: sea ice and its effects on bears, polar bear seasonal movements, human-polar bear interactions, ice seals, and polar bear condition. [5]

Following the community planning meeting, the principal investigator contacted tribal councils and North Slope Borough contacts in each village to establish a timeline for research visits and request a list of potential interviewees. Because of the depth of knowledge held by Elders, past traditional knowledge studies have focused on interviewing older community members, who may have retired from hunting. In contrast, because this project emphasizes current phenomena related to polar bears and climate change, the principal investigator asked tribal councils to include an equal proportion of younger, active polar bear hunters in their suggested participant pool.

When possible, the principal investigator contacted potential interviewees ahead of time to let them know about the project and invite their voluntary participation. While tribal councils and North Slope Borough officers provided initial lists of interviewees, subsequent "snowball" sampling also occurred as participants recommended names of additional knowledgeable individuals to interview.

The location of interviews depended on availability of space and the participants' preferences. Most interviews were held in meeting rooms in pubic village buildings; others were conducted in individuals' homes. Each interview was initiated with an oral overview of the project's background, goals, partners, and funding, emphasizing voluntary participation and informed consent. This information was also provided to participants in written form to take with them. Interviews were not audio-recorded. Instead, with the participant's permission, detailed notes were typed during the interview, and paraphrased documentation of the interviews was later reconstructed for analysis.

[5] Several additional recommendations were made by North Slope Borough staff and community advisors which were not brought to their full potential in the current project, and which should form a component of any future or iterative studies. This include: (1) inclusion of youth in all interviews to ensure sharing of knowledge between generations. Youth were invited informally, and many interviews included multiple generations. However, greater coordination with schools and youth ambassador programs is recommended for future polar bear TEK work in the region. (2) A greater focus on women's knowledge. The author agrees that women's knowledge is underrepresented in most TEK work on polar bears to date across the Arctic. Women are involved in whaling, polar bear hunting, and processing, and have ample opportunities to observe polar bears. Because women have historically been the ones to process polar bear meat and hides, they possess knowledge and oral traditions regarding polar bears that their male counterparts may not. However, traditionally, polar bear hunting is strongly linked to Iñupiaq masculinity. Therefore, nomination of potential interviewees by tribal councils and community leaders tends to generate lists of men. In the current study, several women who were invited to be interviewed declined, citing concerns about causing conflict by displacing men from the study.

The principal investigator conducted interviews, working with local research assistants when possible. In limited cases, Iñupiaq translation was provided by research assistants or other local experts. Interviews were conducted in Wainwright (n=10) and Utqiaġvik (n=13) in October and November 2017, in Nuiqsut (n=12) in March 2018, and Kaktovik (n=12) in June 2018.[6] This number exceeded the pre-estimated number of interviews needed for data "saturation," i.e. repetitive and reinforcing results from multiple interviewees within cohesive communities, such as small Alaska Native villages (Corbin and Strauss 2014). Each interview lasted between 30 minutes and one hour. Participants were given an honorarium for their time, at $75 or an amount set by their tribal council.

In the beginning of each interview, the principal investigator documented the local expert's age and numbers of years spent actively engaging in subsistence activities in his or her current village of residence. A summary of this information is included with the results for each village. Each interviewee was assigned a unique, confidential ID in order to keep results separate from identifiable information.

Interviews were semi-structured, allowing the interviewer to elicit targeted responses while also allowing for emergent themes in the data (Huntington 1998). The research instrument was modeled closely on that used in an earlier Bering and Chukchi Sea study of polar bear TEK (Voorhees and Sparks 2012; Voorhees *et al*. 2014), while also reflecting region-specific concerns raised in the March 2017 planning meeting (described above). Discussion focused on polar bears within the last 15 years, seeking current observations as well as comparative assessments of change over time. Questions were phrased as simply and neutrally as possible.

Themes covered in interviews included changes in sea ice, wind, and weather; the impact of these changes on polar bears (if any); polar bear body condition (i.e. whether they appear fat or skinny); local abundance; behavior; feeding; seasonal movement; habitat use; dens; cubs; and ice seals. Additional themes included aspects of human-polar bear relationships such as subsistence traditions and interactions between people and bears during whaling. Themes that were "emergent" (not anticipated by the investigator but emphasized by multiple participants) are also discussed in the results section of this report.

Maps served a central role in the interviews, acting as points of reference for generating discussion, as well as a context for documenting data. Our collection of geographical information followed the concept of "community clusters," (Dowsley 2009) in which data is collected according to the organic boundaries of hunting territories, rather than being restricted to wildlife management units or boundaries.

Mapping techniques were modeled on those used by Kalxdorff (1997) and consistent with methods used in previous Bering and Chukchi Sea polar bear TEK research (Voorhees and Sparks 2012; Voorhees *et al.* 2014). For each village-based region in the study, the principal investigator used up to three laminated 1:250,000-scale USGS maps (depending on how many maps were required to cover local hunting territory). Each interviewee was given his or her own mylar overlay sheet(s), marked with their unique, confidential ID number as well as geographical

[6] Total number of interviews vs. total number of participants.

reference points for subsequent compilation with geographic data from other interviewees in the village.

Place-based information was drawn onto mylar sheets overlaid on maps as points, lines, and polygons. For each mapped element, typed notes were kept regarding any associated behavior—such as feeding, or movement. Characteristics such as condition and size were also noted. When dens were noted, the interviewer sought to determine whether the den was maternal or resting, but this clarification was not always available. Tracks were mapped as indirect evidence of polar bear presence and/or movement.

The approximate year and season of each observation was recorded. Based on conversation with participants, seasonal boundaries were set as followed: fall: September-November; winter: December-February; spring: March-May; summer: June-August. This calendar guided seasonal grouping of map data during compilation. Outputs for each village included maps for polar bear activity in fall/winter and spring/summer for the last 15 years. Through heads-up digitizing, a mapping specialist transferred the drawings from mylar sheets into GIS datasets using the appropriate USGS 1:250,000 scale topographic maps as a base. Initial compiled maps were reviewed and edited by village participants. Edits were incorporated to correct transcription errors from the mylar sheets and habitat feature geometry was modified to more closely follow landscape elements that define these features, such as barrier islands and riverbanks.

In the initial data analysis stage, the principal investigator coded expanded fieldnotes according to standard social science "grounded theory" approach (Charmez 2014). Coding is an inductive method of qualitative analysis that builds on repetition in the data. It entails identifying common themes in the text, including those elicited by targeted questions (i.e. the condition of bears coming into villages) as well as emergent and unanticipated themes brought up by participants (i.e. more "tired" behavior observed in bears). During the first stage of analysis new codes were defined; during the second stage the resulting codes were applied comprehensively to fieldnotes.

Taking initial findings back to communities for verification and correction is a vital component of accurate and ethical Traditional Ecological Knowledge research. For each village, draft results were mailed to participants (each participant was sent the results for their village as a whole, but not the results for other villages). Each participant was invited to meet with the investigator during a visit in early 2019. They were also invited to respond to the draft report by mail, phone, or email. An in-person visit to Nuiqsut was prevented by logistical obstacles. Participants were given a second honorarium for their feedback. New and corrected data from participant feedback was incorporated into a final report.

Communities in the Study

The four communities included in this study (Wainwright, Utqiaġvik, Nuiqsut, and Kaktovik) are located within the Iñupiaq North Slope region of Alaska. All rely heavily on subsistence hunting and fishing for traditional foods.

Utqiaġvik is the largest village in the North Slope Borough, with a 2010 census population of 4,212 (U.S. Census Bureau). This hub town was known as "Barrow" until 2016, when

community members voted to rename it based on its traditional place name, which means "place where snowy owls are hunted."[7] Located 72 miles southwest of Utqiaġvik, Wainwright has approximately 560 residents (U.S. Census Bureau).

Kaktovik is located on Barter Island, 280 miles southeast of Utqiaġvik, on the northern border of the Arctic National Wildlife Refuge. Kaktovik has approximately 240 residents (U.S. Census Bureau). Despite its small size, Kaktovik has become an increasingly popular destination for tourists from around the world, who come to view polar bears that scavenge on whale carcasses near the community following fall whaling each year.

Unlike the other three coastal villages, Nuiqsut is located inland, along the Colville River and approximately 18 miles from the coast. The community was formally settled in a traditional use area by families from Utqiaġvik in the 1970s. Approximately 400 people now live in Nuiqsut (U.S. Census Bureau). Residents primarily encounter polar bears at their whaling camp on Cross Island, 75 miles to the northeast.

Of the four communities, Utqiaġvik and Wainwright most strongly identify with traditions of subsistence hunting for polar bears, though all North Slope Iñupiaq people have co-existed with polar bears for thousands of years.

[7] http://www.north-slope.org/our-communities

Results

Wainwright

Ten local experts were interviewed in Wainwright. Their ages ranged from 29 to 81; the length of time spent actively hunting in the Wainwright area was between 24 and 75 years.

Sea Ice and Weather

Select Quotes on Sea Ice and Weather:

"*In those earlier days," pack ice could be observed by November from Wainwright to Icy Cape. "The ice in front of the village used to be higher than street poles, it was a big wall forever."*

"In the last 10 years the sea ice has been like it is now, open water."

"We haven't seen any old ice in years now. The lagoons should be frozen over [in November] but it's still open. You can see the water out there until January or February, that's when it starts to really freeze [now]."

"It's really strange to see the ocean in November [at the time of the interview]."

"When the ice is first formed it's like slushy ice. It's very dangerous to walk on, even when you try to go out and make trail; the ice is no good. The ice that we see is just piling up, from blowing around, that's how it gets thicker."

"It's hard to predict when the sea ice will develop. Right now we should have been seeing ice developing out there, right around November, and it's not. Ice depends on the weather, it can get normal, if it's real nice and calm, from this period on. If there's no hard wind, [the ice] will start developing fast [but] with strong wind it will move it away. Last week the ice was starting to form, but the new stuff got blown out. Hopefully [the new ice] will form pretty fast after the sun goes down."

Sea ice in the Wainwright region has changed in multiple dimensions: the timing of freeze up and melting season, the stability of ice once formed, its texture, surface features, and thickness. Ice conditions are remembered as "normal" in the '60s and '70s but began to change quickly in the '80s and '90s.

In the recent past, multiyear ice floes could appear as early as August, but today multiyear ice is no longer present within observable range. *"Nowadays it's a thousand miles away from here…maybe our world is this way [now]."*

Local polar bear experts who were interviewed were surprised to see open ocean water at the time of our conversations in November and noted that a true deep freeze could now come as late as January or February.

During good ice conditions in the past, thick ice off Icy Cape was a destination for polar bear hunting. "*That was a good place to hunt bears back in the day, all the way to Point Belcher. They'd go camping up there, and all over, east and west of Wainwright. We'd make tents with snow blocks"* At certain locations the ice would pile up in shallow areas surrounded by currents, causing the ice to become "anchored." One Elder used the term "ice blossoms" to describe this formation, which was known to be a good spot both for whaling and for polar bear hunting. He remembered hunting for bears about 11 miles out from the shore at an ice blossom. People would travel on camping expeditions on the ice for both purposes. Beyond the blossoms, conditions became more hazardous for travelers due to fast currents and broken ice.

Today, sea ice around Wainwright tends to consist of entirely new "annual" ice. When this ice first forms it is slushy and remains thin throughout the winter. Interviewees characterized it as unstable and unsafe for human travel.

The timing of freeze-up around Wainwright depends not just on the temperature, but to a great extent, on the prevalence of winds. Because the ice is new and thin, it is prone to disperse in windy conditions. Therefore, wind has more weight as a factor in the development of ice, and the timing of annual freeze-up is now less predictable than it was in the past. Overall, sea ice conditions are now understood to be less uniform from one year to the next. One interviewee also expressed concerns about ice-breakers (large ships) disturbing new ice as it forms, which could prevent it from solidifying.

The surface features of sea ice have also changed. One participant described the experience of traveling over sea ice in the past as *"going on a rollercoaster."* Today, it is relatively flat. The "blossoms" described above are no longer a common feature around Wainwright.

Inland freeze-up has also been affected: one interviewee remembered hunting for caribou on lagoons in October with a honda (ATV), which he can no longer do. At the time of our interview in November 2017, the lagoon was just starting to form "dark spots," an indication that the slush-water was finally solidifying.

Impact of Sea Ice and Weather on Polar Bears

The arrival of polar bears used to be predictably associated with the arrival of the "main ice," or old, multiyear ice. With the disappearance of this ice, a different calendar governs the presence of bears in the community. Now presence of bears is associated with the solidification of annual ice.

Bears come into the town of Wainwright year-round but are more likely to do so during times when there is no sea ice. However, ice loss is also associated with seeing fewer bears overall: *"Because there's no ice, you don't see as many bears coming as you used to."*

When carcasses wash up (such as grey whale carcasses present along the coast at the time of interviews), bears will be busy scavenging and avoid the village.

One local expert stated: *"A long time ago, the ice was solid. Now that's the biggest threat to bears. There used to be one big ice pack that just moved around. The ice today is young and brittle. The bears need the ice. The most nourishment, like the seals, comes with the ice. I'm not sure what they're eating now."*

One Elder spoke about the reduction of sea ice habitat for polar bears, which has affected both bears and subsistence hunting for bears:

"In those earlier days, there was pack ice that stuck from Wainwright to Icy Cape. Point Lay people traveled around Icy Cape for polar bears. That was a good place to hunt bears back in the day, all the way to Point Belcher."

Body Condition

Select Quotes on Body Condition

"[The bears] aren't resting, they're working all the time, and their fat is getting thin and thinner. In springtime you can get fatter ones, that's when there's ice."

"The skinny ones that come into town, they probably won't go away. One was right in town about three years ago, about in October. The ones that stroll in are hungry enough to come in, the fat ones are out there relaxing."

"The bears are not really different in size from 20 years until now. They're all different, they're not made to be the same. All different shapes."

"I didn't hunt polar bears some years when they were skinny. There's hardly any fat those years. That is when the ice was bad. It's not like the past years, where they were fat, the years went by, they're not as fast as they used to be."

There was disagreement about whether the condition of polar bears has changed over time in Wainwright. Interviews with Elders indicated that polar bears have become skinnier, but middle-aged and younger hunters reported that their condition has stayed about the same and is generally "good." Both groups noted that condition varies from year to year, correlating with ice conditions. In years with less ice, bears are more likely to be described as "skinny."

Elders reported that "skinny" bears are more common than they used to be "a long time ago." They make this observation based both on observing bears and through the process of butchering and cooking: *"Polar bears a long time ago used to have more fat, like all away down the back, and now it's very thin."* In the past, bear meat was oilier. An explanation given for bears worsened condition was that they "*aren't resting, they're working all the time, and their fat is getting thin and thinner."*

It is possible that differences in responses about polar bear condition reflect generational windows; Elders have a longer period of memory from which to draw comparisons. Younger interviewees, with a shorter window, may have missed a baseline condition with which to compare the present. Alternatively, it is possible that Elders observe more skinny bears because older community members are less likely to be active out on the landscape; interviewees acknowledged that skinny bears are the ones most likely to come into town.

One interviewee expressed concern that collared bears are more likely to be skinny than non-collared bears. Participants worry about the effect of repeated sedation on bears and the safety of eating bear meat.

Given the varied assessments of trends in condition, it is difficult to declare a consensus on the topic for Wainwright. Future research should further clarify whether interviewees' perception of polar bears' condition reflects a propensity to stay within the village boundaries or spend time out on the land and ice.

Local Abundance

Select Quotes on Local Abundance

"There are less bears [in general] but more on the beach. They will sleep on the beach in July."

"Just like walruses we don't see any polar bears nearby. Life has changed drastically over our lifetimes. When we were growing up, there was always ice; now it's open water."

"*The numbers of polar bears have gotten low, not too many sightings. I don't know if it's the ice. If there was ice there'd be bears; there's still a lot of seals."*

"As things go, there are fewer bears around than there used to be. Bears are very unpredictable. Because they have a good sense of smell they will be around, but more or less keep themselves at a safe distance."

With the exception of disagreement from one Elder, interviewees agreed that the number of polar bears seen by Wainwright residents has decreased over time, which they attributed to longer periods of open water. However, there are more bears observed on the beaches near Wainwright in the summer now compared to the past.

Some interviewees highlighted the absence of polar bears at the community's spring whaling camps now compared to the 1980s:

"[I remember] one day when we were whaling in Icy Cape, in the spring, early '80s there were lots of bears: small and big. We had to have someone guarding the tent all the time. At that time there were more bears, nowadays we rarely see them when we're butchering whales."

"When we were butchering the whales this past spring 2017, we didn't see polar bears."

Overall the number of bears seen both outside and inside the village has decreased, with the 1980s being a common reference point after which decline occurred. One interpretation offered for the reduced number of bears is that they have relocated to the East due to greater food availability.

Behavior

Select Quotes on Behavior

"They've always been a threat. Everything's the same, there's just no ice."

"Bears are not more of a threat to people [now]."

"The bears don't wait until the people are done butchering; they try to take over the whole thing. Then when they can't stop that's when they get shot. They have no patience now, they are hungry."

"When I was a little boy [my father] used to go hunt polar bears with a dog team. One time he shot a polar bear, and he didn't know it was still alive. It got up and tried to get him. A polar bear always plays dead, then get back up, that's what a polar bear does."

"Polar bears always play dead. They'll get back up and come after you. You should never approach a wounded polar bear from behind; you've got to go around from the front, so you can shoot them."

Most local experts indicated that polar bear behavior, specifically as it involves human-bear interactions during spring whaling, has not changed over time. Bears have always posed a potential threat to humans and continue to do so today. When aggressive behavior at a whaling site (and beyond) does occur, interviewees attribute this not only to the condition of the animal in question, but also to the subjective hunger of the bear, even if it is "fat." One interviewee noted that during whaling bears seem less patient and willing to hang back during butchering than they did in the past. He attributed this change in behavior to the bears experiencing greater hunger just prior to the spring whaling season.

Experienced hunters emphasized how important it is to ensure that a bear that has been shot is truly deceased before approaching it. This is something they learned from their Elders and through stories, as one interviewee illustrated:

"When I was a little boy [my father] used to go hunt polar bears with a dog team. One time he shot a polar bear, and he didn't know it was still alive. It got up and tried to get him. A polar bear always plays dead, then get back up, that's what a polar bear does."

This lesson from Traditional Knowledge about bears' ability to play dead is just as relevant today in the context of defensive kills that take place within or close to village boundaries.

Feeding

During spring whaling, bears feed on whale carcasses:

"The older ones know [about the whale carcasses]. One time we caught a whale and lost it because it went under the ice. The whale went bad, and it was covered with claw marks from the bears eating the whale. They would dive under to get at the smell. There will be 30 bears surrounding the whales. The youngest ones will wait their turn."

In summer and fall, polar bears scavenge dead walrus from the beach.

Icy Cape is a known site where carcasses of whales and other marine mammals was up, providing scavenging opportunities for polar bears.

Seasonal Movement

The most significant change in the timing of polar bear presence around Wainwright is that they can now be seen in the summer as well as during the "regular" polar bear season in the fall, winter, and spring.

"In the past we didn't see them from May until November, but nowadays you see them anytime. Year round. There's no place for them now, no place for them to rest."

These year-round sightings can be punctuated by periods of absence, especially when scavenging resources (such as walrus carcasses in the summer) are available elsewhere. Spring whaling has historically been the time of year when polar bears have been most concentrated north of Wainwright, but the number of bears seen during whaling is now reduced and varies more markedly from year to year.

When the ice goes out, some bears remain on shore. During summer, bears spend time on the beach near Franklin Point, where they can scavenge for walrus, whales, and seals. In July and August polar bear tracks are commonly seen along the beach. Although bears are present in the area in summer, they are still more likely to come directly into the village in winter than in summer. Summer bears are seen as transitory, in search of resources. One hunter reported, *"I've seen more bears coming from the north, and going on the beach in the summer, or swimming by. They're looking for food."*

Freeze-up, even when delayed, continues to be a time when bears are known to arrive in a wave in the coastal vicinity of Wainwright; however, the timing of these appearances varies both with weather conditions and with the availability of scavenging elsewhere.

Habitat Use

Select Quotes on Inland Habitat Use

"When they can't find seals then they travel inland, some are skinny, some are healthy. They can smell really far away, if it's in the right direction. The furthest inland I've seen was about 12 miles."

"Nowadays, polar bears are coming into the land more and more every year. There are starting to be more inland."

"Until 20 years ago you only saw bears when they were denning. They are going farther and farther inland, which is prime grizzly country. It's really new. I've never heard that there were so many bears there. In old reports there weren't that many. "

"In the past 10 years there are more bears roving inland, and lots of the young hunters will get them. One of [the young hunters] got about three or four close to the cabin. [It's] because of the [lack of] ice."

"They even go way up there on the river. In the past 10 years we killed about five or six polar bears close to the cabins."

"If there are no animals that are beached [the bears] go inland. They hunt tuttu [caribou]."

Overall, bears appear to be spending more time on shore and on barrier islands in the Wainwright area. The majority of interviewees reported that within the last 10 years it has become more common to see bears inland from the coast compared to the past.

In the past, it was females and cubs that were most often seen as they emerged from dens in the riverbank in the spring. Today, bears are also seen inland in the fall and summer, where they have been observed eating berries and approaching cabins. Polar bears are especially likely to be encountered along creeks and rivers, where they are said to wait for caribou to cross the water. There was speculation amongst interviewees that polar bears are hunting caribou (*tuttu*), perhaps primarily at night, but there were no reports of direct observations of this behavior. One interpretation given for this phenomenon is that bears travel inland when they cannot access seals. Bears seen inland represent a range of conditions and were not reported to be disproportionately "skinny." Polar bears that travel inland often attempt to break into camps or cabins and may be killed during encounters with people in the fall. Franklin Point is known to be polar bear habitat in summer and less commonly, in winter.

Dens

Wainwright residents do not commonly encounter polar bear dens. Female polar bears make their dens in the area in November or December and emerge in April or May. Dens are never made in the exact same place from one year to the next. Dens used to occur primarily on banks by the coast but can now be found further inland along waterways such as the Utukok river.

Drifts that pile up along snow fences near the village were also noted as possible denning sites, though it was not clear whether these would be "resting" or maternal dens.

Cubs

Consensus emerged it is most common to see two cubs in a family group, a number that has not changed significantly in participants' living memory. Family groups with three cubs less common. Cubs generally appear to be healthy and in good condition.

Ice Seals

Ice seals are generally abundant. One hunter reported catching sick seals starting within the last three years. He described the seals as having no fur, with bare, human-like skin. The animal's insides were also "rotten." However, there were no accounts of this seal disease also appearing in polar bears.

Human-Polar Bear Interaction

During Whaling

Spring whaling by the village of Wainwright (near Point Belcher) is a time when people and bears are drawn together. Large gatherings may result, including mothers and cubs: *"During spring whaling in everyone's eyes we're the endangered species"* (because there are so many bears). Whaling is known to attract some of the largest bears in the area. The largest bears tend to dominate the area closest to the whale.

Although people may be outnumbered by bears at times, most participants felt that they did not pose a threat over and above that usually posed by human-bear encounters (i.e. their behavior had not fundamentally changed). At whaling time, bears are usually preoccupied by eating scraps leftover from carcasses, and people try to avoid shooting bears, as this would take time away from harvesting whales.

However, one respondent said that bears used to hang back while people worked on whales, but now seem more impatient and aggressive. "*Polar bears are a threat during whaling. The bears used to hang back, [but now] they are more aggressive. During whaling bears are more aggressive than they used to be."* Another participant noted that bears have "*no fear of people*" during spring whaling.

This can become a concern during years with good ice, when a wider range of the community—including children—spends time at whaling camp. However, in 2017, the ice was rough, and the camps were populated primarily by whaling crews.

Bears occasionally follow people hauling whale meat back to Wainwright. These are often younger people helping the crews by pulling whale meat on sleds. Nobody reported a direct encounter resulting from bears following the sleds.

In the past, bears were attracted to the bearded seal skins used to cover *umiat* (whaling boats), but this kind of traditional boat has not been used in Wainwright for at least 10 years:

"Why did they stop making umiat? The women are charging too much now!! Got too expensive, got to be too much work. [We] had to replace it every other year…they started using wood boats, then aluminum boats; aluminum boats are much tougher."

When bears are perceived to pose a threat to humans at the whaling camp, the whaling captain may speak to the bear in Iñupiaq, telling it to go away. Then, he may deploy cracker shells as deterrence. During spring whaling, bears are said to be so intent on scavenging the whale carcasses that they ignore normal deterrence methods; gunshots in the air are slightly more effective.

The following narrations illustrate instances of heightened human-bear interaction at the whaling camp.

"We were spring whaling, and these two bears followed after us to the camp. The captain shot up in the air, but an hour later [one] came right back. The Captain shot one more time in the air, but he came right back to us, swinging his head. It was a big bear. It was the first whale, and he was hungry. When the bears are hungry they will slash the snow and ice with their paws and chomp their teeth. Bears put their head down before they are about to attack."

"There is a nighttime polar bear watch during camp. The watcher sleeps during the day, then the Captain wakes up the watch guy. [The watch] keeps the stove going, makes coffee, then goes on polar bear watch, then goes back to sleep. One of the young watchers fell asleep, and a bear came to camp and was eating blubber right behind the snow block, but luckily the wind was right that it didn't bring the smell of us to the bear. Bears can be really quiet, but you can feel them. There were people sleeping all around, with the bear was eating the blubber. We shot in the air, and he ran off to the ice edge. But he came back and started slashing the snow and smashing his teeth. Someone grabbed a pistol and was aiming it at the bear's head; he had to be careful not to shoot the propane. The bear looked right at us, then went right to the zipper of a tent."

When bears must be killed at the whaling site in self-defense, participants emphasized that they are fully used and not wasted.

In Town

"If we do see them, just like anybody, we will rush to where it is, and look at it with binoculars. If it keeps returning, the younger hunters will go and try to shoot it. Right now in our village they don't let the bears come in because there's lots of kids playing out; we'd rather have a safe village."

There has not been an increase in the number of bears coming directly into town. If anything, the number seems to have decreased over the last twenty years. Individual, young bears around six

to eight feet in length are those most likely to be encountered in the village. Participants note that these bears usually appear to be hungry.

Polar bears come into Wainwright primarily in the wintertime. Polar bears coming directly into the village are described as "determined" in their food-seeking behavior. They are considered to be a safety hazard, especially for children, and are usually killed for defense if they cannot be easily deterred. A polar bear patrol begins running around freeze-up.

Cubs and family groups are met with aggressive deterrence efforts because *"when mothers bring the cubs into town, they're telling the cubs there's food there."* However, single bears are much more likely to be killed than family groups. The decision about what to do about a particular bear in town often plays out over the VHF radio, with some residents wanting to focus on deterrence, and others on harvesting the bear.

Part of the threat posed by bears coming into Wainwright pertains to concerns about them mauling dogs and eating them. Several participants noted that the decision to kill a bear sometimes has to be made to defend dogs.

In addition to common food and garbage attractants in the village, bears may be brought in by an unusual subsistence or sharing event. As one participant recalled, *"One year we didn't get any whales, and Utqiaġvik sent us a plane load of maktak. It was left outside the school, and a polar bear got into it. That was 2011. "*

Village practice is to put any waste containing blubber out in the ocean for bears. However, when this practice is not followed, bears may be drawn to the marine mammal. Bears have also been observed trying to break into ice cellars.

In general, bears are known to come out at night and hide during the day. Streetlights have been installed in the village; one anticipated benefit was that the extra light would prevent bears from visiting Wainwright. Some participants reported that there are fewer bears coming into the village now compared to twenty years ago.

When hungry bears are seen resting on the beach, some residents will leave a seal for them: *"I've seen some hunters get a seal and leave it on the beach for the bears. Some people give the seals to the hungry bears, they do that."*

Polar Bear Deterrence and Patrol

An informal polar bear patrol has always existed in Wainwright, but at times there has also been a formal patrol, usually starting after freeze-up and restricted to winter. One respondent noted that in his experience, this formal patrol was often augmented by informal patrollers and hunters. Bears may be killed before the formal patrol has arrived. This is consistent with what other participants reported about human-polar bear interactions within Wainwright. One participant felt that the patrol could not be as effective as regular Wainwright community members because they did not have the right tools, at least at the time he served.

Subsisting on Bears

Until the 1960s, polar bear hunting was a source of income through trade of hides for food and other necessary supplies. Subsistence interest in the polar bear hunting tradition remains strong in Wainwright. As one interviewee stated, *"Any season is best time to get bears; we won't pass it up."* Any bear that is hunted is widely shared in the community. Both men and women may hunt polar bears in Wainwright. Many people in the community continue to enjoy eating polar bear, although younger people are less likely to eat the meat.

Elders recall that polar bear hunting used to an "active" pursuit in which (primarily) men would go out looking for polar bears once a year, often with a dog team in areas of high ice pack (such as "the blossoms." In contrast: *"Today the only time you hunt polar bears is when you accidentally run into them."* The amount of work involved with processing a bear is noted as a factor that sometimes discourages hunting:

"Nowadays you don't hear people saying, "I'm going out [to look for polar bear]."

"Bear hunting season is getting later. Today the only time you hunt polar bears is when you accidentally you run into them. Years ago, we would go out and look for them."

Up until the 1970s, the market for polar bear skins meant that people regularly ate polar bear meat: *"When my parents were alive we used to have polar bear meat; it's good having polar bear. They used to eat a lot of it."*

Today, polar bears continue to be an important subsistence species in Wainwright, although polar bear meat has become less common in the average resident's daily diet.

After a bear is hunted, it's stomach and internal organs are placed in the ocean, and the meat is divided among Elders and the wider community. A taste for polar bear meat has persisted in Wainwright, perhaps more so than in other communities in the region, although preferences vary between individuals.

"When someone catches a bear, he will go on the] VHF [and say]: "Polar bear meat come get some!" Polar bear hunting is very important. It's one of our nourishments, that makes us Iñupiaqs. When we're eating Western foods, we stay hungry; when we eat Eskimo foods, we stay full."

Local experts caution against eating or touching the liver, which is poisonous (due to high vitamin A content) and can cause permanent discoloration to one's skin. Some participants expressed concerns about pollutants and radioactivity in bears and felt that polar bear meat tastes different than it did in the past.

There is a preference for hunting smaller bears, which are easier to process and cook and are also said to taste better. This preference for small bears may have increased over time due to concerns with build-up of "toxins" in larger bears.

Polar bear teeth can be used to make fishing hooks. Hides may be given away to Elders or expert sewers to turn into clothing. Polar bear fur is used to make traditional mittens and polar bear pants, called *qualiqsaqs*, which are extremely warm and waterproof:

"If you wear them you will be hot all day. They used to wear them without pants, because it was too warm otherwise. My dad had a pair when I was young. They are nice and warm. The hair is hollow so that makes it really warm and light."

An Old Tradition: Raising Cubs

Several interviewees spoke about the old tradition of hand-raising polar bears in Wainwright. Orphaned or abandon cubs would first have a gland removed from under their tongue which would "take the wildness out." The bears would act as pets until they got too big. One participant remembered that someone had a polar bear during his childhood in the 1970s, but in general this was a practice that happened "long ago."

"People used to get cubs, then they used to take the gland off. It would take away that wild thing under the tongue. It happened so long ago. I've heard that they would take the wildness out, cutting away something [under the tongue]."

"Orphaned cubs can be raised; you take a gland out when the bear is young, and they can be tamed. [In the old days LP] took some cubs, raised them a couple months, then Game and Fish took them. Some people [used to raise] them then let them go."

Other Species

Brown Bears

Select Quotes on Brown Bears

"My dad would talk about brown bears. He warned me "Don't mess with them. Don't chase them; they'll turn around and chase you back. If they smell you, they will hunt you. The brown bear can smell you from 15 miles away, and he will never forget your smell. The brown bears are dangerous. If You shoot a polar bear or black bear he's going to run away; if you shoot a brown bear he's going to come back to you."

"There are a lot of grizzlies around, because we have cabins, and every bear is seen as a cabin-wrecker. They're worse than polar bears [when it comes to breaking into cabins]. We've had a few of them run to us while we're out here hunting ducks in spring. There are lots more grizzlies now. Maybe the other villages scared them away!"

"I've seen a brown bear sneaking up to fur seals; he was sneaking up on them. That's the only time I've seen it. There are more and more brown bears nowadays."

Consensus emerged that brown bears are more common in the Wainwright area now than they had been in living memory. Compared to polar bears, brown bears are seen as more problematic because of their tendency to break into inland cabins. Hunters were more likely to have encountered brown bears than polar bears inland. As one participant said, *"I see brown bears now in every river."* Brown bear tracks are seen from spring through summer. Brown bears go after geese in spring. One hunter recalled a unique incident in which he observed a brown bear "sneaking up" on a fur seal.

Caribou

A higher frequency of internal disease in hunted caribou has been noted by participants. This raises concerns due to their central position in the local food chain. One local expert noted that in the past, caribou from the south used to be "fatter" than those to the north, but that this pattern has recently flipped on its head, suggesting changes to the diet of caribou across varying geography.

Fish

There is the same amount of grayling, whitefish, and burbot as always. Some Elders have also noticed new kinds of fish in the area.

Walrus

Walrus hunting usually takes place in July or late August. Lack of sea ice in 2017 meant that hunters went largely without walrus. Those who did catch walrus found that they did not have enough to both share and save for themselves.

"Aiviq (walrus) were scarce this past year. This past year I just got two, [whereas I] usually get three or four. There's not enough left for me after the village [takes a share]. Their migration routes have changed, everything is different now. "

Walrus come ashore due to lack of sea ice. In 2010, 40 to 50 walruses washed up on the beach, dead from a cause unknown to the village. Bears scavenge on dead walruses.

Whales

Initial results suggest an increase in beached grey and bowhead whales along the coast, possibly due to the increased presence of killer whales. As is the case for other species, the timing of whale migration has shifted, throwing off sequential subsistence hunting calendars that have remained roughly the same across generations:

"I've seen bowhead whales go back early when I'm out hunting. Usually they come around August or September, but not June or July [on their way back]. Everything is coming earlier than be expected, ducks and whales. Right now it melts so fast, already ducks are coming, and we're not ready for them yet, we're still hunting whales, we're not ready for ducks, we have to try to get both. All the animals are coming earlier."

New Species

Participants noted that several new species had move into the area in recent times, such as lynx, wolves, and musk ox. Musk ox in particular have been seen in the area for the first time within the last few years. *"Point Hope used to tell story about musk ox. They would come to the school and tell us stories."*

In the last five years the timing of "snowbirds" in the area has changed. In the past they would arrive in April, but they now come as early as February or March. One participant noted seeing a new kind of yellow bird that he did not recognize, also within the last five years.

The timing of animals' local movements and larger migrations in and out of the Wainwright area is shifting, making it difficult for subsistence users to predict when they will need to focus on one animal resource or another:

"Every animal is affected, the whole food chain. Their migration routes are shifting and changing, they are not in their [usual] migration route. Like whales, they usually come in April, [but] now they are coming earlier, and leaving us earlier. We think they'll be here but then they're gone…. You can't forecast it before; you can't forecast what will be tomorrow, you just go with it, you have to shift to another way of living, we have to adjust to another lifestyle, and that's really hard for us… There used to be a couple weeks between whaling and duck hunting, but now you have to go duck hunting right away. It's something we're struggling with but we're doing it. I just hope things get better for the animals out there, but it doesn't look that way. I think we've just done too much for this world to keep up with us."

Plants have also changed. The tundra colors are described as "different" and "brighter." The grass is shorter and possibly a new kind.

Passing on Knowledge

Wainwright differentiates itself from other villages in the region as being a highly active subsistence community. Teaching young people how to hunt and butcher polar bears is considered important to continuing an Iñupiaq way of life. Interviewees had taught their own children and grandchildren, as well as other peoples' children.

"Every trip I take, I take kids out. I let the nieces and nephews see how to do the work. They hop in the boat or follow me on the snow machine. It's tradition, you can't break tradition. It's teaching, teaching, teaching. My grandfather said the stuff I showed you, you're going to be the one to show others. You're going to be the ones to show all of them who are busy with village stuff. "

Bears caught during whaling, when the community comes together as a whole, provide an important opportunity for young people to watch their Elders process bears. When butchering a polar bear, people have been taught to take the shoulder blades, back legs, and meat off the ribs, to cut the neck off, but leave the stomach.

Even though the timing of the seasonal subsistence round has changed, traditional knowledge remains highly relevant and can be helpful in solving new problems as long as certain features of the landscape and waterscape (such as currents) remain the same. The following story illustrates this point:

"Every time I come from hunting, I share the meat with an Elder. He shares a story with me from the same spot 60 years ago. Sometimes I remember stories about mistakes from Elders and follow their stories to find solutions. [When we were in a bad situation that I solved] my cousin would ask, "How did you know this?" It was from how Elders fixed mistakes. I've helped out on a lot of hunts. Stories do help…. One time, my cousin and I got lost out on the water. There was fog, and no way out. My uncle said the first current goes south to north, then the next current [out from the shore] goes north to south, then the third goes south to north. We were on the second current 50 miles out, so the little tiny waves were telling me which way to go [and I navigated back]."

Utqiaġvik

Thirteen local experts were interviewed in Utqiaġvik, ranging in age from 35 to 61, with active hunting experience of between 25 and 50 years.

Sea Ice and Weather

Select Quotes on Sea Ice and Weather

"In 1982 when we moved here, the pack ice was here every year. There were huge ice ridges. The thickness now is not what it used to be. 1995 was the first time [I remember] that we saw the first sea ice in December."

"We've gone all the way into December or January with no ice; then it just has three months to build and get stronger and grow. It used to have six or seven months [to develop], [which would] be safer."

"It should be 20 below today [Nov 2017], not 20 above. There should be four or five feet of snow, but there's just a little bit."

In the past, annual freeze-up started in September or October and sea ice would be frozen solid by November, but now open water can extend into January. Interviewees remember the 1990s as a time when they first noticed a delayed freeze-up. This delay is significant not only in extending the open-water season, but also for shortening the period of time that ice has to solidify and thicken once it does form. Thus, the delayed freeze-up shapes the quality as well as the temporality of sea ice.

Multiyear ice used to extend into the Utqiaġvik region starting in October, but this has not occurred since approximately 2007. There is now a complete lack of multiyear ice in the proximity of Utqiaġvik. One reason that the loss of multiyear ice is carefully noted, beyond its implications for game and hunting, is that the very old ice or "glacier ice" was collected for drinking water, a practice that Utqiaġvik residents can no longer follow.

"A lot of times the multiyear ice had fresh ice [in it], so you didn't have to haul water. You could harvest that fresh water. This kind of ice is not common anymore; that's what we used to look for living out on the water. Over time, this ice would form like glaciated ice, over time it becomes less salty, and is very fresh drinking water…That's a noticeable change…the amount of fresh ice."

The multiyear ice used to be 8 to 10 feet thick. The community used to have to travel many miles from the shore to reach the edge of the shorefast ice to access whales, but now whaling occurs much closer to the community. The new shorefast ice that forms each year is thin (two to four feet thick) and extends only two or three miles from the coast. Changes in ice thickness in turn change the character of the "icescape"; thinner ice forms much smaller ridges, leading to a less differentiated ice surface habitat.

This new icescape is unstable, and easily blows away, a process that may be exacerbated by changing wind patterns. In the spring, leads and holes open more readily. The feel and quality of the ice differs as well; interviewees who spend time out on the ice say it has more "give" to it, and because of its delicate qualities, one must wait for a calm day to safely venture out on the sea ice.

One participant noted that despite changes in ice formation and ocean temperatures, currents remain largely intact, and certain areas remain rich in resources. He descried the shoreline west of Utqiaġvik as a "conveyer belt" of marine life:

"That area is always sheltered, and there's ice always moving; there is a pattern of how the ice melts—it's a conveyer belt of resources. The ice extent has retreated a quite bit, but once it re-forms, and freezes that conveyer belt system doesn't go away."

Other changes observed in weather include a delay of snow and snow accumulation in fall and an excess of rain during recent summers.

Impact of Sea Ice and Weather on Polar Bears

"My whole life up until the time I was in high school, the ice and polar bears was all the same. You could tell when [bears] were going to come to town and when they were going to den, it was predictable, like clockwork, then about 2005 the ice started changing."

As described earlier, multiyear ice previously arrived in the area in October, but this has not occurred since approximately 2007. This multiyear ice was known to bring polar bears. As detailed by one participant, *"They used to come down from the ice at this time. Then they would travel along the coastline in either direction from the point."*

With an absence of multiyear ice, the timing of polar bears presence in the Utqiaġvik area now follows a different rhythm marked by different events, such as fall whaling. When there is no ice present along the coast in the fall and winter Utqiaġvik sees few bears, although there are usually a few to be found on the beach at Nuvuk Point. However, this general reduction is punctuated by concentrations of bears on the coast and at the bone pile during ice-free times. For example, in August "seven or eight years ago" approximately 180 bears gathered near Utqiaġvik. There was no sea ice at the time.

There was disagreement across interviewees about whether climate change has influenced overall local abundance of polar bears, a finding discussed further in the section titled "Local Abundance." However, it is clear that lack of sea ice has affected the local distribution of bears, causing them to concentrate in coastal areas during ice-free times:

"Sea ice has affected bears by bringing more around, on the coast. The bears gather at that bone pile, at the Point [Nuvuk]."

"There's hardly any ice or anything, that's why they stay around the village or on the tundra. [But] they mostly stay up by Point Utqiaġvik [Nuvuk]."

Interviewees largely agreed that the absence of sea ice has also affected the location of polar bear denning: *"The ice used to be like multiyear ice, the layers on top of layers…Polar bears would hang out around that multiyear ice, and their den would be near that kind of ice."* In the past, dens were rarely seen inland, but this is becoming a more frequent occurrence.

Body Condition

Select Quotes on Body Condition

"Most of the bears you see in general are fat, with very few skinny ones, but there is lots of variety in bears, and you are always seeing different bears, so it's hard to say what their condition is overall."

"During whaling the bears all look healthy. The ones you see on land in fall time are skinnier."

"I haven't noticed any difference [in the condition] of bears over the years I've been hunting. I think it's just like caribou, some will be skinny, and some will be fat. It doesn't depend on age, or whether they are male or female; it's just variety."

Hunters agreed that bears are generally in good condition with "a lot of fat on them," and that this has not changed compared to the past. It is still considered notable and unusual to see an extremely "skinny" bear. However, local experts also acknowledged seasonal and individual variety that makes generalizing condition difficult. Seasonally, bears are skinniest from late summer into fall, particularly while they are spending time on land prior to freeze-up. It seems possible that there is greater seasonal variability in condition now compared to the past, a question which should be explored in future interviews.

Size

An unexpected, emergent theme in interviews in Utqiaġvik was polar bears' reduced size overall.[8] Local residents no longer see the largest class of bears, measuring over 12 feet. Those Elders with memories of bears 50 to 60 years ago emphasized this overall change in size. As one individual put it: "*"I know bears used to be bigger. Those bears were huge in the '60s and '70s."* It has become more common for interviewees to see small juvenile bears. However, it is possible that the size of bears encountered by individuals depends on how much time each person spends out on the land currently (for example, larger bears may avoid coming into areas of human settlement). Further interviews should explore this topic further.

[8] "Size" is a difficult concept to define, as it likely incorporates both age and condition.

Sick Bears

There was consensus across the interviews that seeing a sick polar bear (distinct from a merely skinny bear) has always been rare and continues to be rare. One participant characterized it as a "once in 10 years" event. None of the local experts, including those who harvest bears, had observed the characteristic symptoms of the new ice seal disease (patchy skin, green and pustule-filled flesh) in bears. Two hunters shared memories of harvesting bears that appeared unusual due to old age. For example:

"In February [1998], when the ice was coming back, I helped my older brother get a bear out on the ice in the springtime. It was a really old bear, and the top part of its claws were all white. When we started cutting it, the fat was very coarse. We finally got it all skinned and quartered up. He was about 9 ½ feet long."

Local Abundance

Select Quotes on Local Abundance

"There's been more bears; a lot of Elders have told me the same thing, people that go out and see bears can recognize this over the years."

"It's kind of the same number of bears coming into town, but there are more bears around in general since the 1980s."

"There are no more on land than there used to be. [The number] just depends on the year; in some years there are lots, but in the last few years I haven't seen very many."

"This year [2017] has been different; last fall there were over fifty bears in the Utqiaġvik area, but I've only seen one this fall. I was expecting to get busy with calls. I'm not sure why there is the variety from year to year, it probably has to do with prevailing winds."

No clear consensus emerged about changes in the local abundance of bears over time, probably due to participants' varying life histories and geographical familiarity, as well as high variability in the number of bears present from year to year. Initial results suggest that younger and active individuals spending the most time on the land outside of Utqiaġvik are more likely to report an increase in polar bears than residents who spend more time within the village boundaries; the latter group is more likely to report seeing fewer bears compared to the past. Further interviews should explore this association more completely.

Based on close reading of interviewees comments, it appears possible that bear numbers have increased in the region (outside the boundaries Utqiaġvik) but that there have been periods of reduced abundance noted in the last two years (2016 and 2017). Overall, however, variability from year to year appears to be a prominent feature of polar bear abundance in the Utqiaġvik

region, and further research should verify the hypothesis that this variability itself may have increased over the last 10 to 15 years.

One possible explanation given for the variability in abundance of polar bears from year to year during late fall and early winter (beyond ice conditions) is wind direction: *"The variety of bears from year to year] probably has to do with prevailing winds…When we have ice on the water, one direction of wind brings the bears closer*." (That direction is to the East). Interviewees indicated that wind conditions have become more irregular in the recent past.

Local experts did not report an increased number of bears coming into the town of Utqiaġvik itself. Although ice-free times are associated with seeing fewer bears, "mass gathering" events on the coastline near Utqiaġvik also correspond with ice-free times. Several participants recalled an instance "10 to 15 years ago" when approximately 180 bears gathered on the beach to scavenge whale mean.

Bears are reported as "getting stranded" on land during the summer, but interviewees did not indicate that this is happening more than it has in the past. At the same time, responses indicate that the number of bears seen in summer at Nuvuk Point and on the beach just north of Utqiaġvik has increased compared to several decades ago.

Feeding

Bears in the Utqiaġvik region feed on ringed seals (*natchiq)*, spotted seals, and bearded seals (*ugruk*). During and immediately after whaling season, the bone pile provides a limited source of food for bears in the area; the piles do not draw large numbers of bears comparable to those seen in Kaktovik.

In the summer and fall, bears scavenge on washed up seal, walrus, and whale carcasses along the shore, on barrier islands, and along more inland waterways. (This is one reason that hunters prefer to avoid catching bears in the fall: because the scavenging diet makes bears "taste funny.") Larger numbers of killer whales in the region have increased the number of washed up carcasses from other whale species, providing a new opportunity for polar bears (*nanuq*) to scavenge. Fall storms are known to wash up animal carcasses in the fall; later, in December or January, these remains may freeze into the sea ice as it forms.

"Bears scavenge on dead seals, walruses, grey whales, bowhead whales and beluga that wash up on the shore. [The carcasses don't necessarily need to freeze into the ice to be available]."

Scavenging opportunities for polar bears in the summer may have increased due to the presence of killer whales, which target other marine mammals, including young bowhead whales.

Possible shifts in polar bear diet did not feature strongly in local experts' responses. One hunter noted that polar bears have eaten snow goose eggs around Teshepuk lake in the past, but it was not clear if this is a new phenomenon.

Seasonal Movement and Habitat Use

Summer and Fall:

"A long time ago there were no bears here in summer. Now they are here [near Utqiaġvik] any time they want, in June, July, August, and September."

There was disagreement between participants about whether polar bears have always been around Utqiaġvik sporadically in the summer. However, there was agreement that bears are *most likely to be sparse or absent* from the Utqiaġvik region in July through October, during which there is no sea-ice.

One participant noted that outsiders often forget that an ice-free period in Utqiaġvik is part of a historical norm and fits is well within the environmental range of polar bears:

"It's always been ice free here from July through September or October, and that's when other people, non-Natives look at the area and think that all the bears are going to run out; they don't recognize what the bears are doing at that time. Then the bears come back…soon enough they'll be here, and they use that body of ice."

It is now possible to encounter a polar bear in the area any time of year, and some interviewees indicated that it has become more common to see bears in the area during summer as the environment has warmed.

In summer (as well as the fall) bears can be found on barrier islands along the coast and at the "whale graveyard" at Point Nuvuk, scavenging. One hunter estimated that an average of 5 to 8 bears can be seen at the whale bone pile throughout the summer, a number which can include mothers and cubs. There are more bears at Nuvuk Point in the summer now compared to the past. However, according to interviewees, there are not more bears coming directly into town in the summer in comparison to past decades.

In interviews it was not clear whether patterns of inland use in summer have changed.

Bears that arrive back on the shore and barrier islands near Utqiaġvik in September and October are often observed to be tired, and spend time resting on the beaches:

"When bears are tired and come on beach, it doesn't matter what [people] do [because they are so tired]. Last year there was a skinny one [that came on the beach] and didn't respond. It was a big one."

In early to mid-fall, bears spend time on the barrier islands around Utqiaġvik. "*When the ice is gone, the bears know how to [act]; their instinct is to use the islands to wait, and some bears go onto the mainland and rest*." During the ice-free season, bears can be found near town on the gas fields and behind the Naval Arctic Research Laboratory (NARL). In September and October, bears congregate during fall whaling:

"Polar bears usually come from the West, or occasionally from the East, and come on land at Nuvuk (the Point) [after whaling]. Three or four days after a whale is butchered, that's when they come in. They walk along the shore following the whale smell."

As freeze-up begins, more bears move into the area from both east and west. The arrival of bears is associated with a shift of the wind to the east. Some bears spend time on lagoons before moving out onto new sea ice in early winter. Bears hunt seals on the young "slush ice" in lagoons beginning as early as September and *"travel with the young ice"* as it forms along the coast. Beginning in late November through January, polar bears are further out on the ice, and seal hunters encounter polar bears during hunting trips.

"As soon as the wind shifts, and that young ice is a platform, the bears will come. The bears get a lot of seals in that [early] slush ice and water, when they're traveling with that young ice. We watch them get seals; even the younger bears get a lot of seals September through this time of year. There are lots of seals along the slush ice."

"You'll see concentrations of them in the fall barrier islands, waiting it out, waiting for winter to set in, then once winter sets in they "vamoose," take off, they can't wait for that hunting season."

Winter and Spring:

"When winter has set in, polar bears are everywhere, [but] not concentrated anywhere [in particular] … You'll see them along the coast between Utqiaġvik and Wainwright." They concentrate around pressure ridges and later, polynyas.

During seal season, humans and polar bears occupy the same hunting areas:

"During the springtime, we live with them on the ice, making our trails starting in February and March, where the lead edge is going to be created for the spring whale hunt. We'll see polar bears throughout there; we're in their domain."

In Spring, family groups with cubs emerge from their dens. *"If we start from the spring, spring is the time when cubs are going to come out. There are a lot of subsistence activities around sea mammals and things like that at that time. They will tend to be hunting seals on that flawed [rough] ice."* This ice "rubble field" provides a hiding place for seals as well as an ideal feeding habitat for bears.

In April and May, bears scavenge on whale carcasses left behind by the spring (human) whaling season. According to one participant, *"Springtime whaling is getting to be earlier and earlier, so the bears come in earlier too."*

Dens

"My grandfather knew where dens were, but that is because he used to go out for a week [walking] along the coast."

Interviewees report that dens are rare in the Utqiaġvik area. They are more likely to be found in places "up small gullies" and on the banks of high bluffs where snow accumulates. A few denning areas were identified on the USGS topographic map used in interviews. Denning areas are sometime identified by footprints left by cubs. Elders stated that intimate and regular knowledge of the land is required to be familiar with denning sites, which shift from year to year.

There was no consensus as to whether dens had become more common or less common in the region. However, responses did suggest that denning on multiyear ice has been reduced due to the absence of this sea ice habitat. Further interviews should address a possible resulting increase in denning further inland. In the spring, some individual bears are observed resting in "tents" of snow, but these are resting dens, rather than maternal dens.

Cubs

There was strong agreement across interviews that cubs seen by Utqiaġvik residents are almost always in good condition, and that it is very rare to see a "skinny" cub. The number of cubs seen in family groups does not appear to have changed within living memory (although one respondent reported seeing more cubs compared to the past). A group with three cubs is considered rare; two cubs is the most common number, and a single cub is more common than three. Family groups are sometimes encountered in snowy bluffs in the spring, especially to the west of Utqiaġvik. Cubs are most commonly seen during spring whaling season and may also be observed with their mothers on barrier islands near Utqiaġvik in the summer.

Ice Seals

Select Quotes on Ice Seals

"With the seals we're having more of a "heyday." With the younger ice, it's easier [for the seals] to have access to breathing and air, and there's going to be more places to harvest seals because of the new ice, for both people and bears. It's learning for us, but for bears it's just a matter of opportunity."

"A lot of [whether bears are around] has to do with timing of use of the seals…the timing of seals and denning. The denning starts as soon as the ice forms, then they start having their pups. The timing of [seal] pupping has not changed, it's the same."

"Seals nowadays have patchy skin; that's what I've been seeing in the seals. When I was little I don't remember that happening, then a couple years ago the ones we got were sick, with green and yellow inside. You can't eat them."

"There are sick bearded seals—the first time was 2014, there was the meat, then pus, grains of pus in the meat. We couldn't eat the meat, just used the skin to make boats. Some of the ringed seals, sometimes, they come on the beach to rest, and they're missing fur or have pink spots. Ugly, but I'm not sure if that goes with having bad meat."

Ice seals present in the Utqiaġvik region include ringed seals, bearded seals, and spotted seals, with ringed and bearded seals being most common. Ribbon seals are rare but occasionally are seen. Spotted seals have become more abundant in the area in the last 10 years. In 2017 they were observed in especially high concentrations. Fur seals have moved into the region even more recently, in tandem with warming conditions. More ringed and even ribbons seals are being seen further inland in rivers and at Teshepuk Lake, while bearded seals remain further away from coastal areas. Bearded seals have been observed with missing fur within the last eight years, but this has been less of a problem in the last two to three years. Interviewees agreed that ringed and bearded seals have not increased or decreased in abundance. The time of greatest abundance for all ice seals is in the spring.

Seal denning—which depends on snow cover—has been insulated from the effects of warming to some extent, because snow cover conditions on ice remain adequate throughout the seal pupping season.

All ice seals are reported to be in very good condition. However, hunters reported seeing disease in seals beginning in 2014, and especially in bearded seals. The characteristics of this disease are patchy skin, green and yellow internal discoloration, pus, and altered heart and stomach lining tissue.

Human-Polar Bear Interactions

In Town

"They're smart; they know that people are dangerous, although the younger ones don't. Usually when they come into town, they just walk through, on the outskirts of town, and get into a dumpster for pieces of seal or maktak."

The majority of local experts interviewed stated that the number of bears coming directly into Utqiaġvik has remained constant over time within their living memory, as has the behavior of bears coming into town. Participants noted that lights and car activity appear to deter bears away from Utqiaġvik, a factor less prominent in the smaller North Slope communities of Kaktovik and Wainwright.

Whale bone piles at Nuvuk are maintained partly in order to deter bears from coming into town, but this strategy has not been fully successful.

"There is a whale pile [on the Point, Nuvuk] to keep bears from coming into town, but they still come into town looking for meat."

Periods of open water in fall are associated with polar bears spending time in and around Utqiaġvik. Bears that come directly into Utqiaġvik are more likely to be young, though older bears are sometimes encountered as well. As is commonly reported in other North Slope communities, Utqiaġvik residents say that the curiosity and inexperience of younger bears is a

factor pulling them into human settlements. In contrast, *"If they are an old bear, they get so intelligent that they stay away."*

If deterrence isn't effective quickly, bears can become inured to deterrence methods, and can even learn to become familiar with specific patrollers: *"Young bears get deterred even harder [than normal], because they get to know you, it can be a little bit of a pain to try and keep them away for good."*

A subset of the bears coming into town are in poor physical condition (i.e. "skinny,"). Hunger is a factor that can make bears more dangerous to humans because *"When they are hungry they are not afraid of anything."* However, local experts did not report an increase in the number or proportion of skinny bears coming directly into town. Emphasis was placed on the characteristic wariness of settlements, and their avoidance of encounters with humans.

Just as young bears can become dangerous if they are not deterred, very old bears can be uniquely dangerous:

"When a bear has gotten really old and lost its teeth and has scars, has old age, they know where to go die. They will come closer [to people] and they are not afraid. If they smell food, they'll try to stay near food, as they are not able to hunt anywhere, and are disabled from old age injuries. They can't see too well, they're not sharp anymore, but they still know how to target small things like children. It's those big bears that are old, suffering, at the end of their lives [that can be dangerous and get shot."

In the past, patterns of human settlement and beach use meant that people had concern for the safety of their children in polar bear country:

"Children used to play on the beach a long time ago, when the Inupiat were transferring from sod houses. Seals would be basking on the beach, and bears would come in from the ocean depths. That would be a time of conflict, especially between younger bears, because they were just learning how to hunt, and learning how to be on their own. They had been shooed away by their mother. These bears looked at kids as food and were curious enough to kill. Sometimes if you weren't paying attention and your kids were playing on the ice edges, bears would come up out of nowhere. Sometimes these kids would make it away but would be injured. We've always thought that bears are a menace to the community."

Today, children are not as vulnerable to bears coming into town, due in part to the use of school buses, and in part to greater development of the town itself.

During Whaling

Spring whaling is a time when humans and bears interact closely. Bears may initially be attracted by food cooking at whaling camp, and then to the whale carcass itself. Once a whale is harvested, the community works to butcher it quickly, before the smell attracts too many polar bears. A patroller is assigned to keep the crews safe from bears, particularly at nighttime.

Because bears are attracted to the whaling activity, and because some become bold, young hunters sometimes catch their first bear during spring whaling, when they are surrounded by Elders who can teach them how to properly harvest and process the animal.

"Same with the polar bears, [the young people] are guided from Elders out there with them, they really teach them how to take [the bear], how to cook them and skin them up. They bring back the meat and put it in the captains' yard, people come get what they want from the animal."

This serves the dual purposes of keeping whalers, their families, and children safe from bears at camp, while also providing subsistence hunters with an important traditional rite of passage.

The most problematic bears at whaling camp tend to be young, inexperienced bears, characterized by interviewees as "curious."

Interviewees agreed that there has been no increase in human-polar bear conflict during whaling. Bears behave in the same way that they always have, feeding but preferring to maintain a distance from humans. Although whaling can attract relatively large groups of bears, there was no mention of increased numbers of bears being attracted to spring whaling in Utqiaġvik; other data sources or future interviews could clarify this point.

Keeping a clean camp is a serious task when polar bears are around. A trash site is maintained at least 100 feet away from camp.

Like Kaktovik, Utqiaġvik has a designated area for whale remains, at a distance from the village: Nuvuk Point. Bears scavenge at Nuvuk Point in small numbers nearly year-round. However, polar bear tourism has not developed at the bone pile as it has in Kaktovik. (A previously operating tour company had shut down by late 2017). By placing whale remains from both spring and fall whaling at Nuvuk Point, crews hope to draw bears away from town and towards an alternative scavenging site.

"The whale provides an easy place for animals to concentrate and feed off the bones that are not taken. It will sustain them quite a while. It's been that way for hundreds of years."

"It's the same with both the spring and fall whaling: bones are left. Whales that are lost or that get beached and we can't get to, that becomes a big concentration of bears. Human activities [have affected polar bears] for many thousands of years."

Attractants

Local practice in Utqiaġvik dictates that all marine mammal scraps are kept separate from other trash. That waste is then relocated to the Nuvuk bone pile rather than the dump. Waste from ice cellars is sometimes relocated to the Browerville area. When marine mammal waste is not relocated to one of these sites, or mixed in with the regular trash, dumpsters and the dump itself can become attractants. Whale fat placed next to dumpsters for proper disposal can also attract bears prior to its relocation.

During seal hunting, hunters must watch for polar bears and be prepared to scare them away:

"When you are going to go hunting, you drive around to make sure that there are no polar bears around, because once you kill the seal, they will come and want the seal, they will not go away. He's going to want the seal you just have to go watch him eat it."

Polar Bear Deterrence and Patrol

Utqiaġvikmiut place themselves in the center of a spectrum of interest in opportunistic polar bear hunting. Whereas an opportunistic polar bear hunting tradition is strong in Wainwright, in Kaktovik, "mercy kills" are a last resort. Utqiaġvik lies in between these extremes. Human-polar bear encounters in town or during whaling can provide an opportunity for young hunters to take bears, and occasionally problem bears must be killed. However, there is also a strong emphasis on organized deterrence in Utqiaġvik. A common complaint among interviewees is that dedicated patrols have been subject to inconsistent funding. Dedicated patrols are therefore used primarily during whaling seasons. Staff of the North Slope Borough Department of Wildlife Management operate as an effective as-needed patrol in practice during other times of year. When a bear is observed in town, they announce it on the community-wide VHF radio. The first attempt at deterrence depends on loud noise with firecrackers and slugs, but some "problem bears" do not respond to this approach:

"If a bear is in town they'll scare it away with explosions, and if it doesn't go away after a day or so a hunter will go and get it, if it's that hungry or brave to stay around town."

"They don't shoot them, just scare them off, but the next day they may come back, so they'll do the same thing over. When they get tired [of scaring them away] someone hunts it to give away food. The hunters are the polar bear patrol."

Unlike in Kaktovik, a polar bear tourism industry has not developed in Utqiaġvik. However, Utqiaġvik is a diverse community, and not everyone is familiar with polar bear safety. Occasionally, patrollers and community members must intervene to keep people from approaching bears.

Subsisting on Polar Bears

One Elder recalled that before the 1950s, dog teams were used to hunt bears, but in the early 1950s snow machines took over. In the past, polar bear skins (along with other animal skins) were important to survival in the barter economy; hides were collected and used in trade and to purchase food. Unlike other fur animals, however, bears could not be trapped and thus required hunting expertise to catch. Despite changes in the economy and technology, polar bear hunting continues to be a specialized subsistence practice today.

Many people in Utqiaġvik continue to enjoy eating polar bear meat as part of a subsistence diet. As one interviewee said, *"Polar bear meat is nikqipiak—our foods."* The best time to eat polar bears is between March and November, when they have been eating ice seals (rather than scavenging on dead marine mammals). Elders particularly crave polar bear meat; the paws are

considered to be a delicacy. It is traditional to bring polar bear meat to Elders, especially if it is a hunter's first successful bear hunt.

The rest of the meat is pared down into shares and distributed throughout the community via announcement on the VHF radio. Hunters put in a great deal of time and energy hunting and processing the animal so that the meat can be shared with the wider community. Unlike other subsistence foods that can be frozen and eaten later, bear meat is eaten fresh (after cooking for three to eight hours), so it demands immediate attention:

"It's different when you get a polar bear, because you can't age it or eat it frozen [like other subsistence animals]; when you get a bear, you have to take care of it right away. People like to eat it fresh, that's just the nature of polar bear. It has to be gone within the first couple weeks, so you have to have a network of people [to take and eat it]. Lots of people at the church depend on hunters to provide. When I get a bear it's usually gone in the first couple days, because people know who the hunters are in town."

When an old or skinny bear is taken (as occurs with defensive kills in town sometimes), the meat is less desirable. However, in Utqiaġvik there are individuals who are willing to eat the meat even from older bears after cooking it for an extended period of time.

Taking care of the hide is also a lengthy process that depends on traditional skills as well as resource inputs of time and money:

"It's a lot of hard work. When I harvest a bear I skin it, scrape the oil off from the skin, distribute the meat, go back to the ocean and wash the skin, take it back home and scrape some more oil off, then take it back to the ocean and wash it with snow and salt water. It's not easy. Then you put it on a frame and stretch it out and let the January and February sun bleach it. Then I bring it back in and then you have to scrape it again for the ladies to sew. There are tanneries that do it, it takes about a month; tanning a skin is not cheap."

In recent years it has become increasingly difficult to find a place to tan polar bear hides, as tanneries are targeted by federal inspections, thus shifting this work back on to the hunter and his family. Home tanning is never as effective as professional tanning and makes the hide more difficult to sew with or incorporate into other traditional clothing and handicrafts.

Polar bear fur—which is extremely warm and waterproof— is still used to make mittens, boots, and *quliksaaqs*, or waterproof polar bear pants, ruffs, ornaments, and floors for whaling camps. On the market, traditional handicrafts made from polar bear fur can be an important source of supplemental income.

Polar Bear Hunting Season

Winter into springtime (November through April) is the preferred season to harvest polar bears because their fur and meat are best at this time. However, the time of year when polar bears are actively hunted is now delayed: *"The best time to hunt bears is after November when they've*

been eating seals. However, the polar bear hunting season now starts two to three weeks later than it used to due to changing ice conditions."

"The best months to hunt are November through April. In the summertime they've been scavenging, so they taste funny. In November through April, the hides are nicer too."

"As long as they're out on the ice, they are white; in the fall time they get dirty."

One of the most experienced polar bear hunters interviewed described his preference for hunting in the dark of January, because this is when bears' skins are in best condition, and the moonlight at night helps with observing bears at this time.

Polar bear hunters in Utqiaġvik today prefer to catch small bears because the meat tends to taste better, and the fur is softer on younger bears. Furthermore, harvesting a small bear reduces the work associated with processing a bear, which is substantial and usually done solely by the hunter.

"It is better to get smaller bears for eating and working on. The biggest bear I have ever harvested was about 11 feet long. It took hours to take care of.

"I like to get six and a half to seven-foot bears. They [Dad and Uncle] would teach me how to get those bears; bigger bears are tough to handle when you're alone."

Regardless of preference, hunters follow local rules that dictate against harvesting any member of a family group. Some also prefer to avoid female bears altogether but distinguishing the bear's sex in a hunting situation is often impossible.

Approaches to Hunting

"The polar bear was revered in the past as being scary and dangerous. When a bear came into a community, it came because it was hungry; they didn't come in for no reason. When a successful man heard of a bear in the proximity they would go after it right away. They would go after it and kill it."

In many North Slope communities today, polar bear hunting is largely opportunistic, consistent with the tradition described above. However, in Utqiaġvik, bears are actively sought out by a small group of expert hunters in winter and early spring:

"When I go hunting in December or January I go looking for bears, but other times it's more opportunistic."

"I start hunting in January. Whenever I go look for them, the tracks at Nuvuk is where we'll usually start. I'll go to the Point (Nuvuk), and then if I don't see them there I go to Monument and look for tracks all along the coast."

Sometimes, active hunting is motivated by a specific need, such as an Elder having desiring polar bear meet, or a whaling family seeking a polar bear hide to line the floor at whaling camp.

Hunting for Bears During Whaling Season

Bears are sometimes harvested during whaling season. Whaling, which attracts bears and provides an opportunity for younger hunters to harvest one surrounded by community members and Elders who can teach them how to process the animal. Bears harvested by a whaling crew member at this time traditionally belong to the crew's whaling captain. It is preferable to take a bear when whaling itself is complete, as polar bear hunting and processing diverts precious time and energy away from the task of whaling. There are additional reasons to avoid mixing polar bear hunting and whaling:

"The decision to hunt depends on whether we want to scare it away or skin it and eat the animal. Sometimes it's a safety thing. More than likely we'll take one when we won't contaminate whaling camp and have time. The whales can smell too, so we try not to contaminate camp, or the whales will smell you and miss you [stay away]."

Revitalization of Hunting

The work involved with taking care of a harvested polar bear deters some in the younger generation. Some are now satisfied to capture polar bears in photographs.

Despite an overall decline in polar bear hunting, many continue to feel that it is important both to Iñupiaq identity and as sustenance:

"Polar bear hunting is very important for keeping Eskimos as Eskimos."

"Polar bear hunting is important because it brings food to the table."

"Overall there is not as much interest in hunting bears compared to the past. I hope the tradition keeps going."

A small but meaningful cultural revival of polar bear hunting is occurring among a limited group of young to middle-aged hunters in Utqiaġvik. Many of these individuals experienced intergenerational disruption of the polar bear hunting tradition and have had to learn from a very small group of local polar bear hunting experts. For some of these individuals and their families, polar bear hunting provides a way to connect with a way of life severed by settler colonialism. It is explicitly recognized by this cohort as an integral part of spiritual "decolonization" and healing. As one hunter described:

"Before I started hunting I had nightmares of bears for months and months before hand. [In my dreams] I would stop when walking home and see one, but I would wake up right before it got me. After I caught that first bear, the nightmares stopped."

Like previous generations of Iñupiaq hunters, these individuals remember their first bear as an important rite of passage; hunting one's first bear has taken on additional meaning within a context of cultural revitalization.

Other Species

As in Wainwright, lynx and muskox are now being seen in the Utqiaġvik region. Killer whales are now more common, though not new. As described earlier, fur seals, which in the past were delimited by the Kotzebue region, started to be seen by Utqiaġvik residents within the last two to three years: *"My son came home with a seal and didn't know what it was. He was not used to seeing a seal with ears!"*

Brown bears (*aklaq*) were mentioned very little; they are not usually observed in the vicinity of Utqiaġvik but are known to break into cabins traditionally kept by Utqiaġvikmiut to the south.

Impact of Sea Ice and Weather on Subsistence

Select Quotes on Impact of Sea Ice and Weather on Subsistence

"I used to hunt for bearded seals [in the spring] and take two or three before the ice went out early. Now you always have to go further and further out [looking for animals]"

"The ice has changed a lot since I was little. We used to have ice all year round, but now it goes way out. It used to be out like 5 or 6 miles at the most, then it would come back. The ice has gotten thinner; it used to be really good for whaling, but now whaling is getting a lot more dangerous. The lead for whaling has gotten really close to the coast. It had been 5 miles out when I was young, but a couple of years ago the lead was just ¼ mile out."

"Things are more precarious; there are odd ice breakout events, there is ice breaking closer to shore, and our spring whaling is being affected significantly. We haven't seen multiyear ice. Usually there would be multiyear ice which is safer, heavier, and denser, and that is what we pull our whales up on. But nowadays it's first year ice that's been accumulating and which has been pressured and frozen together. Then the danger goes up significantly. If you don't have safe ice to pull it up on, whales can be lost because of bad ice. Last whaling season there was only one spot to pull up the number of whales that were harvested; it just got messy, and even that ice wasn't the best.

The most prominent impact of changing sea ice and weather on subsistence is an increase in dangerous, unpredictable ice conditions for hunters and travelers. New knowledge about sea ice behavior must be quickly created if hunters are to stay safe. Traditional knowledge is naturally adaptable, but

"You have to throw a lot of the knowledge out the door because it's so dangerous. A lot of the dos and don'ts and the laws [about the environment] you would follow you almost can't use

because of the different times. We probably don't have words for some of the conditions we're seeing (in Iñupiaq)."

The thin, annual sea ice behaves very differently than the thick multiyear ice of the past:

"The other change is the thickness of the ice. It's not the same, and it's almost like we're relearning how to use ice that is not multiyear ice. We try to learn how that type of ice can be used, vs. the ice that was very normal to use, that we understood so well. Until it deteriorated, we knew what the strength was, the probability of it floating away. It provided security. That knowledge was drawing on years and years of working with Elders and adding observations. The change in the ice dynamics is something we are dealing with.

Changes in the three-dimensional qualities of the ice "terrain" are also having impacts:

"When the ice is flat [instead of having pressure ridges or being "rough,"], it's dangerous. Now there's hardly any rough ice. It's dangerous but we have to go through it [to do hunting]. We try to stay on the hard ice, on the safe side. Young people have to learn about those kinds of things; sometimes people don't know how to navigate and get lost. We have to go look for them and bring them back."
Inland, the safety of travel is affected as well:

"[Now] the ice warms up and melts; it doesn't get that cold and makes anything wet and mushy. It's scary to cross over lakes when I don't know if they are frozen."

Ice fishing is delayed as people wait for safe, solid ice to form on the lagoons in fall. In the past, ice fishing could take place in October, but at the time of interviews (late October and early November), ice fishing was still on hold.

Sealing and whaling traditions in particular face new challenges because of the earlier melting season. During the traditional time for bearded seal hunting in spring, hunters must travel much further out to find the ice and animals. This not only increases risk also but comes with greater costs in time and fuel. Similarly, lack of freeze-up in the fall makes seal hunting at this time of year dangerous.

Whaling, at the heart of Utqiaġvik's subsistence culture, is being affected by changing ice conditions. Solid, thick ice is necessary to bring a whale in during the spring. Bringing a whale in on the thin, new ice that forms each year comes with danger and challenges.

The ice blows in and out, forms rough edges, and may break off unexpectedly. This makes staying at spring whaling camp on the ice dangerous; people must be able to move camp at a moment's notice if ice breaks and shifts with winds and currents. The unstable ice can also cause loss of struck whales. In some cases, the changing ice has caused Utqiaġvik's whaling crews to select smaller whales that can be supported by the thin ice.

The location of whaling itself is shifting on a yearly basis, determined by proximity to areas where a whale may safely be brought in on solid ice. As the ice edge and location of leads has gotten closer to shore, so has the whale butchering site (also bringing it closer to town).

A lack of suitable areas to bring in whales means that spring whale processing becomes a more concentrated activity and coordinating the processing of whales brought in by multiple crews becomes difficult.

Passing on Knowledge

"Polar bear hunting is about family, friends, and willingness to learn hunting. You have to be thankful and learn how to take care of the animal."

Many of the individuals interviewed felt that it was important for younger people to have the chance to learn the polar bear hunting tradition, which entails respecting polar bears and learning to hunt them the right way.

The teenage years are the ideal time to learn to hunt polar bears (although many individuals are now learning later on).

"I think it's important for kids to be able to hunt polar bear. It provides more meat, just like caribou, ducks, geese, and seals. Our kids want to go polar bear hunting, and there's no age limit, but we'll probably wait a few years. It is pretty dangerous, he has to be able to protect himself."

"My son would like to learn; he is 16—he's gotten everything except a beluga and a polar bear. Continuing the tradition will be up to him."

Because polar bear hunting is a specialization (and perhaps also due to declines in bear hunting caused by intergenerational interruption), active bear hunters are involved in teaching young people beyond their immediate family. Just a few active individuals are now responsible for teaching others how to properly hunt and process polar bears. As one man who had recently learned how to hunt polar bears from a mentor outside his family said, *"I learned a lot from getting on dance groups and talking to Elders."*

Small groups of hunters go out looking for seals in winter and encourage young people or less experienced hunters to "follow" them in order to learn. Bears are sometimes encountered during these trips, providing an opportunity for an inexperienced hunter to catch his or her first bear. Proper hunting rules include sharing the bear with Elders.

Whaling provide another context in which young hunters can learn polar bear hunting skills from their Elders:

"A couple years we all went whaling in polar bear country. Quite a few bears were taken at that time. The past few years in spring it's been like that: the youngest folks will harvest bears. There are so many more and more younger whaling captains than there used to be in the past. In the

80s there used to be like 10 or 15 captains, and now there are 30. A lot of them are young and are still learning. When they have an older person then they are guided, about how to take care and process the animals."

One local expert noted that *"Once they learn how to hunt polar bear they hardly ever forget."* However, new and old social barriers sometimes prevent young men who would otherwise become more regular hunters from doing so:

"It seems like they will get one or two, then it's hard for them to go out because they have work. It's hard to go out when it's time to go out. When they're younger they are thinking about it, but then they have girlfriends; when they are teenagers they are teenagers, they do other things by nature. Then they might come back to it later [when they are older]."

Furthermore, youth in the community often leave for education and jobs in urban centers beyond the region. On the other hand, Alaska Natives from other communities may come to Utqiaġvik for college and develop an interest in learning how to hunt locally at that time.

Nuiqsut

Twelve residents of Nuiqsut participated in the study, including Elders and active hunters.[9]

Sea ice and Weather

"*The weather, and everything that breathes the air is being affected*."

"Today every season is trying to be ice-free."

Nuiqsut residents strongly agree that sea ice habitat has changed dramatically, a transformation they first began to notice as early as the 1980s, and which accelerated after the early 1990s. Their accounts of sea ice combine observations from the coast north of their own inland community, at their whaling camp on Cross Island, and from Utqiaġvik, where many continue to have close family ties, and where many Nuiqsut residents travel for whaling each spring.

Interviewees who grew up in Nuiqsut thirty years ago or more remembered snow *"higher than the houses,"* and commonly experienced temperatures of thirty below freezing in deep winter. Even at such temperatures, children spent time outside sledding, although they were told to stay close to the village *"or Nanuq will get you!"* This contrasts with norms today, where such temperatures would be experienced as too cold for children to play outside, perhaps due to lifestyle changes as well as warming temperatures.

Fall freeze-up season occurs two months later than it did historically, and melting season now occurs in April, rather than May.[10] Furthermore, because melting occurs quite rapidly, it has caused new problems with flooding for the community.

While participants reported that the temperature of the air and of the water is rising, they indicated that changing patterns of sea ice are not due to temperature alone, but are highly dependent on wind strength and direction.[11] One of the greatest changes in coastal waters north of Nuiqsut is a shift towards long periods of open water, attributed to changing wind patterns. When there is an east wind in the fall, ice solidifies on the coast, but a west wind takes the ice out to sea. And, as one participant summarized, "*We used to have [a dominant] east wind, now we are having west wind."* In the past, Elders remember that shorefast ice was strongly anchored to the shore. Today, the changing wind patterns keep ice from forming even when temperatures are low enough. The winter storm season is delayed in some years, occurring in March, rather than in January and February, as in the past.

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[9] The ages of participants are not available for Nuiqsut.

[10] In 2018, an interviewee noted that the timing of winter storms was delayed. "We usually have all our storms in January and February but [this year] it was all in March."

[11] The theme of shifting winds, and their effects on ice conditions, emerged across the study area. Whereas conversations about changes in sea ice often focus on Arctic temperature shifts, TEK accounts suggest that changing wind patterns should be given greater attention in considering the effects of climate change on both humans and animals on Alaska's North Slope.

Whereas in the past, icebergs were commonly present into July, multiyear ice is now completely absent from the subsistence sphere of Nuiqsut residents: *"There's no ice; the ice is totally gone. When I was a young boy twenty to twenty-five years ago, they used to have icebergs as big as buildings, as big as the school."* As noted across the region, large icebergs (described as "two to three-stories high") have not been seen by Nuiqsut residents within the last fifteen years, with some interviewees recalling that old ice began to be noticeably less common in the 1980s. One participant recalled, "*1984 or 1985--that's when the ice first retreated, and [since then] we've never seen that [old ice] much, especially in the last five years."* In the past, Nuiqsut residents used to obtain fresh drinking water from very old multiyear ice, but this is no longer possible. The old pack ice has been replaced by the new, thin ice that is described as "slushy," "weak," and even "sick."

Nuiqsut residents now observe a cycle of stronger new ice formation approximately every five years. Speaking in 2018, one interviewee stated: *"Every five years the [new] ice [is more robust and] stays 10 miles wide, forty miles long. The last time it happened was three years ago*." During years of relatively good (new) ice formation, Nuiqsut hunter are able to travel "eastward all the way to Hampton Bay, or 10 miles north, or west past Northstar Island. During these times, pressure ridges are still large enough to shape the hunters' course of travel.

Impact of Sea Ice and Weather on Polar Bears

Select Quotes on the Impact of Sea Ice and Weather on Polar Bears

"Polar bears are the ones that are seeing the change because of the ice melting. Bears come to Cross Island and fall asleep in about August or September. There are lots of bears coming into the barrier islands."

"*Around 1998 [polar bears] started coming to the barrier islands. Polar bears were all over the coastline the first time there was no ice. Some years if there's lots of ice then we don't see them*." *"There have been changes in sea ice; there are no seals. It must be harder for the polar bears, especially for the ones that go to these barrier islands. That's where they are mostly staying in the summer months--on the barrier islands. They have no ice; they are stranded."*

Since the late 1990s polar bears have been spending more time on barrier islands and along the coast north of Nuiqsut. Some bears are spending summer months on the barrier islands as the northern edge of the sea ice quickly recedes. Other bears arrive at Cross Island in August or September, visibly tired. Access to ice seals is dramatically reduced during ice-free times, and overall abundance of ice seals is reduced in territory observed by Nuiqsut residents, likely impacting prey availability for bears.

Some respondents attribute the poor physical condition of some bears—and possible reduced overall size for all bears—to newly limited access to sea ice and ice seals. During ice-free times, polar bears are more likely to be seen inland. This is still relatively rare, however. Participants report that during years of "good" new ice (still noted to occur according to a five-year cycle), polar bears are seen far less often because they are out using the sea ice habitat.

Body Condition

"Some are skinny, and some are healthy, every year there are some of each."

The condition of polar bears encountered at Cross Island is highly variable, even within a given year. No consensus emerged on overall trends in condition. Skinny bears are still considered anomalous, however. Skinny bears are most noticeable when residents first arrive at Cross Island for fall whaling, as well as during whale butchering. Many interviewees agreed that the majority of bears seen at Cross Island during whaling season are in good physical condition. However, some interviewees indicated that the proportion of skinny bears seen at the beginning of whaling and butchering has increased slightly compared to twenty years ago. When bears become thin, *"It looks like they went to the store and bought coats"* because their fur becomes loose on their bodies. When bears are in poor condition, they are more likely to become problematic for whalers.

One whaler stated his belief that condition varies according to the bears' survival strategy during ice-free times: *"The ones that stay on the islands [in the summer] aren't that skinny; it's the ones that swim across from the ice, trying to come back; those are the ones that are skinny, the ones that stay on the island are fatter."*

Another interviewee recalled an instance within the last five years when parts of a whale carcass had been brought to town from Cross Island for processing. A "skinny" polar bear showed up just a few hours later. This was the first time that he ever remembered a polar bear following a whale carcass all the way into Nuiqsut:

"The whaling crews brought back maktak [to Nuiqsut] in September. We were carving whale up [in town], and four hours later a polar bear showed up. He was really skinny. This was the first time that happened ever."

There was no consensus on the subject of whether the average size (i.e. length/height) of polar bears has changed over time.

It is rare to encounter "sick" bears—i.e. bears that show evidence of disease or injury. However, if a bear becomes sick, it can pose an additional threat to whalers at Cross Island:

"I've seen one sick polar bear at [Cross Island]. We had to put it to sleep. It was an 11-footer. It was getting so dangerous. It had a scar like it might have been mauled by a bigger bear. That bear was all messed up. It was really slow like it hadn't been hunting because of his sickness. "

Local Abundance at Cross Island

"In 1998 they started coming to the barrier islands. Polar bears were all over the coastline the first time there was no ice. Some years if there's lots of ice then we don't see them.
There are more polar bears on the barrier islands than ever before."

Cross Island is a historical whaling site for Nuiqsut and Utqiaġvik residents: "*Around the 1920s, our great-grandfather used to go from Utqiaġvik to Cross Island."* Leaving bone piles at Cross Island is an established practice. Whaling is possible only in the fall, as whales follow the coastline on their migration route; in the spring, bowhead routes take them too far away from Cross Island to be accessible. In the spring, Nuiqsut crews join Utqiaġvik for whaling.

After a period of interruption, fall whaling at Cross Island resumed in the 1970s. For many years after whaling began, few to no polar bears were encountered at Cross Island during fall whaling: *"Twenty years ago there was nothing at all. [At that time] we were in a tent, we had no fear of polar bears."*

Participants agreed that the number of bears observed at Cross Island has increased markedly in the last twenty years and accelerated as recently as five years ago. In 2017, there were far more bears than in the previous year. Interviewees attribute mass gatherings of bears during whaling at Cross Island to reduced sea ice.

When bears first appeared following successful whaling, *"there used to be just one or two skinny ones."* 1998 is remembered as a notable ice-free year, when bears first started gathering on barrier islands and were present during fall whaling. Today, dozens of bears of varying condition are encountered during fall whaling on Cross Island each year, a number which continues to increase overall while fluctuating annually.

The incursion of bears has meant that Nuiqsut whalers must now keep whale remains as far away from whaling camp as possible. It has also affected the logistics of whaling camp, which must now be bear-proofed.

Bears are now present on the island when crews first arrive, before a whale is harvested.

"On Cross Island you'll see 30 or 40 bears [when you first get there]. Before the first whale is landed, there will be more coming."

More come immediately after a whale begins to be butchered: *"The bears smell the whale. They are on the other islands then swim to Cross Island."*

Males, females, and cubs are all attracted to the whale carcass in the hours and days after butchering, however, some interviewees noted that mother bears with cubs are more common than lone males.

Cross Island is changing shape due to ocean erosion. While the sandbar is growing on the north side, other parts of the island are being eaten away by the current.

Interviewees stated their belief that Kaktovik serves as a competing attraction, drawing bears away from Cross Island if crews do not bring in a whale, or once bears have finished scavenging remains at Cross Island.

Polar bears are reportedly present at Cross Island and surrounding barrier islands during other times of the year, including spring and summer: *"There is nothing for polar bears to hunt during the summertime. They used to go north. Thirty or 40 years ago they'd be out on the ice pack. They started staying on the barrier islands a little less than 30 years ago."* However, Nuiqsut residents have fewer opportunities to observe them directly during times outside of fall whaling season.

Behavior

During interviews, many local experts commented on observing "tired bears." Specifically, they described noticing that more bears—especially family groups—arriving at Cross Island and other barrier islands during fall whaling appear to be exhausted from physical exertion. They also noted an increased number of bears "resting" on the islands:

"There are more bears coming to rest on the shore. If you're [the barrier island] the only thing out there floating, the bears will come. They are exhausted, there is nothing to rest on. There was a bear recently that was trying to get into someone's boat to rest."

"Barrier islands are a place [for the bears] to relax. One year [in the fall] we were out scouting for whales, and we were out by Narwhal Island, 20 miles northeast of Cross Island. There was no ice, and there was a polar bear that was very tired and trying to get in our boat. [Then it] turned its body straight towards Cross Island. We were way out, but he knew just where he was going."

According to interviewees, tired behavior is a relatively new and noticeable trend. Future interviews should clarify when this trend began.

Feeding

In winter and spring, polar bears hunt for seals on the ice or on barrier islands, depending on sea ice conditions. In summer and fall, they scavenge marine mammal carcasses on the barrier islands north of Nuiqsut.

No Nuiqsut interviewees had observed polar bears eating new foods or exhibiting novel feeding behavior. Bears are known to occasionally eat bird eggs:

"All these barrier islands are full of seabirds, ringed seals and spotted seals. Birds of all kinds nest on the barrier islands, and the bears will eat all the king eider, and seagull eggs in May, June and July."

Polar bears are occasionally seen inland during caribou hunting season, a behavior which is not new. Brown bears are known to hunt for caribou, but this is not a behavior that has been observed for polar bears. During "hot" summer weather, caribou venture out to barrier islands, but there were no reports of polar bears going after caribou during these times.

In August and September, polar bears eat Arctic Char from shallow areas "with their paws" at the mouths of rivers, as well as further inland along river banks. They are also known to catch trout. Unlike in Kaktovik, polar bears scavenging from fishing nets is not an issue in Nuiqsut.

The main consensus from Nuiqsut residents regarding polar bear feeding behavior and diet is that *nanut* are believed to be relying more and more heavily on Nuiqsut whalers for food in the fall.

Seasonal Movement and Habitat Use

In August or September, Nuiqsut whalers travel to Cross Island. The timing depends on the bowhead whale migration:

"The past couple of decades we have been going a lot earlier [because the whales are there earlier]. We used to go out to the island mid to late September; now it is so much earlier."

Regardless of exact timing, polar bears are already present on Cross Island when the crews arrive each year. When they are done scavenging whale carcasses, some bears depart, with others remaining on Cross Island into December. The most intense period of habitat use for Cross Island is August to December. However, bears can be encountered at Cross Island any time of year:

"There are a lot of bones and carcasses from the previous year's whaling [on Cross Island]; they polar bears will [still be] eating that in the summer. They could be eating King Eider eggs. Bears are around all year around; there's never a time when there's no bears [in the Cross Island/adjacent coastal area]."

In fall and early winter, Nuiqsut residents also see female polar bears traveling up riverbeds, perhaps in search of denning habitat. The occasional lone polar bear is encountered inland, especially during caribou hunting season in the fall, but this phenomenon does not appear to have changed in frequency over time.

While pregnant female bears den from December through March, male bears spend January and February widely dispersed on the sea ice, while. When sea ice conditions are poor in the winter, both ice seals and bears concentrate on barrier islands. When family groups emerge around March, they are sometime observed by Nuiqsut residents as they move towards the sea ice.

Dens

"[Historically] the bears would come in from the ocean in October and November. They would come inland, and go to sleep on the banks, and just get covered with snow, then they would move around and make a den inside the snow and come out in March."

Overall, hunters agreed that there is slightly more denning in the inland Nuiqsut region compared with the past. Elders noted that more bears are denning on barrier islands and inland because of lack of sea ice and are denning in areas that overlap with industry development. This was particularly noticeable around 2015.

Local experts noted that there were maternal dens on Cross Island "about five years" prior to interviews; this was a notable, rather than regular occurrence.

Today, bears den between December and March. Some interviewees indicated an earlier period for the initiation of denning in decades prior; future interviews should examine whether denning is now beginning later than in the past, and whether overall denning time is reduced, distinguishing between maternal and "resting" dens.

Participants noted that dens have been observed on the coast and inland by industry workers in the last two years, but it is not always clear what proportion of these dens are maternal versus resting "tents," as they are called locally:

"Four years there was a discovery [of the den at development site]; they didn't know there was a den until it came out. They are hard to see, especially when they're out on the ice. They den right on the coast lines, right on the bluff. Where there's snow pack, they stay for up to 6 months at a time."

It is possible that development and exploration has led to a greater awareness of previously existing denning habitat. Interviewees expressed concern that coastal industry and associated seismic activity may be scaring bears away from the coastlines, causing them to den further inland.

Cubs

Nuiqsut residents observe cubs at Cross Island in the fall, and closer to Nuiqsut when family groups emerge from dens around March. *"A lot of bears, they'll come out [in the direction of] town, [and] some come right through town. You see a lot. It's females with cubs most of the time."* Overall, it has become slightly more common for Nuiqsut residents to encounter family groups now compared with the past. Given observations that dens have shifted further inland, further interviews should explore whether it has become more common for residents of Nuiqsut to encounter family groups during the time that they are emerging from their dens in spring. The number of family groups seen during fall whaling varies from year to year, ranging between two and twenty, with the 2017 whaling season being notable for the lack of mothers and cubs.

Interviewees agreed that the number of cubs in a given family group has stayed the same, with two being the most common number, and one or three cubs being less common. Only one hunter indicated that cubs are skinnier than they used to be.

Ice Seals

"*Climate change is for real, and it's taking a big toll on all the marine mammals. Some summers bearded seals are hard to find, some seasons they are all scattered. Some years you can easily harvest them, and some summers you have to go out look for them, travel a further distance*."

Nuiqsut residents are familiar with three kinds of ice seals: ringed (*natchiq)*, spotted, and bearded (*ugruk).* Spotted seals spend time in inland channels and "taste like fish," whereas ringed seals are found further out. Around August hunters go looking for bearded seals and encounter high variability in their presence from year to year.

Lack of sea ice is associated with absence of ice seals; however, seals may also congregate on barrier islands during ice-free times, in turn attracting polar bears. One Elder suggested that ice seals are concentrated further inland along channels than in the past: *"Even the seals are coming in[land]. During my younger days I saw seals just on the coast, [but] now they're coming into the rivers during the summer time looking for fish, spotted seal and ringed seals."*

There was no consensus on whether any of the ice seals are increasing or decreasing in number locally. While it was suggested that the distribution of marine mammals has in general shifted eastwards from Utqiaġvik towards the coast north of Nuiqsut in recent years, other factors such as sea ice affect their presence in the region. In addition, high year-to-year variability was noted, especially for bearded seals. Two hunters reported seeing sick and "deformed" ringed seals in recent years.

Subsisting on Polar Bears

Nuiqsut community members consider themselves to be whalers first and foremost, and do not identify strongly as polar bear hunters[12]. Inland foods such as caribou are more important than marine mammals, a tradition that strengthened after Nuiqsut was resettled in the early 1970s[13].

"We just chase them away, we don't [try to] kill bears; we aren't bear hunters. Our people just don't butcher bears, you leave them alone, they'll leave us alone. Our people have hardly eaten polar bear since we left Utqiaġvik, back in the day. We rarely eat walrus, we rarely eat beluga whale, like we used to. All we do is just watch them. Our foods are caribou, fish, bowhead and moose."

"[People in Nuiqsut] are not really polar bear hunters, they just have the polar bear patrol. People don't think of themselves as polar bear hunters. But it's still a celebration for certain people when they get a bear."

However, people do share and enjoy the meat when a polar bear is killed, and often remember polar bear meat as something enjoyed periodically during their childhoods:

"Polar bear hunting is an important tradition. A lot of the Elders love the meat. My parents have been craving it."

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[12] Prior to the Marine Mammal Protection Act, Nuiqsut residents took part in polar bear hunting in order to sell and barter hides. This market corresponded with more active polar bear hunting than is practiced today.
[13] In contrast, interviewees described Utqiaġvik, Wainwright, Point Hope, and Point Lay as North Slope communities with the strongest polar bear hunting traditions.

One interviewee remembered that his father had spent years looking for the legendary 10-legged polar bear with his dog team out on the ice and harvested many regular polar bears during his hunting career.

February and March are the best months to hunt polar bear, because the meat and hide are in good condition at this time. A hunter's first bear is a notable occasion, often remembered and told in story form decades afterwards. Young men learn how to "take care" of the polar bear meat and hide from Elders during this time. The fact that polar bear hunts usually occur at Cross Island around whaling season means that Elders are present to teach younger hunters. Many people remember the laborious and time-consuming process of learning to butcher their first bear on their own, which often leads to ambivalence about hunting more bears. New hunters learn to cook polar bear meat for four to six hours to prevent it from spreading trichinosis.

In general, polar bear kills are opportunistic, and closely linked to whaling at Cross Island, where "problem bears" are harvested:

"There is more of a polar bear hunting culture in Utqiaġvik, closer to the coast. We're mainly in the middle of [the land, away from the sea]. Nobody goes out looking for bears."

Regarding the statement "nobody goes out looking for bears," it is worth noting that it is culturally inappropriate to state that one is going hunting for a polar bear in all Iñupiaq communities. To do so is considered presumptive, foolish, and liable to predispose a hunt to failure:

"You've gotta have respect for the animals; it's not right to say that you're going out to get [hunt] them."

Relying on speech alone, it can be difficult to distinguish whether polar bear hunting is truly opportunistic, or only described as such. In the case of Nuiqsut, however, classification of polar bear hunting as opportunistic appear to be consistent with a general ambivalence about killing polar bears, as well as the unique opportunity (and sometimes, necessity) of taking bears on Cross Island in the fall:

"Whaling is a time for getting polar bears. Aggressive ones get killed at Cross Island. [First] they are hazed with loader and cracker shells. They usually learn and don't come back. One time I used a motor [loader] to push away a bear. It was skinny and aggressive. When they're like that they're not afraid of the loader. The whaling captains are the ones who consider themselves to own polar bears [that are taken during whaling]."

When bears emerge from the water, their fur is said to be "bullet-proof," which can pose a challenge to defense-of-life kills:

"When the fur on a nanuq gets wet the bullets can't penetrate the skin. One time my dad was shooting at a nanuq, but apparently some of the bullets bounced back; he found the bullets later. The nanuq was coming towards him. He had one last shot in the rife. He got the bear inside the mouth and then he brought it down."

Unfortunately, the skinny bears that are more likely to be killed during whaling are also less appealing as a subsistence food. When hunters are able to choose what size bear to kill, they prefer large bears*: "We try to get 12 footers, because when you stretch them that is the size will fit the tent. You put caribou skins on top. It's super warm."* The large hides are especially useful for the floor of tents during spring whaling in Utqiaġvik. Hides go to the captain of the crew member who shot the bear, as a tribute to the large amount of financial resources a captain must put into supporting his or her crew each year. In addition to tent floors, hides are made into pants, mittens, and mukluks, although some noted that increasingly fewer women are willing to do this work.

One Elder spoke about his ambivalence towards killing polar bears, and explained how it is rooted in his personal history:

"I have never taken a polar bear, because…there's a story behind it. My Dad was [always out] on the ice, he brought in twelve nanuqs, and people would come over. One time when my mother was cutting up meat, this old lady came in, who we knew was a shaman. She sat down right between us while we were eating, and she started jabbering, I couldn't understand her language. She was eating, and she took nanuq out of her mouth and put it in mine. It instilled something into me. "I don't think I'll shoot that nanuq." After that I've never had any hankering to shoot after a polar bear. I don't know what….maybe it's what she was saying when she was putting the meat in my mouth. I will eat it, but I don't have the heart to shoot them."

This Elder's personal account needs to be contextualized within a traditional worldview that emphasized the interchangeability between humans and polar bears. Whalers who disappeared on the ocean, for example, were sometimes believed to have turned into polar bears. Shamans—both male and female—had special abilities to turn into different and powerful animals.

Human-Polar Bear Interactions

At Cross Island

For Nuiqsut residents, fall whaling at Cross Island presents the primary context of human-polar bear interactions. Whaling was re-established at Cross Island in the 1970s following a lengthy interruption, but whale skeletons from the 1900s demonstrate the historical legacy of whaling at this site. When crews arrive in August, polar bears are already present, scavenging on remains of previous whale carcasses.

As noted elsewhere, the start of whaling season has become earlier due to altered timing of the bowhead whale migration. Some bears are already present on Cross Island when whalers arrive, regardless of the timing of the bowhead migration. The first task crews face is to scare away polar bears that have broken into camp cabins during their absence. Crews are careful to keep a clean camp to avoid attracting bears, and as a rule do not bring seal oil to whaling camp despite its importance as a traditional food source during hunting expeditions.

One of the most prominent messages of local experts from Nuiqsut was the increase in polar bears at Cross Island each year (detailed in the section "Abundance at Cross Island"), as well as the intensification of human-bear interactions during whale butchering, a theme repeated in multiple interviews.

It is important to note that interviewees made a distinction between older bears which exhibit a healthy fear of humans (and which return to the whaling site year after year), and younger bears (both male and female) which are more likely to become skinny, as well as to become problematic. More experienced bears wait for "their share" of the whale; this subset of bears has even become more "tame" over the years, as humans and bears share an island that is shrinking each year due to erosion.

As the whale is processed, crew members move leftovers to a designated bone pile about ¼ mile from the butcher site:

"After the first whale is caught is when the bears get real aggressive. We quick try to get [the whale carcass] to the bone pile quickly. There will be 10 bears fighting over three little pieces of blubber."

Moving scraps to the bone pile—i.e. immediate diversionary feeding—is absolutely necessary to keep whalers safe. Whalers describe the scraps (tongue, blubber, etc.) are given to bears as their "share," the term they also use for their own portion of the meat, emphasizing co-existence and the sense that it is natural to share part of the whale with *nanuq.* Furthermore, *"if we have a strike and loss, we take the maktak, and let the bears have the whale, that is their delicacy."* However, moving fat and scraps to the bone pile for bears has become more urgent and necessary to avoid conflict in recent years:

"Last fall as we were getting ready to butcher the first whale that was harvested, there were close to a dozen polar bears that were approaching us. Just this past couple of seasons they've been taking the whale fat over to the bone pile right away to keep the bears from bothering us."

The largest, most dominant bears are most successful in scavenging from the bone pile. Younger bears are displaced from the pile. There have been instances of dominant bears killing cubs at the scavenging site. Younger and weaker bears displaced from the bone pile will in turn try to feed off the whale currently being butchered by people, causing potential conflict with humans. With these younger bears in particular, close encounters are becoming a greater feature of the whaling season: *"Close encounters are a new thing. The bears are skinny and starving because of climate change. It's becoming more common 24-7."*

North Slope Borough provides a 24-hour patrol during whaling season, which makes use of cracker shells, gunshots, trucks, and even front-loaders to deter bears. Local practice is to speak to bears in Iñupiaq, asking them to leave. In most cases, deterrence is successful. Deterrence is preferred over shooting a bear, as the crews are busy with whaling. Bears are killed if repeated deterrence proves unsuccessful. As one interviewee summarized, *"We just chase them away, we don't [try to] kill bears; we aren't bear hunters."*

Nighttime presents a special challenge to deterrence: *"You have to be careful when they're out there. You can't just visit next door, you have to bring a rifle. Mostly [at camp] bears bother people at night. During the day they rest a lot, but they get active around six or seven in the evening until early in the morning."* The bears hide under the bones, waiting for human activity to die down.

It has been difficult to find people willing and able to serve as polar bear patrollers on Cross Island due to the critical—and sometimes traumatic—nature of close encounters. Patrollers are under enormous pressure to keep crews safe. As one patroller recounted:

"I got charged almost every night last year [on bear patrol]. It's a nightmare seeing polar bears. coming at you. I don't like doing the patrol. You try to haze bears away for 12 hours when it's dark and foggy. Dirty [i.e. camouflaged] polar bears come around. I would stay in the loader, and yell at them first, then if they don't move, I honk and use cracker shot. I'm not doing polar bear watch again unless they give me a truck!"

There is a sense among whalers that a subset of bears is becoming hardened to hazing, and that more and more measures have to be taken each year both to keep a clean camp to minimize secondary attractants, and to build up resources and strategies for deterrence. Whalers have to be very careful of the foods they bring to whaling camp:

"One time a I brought a bucket of seal oil out to whaling camp. A mother and cubs stole the whole bucket of seal oil and blackmeat and licked it clean. I was happy because it was a mama and two cubs. You could tell which ones ate it, they were guilty, all relaxed. I had put three weeks of work in that seal oil. Next year I brought just a small jar of seal oil!"

Strategies for keeping a clean camp include keeping trash away from the camp and waiting until the last day of whaling to burn it so that the smoke does not attract bears. Inevitably, people track whale oil into the camp cabins during butchering. Before leaving, crews treat the insides of cabins with bleach, and pour a circle of bleach around the structures to mitigate the attracting scents.

In Town

Nanut are occasionally encountered in and around the vicinity of the village, but these instances are rare enough to be remembered in detail. When bears do enter the village, it is usually at night. While a polar bear patrol is always necessary during whaling, a formal patrol has never been established in Nuiqsut itself. The community sometimes gets warnings about bears heading towards Nuiqsut from the Alpine industry site.

Several interviewees reported that bears are coming into town more frequently than in the past, particularly in association with transportation of whale meat back to the community following fall whaling, a phenomenon attributed to lack of sea ice and hungry bears:

"Last time they had a nanuq here [near town] was last year in fall time. I think it was skinny. It followed one of the crews from the whaling camp. The crew had maktak. They were going slowly, and the bear tagged along with them. Nobody noticed until they were halfway into town."

Nuiqsut is further inland than most communities in this study, and village-based attractants have not been a significant factor in human-bear interactions in the past, although this could change if bears continue to follow whale shares into the community. A dump approximately ¼ mile from Nuiqsut does not generally attract polar bears. Ice cellars are still in use but were not noted as significant attractants. In July, drying white fish occasionally draws attracts polar bears.

Other Species

Brown Bears

Brown bears are occasionally encountered in and around the village of Nuiqsut in late summer. There were no accounts of them overlapping with or interacting with polar bears in the Nuiqsut or Cross Island areas. Participants indicated that they do not see any brown bear-polar bear hybrids. Initial comments by interviewees suggest that brown bears have become less abundant in the region within the last four decades; further interviews could clarify this point.

Caribou

Caribou are known to spend time on barrier islands north of Nuiqsut during the summer: *"If the caribou are swarmed by mosquitos they'll go swim to the barrier islands, hundreds of them. We see them when we go out hunting for bearded seal in July. At that time we don't get caribou because we are too busy getting bearded seals. Caribou time is August and September."* Interviewees did not describe the presence of caribou on barrier islands as a new phenomenon, but future interviews could clarify this point.

Industry is recognized as a potential threat to local habitat use by caribou. The spring migration of caribou no longer brings them close to Nuiqsut. *"[We are] right in the middle of oil and gas development, noise, activities, especially during the ice-free season. I never thought I'd see an oil rig Impacting our subsistence way of life. Forty years ago, we had no trouble getting caribou but now you have to go 40 or 50 miles away."*

Fish

Nuiqsut residents have concerns about the impact of historical military waste sites on the fish they eat. Burbot and broad whitefish are reported to be riddled with white spots and mold, which locals attribute to contamination from military waste, approximately 65 miles south of the village. The affected fish are avoided due to fears that they could make people sick.

New Species

Reports of new species tended to be rare and specific to individuals, and included porcupine, lynx, and dragonflies, all within the last 10 years. Residents noted that moose may be a recent arrival in the region, historically speaking, although they have been present at least since the early 1970s, when the village of Nuiqsut was resettled.

Impact of Sea Ice on Subsistence

Participants agreed that fall bowhead whaling at Cross Island now occurs later than in the past:

"Whaling is late August and early September. The past couple of decades we have been going a lot earlier [because the whales are there earlier]. We used to go out to the island mid to late September; now it is so much earlier."

The delayed arrival of bowheads in the region has implications not just for the subsistence hunting calendar, but also for the timing of scavenging opportunities for polar bears.
In the immediate vicinity of Nuiqsut, the fact that freeze-up is delayed by two months means that fall ice-fishing for Arctic Cisco begins later than in the past. In April, rapid melting floods the river, making many normal subsistence and everyday activities temporarily impossible.

Because Nuiqsut whalers also participate in Utqiaġvik's spring whaling, respondents commented on the effects of warming on whaling in that location. They described how changing spring haul-out conditions pose challenges to processing whale carcasses according to preferred traditional practice: "*With the thin ice] you have to find the right place to haul. That forces people to butcher the whale in the water, which is a "no-no," at least to me. The saltwater deteriorates the whale, and makes it taste different when it goes in the cellar. One crew always dipped their whale in the seawater to rinse it off. We told them, just try one year not doing that, and they never did it again. It makes the whale taste different*."

Erosion

Erosion was an emergent theme in interviews with Nuiqsut residents. Erosive forces have reshaped barrier islands, including Cross Island, within living memory. Several people noted that the map used for interviews, a USGS topographic map from the 1950s (the most recent edition), no longer reflects the true profile of the coastline. Cross Island has shifted, and its overall size has shrunk. As Cross Island becomes smaller, whalers eye alternative barrier islands for future fall whaling sites. Erosion has also redirected rivers and reshaped riverbanks where polar bears den.

Kaktovik

Twelve Kaktovik residents participated. They ranged in age from 35 to 73. The range for years spent actively hunting in Kaktovik was 5 to 56 years.

Sea Ice and Weather

Select Quotes on Sea Ice and Weather

"*The ice conditions back in the day…you'd see the rough, piled up ice; nowadays I cruise all around the coast and it's mostly flat ice. We're losing our winter. Back in the day the ice ridges used to be very close [to shore] and now they are far away. It's easy for the ice to take off."*

"We can't go out on the ice, it's too busted up from strong winds."

"*We used to have a lot of ice here during the summer months, [but] now that's all gone*."

"Sea ice used to go out at the end of June and come back at the end of October…it's not like it used to be."

At least into the 1980s, the waters off Kaktovik were characterized by multiyear ice (also referred to as "permanent" or "main" ice by participants). Multiyear ice features were reliably used as sources of fresh water. Today, multiyear ice is far enough out to be inaccessible to hunters during a significant portion of the year. Now the sea ice environment is dominated by "new ice," ice which re-forms annually, and which measures just two to three feet thick at its height. This young ice is easily buckled and dispersed by strong winds, preventing solidification far into the winter. There is concern about the safety of sea ice around leads in the spring because of strong currents.

Multiple punctuations in otherwise rapid but gradual change in sea ice have been observed by local residents. One interviewee remembered 2005 as a distinct turning point in ice conditions. Another recalled conditions changing noticeably as early as the 1990s. The quality of sea ice has changed, becoming more prone to breakup. Changes in ice conditions are often remembered in conjunction with shifting wind direction and strength. East winds blow ice away from the shore, while west winds blow it in. The strong association of sea ice fragility with shifting wind conditions noted by residents may be overlooked in non-TEK assessments of sea ice changes.

Large pressure ridges of ice used to form close to shore. Today ice ridges occur further out from shore and are much smaller. Pressure ridges that do form close to shore, like the near-shore ice in general, are prone to movement and dispersal because of the wind. In general, the sea ice has transitioned from a three-dimensional environment to a flatter terrain.

"The ice conditions back in the day…you'd see the rough, piled up ice; nowadays I cruise all around the coast and it's mostly flat ice."

The winter sea ice season is shorter overall. Freeze-up is occurring later; instead of solid ice in October as in the past, now there is only "slush ice" at this time. Melting is also occurring earlier. "Boating" season now occurs a full month earlier than it did during older participants' childhoods.

One hunter remembered that in his youth, children would go out on the ice to get their first seal in June, but this is no longer possible due to earlier melting. Another recalled using the ice environment in spring in ways that would no longer be possible today:

"What I know from when I was a child…when school was out we used to go all the way to Arey Island at the end of May and there would still be ice out here, and we would be able to go camping for a week or two or three and the ice bergs would still be around here in June. The lagoon would still have ice by the fourth of July sometimes."

Select Quotes on Weather Patterns

"I've watched seasons change all my life, they were close together and same length, now we don't have them anymore."

"The blizzards have gotten stronger, [up to] 100 miles per hour this year. We used to have winds of 45 to 50 for three days [only] then that would be over."

"How the seasons mingle, you can't tell now…the seasonal patterns and anticipations for animals aren't there."

"The winds are changing too. It's not like it used to blow when we used to have storms in the winter. There are more winds that are different kinds, colder. [It] used to blow east and west and now we're getting north winds."

"There has been less snowfall starting three winters ago. Or it blew away in the blizzards. When we travel up to the mountains in the springtime [there is less snow]. Some rivers are not freezing in early fall, that's another change, in October it used to be frozen so you could travel all over the hills."

In the past, the local snow fences surrounding the village would be "full" by October, but now this mark of winter's arrival is delayed. On the other hand, winter blizzards may leave snow on the ground later into the spring than in the past.

According to at least one hunter, snow coverage was markedly reduced in the mountains near Kaktovik for three years prior to 2017; that year in turn was characterized by extensive and late snowfall across the North Slope. Overall, participants note that snowfall is more dynamic and less predictable. Several participants connected periods of amplified or reduced snowfall to dramatic and unexpected shifts in wind. For example, newly strengthened blizzard events bring greater snowfall.

According to local observation, both the strength and the direction of winds has diverged from known patterns. In the past, winds blew predominantly east to west, but now interviewees report winds coming from multiple directions, sometimes changing rapidly within short time periods. Despite overall warming, observers note increased northern winds that bring cold air into the region.

During blizzard years, the storms begin around January and have grown both stronger in speed and longer in duration. Blizzards may or may not contribute to snow buildup around the village itself, and at times can result in blowing snow away from the area. However, in 2017 blizzards settled over Kaktovik and nearby mountains, where winter travelers found it up to 10 feet deep. Deep snowfall was still present in June in Kaktovik; participants noted this as somewhat unusual. This situation contrasts with accounts that during most years there is now less snow compared to the past. The overall sense is that present-day weather patterns cannot easily be characterized in any particular way, but only by their unpredictability and polarity.

Impact of Sea Ice and Weather on Polar Bears

Select Quotes on the Impact of Sea Ice and Weather on Polar Bears

"The bears usually come in August or the beginning of July, when all the ice melts they go to the sand bar and lay there and rest until we catch a whale."

"It's depressing when you see this: polar bear bears are on land, rather than on the ice because there's no more ice."

"They need ice to survive for the seals…but during the summers we're ice free. That's why the bears are coming from the barrier islands, from the west side and coming from east, coming to Kaktovik."

"Bears have to learn how to survive on the land. They're livelihood is on the sea, but they are having to learn how to live on the land."

One Elder recalled that when he lived in Kaktovik in the early 1980s there were hardly any bears in the immediate vicinity of the town, but when he came back in the 1990s, polar bears were present and coming into the village. He recalled that school children began to be escorted home for their safety. This coincides with the time when many people began to notice changes in sea ice.

Because of the shorter sea ice season, interviewees reported that bears are spending more time on land and barrier islands around Kaktovik. They note that polar bears can make use of surprisingly marginal sea ice habitat while it persists but are forced on land during periods of open water.

Adjustments in the timing of the Kaktovik polar bear patrol over time reflects the extended amount of time that bears are spending on shore. Originally, the patrol ran from August to

January, but now it is more likely to begin in July and may extend until February. Whereas in the past, bears came to sandbars by the bone pile immediately before fall whaling, they now arrive as early as July and "rest" on the beach, presumably in anticipation of the subsistence whaling season. Following whaling, bears remain on land longer than in the past due to delayed freeze-up, which occurs about a month later than the historic baseline in most participants' accounts.

Body Condition

Select Quotes on Body Condition:

"It's hard to say, from the village…there are still healthy ones around, healthy ones are more leery and wise to stay away from town, the skinny ones are more bold to come into town looking for food."

"The ones that I see that are scrawny, [and their] skin color is blemished or dirty."

"Maybe that one [present in the village at the time of interviews in June 2018] couldn't hunt out on the ocean, can't catch the spotted seals; it's gotta come into town to get what's easier to catch. The healthier ones, they're out there on the ocean; they are probably eating the ones that he couldn't catch."

"There are more skinny bears around than there used to be. There's a big variety [of conditions] when there's the bone pile, but when the summer is here you'll see them trying to eat food, then they're skinny."

"When the bears first come around they are pretty skinny. They just lay around and conserve their energy. When they start feeding on the bone pile they fatten up really quickly. They probably couldn't survive without the bone pile at this point."

Participants were understandably hesitant to characterize the condition of bears in the Barter Island area in general terms. The condition of bears seen around Kaktovik varies markedly with the seasons. According to local observation, when bears first arrive in the area in late summer, they are more likely to be skinny. As whaling season passes and bears feed on the bone pile, their condition improves.

Furthermore, regardless of the time of year, there is a wide variety in condition between bears. Although there was no strong consensus, a slight majority of participants indicated that bears have become skinnier overall. However, these same participants qualify this information by emphasizing that bears that come close to town may be more likely to be in poor condition (i.e. "skinny") and in need of supplemental scavenging. Thus, a village-centric perspective tends to select for bears that are in poor condition.

Dead bears

Interviewees noted that seeing dead polar bears is a rare phenomenon, perhaps due to the fact that they are said to hide just prior to their death. Compared to other North Slope communities, residents of Kaktovik were slightly more likely to report coming across dead bears. The deaths of specific bears were attributed to attack by another bear, starvation, or fatigue.

The death of several bears in 2017 was explained by one participant as resulting from fatigue due to swimming the expanding gap between land and sea ice:

"Last year we were boating in June and we were seeing dead polar bears when we were walking on the beach. There were 3 dead bears. It looked like they were very skinny."

Bears freezing to the beach due to exhaustion was also noted as a concern:

"During the fall is when we have our really nasty weather. Most of the bears are caught out on the ocean, [and] they have to swim all these miles; some of them swim a couple hundred miles from the ice flow. When they get to the beach they are tired and dehydrated, [and] they will make a nest. [They sometimes] freeze to the beach, then can't get out. In the fall time. The first thing they always do is make a bed to rest. There have been quite a few dead on the beach."

Local Abundance

Select Quotes on Local Abundance

"The bone pile has been there for about 30 years. The number of bears coming to the bone pile has declined over the years; [I've] definitely noticed fewer. When I first came around there would be 100 plus bears around."

"We used to count 100 or 101 [at the bone pile], now we're down to 69 last year, a few less than a few years ago."

"The polar bear population has declined; there are fewer than fifteen years ago. I started to notice that decline around 2008. There was no summer ice around that time; [I] noticed ice retreating."

"There are fewer polar bears in general now, but when they congregate, there might be 60…they disappear overnight and come back the next day."

Local abundance has fluctuated over time, and comments on this subject tend to reflect interviewees' individual lifespans and time frames of reference. Overall, however, participants reported seeing fewer bears in the region in the last 10 to 15 years.

When bears are seen, they are often observed congregating in large numbers annually at the "bone pile," where they have been gathering for at least the last thirty years. Interviewees indicated that bears are attracted to the pile due to open water and lack of feeding habitat but were also in consensus that the number of polar bears seen at the bone pile between August and October has declined compared to 10 or 15 years ago, and perhaps more so in the last few years. At least one participant attributed this decline to loss of sea ice, which was most marked beginning in 2008. However, it also appears that the period of time during which the bone pile acts as an attractant for lone bears has extended through the calendar year.

Behavior

An unexpected theme that emerged across the interviews is increased observation of bears behaving in a tired and lethargic manner. Lethargic behavior has become noticeably more common in the last five years, and especially within the last two or three years. There are two components of these observations: 1) the behavior of bears that arrive on the beach via swimming in the fall and 2) the behavior of bears that come into town or are around people.

Bears must travel hundreds of miles from the main ice flow to reach the barrier islands in the fall. Locals observe that upon arrival, these bears collapse or make "nests" on the beach. Depending on the conditions, they may freeze to the ground and, reportedly, have difficulty getting up.

Regarding the behavior of bears that come into town:

"Bears that are coming around town are scrawny, lethargic, and not moving as fast as they used to."

"I started to see that difference in their behavior two or three years ago. They are lethargic, and come out from nowhere, you never saw animals like that [before]. When the mothers—in the fall was when they used to kick their cubs out—they'd be running, around like an adolescent, that's what they used to be like, like a bothersome kid. You've got to run after the kid. The bears now are lethargic. The older ones have no purpose, when they see you… once in a while when you encountered them the bears would get spooked, now they are aimless, their direction in what they're doing is different. They are looking for a place to rest or something."

Feeding

"They've been always eating fish since I've been there. Nets are a major attractant. That's a number one rule in Barter Island."

Bears spend time on the banks of the Hulahula, Aichilik, Niguanak, and Kongakut Rivers waiting for spawning fish in June and July, when they also eat Arctic Char out of peoples' fishing nets.[14]

[14] Arctic Char are an important part of ice seals' diet.

"Arctic char they like best. They get them out of people's fish nets."

"A [polar bear] got caught in fishing nets. Two years ago, we had to tranquilize one. They were dragging the nets out from the water. I think they learn, this one guy would put [the net] up on the beach, there would be bear tracks around and it was set in the water. They learn."

Interviews indicated that this is an ongoing—rather than novel—feeding behavior for polar bears in the area. However, it is not clear if fish, particularly Arctic Char, have become a greater source of food for bears compared to the past; future interviews and should address these questions further.

Some interviewees indicated that polar bears eat caribou (*tuttu)* fawns:

"I have seen them eating young caribou. In spring or fall time there's always caribou in this area. Polar bears eat fawns right after they are born. First I've ever seen it."

It was not clear whether this is a rare or common phenomenon; some interviewees discounted it.

In addition to fish, ice seals (including *ugruk)*, belugas (*sisuaq)*, and bowhead (*aġviq*) carcasses are within the known dietary range of polar bears in the area.

One interviewee stated that the feeding behavior of "starving" polar bears has changed to include more digging for marginal foods like squirrels and even wood and grass. Another emphasized "dumpster digging" as a commonly observed feeding practice (addressed further in the section titled "Attractants."

Seasonal Movement and Habitat Use

Select Quotes on Seasonal Movement and Habitat Use

"When ice comes in they take off…In November, Dec, Jan and Feb they take off [for the sea ice]. As soon as the ice starts leaving they start coming to land."

"We are out there every day seeing bears. The majority of the bears that come here and to all the other communities on the North Slope—these bears are very smart, they travel with the whales and come all the way from Point Hope, Utqiaġvik, and Nuiqsut in the spring. The same number of bears is coming in every year. Resident bears. Then they head up out on the ice. They hang out here until the middle or end of November. Freeze up is a month behind schedule, so bears stay longer."

"[There is] still more summer with global warming, but [it's] still real cold. The bears come every year, never miss. In May, June, July, August, September. They've got four legs [so] you don't know where they are going to be."

"Same bears come each year, from their parents, over their years, they bring their little ones. Local bears. Come out around springtime."

"The last five or six years there was an abundance of them at one time all of a sudden in March April and May [but not in 2018]."

In spring, interviewees observe a small pulse of bears traveling from land out on to the ice as they emerge from dens. As ice melts in summer a subset of bears comes to shore, and they can be observed increasingly commonly in July. The polar bear tourism season currently runs from July or August to November. In fall, bears arrive in the Kaktovik area. Within the last five years, bears have started coming to Kaktovik well ahead of the whaling season. *"They are here in August because they know we are going to go whaling, usually Labor Day weekend, they'll come right to where we are having the whale hunt*." In the past, bears predominantly moved into the area for the whaling season from the east, but within the last decade more bears have been arriving from the west and south. When new ice forms in early winter, bears leave the Kaktovik region for the sea ice. Because freeze up is now a month later than in the past, bears are spending longer on land and barrier islands near Kaktovik (until the middle or end of November). However, in recent years, bears have been seen in and around the community even during winter months when they would normally be absent.

Inland Habitat Use

Early August is caribou hunting season, and a time when Kaktovik residents travel inland. It is not common to see bears inland in the areas south of Barter Island. Ten to 15 miles was noted to be the most common inland range for polar bears. However, stories are told about the rare polar bear that travels further:

"Sometimes the bears will go through the mountains. A few years ago there was a polar bear in Fort Yukon, a big white animal, and an Indian man killed it. [That bear] made it all the way through the mountains. Maybe it followed the river to Fort Yukon."

There was disagreement between participants about whether bears have become more common inland (or whether they are moving further inland) over the last two decades, with some noting an increase. This difference likely reflects varying patterns of land use by individuals and their families.

Bears in June

During the time of interviews (June 2018), at least one skinny bear was spending time in and around the village of Kaktovik, and several interviewees noted that this was the first bear they had seen in the calendar year. They contrasted the condition of the bear seen in June with that of bears usually seen earlier in spring (but which were not seen in 2018) when they emerge from "dens" and which are generally in good condition:

"We usually see a few when they come out of their dens in March. Then they look pretty healthy; they've been denning all winter, just getting out of their holes and looking for food."

It was not clear whether this wave of bears usually observed in the spring is sourced from resting or maternal dens.[15] The odd timing of the bear's arrival in June 2018 brought into question whether the animal had come from inland or from out on the ocean. Interviewees emphasized that it is quite unusual to see a bear in Kaktovik in June, because "*usually they avoid the village this time of year*." Participants speculated that the bear was probably passing through to check the bone pile. One hunter noted that it was unusual to see a single bear unaccompanied by any others.

Select Quotes on Bears in June

"The one we're seeing now [June] is the first we're seeing. Did it come from a den or the ocean? It's so scrawny."

This bear that is here now is the first I've seen. I'm assuming it came out of a den, but maybe not. They should be coming out in March, April, and May, they should be coming out, but there's nothing. The last five or six years there was an abundance of them at one time all of a sudden in March April and May. The ones that are coming out in June--this is unusual."

"*It's uncommon for bears to be around in June."*

"This spring is weird; it's the first time I've seen them like this, animals that are showing up like this."

"When we see a big skinny bear…we get a few of that a year, we are thinking he's old and sick, [seals are] pupping out there [so he shouldn't be hungry]."

"To me it's normal, they're here. But usually there's more than one bear; it's strange to see just one."

"One or two bears seem to straggle in in June. They check out the bone pile, scouting it out, they're used to coming here during whale season, they know there's going to be a supply of blubber at the bone pile."

Dens

Select Quotes on Dens

"[Industry] does studies of dens—body heat—to make sure there's no dens [at development sites]. There are no known dens right around Barter Island; I've never noticed any; they're miles and miles away. They used to be out in the ocean, some way up in the hills. On the river system there's huge banks, big snow drifts on the side. The closest one is probably 12 to 15 miles away."

[15] Further research could clarify this point.

"There is less snow but if they find snow banks they can still den [where they have before]."

Bears in the region den on the eastern or western sides of mountains and riverbeds, wherever deep snowbanks accumulate in the late fall and early winter. These conditions do not occur in the immediate proximity of Kaktovik, and the exact location or frequency of dens in the region was not known to most participants. A den was known to be located on Drum island several years ago. One interviewee noted that dens *"used to be out on the ocean,"* indicating that they have moved further inland. Another noted that barrier island erosion may be reducing denning habitat. Finally, one participant stated that reduced snowfall has contributed to reduction of denning habitat in some recent years.

Cubs

Cubs are seen primarily in the summer and fall, feeding at the bone pile with their mothers. During much of the rest of the year, male and "loner" bears are most common. Participants generally agreed that the number of cubs in family groups has stayed the same over time, with one or two cubs being the most common number, and three cubs being the least common, but not unknown. Cubs are reported generally to be in good condition.

Ice seals

Select Quotes on Ice Seals:

"We rarely see seals, hardly anyone hunts seals around here. Sometimes they're hard to find. There are spotted seals. We rarely see ugruk---we hunt them in July. I caught two or three in the last years. I love it out there and hate to see it go to waste."

"Seals are around but [there are] not as many as there used to be when there was ice. Ice seals seem healthy. [They have] lots of fat, and look healthy."

Harbor, ringed (*natchiq)*, spotted, and bearded seals (*ugruk)* are found in the Kaktovik area. They can be difficult to find, however, and seal hunting is not as prevalent an activity in Kaktovik as it is in other communities on the North Slope. *"People aren't used to eating the seals*." One place in which seals are known to be found is on the west side of Natchiq Island, as well as in Kaktovik Lagoon.

There are fewer ice seals in the vicinity of Kaktovik today due to the extended distance between land and offshore ice in spring and summer; their local abundance is reduced due to sea ice loss. While the smaller ice seals can still be found close to shore, *ugruk* are further out on the ice (where Kaktovik residents hunt them in July). This, in turn, influences the behavior and feeding habits of polar bears:

"Nowadays the seals go far away with the ice. The polar bears come around because they cannot find the seals—the bearded seals that they used to hunt to eat. [Now] they mostly eat the little ringed seals, or spotted seals, four- or five-foot seals."

Those seals that are observed are reported to be in healthy, "fat" condition.

One interviewee noted that years with higher numbers of *ugruk* tend to alternate with years in which other species of ice seals are abundant. Residents have concerns about the suitability of some ice seals for subsistence during certain times of the year:

"This time of year the seals get black. They say "don't hunt them with the black on their head." Their meat doesn't taste good; there's something wrong with them this time of year." This appears to be an ongoing, rather than new phenomenon.

Human-Polar Bear Interactions

At the Bone Pile

The Kaktovik "bone pile," which has been in its current location for about 30 years,[16] draws humans and bears together and is a site of intensified human-polar bear interaction. Although late summer to fall is the peak time for polar bear presence around Kaktovik, individual bears can now be observed "scouting out" the bone pile almost any time of year.

Prior to the current practice of maintaining bone piles, whale remains were pushed back into the water. The current bone pile site is located near and/or overlaps with a former military dump site from the "Distant Early Warning Line." One interviewee voiced concern over the effect of contaminants and scrap metal from this old dump site on present-day scavenging bears.

Bears arrive well before whaling has started, a pattern which, according to one interviewee, became highly noticeable about five years ago. Bears are sometimes encountered swimming "13 or 14 miles out" during actual whaling. Intensive deterrence is a necessity once a whale is landed: "*We keep them away from the whale when it's first caught, but they are really smart animals. We make noise, scream, and wave our hands; sometimes we throw something, they're really scared of four-wheelers, when we rev them up they will turn around and walk off.*"

Today, chunks of blubber are sometimes purposefully cut off and given to bears at a distance from the main butchering site to keep them at a safe distance from people. One interviewee indicated that intentional diversionary feeding has become a more common practice in recent years due to bears' increased boldness around fresh whale carcasses, which potentially endangers community members attempting to butcher the whale. However, some interviewees stated that polar bears have not become more aggressive at the bone pile than they were in the past, emphasizing that their essential nature has not changed.

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[16] In the 1960s, whalers brought their catch to Pipsuk Point, but polar bears did not come to scavenge the carcass at that location.

After a whale is processed, remains are placed at the bone pile, and people bring their shares home. After further processing the meat and blubber, scraps and excess fat are also returned to the bone pile.

Interviewees emphasized the role of polar bears' memory and even inter-generational learning in bringing large numbers back to the bone pile year to year: "*The animals don't forget; they never forget where they get their first good meal [of the season] and they'll come here every year. Males, females, and cubs*." However, the number of bears coming to the bone pile has decreased over the last 10 to 15 years for reasons unknown to local observers.

The bone pile and the mass gatherings of bears attracted to it are at the center of numerous concerns for community members, including:

1) That polar bear viewing creates local profit, but this profit is not equally distributed. Similarly, some participants expressed concerns about profit being derived from whaling at all, given that whaling is traditionally an important part of Inupiat spirituality.

2) Polar bear viewing places strain on transportation into and out of the village (as residents are displaced by tourists).

3) That the bone pile brings bears too close to the community, putting residents at risk.

4) That the bone pile attracts outside scrutiny on traditional whaling practices by environmental activists, who are apt to perceive and criticize "waste" when scraps are returned to the bone pile.

5) That the year-round attraction of the bone pile brings bears too close to traditional fishing areas, where they catch or scavenge fish trapped in nets, and prevent people from carrying out this traditional subsistence activity:

> *"They took our traditional fishing area during our fishing season, when we put nets out, they know what that is. We are losing our tradition of fishing for Arctic Char, Arctic Cisco, Smelt [and even Salmon]. We are having to use the area near the airport. Now we do it right near the airport."*

An ongoing debate within the community and with wildlife managers is concerned with whether or not maintaining a bone pile in its current location causes more bears to come directly into the village of Kaktovik (in turn increasing potential human-polar bear contact). Most interviewees included in this study indicated that the location of the bone pile is a hazard to the community because it acts as an attractant. Bears remember the pile and will come in to check it year-round. When there is not enough food there, after a whale carcass has been scavenged, or if a bear is curious, it will then come into the village at night to scavenge in dumpsters or on other food remains around peoples' houses.

However, the view that the pile is both necessary and well-located to serve as a diversion from the village is also present. As one participant noted: *"We bring maktak to the point so we don't have to kill [bears]."* Furthermore, some participants expressed a feeling that humans can play a role in providing a necessary source of supplementary feeding to bears via the bone pile.

Inevitably, human- polar bear interactions at the bone pile over the last thirty years have changed the cultural meaning of a polar bear's death. Granted, Kaktovik has never had strong polar bear hunting tradition compared to its neighboring Alaska Native communities. However, in the past, hunting a polar bear was considered an achievement to be celebrated.

Today, most polar bear kills in Kaktovik take place in the context of human-polar bear interaction around the bone pile or in the village and are likely to be at least partially classified as defensive or "mercy" kills. While this can still provide an important opportunity for young subsistence hunters to get their first bear (thus continuing the polar bear hunting tradition), interviewees expressed their concerns that hunting in this setting is "too easy," creating sadness rather than celebration around polar bear harvests. Lack of interest in polar bear hunting among Kaktovik residents is in turn reinforced by this altered human-polar bear relationship.

Because of Kaktovik's tradition of low polar bear harvests, as well as this evolving dynamic of ambivalence around bear hunting, Kaktovik is recognized by its neighbors and own residents as a community that avoids hunting bears unless absolutely necessary. "*We only shoot them when we really need to."*

Select Quotes on Bears at Bone Pile: Human-polar Bear interactions

"When people go whaling, the bears aren't going to wait, it's going to escalate, usually it's just a verbal method of controlling or stopping. It's a year-long problem. It's permanent now with the bone pile."

"[Bears] probably couldn't survive without the bone pile at this point."

"They probably see that we respect them, and they respect us."

"Bears have not gotten more aggressive at the bone pile. They don't chase after people, some of them try to come in when the whale is being butchered, [and] people chase them off with a Honda [ATV]. Cops and the polar bear patrol [come]; everyone gets involved and watches their backs. But [the bears are] not violent."

Attractants

It is common for polar bears to come directly into the village of Kaktovik—especially at night—to scavenge from dumpsters, and to linger on the outskirts of town.

One main attractant in the village itself is maktak that is left out over the winter. With unpredictable weather conditions, the timing of snow melt has varied from year to year. When melting season does come, the smells predictably attract bears:

"The snow is melting. People forget to put the maktak away, and nanuq smells it. Everything's melting out. Smells...bring bears in."

This problem of food storage in polar bear country has prompted joint governmental, non-profit, and local efforts in the region to fund special bear-proof meat lockers. In interviews, however, residents noted that these meat lockers are difficult to access during the winter in practice, especially if there is an unusual amount of snow, as in 2018.

"*I live in the middle of the village. The metal boxes are too much hassle, the season is brutal, you'd almost have to have the discipline to go out. They're too hard to get to in the winter. You'd almost have to build it into the house, those are the kinds of things we'd need."*

There is also cultural preference for whale meat that had been left outside where it is more likely to "mellow"—i.e. ferment and develop a preferable taste. This also contributes to less use of meat lockers. Traditional ice cellars are no longer used by most residents.

Dogs have a long history of serving both as attractants and deterrents for polar bears in communities on the North Slope: "*Bears will try to play with the dogs, not eat them. [People will] scare the polar bears away, but sometimes they get aggressive towards the dogs. Then we just call nanuq patrol*. "

Despite the presence of the polar bear patrol, in practice all Kaktovikmiut necessarily take part in deterrence. Shooting a bear is an undesirable outcome for the community:

"We only shoot them when we really need to. We just try and scare them away; sometimes we will get a piece of scrap metal from [someone's] yard and pull it away to take them out of town."

As described in an earlier section on the whaling bone pile, there is some disagreement between participants as to whether the site at which the community leaves its whaling remains is best thought of as a diversionary feeding location ("*We bring maktak to the point so we don't have to kill them*") or as an "attractant gateway" that subsequently leads bears into the community. During the 2018 interviews, a possible shift towards the latter opinion was perceptible.

Several interviewees also expressed concerns about the location of a newly established dumpsite south of Kaktovik, which potentially draws bears into the community from a new direction, serving as a second attractant gateway. One participant emphasized the importance of the community value of disciplined waste disposal in avoiding negative interactions between humans and bears.

Subsisting on Bears

Kaktovik residents consider themselves to be whalers first, and do not identify as polar bear hunters. While some Elders still enjoy polar bear meat, most interviewees did not express a strong interest in eating it. Polar bear meat was described as "different, strong," and "tough on the belly." Some Kaktovik residents are concerned about trichinosis, as well as the hazard of developing skin discoloration due to accidental exposure to the bear's liver.

Some participants repeatedly expressed concern about contamination of meat from bears that have been collared or captured for scientific study, a concern they do not feel has been taken seriously by researchers and wildlife managers.

Finally, if problem bears are skinny or obviously sick when they are killed, the community has concerns about the quality of the meat and may discard it. The primary framework in which polar bears are killed in Kaktovik today is to defend the community. Descriptions of defense of life kills as "mercy kills" belie the fact that bears killed are often those in the poorest condition. Unfortunately, this makes the meat undesirable for human consumption. Residents still salvage the fur and claws, although as indicated elsewhere, the fact that polar bears used to be "wild" but now overlap with human settlements has changed the cultural meaning of use of these materials, incorporating "sadness" about the current state of polar bears.

Kaktovik hunters are aware of the polar bear quota being implemented for the Chukchi Sea population, and express concerns about a quota being implemented for their village, given that bear kills occur mostly as self-defense, in a context in which human-polar bear interactions must be managed not only for local residents, but also for a growing number of tourists. Kaktovik may be on the frontline in this regard; indeed, if general interest in hunting polar bears continues to decline in other Alaska Native villages, the concept of a quota may need to be replaced with a linguistic framework and management mechanism that can accommodate defense of life kills while defraying community concerns about the legal consequences for killing bears for public safety.

However, Kaktovik's ambivalence towards eating polar bear meat (even when compared to other North Slope communities) appears to have begun well before the present time: *"In the late 60s people stopped eating polar bears as much, when airplanes came and started delivering groceries. In the 60s we used to wait for (boat) food."*

Those who do eat polar bear meat today emphasize that it becomes edible—and even delicious—after cooking for at least three hours, after which it is softer and free of parasites. However, this long process also deters people from preparing polar bear meat regularly.

One interviewee noted that Kaktovik residents are now also concerned about the food safety of undercooked walrus meat.

Kaktovik residents do still use the polar bear hide and claws to make traditional clothing and crafts:

"You can make] polar bear pants, mittens, mask maker, make jewelry, gift the claws. First one I caught the tradition is to give the first catch."

The proximity of polar bears to Kaktovik and the changed circumstances under which a bear is likely to be killed have changed the meaning and even the emotional tenor of working and displaying polar bear hides in handicraft work:

"People don't make things with polar bear hides as much now because they used to be wild animals but now they are like captive animals, there's a sadness to making things with them. People who used to use the animals for arts and crafts, [the bears were] under the radar, on their own' [today] it had a different meaning."

Other Species

Within the past few years, residents have noticed new birds moving through the Kaktovik area. Elders have especially commented on this. As one interviewee said: *"A lot of new birds, smaller birds, hawks, and eagles [started showing up]; I noticed about three years ago. This year I've seen a lot more of the smaller birds, they're really showing up now [June]."* Interviewees also commented on the presence new "small mammals" that are unknown to locals.

Belugas are also said to be more plentiful and reliable, coming closer to shore and possibly providing an increased source of food for bears*: "I remember when I was about five or six back in the 60s there used to be some [belugas], they'd bypass here and go to Canada, but lately they've been coming by maybe because of the warmth [mentions this could affect the whales' food chain]."*

The presence of salmon has become more noticeable. Although salmon have been around in small numbers within interviewee's memories, one speaker noted that locals have not tried to use the right-sized nets to catch them; he suggested that in the future people could make better use of this newly abundant resource by obtaining fishing nets more properly sized for salmon.

Brown Bears

Brown bears (*aklaq)* are commonly encountered around Kaktovik in summertime, and particularly during the months of July and August. Residents perceive brown bears to be a greater threat to humans than polar bears. In summertime they can be encountered any time of day within the town of Kaktovik itself. Although the timing of the brown bear presence has stayed the same, Interviewees observed that they have become more common and have locally extended their habitat use northwards in recent years:

"Brown bears are coming up further north than they have in the past. You start seeing them when it warms up."

According to local observation, brown bear and polar bear "territories" were formerly divided by a natural boundary just south of Barter Island, but this boundary is now a zone of overlap between the species. Brown bears are attracted to the bone pile along with polar bears. Drum

Island is another location where polar bears and brown bears are known to interact. As is commonly reported by observers, when the two species meet, brown bears dominate and polar bears tend to disperse. Kaktovikmiut did not report observing any evidence of "hybrid" bears.

One hunter expressed his concern for the growing number of outsiders who hike in the mountains south of Kaktovik:

"[Brown bears] are fast and smart, and they will outsmart you…they disappear into the mountain. The people that do a lot of hiking, I'm starting to worry about them, come from somewhere else, they would have chance encounters. I fear for those people, they don't have that protection."

Caribou

"For some reason this year and last year I just noticed that there are different times that animals are coming out. This time of year…in extreme winter you never saw caribou in the mountains; now there are hundreds. There are 600 or 700 animals, even in deep snow."

Participants mentioned possible recent sightings of wolves and porcupine in the Kaktovik area. Hawks have also been observed in the wintertime.

Concerns about Scientific Study

Kaktovik residents expressed concerns about the effect of collaring studies on polar bears, noting that collars appear to be burdensome to the bears, causing fur to rub away and "strangling" the animals. There is also concern that collared bears may be skinnier than non-collared bears due to unanticipated restrictions on animals' eating and behavior.

One reason given for the general tendency of Kaktovik residents to avoid eating polar bear meat is their concerns about the effects of tranquilizers on bears captured for study, especially given that the same bears may be caught year after year. Contamination concerns dovetail with other factors that currently discourage a local polar bear hunting tradition.

Select Quotes on Concerns about Scientific Research

"We were always inundated by the invasive studies of the polar bears, even Fish and Wildlife Service is trying to help because of our complaints for years, about coming across ears with tied collars, choking, cuts and wounds, some with gangrene. Some don't even have hair under that collar."

"They use this tranquilizer, and they get the same bears over and over. Nobody hardly wants to harvest a bear to eat; it's just for life and death matters that [they] need to get put down."

Erosion

Interviewees noted that the barrier islands are unstable and are currently being subjected to erosion. USGS maps from the 1950s clearly do not represent the current lay of the land in terms of exact coastline or location, shape, and extent of coastal sandbars and islands. In some cases, interviewees noted that long-term shifting patterns of polar bear habitat use along the coast likely reflects the gradual relocation of the barrier islands themselves. Thus, it is worth emphasizing that in addition to sea ice loss, reshaping of the coastline through erosion is also reshaping the physical distribution of polar bear habitat.

Summary of Results

Sea Ice, Weather, and Polar Bears

Sea ice across the fours communities has changed in multiple dimensions: the timing of freeze up and melting season, the stability of ice once formed, its texture, surface features, and thickness. Changes in sea ice were first noticed in the 1980s and 1990s. Multiyear ice and icebergs are no longer present; many residents remembered the practice of collecting fresh water ice from the oldest ice areas, a practice that is now no longer possible.

Residents of Wainwright noted the disappearance of "ice-blossoms," shallow places at the intersection of currents where rough ice used to build. Ice blossoms used to be a noted location for observing polar bears. In Utqiaġvik, annual freeze-up started in September or October and sea ice would be frozen solid by November, but now open water can extend into January. Sightings of multi-year ice initially declined around communities during the period 2002 to 2007. In Nuiqsut, freeze-up now occurs two months earlier than it did historically, and melting season begins one month earlier; rapid melting creates flooding. For those communities with spring whaling, participants noted that in the past crews had to travel many miles from the shore to reach the edge of the shorefast ice to access whales, but now whaling occurs much closer to the shore—and therefore, closer to the communities themselves. It can be a challenge to find a stable place to haul out whales, and the work of butchering multiple whales now occurs in a more concentrated area.

The interplay of fragile ice and wind was a strong theme across the communities. While participants reported that the temperature of the air and of the water is rising, they indicated that changing patterns of sea ice are not due to temperature alone, but are highly dependent on wind strength and direction.[17] Because the ice is new and thin, it is prone to disperse in windy conditions. This appears to be exacerbated by changing and unpredictable wind conditions that can break up ice or blow it away from shore suddenly. In the spring, leads and holes open more readily. The ice itself is described as "weak" and "rotten."

The seasonal patterns of polar bear presence near the communities has shifted as a result of changing sea ice. Bears may now be seen near the communities (with the exception of Nuiqsut) almost any time of year, rather than just when the sea ice is present. Bears are observed on shore and on barrier islands during more of the calendar year, and their presence is especially notable in summer and early fall. It is now common to see large gatherings of bears during concentrated periods of time, such as whaling season, but bears linger at these scavenging sites all year round. These large gatherings of bears are trending upwards in some areas, and are decreasing in others.

Body Condition

[17] The theme of shifting winds, and their effects on ice conditions, emerged across the study area. Whereas conversations about changes in sea ice often focus on Arctic temperature shifts, TEK accounts suggest that changing wind patterns should be given greater attention in considering the effects of climate change on both humans and animals on Alaska's North Slope.

Reported trends in physical condition of polar bears varied by community. In all communities, hunters stated that the condition of bears has historically varied from year to year—often correlating with ice conditions. Variability in condition also occurs across the seasonal cycle and between individual bears, making generalization difficult. In Wainwright, Elders reported that there has been an increase in skinny bears long-term, citing observations of bears in the environment as well as the condition of harvested bear meat. On the other hand, younger, active hunters indicated that the condition of bears has remained "good" throughout their lifetimes, and is generally "good." This difference could reflect both longer periods of reference and different geographical frames of present-day reference (for example, if Elders are more likely to stay close to the village than active hunters).

In Utqiaġvik participants emphasized that while there is high variability in bear condition from year to year, overall bears are "fat" and in good condition. In both Utqiaġvik and Nuiqsut skinny bears continue to be considered anomalous. However, some Nuiqsut and Kaktovik residents reported that they now see more skinny bears in late summer and early fall. In Kaktovik, residents were keenly aware that attractants such as the bone pile may be bringing skinny bears into the community (and therefore more visible to residents), making it difficult to assess the overall condition of bears in the wider region.

In Nuiqsut and Utqiaġvik local experts suggested that bears have become smaller in size overall, a point emphasized by Elders who were alive in the 1950s and 1960s. The concept of "king bears" (stories about a distinctive category of unusually large bears) recorded for Alaska Native communities in the range of the Chukchi Sea population (i.e. the Seward Peninsula) was not encountered in interviews on the North Slope. Local concepts of polar bears "size" can be difficult to translate neatly into biological terms, as it likely incorporates age and condition of animals. As with condition overall, smaller bears may be more likely to be seen by respondents who spend more time in town than those with wider "use areas" in the regions around their villages.

Reports of sick bears were rare for all communities. When bears with an apparent illness or injury are encountered, they are remembered because they are considered especially dangerous to local residents. Accounts of seeing deceased bears were largely absent, but most prominent in interviews with residents of Kaktovik.

Local Abundance

Observations of trends in local abundance over time varied by community. In broadest strokes, Wainwright and Kaktovik reported a long-term decline in local abundance, while local experts in Nuiqsut noted increases in the size of polar bear gatherings on Cross Island during fall whaling (during the rest of the year, Nuiqsut residents have limited opportunities to observe polar bears). No consensus on trends in local abundance emerged for Utqiaġvik.

Local experts in Wainwright agreed that the number of polar bears in and around their community has decreased over time, a phenomenon which they attributed to longer periods of open water. However, there are *more* bears observed on the beaches near Wainwright in the summer now compared to the past. Overall the number of bears seen both outside and inside the

village has decreased, with the 1980s being a common reference point after which decline occurred. An interpretation offered for the reduced number of bears is that they have relocated to the East due to greater food availability.

Some local experts in Utqiaġvik reported an increased abundance of polar bears in subsistence use areas near Utqiaġvik, but these reports were counter-balanced by other observations of reduced local abundance. Future Traditional Ecological Knowledge research should go further in correlating each participants lifetime present-day subsistence search areas with reports on present-day abundance and condition. Variability in local polar bear abundance from year to year appears to be a prominent feature reported across the communities, and further research should verify the hypothesis that inter-annual variability has increased over the last 10 to 15 years.

Nuiqsut participants agreed that the number of bears observed at Cross Island has increased markedly in the last twenty years and accelerated as recently as five years ago. Interviewees attribute mass gatherings of bears during whaling at Cross Island to reduced sea ice.

In contrast, Kaktovik participants reported seeing fewer bears in the region compared to 10 to 15 years prior. There was a consensus that the number of polar bears seen at the bone pile between he months of August and October has declined compared to 10 or 15 years ago, and perhaps more so in the last few years.

Bears come into the town of Wainwright year-round but are more likely to do so during times when there is no sea ice. However, ice loss is also associated with seeing fewer bears *in the wider Wainwright region* overall.

Similarly, when there is no ice present along the coast in the fall and winter Utqiaġvik sees few bears, although there are usually a few to be found on the beach at Nuvuk Point. However, this general reduction is punctuated by concentrations of bears on the coast and at the bone pile during ice-free times. Since the late 1990s polar bears have been spending more time on barrier islands and along the coast north of Nuiqsut. Some bears are spending summer months on the barrier islands after the sea ice recedes. Some Nuiqsut respondents attribute the poor physical condition of some bears—and possible reduced overall size for all bears—to newly limited access to sea ice and ice seals.

Polar Bear Behavior

The topic of "tired bears" was an emergent topic during interviews in Utqiaġvik, Nuiqsut, and Kaktovik. Bears that arrive back on the shore and barrier islands near Utqiaġvik in September and October are often observed to be tired, and spend time resting on the beaches. Nuiqsut residents described noticing that more bears—including family groups—arriving at Cross Island and other barrier islands in the fall which appear to be exhausted. Kaktovik participants have observed bears behaving in a "lethargic" manner. According to interviewees across these three communities, tired behavior is a relatively new and noticeable trend, and is also influencing the way in which bears react within human-polar bear interactions. For Kaktovik, interviewees noticed lethargic behavior becoming more common within the last five years. Future interviews should determine when this trend began to be noticed by residents of Nuiqsut and Kaktovik.

Feeding

Across the four communities participating in this study, there were few reports of observations of novel feeding behavior by polar bears. However, there were indications of possible shifts towards greater relative dependence on extant food sources. For example, local experts in Utqiaġvik noted that scavenging opportunities—and behavior—have increased in the summer at Nuvuk Point due to an increased number of marine mammal carcasses. One possible explanation give for this increase is the activity of killer whales. In Nuiqsut and Kaktovik, participants spoke about polar bears use of Arctic Char. In August and September, polar bears catch and eat Arctic Char from shallow areas around Nuiqsut at the mouths of rivers, as well as further inland along river banks. They are also known to catch trout. In Kaktovik, bears spend time on the banks of nearby Rivers waiting for spawning fish in June and July, when they also eat Arctic Char out of peoples' fishing nets.[18] Interviews indicated that this is an ongoing—rather than novel—feeding behavior for polar bears in the area. However, it is not clear if fish, particularly Arctic Char, have become a greater source of food for bears compared to the past; future interviews and should address these questions further.

Polar bears are occasionally seen inland during caribou hunting season, a behavior which is not new. Brown bears are known to hunt for caribou, but this is not a behavior that has been observed for polar bears. Nuiqsut participants emphasized their impression that polar bears are relying more and more heavily on Nuiqsut whalers for food in the fall.

Habitat Use

The most significant change in the timing of polar bear presence around Wainwright is that they can now be seen in the summer as well as during the "regular" polar bear season in the fall, winter, and spring. Overall, bears appear to be spending more time on shore and on barrier islands in the Wainwright area. The majority of interviewees reported that within the last 10 years it has become more common to see bears inland from the coast compared to the past. Previously, it was females and cubs that were most often seen as they emerged from dens in the riverbank in the spring. Today, bears are also seen inland in the fall and summer, where they have been observed eating berries and approaching cabins. Polar bears are especially likely to be encountered along creeks and rivers

In Utqiaġvik It is now possible to encounter a polar bear in the area any time of year, and some interviewees indicated that it has become more common to see bears in the area during summer as the environment has warmed. There are more bears at Nuvuk Point in the summer now compared to the past. However, according to interviewees, there are not more bears coming directly into town in the summer in comparison to past decades. There was no indication as to whether patterns of inland habitat use by polar bears have changed for Utqiaġvik.

[18] Arctic Char are an important part of ice seals' diet.

The occasional lone polar bear is encountered inland around Nuiqsut, especially during caribou hunting season in the fall, but this phenomenon does not appear to have changed in frequency over time.

In Kaktovik there was disagreement between participants about whether bears have become more common inland over the last two decades, with some noting an increase. This difference likely reflects varying patterns of land use by individuals and their families.

Dens and Cubs

Wainwright residents do not commonly encounter polar bear dens. Dens used to occur primarily on banks by the coast but can now be found further inland along waterways such as the Utukok river.

Interviewees reported that dens are rare in the Utqiaġvik area. Elders stated that intimate and regular knowledge of the land is required to be familiar with denning sites, which shift from year to year. However, responses did suggest that denning on multiyear ice may have become reduced in recent years due to the absence of sea ice habitat. Further interviews should address a possible resulting increase in denning further inland.

Overall, participants from Nuiqsut agreed that there is slightly more denning in the inland region today compared with the past. Elders noted that more bears are denning on barrier islands and inland because of lack of sea ice. They are also denning in areas that overlap with industry development. Some interviewees indicated a later period for the initiation of annual denning than in prior decades; future interviews should examine whether denning is now beginning later than in the past, and whether overall denning time is reduced, distinguishing between maternal and "resting" dens. It is possible that development and exploration has led to a greater awareness of previously existing denning habitat, rather than an actual geographical shift.

Denning is not frequently noticed by locals in the immediate proximity of Kaktovik, and the exact location or frequency of dens in the region was not known to most participants. A den was known to be located on Drum island several years ago. One interviewee noted that dens *"used to be out on the ocean*."

Family groups are most often observed to have two cubs by residents of all four communities, with one or three cubs being the next most likely numbers, respectively. The number of cubs observed in family groups or overall has not changed over time. Cubs are usually observed to be in good condition. Given observations that dens may have shifted further inland around Nuiqsut and Wainwright, further interviews should explore whether it has become more common for residents of Nuiqsut to encounter family groups during the time that they are emerging from their dens in spring.

Ice Seals

In Wainwright ice seal numbers have remained the same over time and are described as "abundant." In both Wainwright and Utqiaġvik, ice seals are reported to be in good condition. In

Utqiaġvik, interviewees agreed that ringed and bearded seals have not increased or decreased in abundance. Spotted seals have become more abundant in the area in the last 10 years. Fur seals have moved into the Utqiaġvik region even more recently. Bearded seals have been observed with missing fur within the last eight years, but this phenomenon has been less noticeable in the last two to three years. Participants stated that seal denning—which depends on snow cover—has been insulated from the effects because snow cover conditions on ice remain adequate throughout the seal pupping season.

Although Nuiqsut residents may have fewer opportunities to directly observe ice seals on sea ice, they did offer observations. Lack of sea ice is associated with absence of ice seals in coastal area s north of the village; however, seals may also congregate on barrier islands during ice-free times, in turn attracting polar bears. There was no consensus on whether ice seals are increasing or decreasing in number. Participants suggested that the distribution of marine mammals has in general shifted eastwards from Utqiaġvik towards the coast north of Nuiqsut in recent years. High year-to-year variability was noted in ice seal abundance, especially for bearded seals. Two hunters reported seeing sick and "deformed" ringed seals in recent years.

There are fewer ice seals in the vicinity of Kaktovik today, which participants attributed to the reduced sea ice. Those seals that are observed are reported to be in healthy, "fat" condition.

Human-Polar Bear Interaction

Spring whaling by Wainwright and Utqiaġvik[19] residents places bears and humans in close proximity. Bears may initially be attracted by food cooking at whaling camp, and then to the whale carcass itself. Once a whale is harvested, the community works to butcher it quickly, before the smell attracts too many polar bears. A patroller is assigned to keep the crews safe from bears, particularly at nighttime.

During spring whaling north of Wainwright, bears are said to be so intent on scavenging the whale carcasses that they ignore normal deterrence methods. Bears occasionally follow people hauling whale meat back to the village of Wainwright. The number of bears coming directly into Wainwright appears to have decreased within the last twenty years. Individual young bears around six to eight feet in length are those most likely to be encountered in the village, most often in winter. Polar bears coming directly into the village are described as "determined" in their food-seeking behavior.

The number of bears coming directly into Utqiaġvik has remained constant over time within their living memory, as has the behavior of bears coming into town. Emphasis was placed on bears' characteristic wariness of human settlements. Participants noted that lights and car activity appear to deter bears away from Utqiaġvik, a factor less prominent in smaller communities like Kaktovik. Whale bone piles at Nuvuk are maintained partly in order to deter bears from coming into town. Bears scavenge at Nuvuk Point in small numbers nearly year-round. Periods of open water in fall are associated with polar bears spending time in and around Utqiaġvik. Bears that

[19] Utqiaġvik residents also whale in the fall.

come directly into Utqiaġvik are more likely to be young, though older bears are sometimes encountered as well.

As is commonly reported in other North Slope communities, Utqiaġvik residents say that the curiosity and inexperience of younger bears is a factor pulling them into human settlements as well as to whale butchering sites; very old bears also pose a concern. A subset of the bears coming into town are in poor physical condition (i.e. "skinny,"). However, local experts did not report an increase in the number or proportion of skinny bears coming directly into town. Utqiaġvik residents make it a practice to keep marine mammal scraps out of the regular trash stream and take them to the Nuvuk bone pile instead. A common complaint in Utqiaġvik was the inconsistent funding for dedicated polar bear patrols. Utqiaġvik is a diverse community, and not everyone is familiar with polar bear safety. Occasionally, patrollers and community members must intervene to keep people from approaching bears.

Interviewees in Utqiaġvik agreed that there has been no change in human-polar bear conflict during whaling. Keeping a clean whaling camp is seen as essential to avoiding conflict with bears. Bears behave in the same way that they always have, feeding but preferring to maintain a distance from humans. Although whaling can attract relatively large groups of bears, there was no mention of increased numbers of bears being attracted to whaling by Utqiaġvik crews.

Utqiaġvik residents place themselves in the center of a spectrum of regional interest in opportunistic polar bear hunting. Whereas an opportunistic polar bear hunting tradition is strong in Wainwright, in Kaktovik, people are less interested in hunting bears for subsistence. Utqiaġvik lies in between these extremes. Human-polar bear encounters in town or during whaling can provide an opportunity for young hunters to take a bear (often their first, an event of cultural importance), and occasionally problem bears must be killed. However, there is also a strong emphasis on organized deterrence in Utqiaġvik.

For Nuiqsut residents, fall whaling at Cross Island presents the primary context of human-polar bear interactions. The start of whaling season has become earlier due to altered timing of the bowhead whale migration. When crews arrive in August, polar bears are already present, scavenging on remains of previous whale carcasses. One of the most prominent messages of local experts from Nuiqsut was the increase in polar bears at Cross Island each year, as well as the intensification of human-bear interactions during whale butchering, a theme repeated in multiple interviews. As the whale is processed, crew members move leftovers to a designated bone pile about ¼ mile from the butcher site. Interviewees made a distinction between older bears which exhibit a healthy fear of humans and younger bears which are more likely to be skinny, as well as to become problematic. Moving scraps to the bone pile is necessary to keep whalers safe. Close encounters with bears are becoming a greater feature of the whaling season at Cross Island. Fewer people are willing to serve as bear patrollers, given the difficulty of the task including close encounters.

Nanut are occasionally encountered in and around the vicinity of the Nuiqsut, but these instances are rare. When bears do enter the village, it is usually at night. While a polar bear patrol is always necessary during whaling, a formal patrol has never been established in Nuiqsut itself. However, some interviewees reported that bears are coming into town slightly more frequently

than in the past, particularly in association with transportation of whale meat back to the community following fall whaling.

The Kaktovik bone pile, which has been in its current location for about 30 years,[20] draws humans and bears together and is a site of intensified human-polar bear interaction. Although late summer to fall is the peak time for polar bear presence around Kaktovik, individual bears can now be observed "scouting out" the bone pile almost any time of year. Bears arrive before whaling starts. Chunks of blubber are sometimes cut off and given to bears at a distance from the main butchering site to keep them at safe length from people. Most interviewees in Katovik stated that polar bears have not become more aggressive at the bone pile than they were in the past, saying that their essential nature has not changed. Interviewees emphasized the role of polar bears' memory and even inter-generational learning in bringing large numbers back to the bone pile year to year. However, the number of bears coming to the bone pile has decreased over the last 10 to 15 years for reasons unknown to local observers.

Most interviewees from Kaktovik indicated that the location of the bone pile is a hazard to the community because it acts as an attractant. Bears remember the pile and will come in to check it year-round. When there is not enough food there, after a whale carcass has been scavenged, or if a bear is curious, it will then come into the village at night to scavenge in dumpsters or on other food remains around peoples' houses. Bear-proof meat lockers have been tried as a means of reducing the incentives for bears to come into the community, but the lockers are difficult to access in winter so have not been used consistently. The view that the bone pile is both necessary and well-located to serve as a diversion from the village is also present. It is common for polar bears to come directly into the village of Kaktovik—especially at night— to scavenge from dumpsters, and to linger on the outskirts of town. Several interviewees expressed concerns about the location of a newly established dumpsite south of Kaktovik, which potentially draws bears into the community from a new direction. People in Kaktovik noted that the community does not have a strong polar bear hunting tradition, and that it avoids hunting bears unless absolutely necessary.

Brown Bears

Compared to polar bears, residents of all four communities see brown bears (*aklaq*) are seen as more problematic for humans because of their tendency to break into inland cabins. Participants were more likely to have encountered brown bears than polar bears inland. Riverbanks are a known habitat area for brown bears. There were no first-hand accounts of observing brown bear-polar bear hybrids in any of the communities. Local abundance of brown bears appears to be decreasing in Nuiqsut and increasing in Wainwright and Kaktovik, and brown bears and polar bears interact regularly in the latter village.

[20] In the 1960s, whalers brought their catch to Pipsuk Point, but polar bears did not come to scavenge the carcass at that location.

Consensus emerged among local experts from Wainwright that brown bears are more common in their area now than they have been in living memory. Brown bears are not usually observed in the vicinity of Utqiaġvik but are known to break into people's seasonal cabins south of town.

Brown bears are occasionally encountered in and around the village of Nuiqsut in late summer. There were no accounts of them overlapping with or interacting with polar bears in the Nuiqsut or Cross Island areas. Initial comments by interviewees suggest that brown bears have become less abundant in the Nuiqsut region within the last four decades; further interviews could clarify this point.

In Kaktovik, brown bears are commonly encountered around the village in summertime, and particularly during the months of July and August. Although the timing of the brown bear presence has stayed the same, interviewees observed that they have become more common and have locally extended their habitat use northwards in recent years. According to local observation, brown bear and polar bear "territories" were formerly divided by a natural boundary just south of Barter Island, but now the two species overlap. Brown bears are attracted to the bone pile along with polar bears. Drum Island is another location where polar bears and brown bears are known to interact.

Map Results

A Note on map results: Maps are based on the cumulative knowledge of specific individuals interviewed, and are *not exhaustive*. Mapped elements show areas where people observe bears, and thus indicate areas of overlapping human and polar bear use of the landscape and icescape during the seasons depicted. In this study, participants tended to focus on places where polar bears are observed in near-shore, shorefast, and inland environments. Please see mapping methodology and discussion. Maps were compiled by Marcus Geist, Artesian Knowledge, LLC.

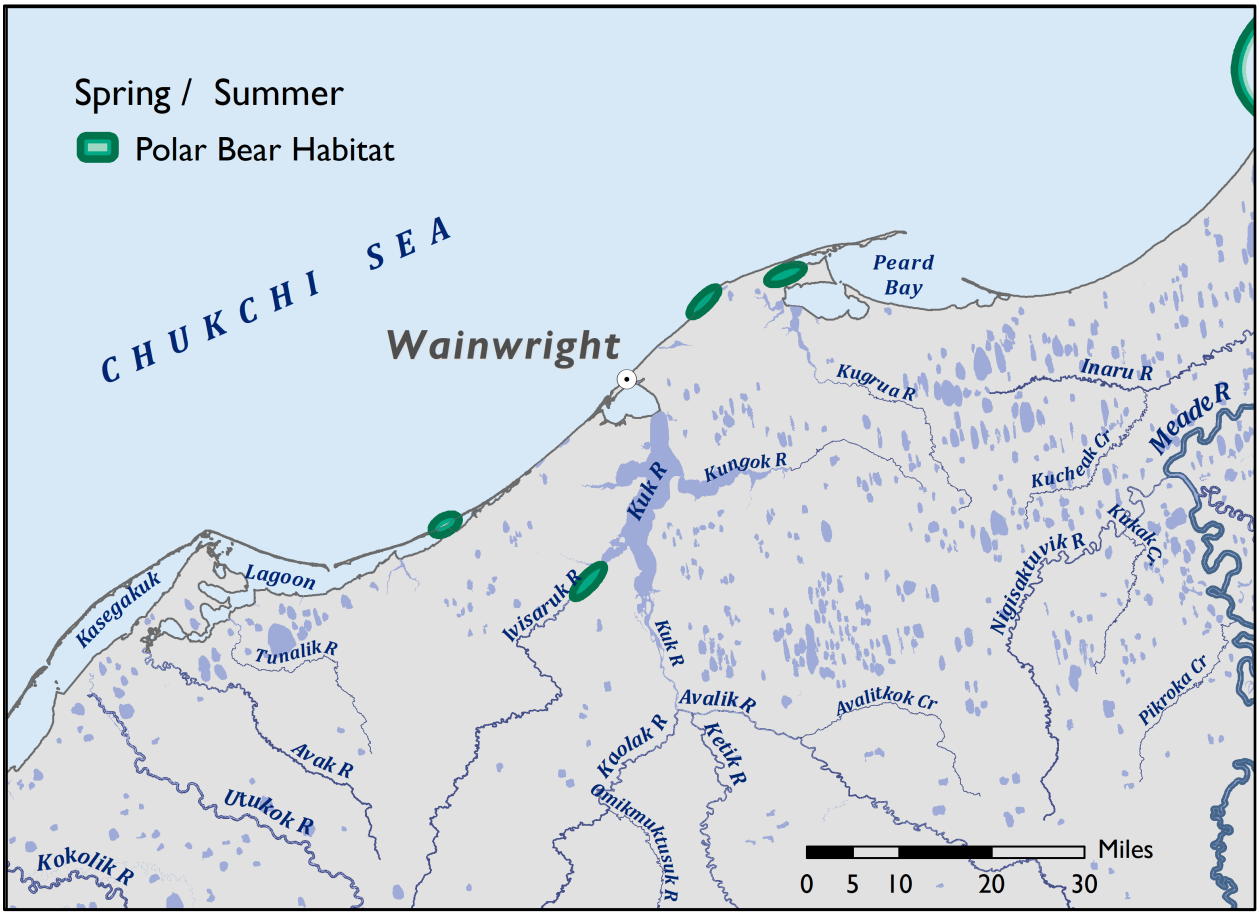

Figure 2: Areas of concentrated polar bear habitat use for spring and summer (March through August) over the last fifteen years, as mapped by Traditional Knowledge Holders in Wainwright, AK.

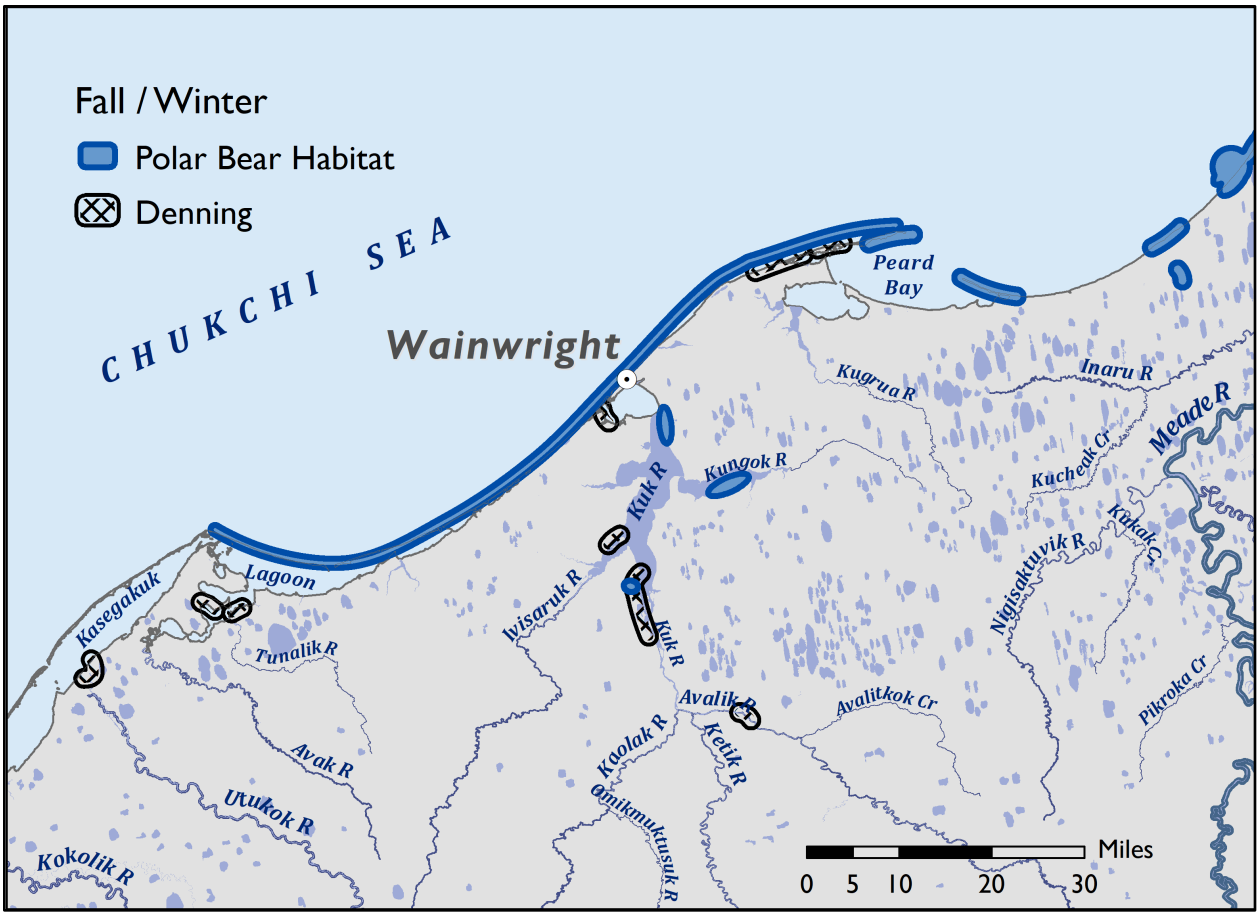

Figure 3: Areas of concentrated polar bear habitat use during fall and winter (September through February) over the last fifteen years, as mapped by Traditional Knowledge Holders in Wainwright, AK.

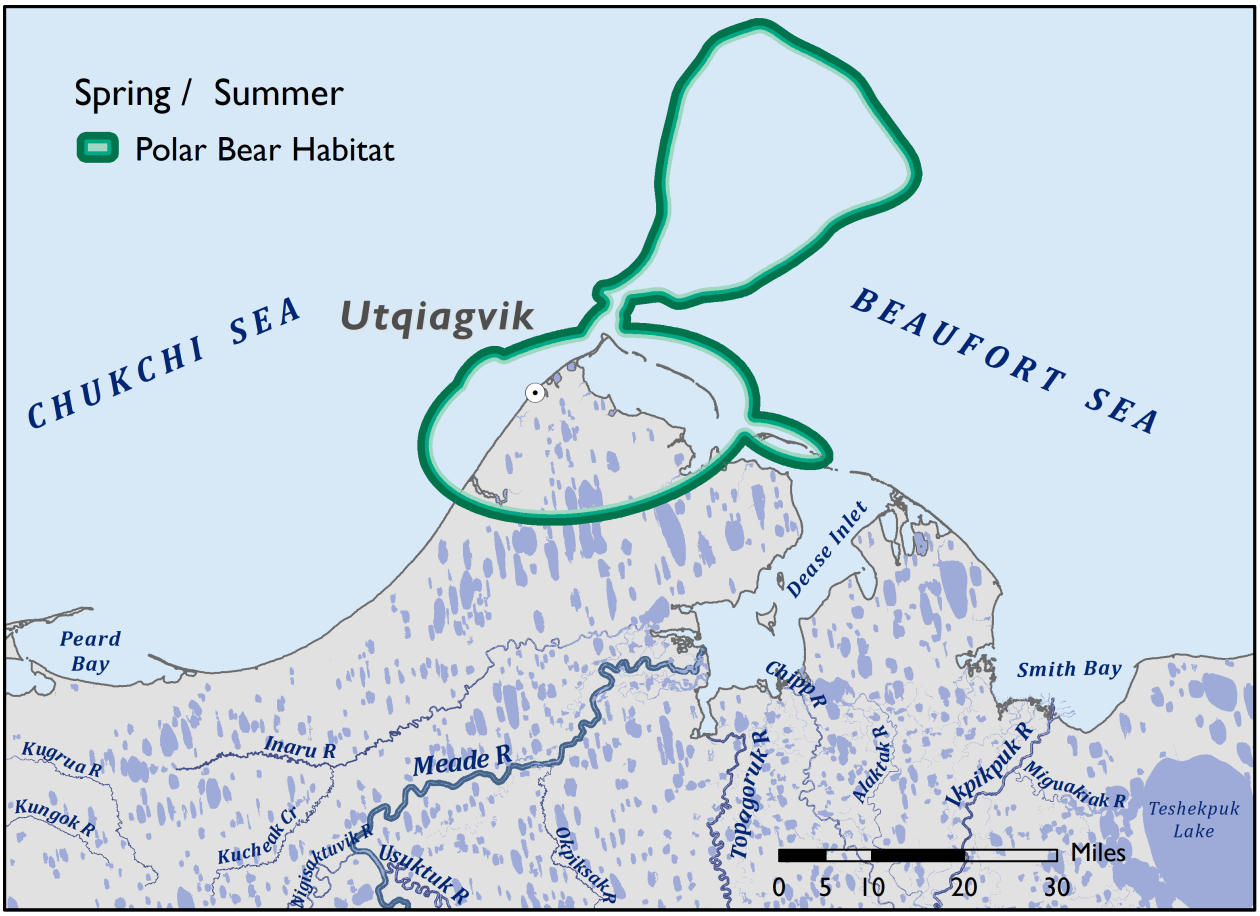

Figure 4: Areas of concentrated polar bear habitat use during spring and summer (March through August) over the last fifteen years, as mapped by Traditional Knowledge Holders in Utqiaġvik, AK.

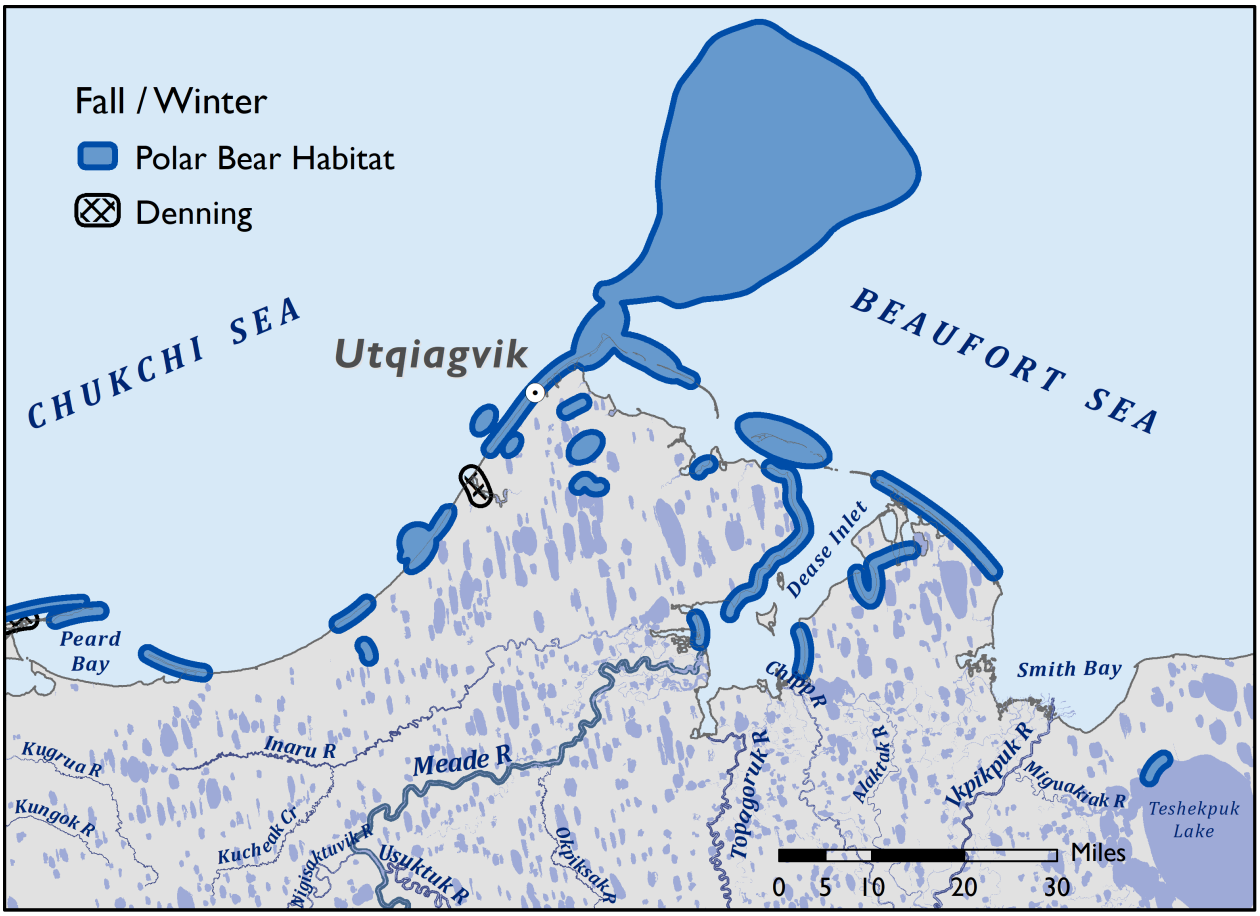

Figure 5: Areas of concentrated polar bear habitat use during fall and winter (September through February) over the last fifteen years, as mapped by Traditional Knowledge Holders in Utqiaġvik, AK.

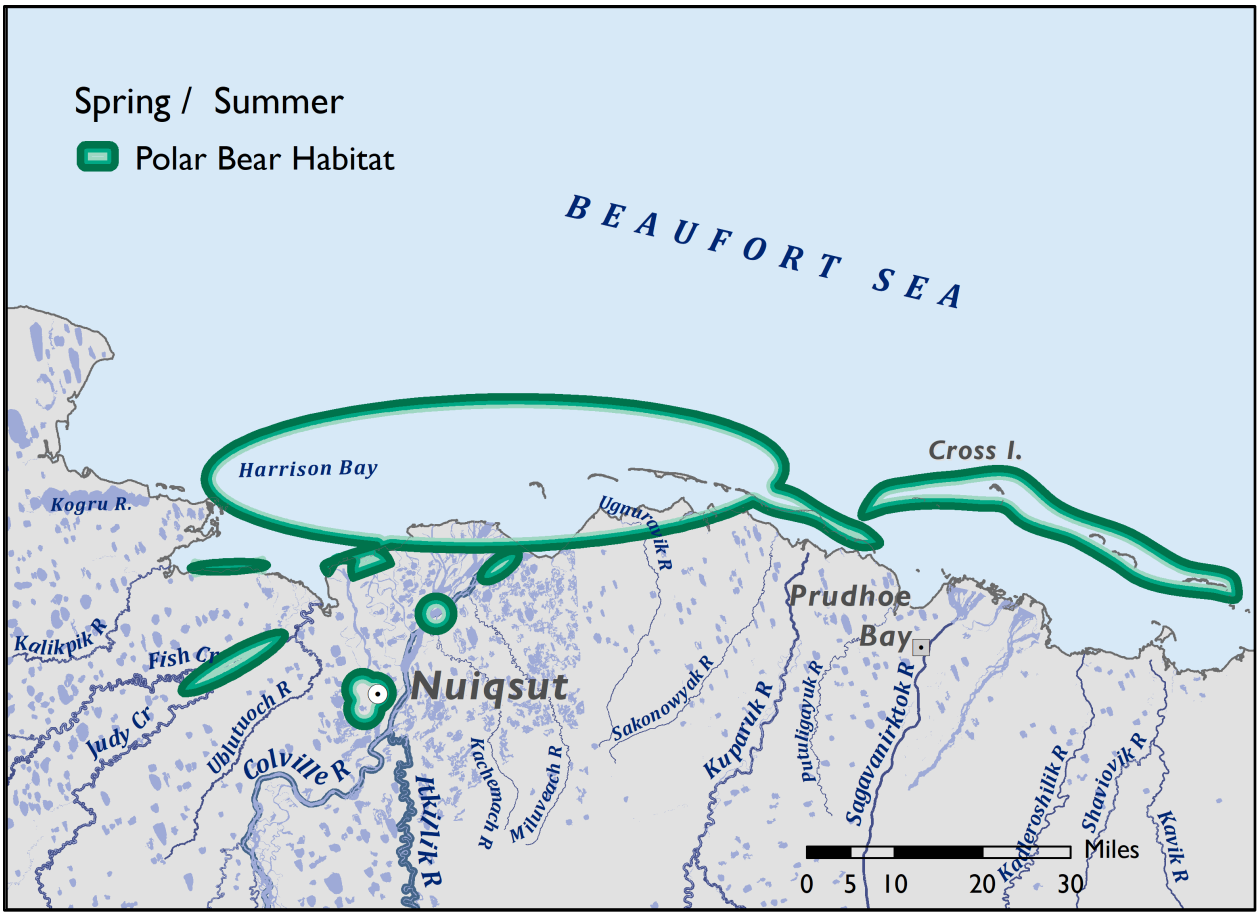

Figure 6: Areas of concentrated polar bear habitat use during spring and summer (March through August) over last fifteen years, as mapped by Traditional Knowledge Holders in Nuiqsut, AK.

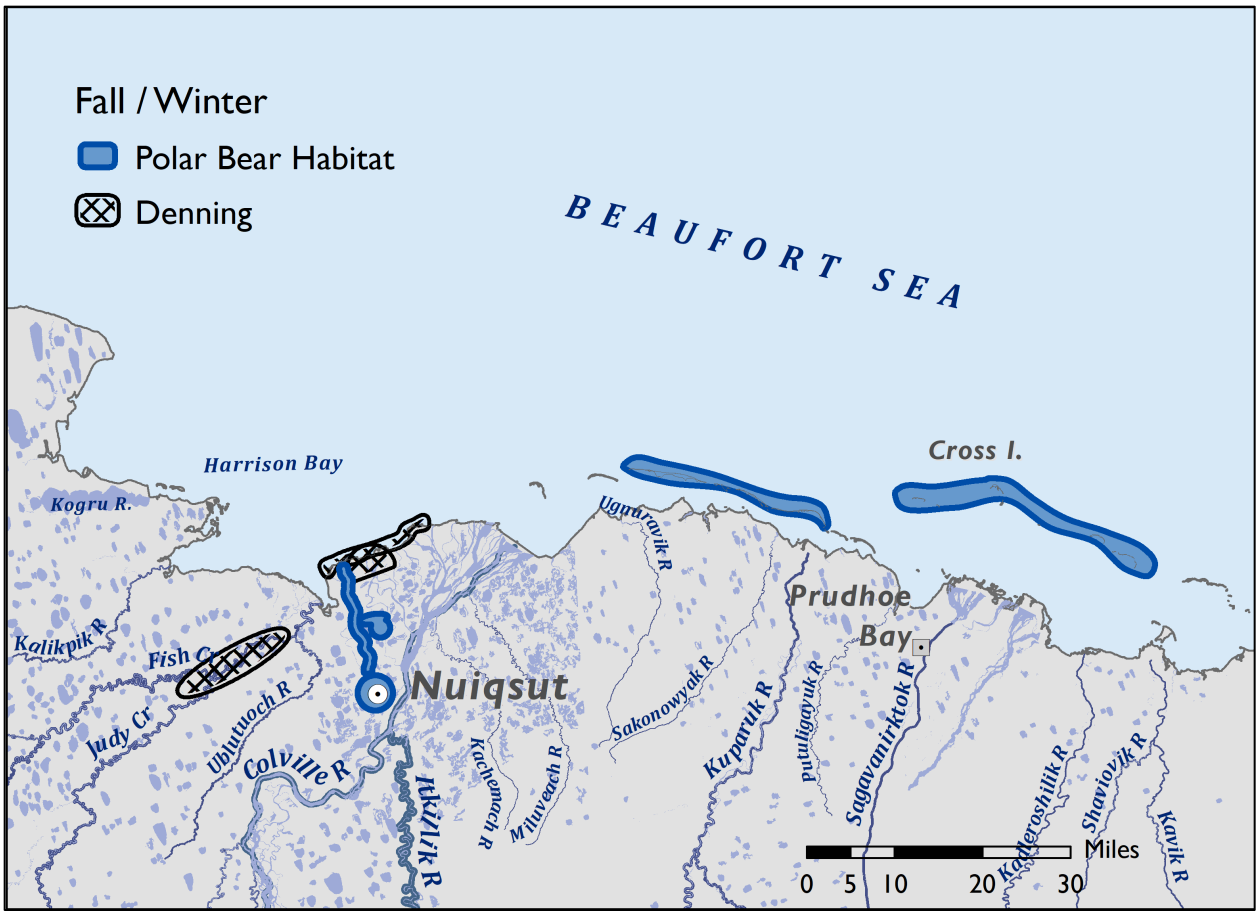

Figure 7: Areas of concentrated polar bear habitat use during fall and winter (September through February) over last fifteen years, as mapped by Traditional Knowledge Holders in Nuiqsut, AK.

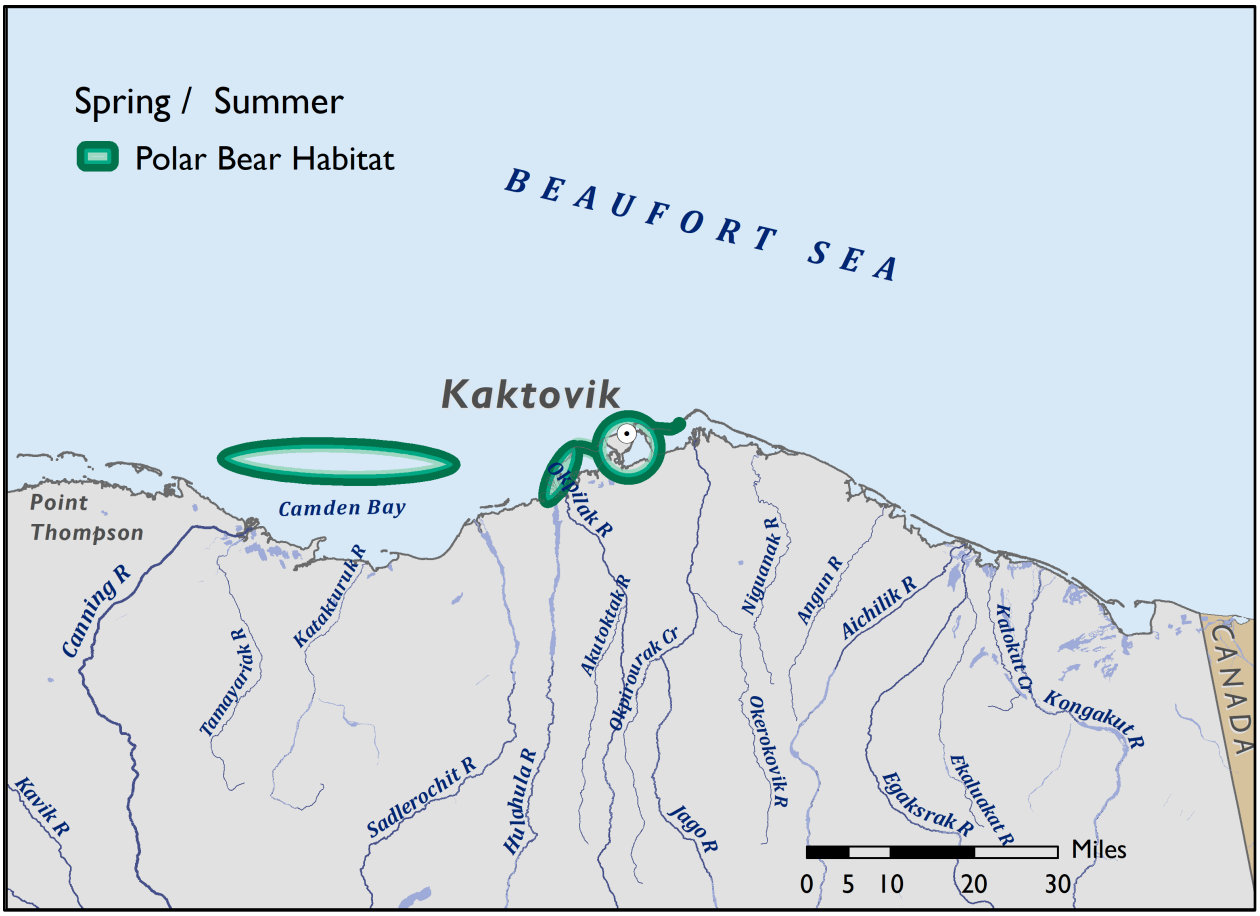

Figure 8: Areas of concentrated polar bear habitat use during spring and summer (March through August) over last fifteen years, as mapped by Traditional Knowledge Holders in Kaktovik, AK.

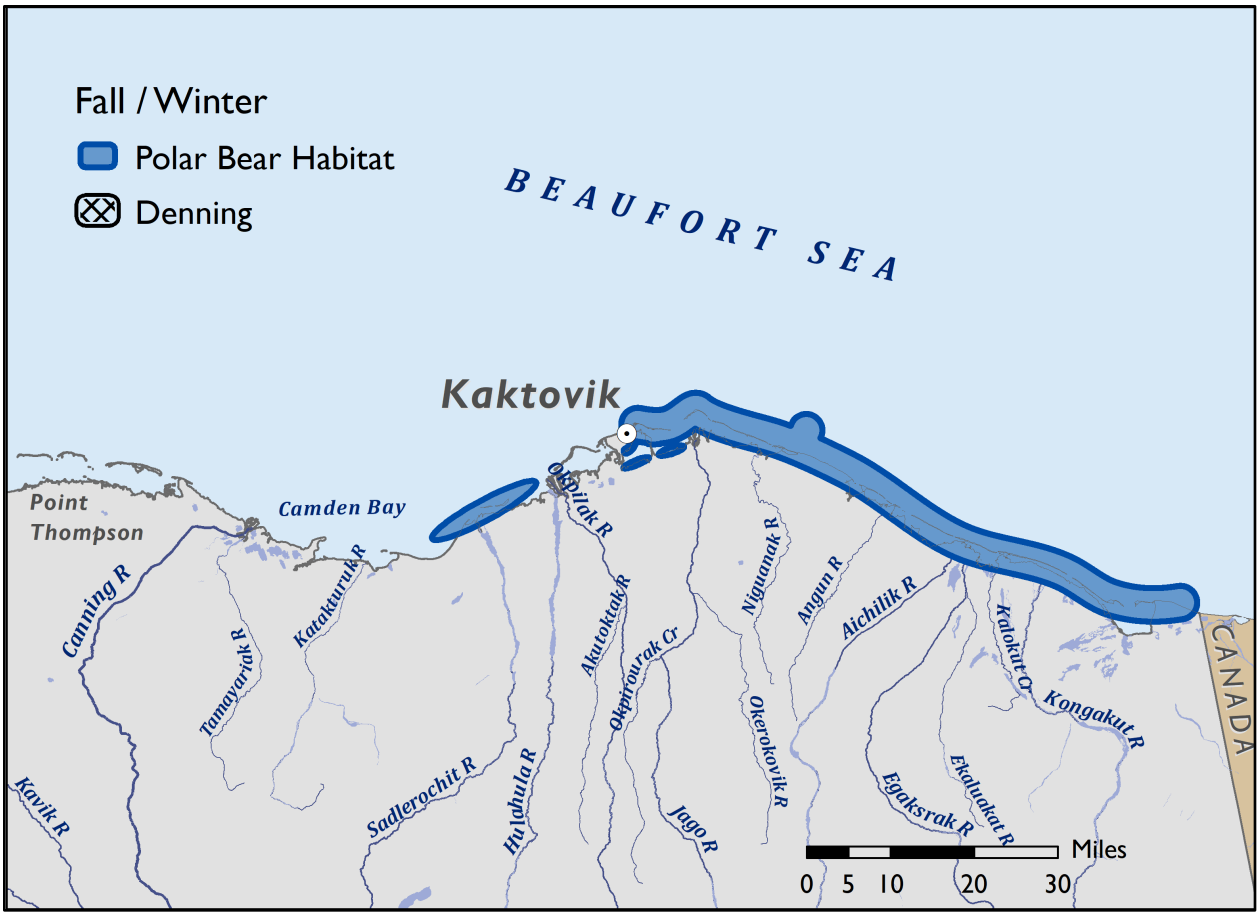

Figure 9: Areas of concentrated polar bear habitat use during fall and winter (September through February) over the last fifteen years, as mapped by Traditional Knowledge Holders in Kaktovik, AK.

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