



Polar Bear TEK: A Pilot Study to Inform Polar Bear Management Models

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Cover Photo: A mother polar bear and her two yearlings near Utqiagvik, AK. February 2016. ©2018. Photo by Andrew L. Von Duyke (used with permission).

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ACRONYMS

| | |
|----------|--|
| AC | Alaska-Chukotka |
| ANC | Alaska Nanuuq Commission |
| ANCC | Alaska Nanuut Co-Management Council |
| IPM | Integrated Population Model |
| MMPA | Marine Mammal Protection Act |
| MTRP | Marking, Tagging, and Reporting Program |
| NSB, DWM | North Slope Borough, Department of Wildlife Management |
| SRB&A | Stephen R. Braund & Associates |
| SWG | Scientific Working Group |
| TEK | Traditional Ecological Knowledge |
| USFWS | U.S. Fish and Wildlife |

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Stephen R. Braund & Associates (SRB&A) would like to first and foremost express their gratitude to the workshops participants from Point Hope, Point Lay, Wainwright, and Utqiagvik for providing their valuable time, observations, and knowledge into this pilot study regarding the traditional ecological knowledge (TEK) of polar bears. SRB&A would also like to thank members of the Scientific Working Group (SWG) of the US-Russia Bilateral Commission, a team of US, Russian, and Native researchers and TEK holders tasked with collaboratively addressing polar bear management issues in the Chukchi Sea. Members of the SWG helped develop interview questions that are relevant to polar bear management and contributed to methods to integrate information from TEK into quantitative population models. SRB&A thanks the North Slope Borough, Department of Wildlife Management (NSB-DWM) for initiating this project, providing input and questions for the protocol, and coordinating the logistics of the pilot study workshops. Lastly, SRB&A thanks Henry Huntington for his thoughtful review of this research report.

EXECUTIVE SUMMARY

In 2000, the *Agreement between the Government of the United States of America and the Government of the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population* (Agreement) was signed by the two countries and stipulates that reliable scientific data, including traditional ecological knowledge (TEK) of the Native people be used to determine the annual sustainable harvest level for the Alaska-Chukotka (AC) population of polar bears. At the request of the North Slope Borough Department of Wildlife Management (NSB DWM), Stephen R. Braund and Associates (SRB&A) initiated TEK research in January 2018 related to the AC population of polar bears. The primary purpose of this study was to collect relevant TEK about polar bears, which can be incorporated into the Bayesian integrated population model used to estimate demographic parameters (IPM; (Regehr et al. *In review*)) and the harvest risk assessment model (Regehr et al. 2018a), which have been developed based on data from capture-recapture research on Chukchi Sea polar bears and may be used to inform future management decisions. Previous researchers (e.g., Kalxdorff 1997, Voorhees et al. 2014) have conducted TEK studies on the AC population of polar bears, and this study is a pilot study in the sense that it attempted to collect relevant polar bear TEK with the purpose of exploring how it could be incorporated into the IPM and harvest risk assessment. This study is a first step in the process of determining the relationship between TEK information and model parameters.

During the week of January 15-19, 2018, Stephen Braund and Paul Lawrence of SRB&A traveled to Utqiaġvik and worked with active and knowledgeable polar bear harvesters from the four North Slope study communities of Point Hope, Point Lay, Wainwright, and Utqiaġvik to help document polar bear TEK based on participants knowledge and observations. One workshop occurred each day with a different study community. A total of 10 harvesters from the four study communities participated in the TEK workshops.

The TEK workshops were organized around six primary topics:

1. Polar Bear Harvesting Characteristics
2. Hunting Purpose and Timing
3. Use Area Mapping and Most Recent Harvest Year
4. Habitat, Abundance, Distribution, and Health
5. Polar Bear Management
6. Local Participation in Polar Bear Management

A summary of the key findings from each of these sections is provided below:

Polar Bear Harvesting Characteristics

1. Polar bear harvest amounts are tied to community populations, history of polar bear use (including relation to whaling practices), and community location within polar bear habitat. The larger the community population, the longer the history of polar bear use particularly as tied to spring whaling practices, and the more prime the polar bear habitat, the greater the likelihood for larger harvest amounts by a community.
2. The number of polar bears harvested within a community varies from year to year depending on several factors including hunter preferences, ice conditions, availability of other resources, the number of nuisance bears, and the location of spring whaling camps.
3. According to workshop participants, all four study communities are currently able to harvest enough polar bears, and they indicated that the upper ranges of their annual harvest reflect the current needs of the community. Furthermore, participants indicated the number harvested is self-regulated by the community and elders, and the number of polar bears needed each year may fluctuate depending on their availability and the availability of other resources.

Hunting Purpose and Timing

1. The primary purpose of polar bear hunting is for food, with additional uses for the fur/hide and claws for arts and crafts, clothing, bedding and other uses. In some cases, nuisance bears must be purposefully sought out and harvested if they pose a threat to the community.
2. Polar bear hunting is done among a specialized group of hunters with the most hunters, among the communities covered in this study, occurring in Point Hope followed by Utqiagvik and then Wainwright and Point Lay.
3. Winter harvests are typical of the past and continue to be the main pattern today, particularly relating to purposeful harvests for food. Summer harvests are becoming more frequent, with more bears noted onshore in recent years; these are typically nuisance bear harvests.
4. Purposeful and opportunistic hunts for polar bear occur. Purposeful hunts occur when someone desires polar bear meat or has a specific request from an elder. Opportunistic harvests occur in two primary types: harvest while engaged in other subsistence activities or nuisance harvests.
5. Encounters with nuisance bears fall into three general categories: encounters during spring whaling, encounters along the shore with washed up marine mammal carcasses, and encounters in or near the community. All communities participate in the NSB's Polar Bear Patrol Program, which workshop participants believe is successful in efforts to deter bears from the community and reduces unplanned harvests. When deterrence measures are unsuccessful, the communities will harvest the nuisance polar bears as a last resort.
6. Participants identified two primary types of nuisance bears that are more frequently harvested: (1) those that are skinny and/or in poor health, or (2) the younger bears who have recently been forced away from their mother and are less wary and more curious.

7. The location of food storage can play an important role in the number of nuisance bears that a community harvests. Food storage away from the community, such as in Point Hope, reduces the chances of nuisance harvests.

Use Area Mapping and Most Recent Harvest Year

1. Participants identified areas in which they have hunted polar bears within the last 10 years. In general, these areas are confined to locations three to five miles offshore along the ice leads and areas with barrier islands. Additional mapping studies would be needed with individual community harvesters to identify the full extent and intensity of polar bear use areas.
2. Overall, for the 12 polar bears harvested in the hunter's most recent year of harvest, all polar bears were male with an average estimated age of 7 years (ranging from 3 to 12 years), an average size rating of 3.5 (range from 2-5), and average weight rating of 3.75 (range 2-5). Approximately 59% of harvests were targeted/purposeful hunts, 33% opportunistic, and 8% nuisance. All harvests occurred between October and June except for one nuisance harvest, which occurred during the summer sometime in August or September. Additional interviews within the community with active harvesters would be needed to fully ascertain the nature of polar bear harvest patterns within each of the communities.

Habitat, Abundance, Distribution, and Health

1. The clear response among workshop participants regarding polar bear movement patterns was that they are associated with their sea ice habitat. Workshop participants identified three primary conditions that provide ideal sea ice habitat for polar bears. Specific to the ice, polar bears need: (1) thick ice with pressure ridges, and (2) ice that has open leads. The third condition relates not directly to the sea ice but rather to the presence of seals. The ice habitat must have an abundance of seals or the polar bears will not be there.

2. Except in Point Hope, workshop participants described trends in sea ice that were characterized by later sea ice formation in the winter, thinner sea ice throughout the winter, and earlier breakup in the spring. These changes began occurring in the 1990s and have continued to the present. Those in Point Hope indicated that in some years these types of changes are occurring in their community, but in other years the sea ice may come early, may be thicker, or may stay later. To these individuals the sea ice dynamics were perceived as a variation from year to year and not a signal of a larger identifiable trend.
3. Regarding abundance, participants in all communities replied that the polar bear population today was either stable or increasing. The reasons for increased abundance included the abundance of other prey species, the observed adaptability of polar bears, wider distribution of polar bears, and the overall healthy condition of bears. At this point, according to workshop participants, changes in sea ice that have been noted have not affected the overall abundance of polar bears. Several participants often remarked on the intelligence and adaptability of polar bears and believed they would be able to adapt to changes in sea ice. A few also discussed that these trends could be either positive or negative for the polar bear population, but it was too early to tell and at this point the population was not being negatively affected.
4. Other indications of increased abundance were a stable or increasing number of older polar bears, cubs, and prey species.
5. On the broadest level, participants reported that polar bears arrive near the community in the late fall/early winter with the arrival of ice and leave the community in the spring with the retreat of the ice. Individuals in Point Lay and Utqiaġvik identified that the largest bears stay farther away from the community, while it is the younger, more curious bears that often wander into town and encounter humans. Participants from Point Lay, Wainwright, and Utqiaġvik all had noted a trend toward decreasing sea ice, and when asked what effect this trend is having on the

distribution of polar bears, all three communities noted more bears were being seen on land in the summer.

6. The consensus among all communities was that polar bears are healthy, and there have been no changes to their overall health or body condition.
7. Individuals reported that they do see sickly or thin polar bears from time to time, but this has not changed noticeably from the past. Changes in sea ice were also noted as not influencing the health of polar bears to date. Both Wainwright and Point Hope stressed that it was the health of the seals (as opposed to the state of the sea ice) that, in their minds, was the best indicator of the future health of the polar bears.
8. The overall theme reflected by many of the workshop participants was that there are changes that are occurring to the environment, especially in terms of sea ice, and that these changes have the potential to affect polar bears. Several expressed that changes could bring negative or positive effects to polar bears, and that it was premature to tell what the ultimate effects would be. Many individuals highlighted two key characteristics of polar bears, (1) their adaptability and (2) their high level of intelligence, which would allow them to survive in spite of changing environmental conditions.

Polar Bear Management and Co-Management

1. Workshop participants indicated that they had little knowledge of past or existing agreements related to polar bear management. While all communities were aware of the 1972 Marine Mammal Protection Act (MMPA) and its implications for Alaska Native marine mammal harvests, all communities but Point Lay had no knowledge of the other three major agreements regulating polar bear harvests and use. In addition, while most individuals were aware of the Alaska Nanuuq Commission (ANC), only one was aware of its successor organization, the Alaska Nanuut Co-Management Council (ANCC).

2. All workshop participants agreed that scientific information can be helpful in making polar bear management decisions—but with some caveats. Information related to resource health (e.g., fat content, diet samples, etc.) and population counts were generally viewed as valuable information. Questions arose regarding the accuracy of past population counts and problems were noted with current methodologies for estimating polar bear populations, such as avoiding communities where polar bear concentrations tend to be high¹. While respondents acknowledged the value of scientific research in informing management decisions, they also stressed that such research should either involve local residents or be considered in combination with TEK when making polar bear management decisions.
3. A common theme across the communities was that Alaska Natives have successfully managed wild resources for thousands of years, without the interference of outside entities. Not a single participant from the four communities believed that Native harvesters are having a negative impact on polar bear numbers.
4. Regarding the issue of Native representation and input into polar bear management decisions, some workshop participants noted improvement in recent years—especially on a regional basis. However, Native representation and input into federal or “outside” management decisions were, for the most part, viewed as inadequate. Participants reported a general lack of communication on the issue of polar bear management, noting that more regular communication from outside entities would encourage local involvement.
5. Workshop participants pointed to the need for improved communication; equal decision-making authority among Native and federal co-management partners; incorporation and consideration of traditional Native management practices; incorporation and consideration of TEK when making management decisions; implementation of local (rather than state or federal) enforcement of harvest

¹ Avoidance of communities by researchers was at the request of the communities so that subsistence activities would not be disturbed by aircraft.

management agreements; and consideration of the entire ecosystem when making management decisions.

6. All participants agreed that the current polar bear population is “about right,” in that it has not changed substantially from the past and is adequate to provide for local communities. While participants acknowledged that changes in ice conditions have affected the distribution and behavior of polar bears, they did not believe these changes had affected populations negatively.

Local Participation in Research and Management Activities

1. A majority of workshop participants had participated, or knew of other community members, who had participated in reporting of data related to polar bear harvests and observations as part of the US Fish and Wildlife Service (USFWS) Marking, Tagging and Reporting Program (MTRP). In all cases, and for all types of information (harvest numbers, harvest location, health and body condition, litter size, and cub survival), workshop participants indicated they would be willing to participate in reporting programs.
2. Workshop participants from all communities believed that a community-based polar bear monitoring and management program would be successful. However, they also had suggestions for how to ensure such a program’s success including the need for improved sampling and data documentation methods, better training and adequate compensation or incentive to hunters.
3. Workshop participants noted that community residents would be more likely to follow guidance from outside organizations if that guidance is supported by strong science and consultation with local residents.

Closing comments and concerns from workshop participants related to polar bears and polar bear harvesting focused on the negative effects of a polar bear harvest quota. Harvesters noted that a quota would not only limit their potential harvest for what they need; but it could also affect hunter behavior and potentially result in more polar bears being harvested than if no quota were in place. Workshop participants believed that their communities do not always reach the quota limit that has already been set for the Alaska Chukchi Sea communities, which demonstrated the communities' ability to self-manage. If a strict quota were to be set, hunters may feel the need to harvest that quota number every year due to competition and fear of being perceived as not "needing" as many polar bears if they were to take less in a certain year. Utqiaġvik workshop participants noted that greater efforts toward educating younger hunters about traditional management techniques would reduce the need for a quota. In addition to concerns about the quota, workshop participants also expressed concerns related to polar bears and hunter safety, climate change, and the potential for offshore oil development (and potential oil spills and discharge).

Discussion of TEK and Western Science

To the study team, the primary takeaway regarding the TEK findings of this pilot study and western science regarding polar bears is that many of the findings showed overall concurrence. Areas identified as showing general concurrence included abundant prey and polar bears, stable reproductive metrics, movement patterns tied to sea ice (along with later ice formation and less thick ice), and overall perceptions of good health and body condition. However, in order to integrate TEK with current modeling and risk assessment efforts there needs to be a greater sample size with sufficient spatial (e.g., more communities) and temporal (e.g., more observations over time) coverage in TEK observations. Future iterations of the modeling efforts could also be expanded to include information from TEK relative to other vital rates/environmental conditions. Other TEK that may not provide a direct input into the IPM (e.g., as data or constraints on parameters) or harvest risk assessments are still important to western science, in

that they confirm overall interpretations, highlight the need for additional information to resolve apparent inconsistencies, or serve as informative priors (pre-existing evidence which is taken into account). Regarding a harvest risk assessment (Regehr, Wilson, Rode, Runge, and Stern 2017), TEK could be used in evaluating management objectives, risk tolerances relative to meeting those objective, harvest strategy, and the effects of sea-ice loss on polar bear population status.

From the indigenous perspective, the study team learned that, while scientific information was viewed as valuable in certain contexts (e.g., health surveys, population estimates), workshop participants insisted that local input and TEK was vital to helping guide research efforts, interpreting results, and management decision-making. Participants explained that successful management with outside agencies would only occur when **communication** was made a priority, TEK was **adequately** included in decisions, **local** enforcement was emphasized, the **entire ecosystem** was considered, and when Natives had **equal** decision-making authority (and not just input). Finally, as stated throughout the report, this study is a pilot study that occurred among a relatively small number of participants from a subset of communities that subsist from the AC population of polar bears. Because this was a pilot study, we acknowledge that stronger inference and increased value for informing population and risk assessment models would result from additional work with a larger sample size, and from further investigation of the linkages between TEK and model parameters. Thus, we recommend additional TEK workshops in these and other Chukchi Sea communities. These workshops should be conducted in cooperation with and guidance from the ANCC to help ensure their success. Moreover, communities should be given an opportunity to review and comment on these findings prior to the finalization of results.

1 INTRODUCTION

In 2000, the *Agreement between the Government of the United States of America and the Government of the Russian Federation on the Conservation and Management of the Alaska-Chukotka Polar Bear Population* (Agreement) was signed by the two countries and stipulates that reliable scientific data, including traditional ecological knowledge (TEK) of the Native people be used to determine the annual sustainable harvest level for the Alaska-Chukotka (AC) population of polar bears. On November 29, 2017, the North Slope Borough Department of Wildlife Management (NSB DWM) contacted Stephen R. Braund & Associates (SRB&A) to conduct TEK research related to the AC population of polar bears, and on December 31, 2017, the NSB provided SRB&A with notice to proceed with the project. The primary purpose of this study was to collect relevant TEK about polar bears, which can be incorporated into the Bayesian integrated population model used to estimate demographic parameters (IPM; (Regehr et al. *In review*)) and the harvest risk assessment model (Regehr et al. 2018a), which have been developed based on data from capture-recapture research on Chukchi Sea polar bears and may be used to inform future management decisions. All references to the IPM and estimating demographic parameters is **PRELIMINARY** and **DRAFT** and refer to in-progress work and discussion that has not been through agency or peer review. Also, this project represents a pilot study to inform polar bear management models with TEK; additional work is needed to determine the relationships between TEK and model parameters.

2 METHODS

2.1 PRE-FIELD

Previous TEK studies focused on polar bears have been conducted in Alaskan communities in the Bering, Chukchi, and Beaufort sea regions by Kalxdorff (1997) and Voorhees and Sparks (2012). For the Chukotka side, Kochnev et al. (2003) and Kochnev and Zdor (2016) produced reports documenting Chukotka Native peoples'

polar bear TEK and harvests. Other TEK studies (e.g., SRB&A 2011) may also contain TEK related to polar bears but focused on a broader range of TEK topics such as the physical environment, other species, sharing practices, and development impacts.

The primary goal of these focused TEK polar bear projects was to identify polar bear habitat to develop habitat conservation strategies; each project included a mapping component of polar bear habitat locations. Kalxdorff (1997) conducted research in 12 villages, from St. Lawrence Island in the Bering Sea to Kaktovik in the Beaufort Sea, focused on documentation of TEK regarding polar bear habitat areas. The study identified feeding habitat along barrier islands and coastline, recurring leads and polynyas, and active ice areas; denning habitat was located along the coastline and barrier islands in addition to river and creek drainages. Seasonal movements occurred between these feeding and denning habitats.

Similarly, Kochnev et al. (2003) conducted research in 53 Native villages in Chukotka focused on identifying areas of den concentrations, feeding grounds, and seasonal bear movements. Kochnev et al. (2003) not only identified important feeding sources and regions depending on seasonality but also concluded that the knowledge provided by the Chukotka people was a valuable starting reference for guiding future scientific research and also played an important role in raising the awareness of local participants of their important role in protecting natural resources, including the polar bear.

Voorhees and Sparks (2012) conducted TEK research in seven Iñupiaq/Siberian Yupik communities to document local residents' knowledge regarding polar bear amid changing environmental conditions associated with climate change and Arctic warming. This study continued the work of Kalxdorff (1997) to develop a Habitat Conservation Strategy for polar bears. Voorhees and Sparks (2012) found that local abundance of polar bears has been declining overall in the past 20 to 30 years but that there are variations in local abundance and local abundance and distribution may or may not be linked to overall population abundance. Furthermore, their findings emphasized that

while there may be changes to polar bears and their habitat due to arctic warming, the bears are adaptable and generally healthy.

For this initial phase of this project, SRB&A coordinated with and received input from the NSB, DWM on the development of a TEK protocol. SRB&A also received input on protocol questions from the Scientific Working Group (SWG) of the US-Russia Bilateral Commission; a team of US, Russian, and Native researchers and TEK holders tasked with collaboratively addressing polar bear management issues in Alaska (see copy of protocol in Appendix A). The Agreement addresses the AC polar bear population, which is recognized as occurring within the Chukchi Sea between lines extending north from the Kolyma River mouth in Russia and north from Point Barrow in the U.S.². Note that the Polar Bear Specialist Group boundaries are different, with the northeastern line extending north from Icy Cape on the US side, omitting the areas farther north near Wainwright and Utqiaġvik (USFWS 2017) (Figure 1). According to Schliebe, Benter, Regehr, Quakenbush, Omelak, Nelson, and Nesvacil (2016), a total of 16 Alaskan communities have reported harvests of AC polar bears to the U.S. Fish and Wildlife (USFWS) Marking, Tagging, and Reporting Program (MTRP) from 1988-2014. Of these 16³, nine have reported more than 10 harvests of polar bears over the last 26 years (Schliebe et al. 2016). Applying the boundaries used in the Agreement, the total number of communities harvesting AC polar bears would climb to 18 with the inclusion of Wainwright and Utqiaġvik (formerly Barrow).

Due to the time constraints of the project and the goal to provide information, including model inputs, for the upcoming February 2018 SWG workshop in Russia, the NSB and SRB&A decided that the initial phase of this TEK project should be viewed as a pilot study, with selected AC study communities. For this initial phase of the TEK study, the four communities chosen were Point Hope, Point Lay, Wainwright, and Utqiaġvik (Figure 2, Figure 3). Due to the time constraints of the project, the NSB DWM brought

² The study team is unaware of an official map depicting the boundaries identified in the Agreement.

³ In order of descending harvests - Point Hope, Gambell, Savoonga, Little Diomedede, Shishmaref, Wales, Point Lay, Kivalina, Nome, Brevig Mission, Noatak, Noorvik, Stebbens, Ageklekak, and Cape Lisburne.

polar bear harvesters, on subsequent days, from Point Hope, Point Lay, and Wainwright to participate in workshops with SRB&A held at the DWM's conference room in Utqiagvik rather than have SRB&A go to the communities to interview a broader range of hunters.

The goal of the pilot study was to determine what questions and TEK outputs would be most useful as inputs into an integrated population model (IPM) and a harvest risk assessment model for use in informing future management. The study could then be expanded in the future to increase the samples size, to accommodate the TEK of remaining AC polar bear harvesting communities, and to update the information at regular intervals (e.g., every five years) if necessary.

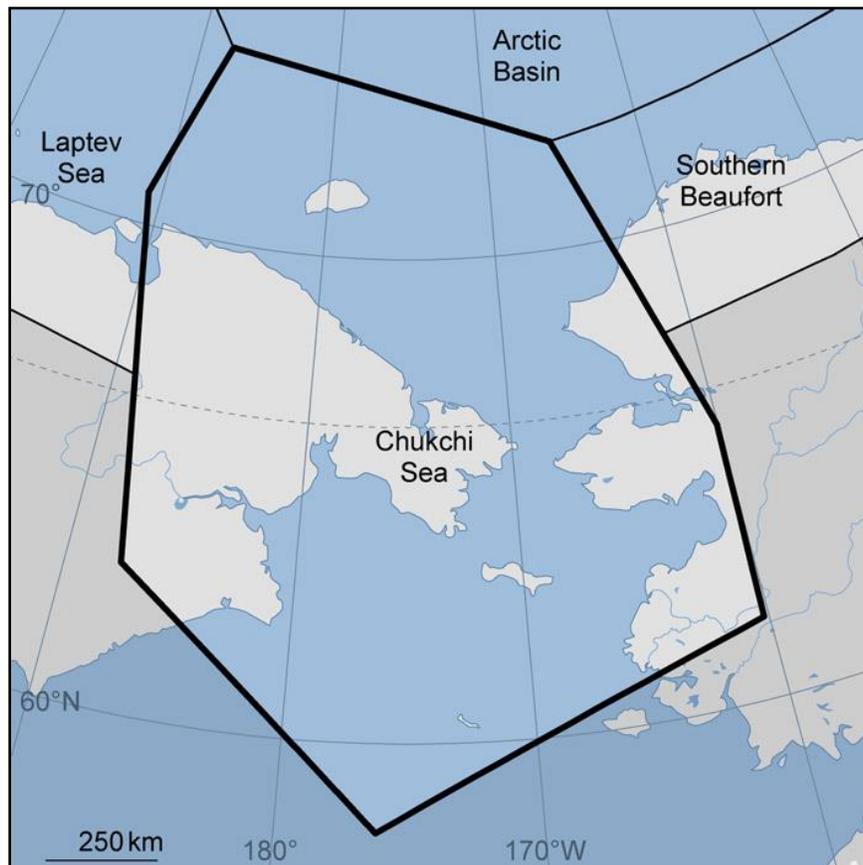


Figure 1: Map of Chukchi Sea Polar Bear Sub-Population (IUCN/SSC PBSG n.d.)

2.2 FIELD

During the week of January 15-19, 2018, Stephen Braund and Paul Lawrence of SRB&A traveled to Utqiaġvik and worked with active and knowledgeable polar bear harvesters from the four North Slope study communities to help document polar bear TEK based on participants' knowledge and observations. One workshop occurred each day with a different study community. In total, 10 harvesters from the four study communities participated in the TEK workshops. Additional Iñupiaq NSB staff from the DWM participated in the workshops throughout the week and provided input and knowledge for many of the questions and, when necessary, English-Iñupiaq translation. Table 1 provides a summary of the TEK workshop participants by community. All participants were recommended for the workshops based on their long-standing knowledge regarding polar bears near their community. As shown in the table, the participants' average age ranged from 36 in Point Lay to 61 in Wainwright, with an average number of years in the study community ranging from 42 to 61, except for the Point Lay participant who had lived in Point Lay for 19 years, having spent the other years living in Utqiaġvik. Unless otherwise specified, the time frame of workshop participants' observations focused on the present status followed by observations of how things have changed over the participants' lifetime.

Table 1: Summary of TEK Workshop Participants Characteristics

| Community | Date of TEK Workshop | Number of Participants | Gender | Average Age | Average # of Years in Study Community |
|------------|----------------------|------------------------|--------|-------------|---------------------------------------|
| Wainwright | 1/16/2018 | 3 | Male | 61 | 61 |
| Point Hope | 1/17/2018 | 2 | Male | 60 | 46 |
| Point Lay | 1/18/2018 | 1 | Male | 36 | 19 |
| Utqiaġvik | 1/19/2018 | 4 | Male | 49 | 42 |

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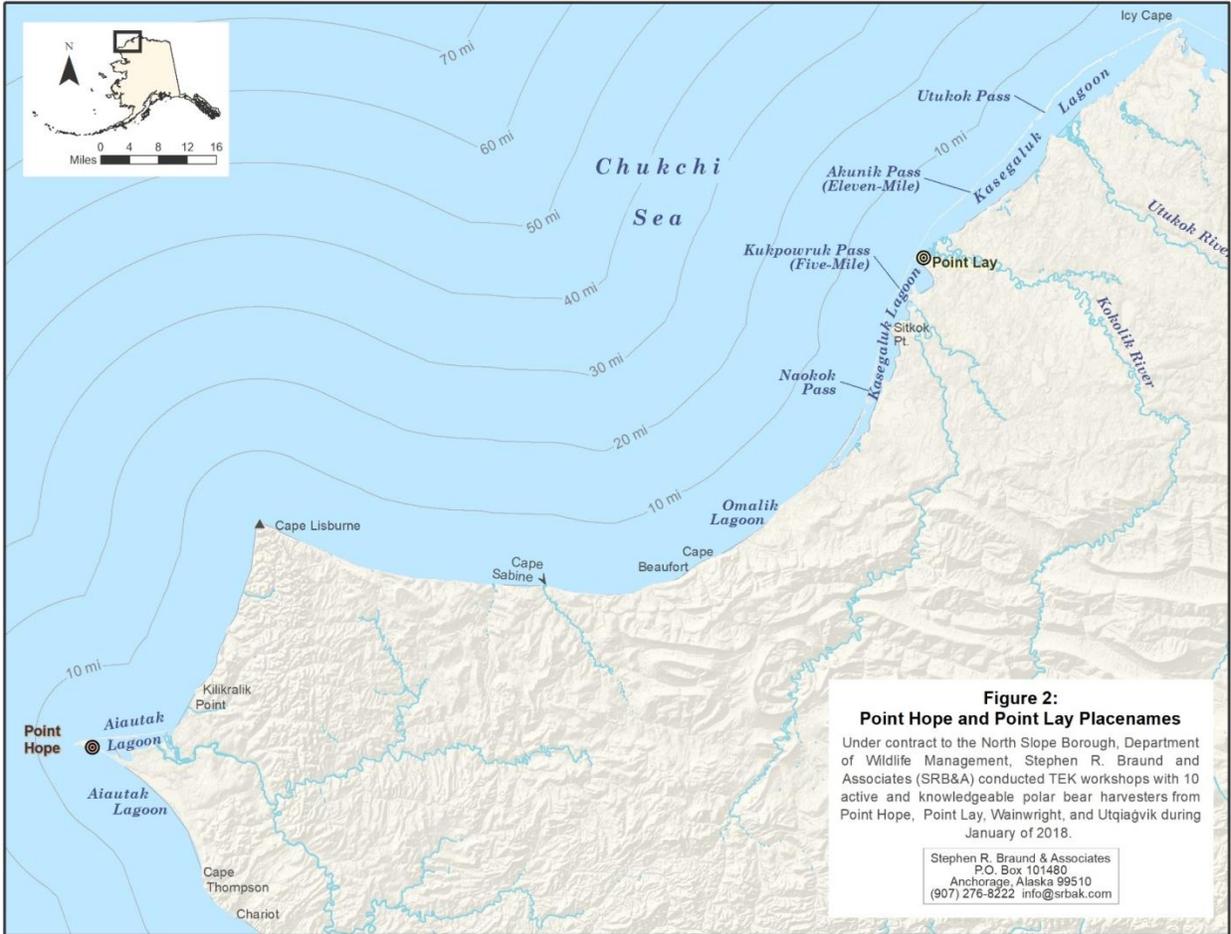


Figure 2: Point Hope and Point Lay place names.

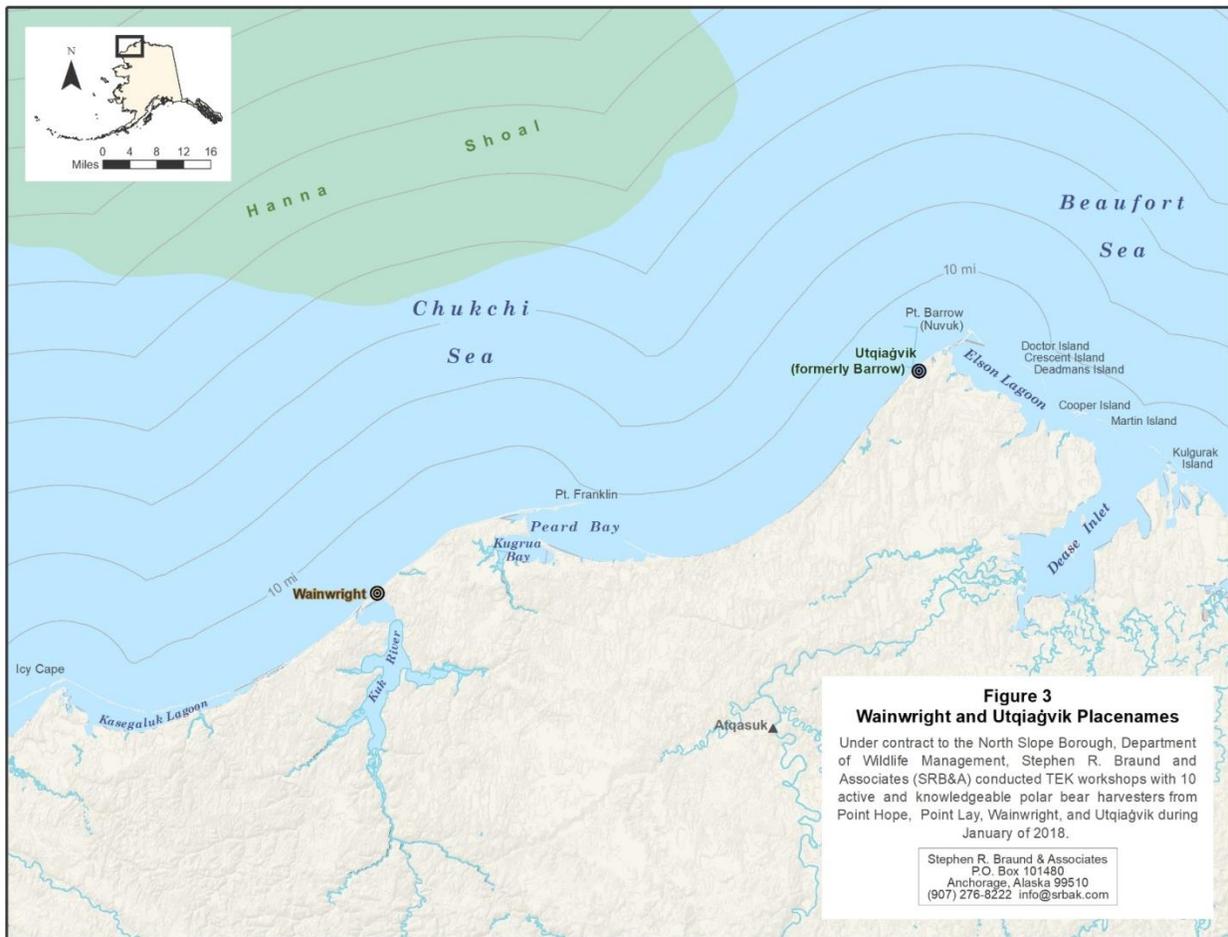


Figure 3: Wainwright and Utqiagvik place names

2.3 POST- FIELD

After conclusion of the fieldwork, SRB&A met with the SWG in Anchorage on January 30, 2018 to report on the status of the TEK pilot study and to request guidance on the best ways to present the TEK information to facilitate its incorporation into the IPM and/or the harvest risk assessment. SRB&A compiled and organized TEK according to the TEK workshop protocol and summarized the results. Where informative and appropriate, SRB&A distilled the TEK for many of the protocol questions into short summary table outputs to potentially assist as key TEK inputs into the IPM and/or harvest risk assessment. Additional TEK gathered during the workshops provided the context for the primary questions and table outputs and provided overall community input into the issue of polar bear management.

On February 14, 2018, SWG members provided SRB&A with a table describing the ecological parameters (e.g., rate of population change [λ_t], probability of movement relative to the study area [ψ_1^{00}]) of the IPM to help move forward the discussion regarding ways that TEK data may inform or be incorporated into the IPM. In the Discussion section of this report, SRB&A has highlighted questions/outputs from the TEK result tables with the related ecological modeling parameters (e.g., λ_t , ϕ_S) where both general TEK regarding trends, or questions that if asked on a regular basis (e.g., annual) in more communities, could provide sufficient distribution of observations in time and space to potentially serve as informative IPM inputs. The section also contains definitions of the various IPM parameters that could be potentially informed by TEK. It should be noted this is a draft concept meant to move forward the discussion regarding integrating reliable scientific information including TEK into the IPM and harvest risk assessment. The authors anticipate that methods of implementing TEK into the IPM and harvest risk assessment will be explored based on future scientific and local community reviews and TEK workshops.

3 RESULTS

The TEK workshops were organized around the following six primary topics:

1. Polar Bear Harvesting Characteristics
2. Hunting Purpose and Timing
3. Use Area Mapping and Most Recent Harvest Year
4. Habitat, Abundance, Distribution, and Health
5. Polar Bear Management
6. Local Participation in Polar Bear Management

The subsequent results are organized around these six primary topics with subheadings for each of the key themes addressed under each topic. For each of the questions with specific application as potential inputs into the IPM or harvest risk assessment, SRB&A attempted to synthesize the information into succinct variables. SRB&A also evaluated the information in terms of completeness, adequacy, and any contextual information that would inform the results and potential applications into a model.

3.1 POLAR BEAR HARVESTING CHARACTERISTICS

This section of the workshop focused on the harvest characteristics of each community including an estimate by participants of the number of polar bears taken each year, the amount participants believed was enough for their community on a yearly basis, and whether their community was able to harvest enough polar bear to meet community needs. Follow-up questions focused on changes from the past and variations from year to year. Table 2 provides a summary of the answers provided to the primary questions in this section.

Table 2: Summary of Polar Bear Harvesting Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|---|------------|----------------|---|-----------|
| II.1 | How many polar bear are harvested in typical year? | 15-20 | 1 | 10-15 | 12-30 |
| II.1.a | Does this amount vary substantially from year to year? | Yes | No | Yes | Yes |
| II.1.b | What factors affect your annual polar bear harvest levels | Ice | Not Applicable | Proximity and Circumstance (whaling, nuisance, purposeful harvests) | Ice |
| II.2 | How many polar bear are enough per year? | 15-20 | 2 | 10-15 | 20-25 |
| II.3 | Able to harvest enough? | Yes | Yes | Yes | Yes |

Note: Roman and Arabic numerals correlate to the protocol questions provided in Appendix A

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Harvest Amount

In general, the four communities' harvest levels are tied to the community population, history of polar bear use (including the relationship to whaling practices), community preferences for polar bear meat, and community location within polar bear habitat. In all communities, regardless of the level of harvest, polar bears have a special place in Iñupiaq culture including: rites of passage, fulfilling food cravings, sustenance, arts and crafts, clothing, and bedding. Utqiagvik, which has the largest Alaska Native population (Table 3), reported the highest levels of harvest and the widest range of variability at 12-30 harvested polar bears a year (Table 2); whereas Point Lay, which has the lowest population, reported a typical harvest of one polar bear a year.

Table 3: Community Population Characteristics

| Community | 2015 Population | Percent Iñupiat |
|------------|-----------------|-----------------|
| Point Hope | 711 | 89 |
| Point Lay | 269 | 88 |
| Wainwright | 557 | 90 |
| Utqiagvik | 4,933 | 63 |

Source: (NSB 2018)

Based on information provided by the USFWS (2018) regarding polar bear harvests in the last 10 years, Point Hope averaged 13.4 polar bear harvests a year (34.9% of the total reported harvest of Chukchi Sea polar bear), Utqiagvik 10.3 (26.8% of harvest), Wainwright 5.5 (14.3% of harvest) and Point Lay harvested an average of 0.4 bears per year (1% of harvest) (Table 4). These harvest estimates are lower than the reported typical harvest amounts provided by workshop participants. These USFWS data were not available to the study team during the workshops, and in future workshops beyond this pilot study it would be helpful to discuss the USFWS reported harvests versus workshop estimates with the workshop participants to try to understand potential reasons behind any differences.

Table 4: Reported Polar Bear Harvest Amounts – Last 10 Years

| Community | Study Year | | | | | | | | | | Total | Average Per Year | Percent of Harvest |
|-------------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------------|--------------------|
| | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | |
| Point Hope | 15 | 5 | 3 | 34 | 31 | 15 | 6 | 5 | 7 | 13 | 134 | 13.4 | 34.9% |
| Point Lay | 0 | 0 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | 0.4 | 1.0% |
| Wainwright | 1 | 0 | 3 | 5 | 13 | 10 | 6 | 7 | 9 | 1 | 55 | 5.5 | 14.3% |
| Utqiagvik | 14 | 10 | 10 | 13 | 7 | 17 | 7 | 3 | 11 | 11 | 103 | 10.3 | 26.8% |
| Other Communities | 7 | 8 | 10 | 7 | 28 | 12 | 6 | 1 | 5 | 4 | 88 | 8.8 | 22.9% |
| Total | 37 | 23 | 26 | 61 | 80 | 55 | 25 | 16 | 32 | 29 | 384 | 38.4 | 100% |

Source: (USFWS 2018)

Population was not the only factor that correlated with community harvest levels. Several participants elucidated how the Iñupiat and polar bears have developed a symbiotic relationship based on thousands of years of spring whaling practices, especially in Point Hope and Utqiagvik. For communities that have more limited or recent spring whaling, such as Point Lay, these relationships have yet to be strongly formed. Speaking on this broader relationship, participants from the communities provided the following insight:

Other elders talk too [about whaling and polar bears]. Polar bears learn where the whaling communities were situated over time. Generations after generations. A lot of them learn to come back at a certain time of the year. They come in the spring time and wait around for the opportunity to have something from bones. Sometimes in history there is “struck and lost” and a whole carcass is to be had by other animals, not just polar bears. (SRB&A Point Hope Workshop, January 2018)

Probably only two to three [bears usually seen around whale carcass]. Here in Barrow I see 20 [around a whale carcass]. In Point Lay I have not seen so much [polar bears]; in Point Lay, there is just a few years of whaling there [in recent times], and they do not have the history of observation of polar bear around whale carcasses. Polar bear have not really learned about Point Lay and do not have that knowledge in them to go back to that place at this certain time of year. Not like Kaktovik where 50 or 60 or 70 bears all congregate. They have not learned area yet. [Believes more will be coming in 20 years]. My grandma always tells me stories of the last whale caught in Point Lay in the 1930s. They were taking shares from Icy Cape to Point Lay by dog team, and it took three days with a sled load and two days without a load to travel that far. They used to meet with Wainwright at Icy Cape and go whaling with each other there. I think they [polar bears] have not learned to come back to this area [Point Lay]. (SRB&A Point Lay Workshop, January 2018)

The Point Lay participant went on to explain that one reason Point Lay harvests fewer polar bears is that Point Lay’s spring whaling season is much shorter (only one whale harvested) compared to the other communities, particularly Point Hope and Utqiagvik, that harvest multiple whales throughout the spring and draw many polar bears to the area over an extended time period. Once Point Lay has harvested their one whale, the whaling crews leave the ice and return to the community, which limits the potential for harvest opportunities with polar bears that are exploiting the rich resources present

along the ice leads. Other communities spend a longer time on the ice during whaling thereby increasing the chance of encounters with polar bears that may be harvested under both purposeful and less often defense of life and property (often locally referred to as nuisance bears) reasons.

Based on the limited number of interviews conducted in this pilot project, there appeared to be more references to a larger number of elders and individuals desiring the polar bear meat for food in Point Hope and Utqiagvik than in Wainwright and Point Lay, which could be a factor in the number of polar bears harvested by a community. As noted by one Point Hope participant who said, “Point Hope is community that really hunts polar bears. Point Hope is one that gets more than any other community” (SRB&A Point Hope Workshop, January 2018). This topic would need to be further researched beyond this pilot study within the communities to reach a better understanding of individual community preferences for polar bears and the relationship to overall harvest levels.

Lastly, all four communities identified and described polar bear habitat near their communities (see Section 3.3.1), which provides residents with the opportunities to harvest polar bear. In particular, participants discussed how the geographic points at *Nuvuk* (Point Barrow) and Point Hope are particularly well suited for attracting polar bears, which could also play a role in the larger number of polar bear that are harvested by the community.

Variability from Year to Year

Point Hope, Wainwright, and Utqiagvik participants stressed that the number of polar bears harvested within a community varies from year to year depending on several factors. Point Lay, with a usual harvest of one bear a year, indicated that if a hunter wants one they can usually go get it, and because the community harvests so few polar bears, the outside factors that influence harvests in other communities do not have as much effect in Point Lay:

It is probably more when the hunters want to hunt something they go get it. Usually one or two hunters who want to catch a polar bear and are looking forward to it. Not like caribou which has lots of hunters. Polar bear is shared but not really sought after by a lot of people. There are just a few of us that will harvest a polar bear if it comes. We not like, "Go shoot the polar bear every time you see one!" If a polar bear is just walking by, we would not necessarily harvest it; we just watch them walk by. They are usually on the other side of the barrier islands – on the ocean side. (SRB&A Point Lay Workshop, January 2018)

According to the workshops, outside factors that contribute to harvest variability include ice conditions, availability of other resources, location of spring whaling camps, and hunter preferences. These factors influencing variability are summarized as follows:

- Ice Conditions – In short, according to participants, polar bears and marine mammal hunters prefer similar ice conditions including stable ice with open leads. If the ice comes late in the season (e.g., after October), leaves sooner (e.g., before May or June), is thinner or unstable, or there are few leads, then hunters will likely harvest fewer polar bears.
- Availability of Other Resources – In general, polar bear are not viewed as a staple food resource but rather a food resource of high cultural and taste importance that meets cultural needs and cravings. If staple food resources such as caribou, seals, and whale are in abundance, it may be that fewer polar bear are taken, but if community members have less food available to them then additional polar bears may be taken. However, generally polar bears are purposely and consistently taken in all communities every year.
- Spring Whaling – If ice conditions cause whalers to congregate in one smaller area (rather than spread out along the lead) there is a higher chance for more polar bear to be taken that year, especially if the whalers are in prime polar bear habitat such as at *Nuvuk*. In general, the closer the spring whaling camps are to the shore and community, the higher likelihood for more polar bear encounters, and there are more chances for taking polar bears (especially related to nuisance

bears, see Section 3.2.3.1). These encounters during spring whaling and resulting effect on polar bear harvests have long occurred in Wainwright, Utqiagvik, and Point Hope. The one Point Lay individual expected more encounters to occur once polar bears begin to become accustomed to Point Lay's spring whaling, which has only recently (2008) been renewed.

- Hunter Preferences – Polar bear harvests may vary from year to year depending on the specific preferences or wants of an individual hunter or elder for which a polar bear hunter will hunt.

Related to variation in polar bear harvests from year to year, workshop participants discussed these factors as follows:

Biggest numbers will be in the spring time when we have unusual ice conditions like last year and year before. All of the whalers were concentrated in one area and when you have that up north when a lot of bears at the same time, there will be polar bears taken at that time of the year around the whaling camps. (SRB&A Utqiagvik Workshop, January 2018)

Ice conditions are the main thing. Sometimes they will swim. We have ice, so people will go out there and check and people go out there. We have this little [NAME's] house and there will always be a polar bear in there. People have to know who approach that house in the old town site; it is a house by an ice cellar. (SRB&A Point Hope Workshop, January 2018)

It varies. Depending on what we caught near town. It always attracts the bears (whales harvested)... Throughout our lives we get what we want to get. It is not like we wake up today and say we want to take polar bear. It is more removing away from community's proximity. We shoot them away from town. We could take them. Sometimes we scare them away and if they keep coming back to town we have to take them. But it has [to do] with whaling too, when whales are caught. If lots caught in spring time we end up having to take more than usual. (SRB&A Wainwright Workshop, January 2018)

If we have a healthy population, we do not see them in town and they do not want to come to town unless they have to [because of being skinny]. We have to take because of safety. (SRB&A Wainwright Workshop, January 2018)

I have not seen that our whaling had caused anything related to polar bear harvests, but I am sure in the future that bears will be harvested at the whaling harvest sites. It is something I grew up with in Barrow. People have been harvesting polar bears at whaling harvest sites since I was a little kid. That is where a polar bear will mostly likely be harvested is at a whale carcass site. Us harvesting the whale will be a good food source that will last them a couple months. Just the fat reserve from whale's body gives them food source and fat reserve. (SRB&A Point Lay Workshop, January 2018)

Polar bear depend on the whale; we depend on the whale. That is the main source of food. Polar bears know there is food coming. We are butchering whales, and we just let them. We do not bother them, and they do not bother us. They are eating their food that is given to them. When we harvest a whale, we give a person that has not caught a polar bear. . . we will let that person go and get it for their first harvest. We know the polar bear will be coming there and feasting. If they do not bother us we do not bother them. I saw a video of Wainwright when cutting there was polar bear coming real close to them. We have not seen that. (SRB&A Point Hope Workshop, January 2018)

Lastly, workshop participants were asked to discuss whether they thought that changes in polar bear distribution and behavior affected whaling practices. All communities responded in the negative and indicated that polar bears do not affect their whaling practices.

3.1.1.1 Ability to Harvest Enough

According to workshop participants, all four study communities stated they are currently able to harvest enough polar bears for their community (Table 2). When asked how many polar bears would be enough for their community, Wainwright and Point Hope said that the current harvest levels of 10-15 and 15-20 are meeting their needs. However, Wainwright later added that the increasing prevalence of nuisance bears in the summer near their community may require that the community's harvest be increased to 20-30 polar bears a year to account for the increased harvest of nuisance bears. Point Lay indicated that two would be enough for their community's harvest levels, which corresponds to their documented harvest patterns over the last 27 years (see Schliebe et al. 2016). Lastly, Utqiagvik participants identified that the higher range

(20-25) of their average harvest of 12-30 bears would be enough for their community needs and that most importantly it is the elders and community members that help self-regulate the community's harvest based on need and the availability of other resources.

Participant 1: *Ten to 15 for Wainwright. Fifteen at most... More people coming over asking for polar bear meat. Five I catch in one year, and they are gone in half an hour.*

Participant 2: *Take is not a big part of our diet. Not like caribou or whale. It is a lot less frequent that we eat compared to whale and tutu [caribou]. Polar bears are an important part of our diet, we love polar bear. I do not know anyone that does not like to eat polar bear. (SRB&A Wainwright Workshop, January 2018)*

Fifteen to 20 would be just right. If you give Point Hope two and another village gets five that is not right. Our community harvests more polar bears we eat it. That is the elders' food we get. We use it for whaling feast and put in ice cellars and put [out] for the feast. (SRB&A Point Hope Workshop, January 2018)

I would think maybe two a year would probably be good. Not many people eat polar bear. Last polar bear that was caught I eat some of it. Yeah, I believe they [community] are [able to harvest enough], it is not real sought after and there are a few people that look forward to harvesting a polar bear. Not very often. We do still harvest them. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *Enough [is] when we think about enough, the hunters in the community and elders will take notice. Almost everybody knows when a polar bear or whale is taken. They are similar and people say enough in the community when there is enough. You hear it on the VHF, you hear it at the store or at post office.*

Participant 2: *Varies too between years and some years the caribou are real close and others have traditional meat like caribou, and some years when caribou are not so close, we have different needs. You have to travel farther to get them [caribou]. Some years we have bad years and some people will go get more [polar bear] and they might have one a year and now they go get two to three a year to equal out the lack of others. It could vary from year to year based on the availability of other resources. (SRB&A Utqiaġvik Workshop, January 2018)*

Wainwright participants discussed that while they are able to get enough now they have begun to see a change in distribution of polar bears compared to 10-15 years ago and attributed this change to the change in ice conditions. One individual during the Point Hope workshop discussed that years when the community does not get enough polar bear are also tied to ice and weather conditions but did not specifically identify a broader pattern of change as Wainwright respondents had. He explained,

Like for example, weather conditions and ice conditions and ice being late. Sometimes you do not get the polar bears that you want to get and there are natchiqs [ringed seals] and sometimes lots of caribous and sometimes not enough aivik [walrus]. (SRB&A Point Hope Workshop, January 2018)

3.2 HUNTING PURPOSE AND TIMING

During this portion of the workshop, participants focused on the hunting purpose and timing of polar bear subsistence activities in each community including the primary use of polar bears, the number of people who typically harvest polar bears, the timing of polar bear harvests, and the relationship between purposeful takes and opportunistic takes (including nuisance bears). Follow-up questions focused on changes from the past and variations from year to year.

Table 5 provides a summary of the answers provided to several of the primary questions in this section.

Table 5: Summary of Polar Bear Hunting Purpose and Timing Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|-----------------------------|---------------------------|----------------------------|----------------------------|
| III.1 | What is the main reason you harvest polar bears in your community? | Food, Fur, Arts/Crafts | Food, Fur, Arts/Crafts | Food, Fur, Arts/Crafts | Food, Fur, Arts/Crafts |
| II.3 | Do many people hunt polar bear, or is it a more specialized activity among a smaller number of hunters? | Specialized (40-50 hunters) | Specialized (3-5 hunters) | Specialized (5-6 hunters) | Specialized (12 hunters) |
| II.4 | What is the typical timing (months) of your polar bear harvesting? | September – May | Winter | October - April | October - May |
| III.5 | When you harvest polar bears are you usually actively searching for them or are you harvesting them during other subsistence activities? | Purposeful & Opportunistic | Primarily Opportunistic | Purposeful & Opportunistic | Purposeful & Opportunistic |
| III.6 | Do you ever take (harvest) a nuisance bear? | Very Rare | Yes | Yes | Yes |
| III.10 | How often are polar bears wounded and not recovered? | Never | Rarely | Rarely | Rarely |

Note: Roman and Arabic numerals correlate to the protocol questions provided in Appendix A

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3.2.1 Primary Uses

All communities indicated that the primary use of polar bear was first and foremost for food (Table 5). Several discussed a special focus on providing polar bear meat to elders, especially when they had a “craving” for it. In addition to the use of the meat, all communities reported important uses of the fur, hide, teeth, and claws for things such as arts/crafts, ruffs, mittens, tent floors, and general warmers. This overall concept of craving and purposeful hunts for elders reflects the high cultural importance of polar bear meat to the subsistence diet. Several individuals described this concept of craving polar bear and its particular importance among elders:

What is inside me when I want my fix, I need polar bear meat. Now with elders fading away with us, and with us becoming elders, and then they will have that craving for it. (SRB&A Utqiaġvik Workshop, January 2018)

For me if an elder calls me and stuff... Mainly for the meat. I am happy with skin. Once I get that skin I would give to the ladies... Even like a young kid it is our tradition, our Iñupiaq way. Once we catch, first we give to elder. I will let my daughter get a polar bear this year. (SRB&A Point Hope Workshop, January 2018)

In addition to the above purposes and uses, participants, particularly from Wainwright and Utqiaġvik, indicated there is sometimes a need to go out and harvest a nuisance bear when it is a threat to the community (see discussion regarding nuisance bears below in Section 3.2.3.1).

All communities also agreed that those who hunt polar bears are a specialized subset of hunters who are skilled and willing to put forth the large amount of time and effort needed to properly process a polar bear. Point Hope indicated that approximately 10 percent of their hunters would purposefully target a polar bear, or approximately 40-50 people in the community, the largest number of hunters of the four study communities. The other three communities indicated a smaller subset of specialized hunters ranging from a dozen in Utqiaġvik, five to six in Wainwright, and a similar number in Point Lay.

Utqiagvik participants added that in their community those who specialize in polar bear harvesting are also the ones who actively hunt for seals because both resources are available at the same time and place. In general, participants indicated that the number of polar bear hunters in a community has stayed relative similar compared to the past. When asked what conditions are preferable for polar bear hunting versus poor hunting conditions respondents identified the following variables related to ice (Table 6):

Table 6: Ideal and Poor Ice Conditions for Polar Bear Hunting

| Ideal Sea Ice Conditions | Poor Sea Ice Conditions |
|--|--|
| Thick Ice - at least 6-10 inches thick for safe travel | Thin Ice - less than 6 inches; 2-3 inches is dangerous |
| Flat Ice - easier to skin and haul a bear out | Rough Ice - too many ridges make it harder to find bears and skin out. Some pressure ridges are good because ice is more grounded and safe and provides lookout. |
| Fewer Leads - easier for hunter to move about and fewer ways for bears to escape | Many Leads: makes hunter movement more difficult and more ways for bears to escape |
| | Slushy Ice - unsafe |
| | Strong Currents - unsafe |

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Workshop participants described these ideal and poor sea ice conditions related to polar bear hunting as follows:

[Ideal ice] If it is good to walk on, it is good to get them and haul them back to the land. That is best part. If you are walking on thin and slushy ice that is bad part. We will have a hard time getting polar bear back to main, safe ice... We have strong currents. It looks like river flows and if there is slush on edge and young ice the hunter would be worried about that back side opening up and him drifting away. We try to get where it is safer. We watch that polar bear for a while, and wait till it comes where it is safe to get it, and then we get it. We do not want to get it where it makes it hard for us to get it. (SRB&A Point Hope Workshop, January 2018)

Thickness of ice and the distance of water the open lead is from the land. Condition of ice. If it is piled up making lots of mountains, when they do make

mountains, a lot of these big hills reach the ground too so they are anchored. Especially in our area, it is a real shallow ocean till about 10 miles out. We have a pretty shallow shelf in our ocean. I am looking at ice thickness and pressure ridges. I am also looking for the lead. That all gives me an idea of how safe the ice would be. A lot of pressure ridges create an anchor on the ground, and the ice will not move on me when I am out there on the ice. A lot of these pressure ridges, the polar bears go on top and look around. Run into polar bear. At least 10 inches of ice [is ideal], I have traveled on two to three inches of ice that has a wave in front of you and you can see the wave under the ice as you travel, and it is so dangerous I do not think it will every do that again. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *Flat, multi-year ice. If you get them in the rubble and you shoot them, you have to work hard to bring them out from the rubbled ice. The rubble ice [is poor for hunting].*

Participant 2: *Two years ago I helped my dad shoot a polar bear in rubble ice. He shot, and I shot, and we killed it on the spot so it would not get wounded and walk to jumbled ice. Best is flat and open. If rubble ice you shoot them dead on the spot.*

Participant 3: *Cracked leads and cracked up ice. Lots of lead systems [are poor for hunting]. (SRB&A Utqiaġvik Workshop, January 2018)*

3.2.2 Timing

Across the communities, participants discussed that polar bear harvest are commonly taken during the late fall, winter, and early spring seasons primarily between October and May with Point Hope also reporting September harvests (Table 5). Winter harvests are typical of the past and represent current patterns today. However, Wainwright participants did observe that harvests are becoming more frequent in the summer time than they use to be, although these bears are generally viewed as nuisance or dangerous bears. As one of the individuals explained,

Some of those taken in summer are for safety reasons and not typically polar bear hunters (SRB&A Wainwright Workshop, January 2018).

3.2.3 Purposeful versus Opportunistic Harvests

Except for Point Lay, where most polar bear harvests were characterized as opportunistic harvests that occurred when a polar bear strayed too close to town, the other three communities described instances of both purposeful (or targeted) hunts and opportunistic harvests of polar bear in their community. As mentioned earlier, purposeful hunts are embarked on when someone has a craving for polar bear meat or has a specific request from an elder. One Point Hope individual described their hunts for the elder saying,

I just go and get them when the elders tell me to get them. When I see the polar bear, and elders did not tell me to get it, then I will just let it go by (SRB&A Point Hope Workshop, January 2018).

Whether opportunistic or purposeful, participants agreed that it is very rare for a polar bear to be wounded and then not recovered.

Opportunistic harvests were categorized into two primary types: harvest while engaged in other subsistence activities or nuisance harvests. In the first instance, polar bears may be taken more opportunistically when engaged in other subsistence activities; Utqiagvik participants told stories of going on other hunts for resources such as caribou or ringed seal and coming across polar bears that are then harvested if they are healthy and in harvestable condition (e.g., fat). Polar bear harvests also may occur during spring whaling activities. In the second instance, polar bears are taken when they pose a threat to the community and deterrence measures and attempts to scare the bears out of the community are unsuccessful. Point Hope was the only community reporting that nuisance bears were rarely if ever harvested, and that the community's deterrence practices in addition to food storage (ice cellars) locations were factors in the lack of nuisance bear harvests (see discussion below in Section 3.2.3.1).

It should be noted that the distinction between an opportunistically harvested bear and a nuisance harvest is not always clear. Point Hope for example discussed that if a bear wanders in to town and someone wants to harvest it for the food then it will be taken, which would be an opportunistic harvest. To the study team a nuisance harvest occurred when no one in the community wanted to harvest one for food, deterrence methods were unsuccessful, and the bear must be harvested to protect the safety of the community or whalers. In some instances, the harvested nuisance bear's meat will be used, but if it appears sick or otherwise unhealthy, only the fur, skull, and claws will be taken. Further exploring the distinction between these two types of harvests and individual community methods should be a topic that is explored in future study iterations beyond this pilot study.

3.2.3.1 Nuisance Bears

Workshops participants discussed situations in which nuisance bears are encountered by the community, steps the community takes to reduce unplanned harvests, and what situations ultimately require the community to harvest a nuisance bear. Encounters with nuisance bears fall into three general categories: encounters during spring whaling, encounters along the shore with washed up carcasses, and encounters in or near the community.

All depends on season. If whaling was close and carcasses are close and then polar bear are close and that increases the encounters of polar bears. If they get curious we have to take them to keep them away from Wainwright. It is the unhealthy ones who show up in town and try to take a dog. Other polar bears are bullying them. Something is wrong with the bear. Otherwise they do not come in to town on purpose. (SRB&A Wainwright Workshop, January 2018)

When a polar bear is really hungry it does not matter how big or small it is. When there is that factor the bear will not stop. There is that source of seal skins, rendered oil or food in the community. It has been like that for many, many generations that he has seen and these communities know that when an animal is starving when he smell something, he will not stop at a gun or person or dog. He will be determined to get that source of food. (SRB&A Wainwright Workshop, January 2018)

Participant 1: *I think mostly for safety. They are not the ideal bear to harvest for food. The nuisance bears are skinny bears.*

Participant 2: *When they go near the houses. Barrow is so big there are thousands of kids, and they like to play out. (SRB&A Utqiaġvik Workshop, January 2018)*

All communities reported that they have individuals who successfully participate in the NSB's Polar Bear Patrol Program in efforts to deter bears from the community and reduced unplanned harvests. Local residents are hired to patrol the community for polar bears coming in and to use non-lethal techniques for deterring polar bears. Three primary techniques used by the polar bear patrols are as follows:

- Shooting live rounds or cracker shells near polar bear to scare it.
- Shooting polar bear with bean bags.
- Chasing the polar bear with snowmachines and four-wheelers out of town.

When these three actions are used together, residents indicated that it can be effective, with several indicating chasing as the most effective of the three techniques. In general, all communities thought highly of the success and effectiveness of the NSB's patrol program. Several individuals who have participated in the patrol program discussed the process:

Participant 1: *You have to scare them so they will not come back; not just shoo them away. You scare them. Gun shots and shoot near them on the ice if not going to take them. It reduces them coming back.*

Participant 2: *Chase them out with snowmachine. I think we need to chase them farther rather than just a little bit out of town so they will not come back.*

Participant 3: *When they first come around, you shoo them away, but they go out and you think they not going to come back. When they do come back, the bear hunter will chase the bear out until it knows [Name] that it is not welcome in the town. Chase him really hard. Chase him until the point they are tired, and that will reduce that bears chance of coming back. It knows it will get tired. That has been taught to whalers and community members. That sort of action. It is in our bear patrol. We try to teach the same kind of tactics that were used through generations. We put that part in our bear deterrent program.*

Participant 1: *Cracker shells and bean bags.*

Participant 3: *Hard chasing been around a long, long time. (SRB&A Wainwright Workshop, January 2018)*

In general, workshop participants expressed a willingness to try other alternative measures for deterrence. Ideas that were raised as possible avenues of alternative deterrence included use of drones and additional education of public and tourists to raise awareness.

Lastly, when deterrence measures are unsuccessful, the communities will harvest the nuisance polar bears as a last resort. As one individual explained,

Yes. Every time we have a nuisance bear, the first one or two times they come to town and start bothering property, we chase them away, but when they keep coming back, we do harvest them. Usually they are brown bears, but if polar bears come back we do harvest them... We give them chances, but if they keep coming back we harvest them. Maybe every two to three years a [nuisance] bear comes in to town. (SRB&A Point Lay Workshop, January 2018)

Participants identified two primary types of nuisance bears that are more frequently harvested: (1) those that are skinny or in poor health, or (2) the younger bears who have just been forced away from their mother and are less wary and more curious. Both types of nuisance bears can lead to potentially dangerous encounters with local residents. Utqiaġvik participants described these two types of bears and noted that often the skinny or poor health nuisance bears are in that condition due to old age as evidenced by the condition of teeth and jaw:

One inside our tent had rotten tooth. Now question would be with bears like these would wildlife show with old teeth, and they become aggressive, they are dying off by old age and come to town for easy picking. Those are dangerous and those kicked off by mom. Those are dumb and stupid. (SRB&A Utqiaġvik Workshop, January 2018)

One Wainwright participant indicated that the presence of more skinny or hungry bears may indicate a higher population of polar bears because more polar bears are competing over the same food resources. He said,

When populations are high they do not get enough food, and they come in to town (SRB&A Wainwright Workshop, January 2018).

Utqiagvik participants also echoed this sentiment that the reason there are more nuisance bears is because there is a higher population of bears overall.

In some instances, such as a dangerous mother with young cubs, it is the TEK and values of the Iñupiat to take both the mother and cubs to not only save the cubs from starvation and further suffering but to also protect the community from scared and unpredictable cubs who have just lost their mother:

Participant 1: *If a very dangerous mother with a cub went into the middle of town and was a threat to community, he was asking if they could put it down. We know the answer is yes depending on the immediate danger. Each community has steps to remove that bear putting it down. You do everything you can to get it out first. [Elder Name] knows that when you deter a bear, the hungry bear will always come back.*

Participant 2: *They are encouraged to take them both, the mother and the cub. If mother is down, you have to take cub down and rather have it die here then send to zoo for next 30 years...*

Participant 3: *That is part of our TK and hunting values. It is important to put in there [report] that it is part of our TK because it might be understood and other people might not think that would be the right thing to do.*

Participant 2: *It will not survive without the mother, so we take it.*

Participant 1: *So, lots of us know when you shoot a mother and put down the mother and the cubs that can go away really fast. And you cannot handle them, and they run away and they die from elements. They do not know how to hunt yet. They are still nursing from the mother, but they are big enough to run away from you fast. They are a lot more dangerous when small than you think. They go a long ways. It is embedded in us that we would rather kill the cubs right now before they suffer for a long period of time. Usually they come back to site where mother was killed. (SRB&A Wainwright Workshop, January 2018)*

Throughout the course of the workshops, the study team learned that the location of food storage can play an important role in the number of nuisance bears that a community harvests. This was most apparent in the example between Wainwright and Point Hope. Wainwright reported higher incidences of having to harvest nuisance bears because community members store their food near their homes (including in ice cellars near homes) and this will draw in a hungry polar bear and create a dangerous situation that can lead to the harvest of the hungry bear. Wainwright indicated that approximately half of their harvests are nuisance harvests, and the other half are for polar bear diet. Conversely, Point Hope, which has ice cellars near the old village outside of the current community location, has fewer encounters with hungry polar bears that are drawn more to the old village site than the current community. One Point Hope individual could not recall having to harvest a nuisance bear since his time in Point Hope (approximately 20 years) and discussed the difference between the communities as follows:

Participant 1: *Wainwright and every community is different.*

Participant 2: *Ice cellars are in their community [Wainwright]. Ours [Point Hope] are way out there. Ours are way out of town by old village. (SRB&A Point Hope Workshop, January 2018)*

Discussing specific instances of nuisance or aggressive bears in 2017, only Wainwright and Utqiagvik identified having any such encounters; Point Hope and Point Lay reported no nuisance or aggressive bears in 2017. Wainwright reported seven nuisance bears, and Utqiagvik reported one. Additional details regarding harvested bears and their conditions are provided in the following section.

3.3 USE AREA MAPPING AND MOST RECENT HARVEST YEAR

This section of the workshop asked workshop participants questions regarding their last 10 year polar bear subsistence use areas and observations regarding their most recent harvest year in terms of ice conditions, effort/success, and condition of harvested of polar bears. More than any other portion of the workshop, the information collected in this part of the workshop focused primarily on the harvesting characteristics of the individual participants and should not be taken to represent their respective community’s harvest patterns as whole. Rather this information serves to provide examples of the type of information that can be collected and its utility in informing sustainable harvest levels, harvest risk assessments, and other management decisions. Table 7 provides a summary of the harvester overview for the last 10 years and most recent harvest year.

Table 7: Summary of Most Recent Harvest Year Characteristics for Participants

| Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|---|------------|-----------|------------|-----------|
| Number/percent of harvesters trying to harvest polar bears in last 10 years | 1 (50%) | 0 (0%) | 2 (66%) | 4 (100%) |
| Most recent hunting year | 2015 | - | 2017 | 2016/2017 |
| Sea ice hunting conditions in most recent year ¹ | Good | - | Poor/Worse | Good |
| Average days attempting to harvest polar bears in most recent year | 2 | - | 7 | 5.6 |
| Average number of successful days | 2 | - | 2 | 1 |
| Average number harvested (including nuisance) | 2 | - | 5 | 1 |
| Typical harvest or not? | Typical | - | Typical | Typical |

Notes: Point Hope n=2; Point Lay n=1; Wainwright n=3; Utqiagvik n=4

¹See Table 6 for description of good and poor ice hunting conditions

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Each participant identified the areas in which they have hunted for polar bears in the last 10 years. In general, these areas are confined to locations three to five miles offshore along the ice leads and areas with barrier islands (Figure 5, Figure 6). The majority of these areas are accessed by snowmachine with only one area also accessed by ATV. Wainwright also identified the general extent of their overall community hunting areas and indicated that the usual area for polar bear harvesting is one to five miles offshore in front of the community with a larger inland location of less common or unusual polar bear harvesting. The Point Lay participant also identified areas where other community members have reported hunting. Additional mapping studies would be needed with individual community harvesters to identify the full extent and intensity of polar bear use areas. Mapping of habitat and movement patterns could also be added to future workshops but was not a focus of this pilot study.

Regarding the most recent harvest year, workshop participants described the individual characteristics of the harvested polar bears including harvest type (e.g., target/purposeful, opportunistic, or nuisance), month of harvest, approximate age, sex, size, weight, and other health observations (Table 8) (see Appendix A for size and weight scale ratings).

Table 8: Characteristics of Most Recent Polar Bear Harvests

| Community | Year | Harvest Type | Month | ~ Age | Sex | Size Rating (1-5) | Weight Rating (1-5) | Other Health Obs. |
|------------|------|---------------|----------|-------|-----|-------------------|---------------------|---|
| Point Hope | 2015 | Target | Apr | 9 | M | 4 | 4 | 10ft |
| Point Hope | 2015 | Target | Mar | 7 | M | 3 | 4 | |
| Wainwright | 2017 | Target | Oct | 5-6 | M | 3 | 3 | 6.5ft |
| Wainwright | 2017 | Target | Oct | 5-6 | M | 3 | 3 | 6.5ft |
| Wainwright | 2017 | Opportunistic | Apr | 10-12 | M | 4 | 3 | Teeth worn out; near whaling |
| Wainwright | 2017 | Nuisance | Aug, Sep | 4 | M | 3 | 2 | No fat. Just take skin. |
| Wainwright | 2017 | Target | May, Jun | 3-4 | M | 3 | 4 | |
| Wainwright | 2017 | Opportunistic | Oct | 10-12 | M | 5 | 5 | 9ft |
| Wainwright | 2017 | Opportunistic | Nov | 10-12 | M | 5 | 5 | 9ft |
| Utqiagvik | 2017 | Target | Feb | 5 | M | 2 | 4 | Good |
| Utqiagvik | 2016 | Target | Jan | 7-8 | M | 3 | 3 | 8ft |
| Utqiagvik | 2017 | Opportunistic | Apr | 5-6 | M | 4 | 5 | 8ft, older with scars on the nose. Some teeth worn out. |

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Overall, for the 12 reported harvests, all were male polar bears with an average estimated age of 7 years (ranging from 3 to 12 years), an average size rating of 3.5 (range from 2-5), and average weight rating of 3.75 (range 2-5). Figure 4 provides a scatter plot of the reported weight and size ratings for the harvested polar bears; the thinnest polar bear with a size rating of 3 and weight of 2 was identified as a nuisance bear. All other bears purposefully or opportunistically harvested for the meat had a weight rating of three or higher.

Approximately 58% of harvests were targeted/purposeful hunts, 33% opportunistic, and 8% nuisance. All harvests occurred between October and June except for the one nuisance harvest, which occurred during the summer sometime in August or September. Again, these numbers do not reflect overall community harvests for the most recent year, just the harvests reported by the workshop participants. Additional interviews within the community with active harvesters would be needed to fully ascertain the nature of polar bear harvest patterns within each of the communities.

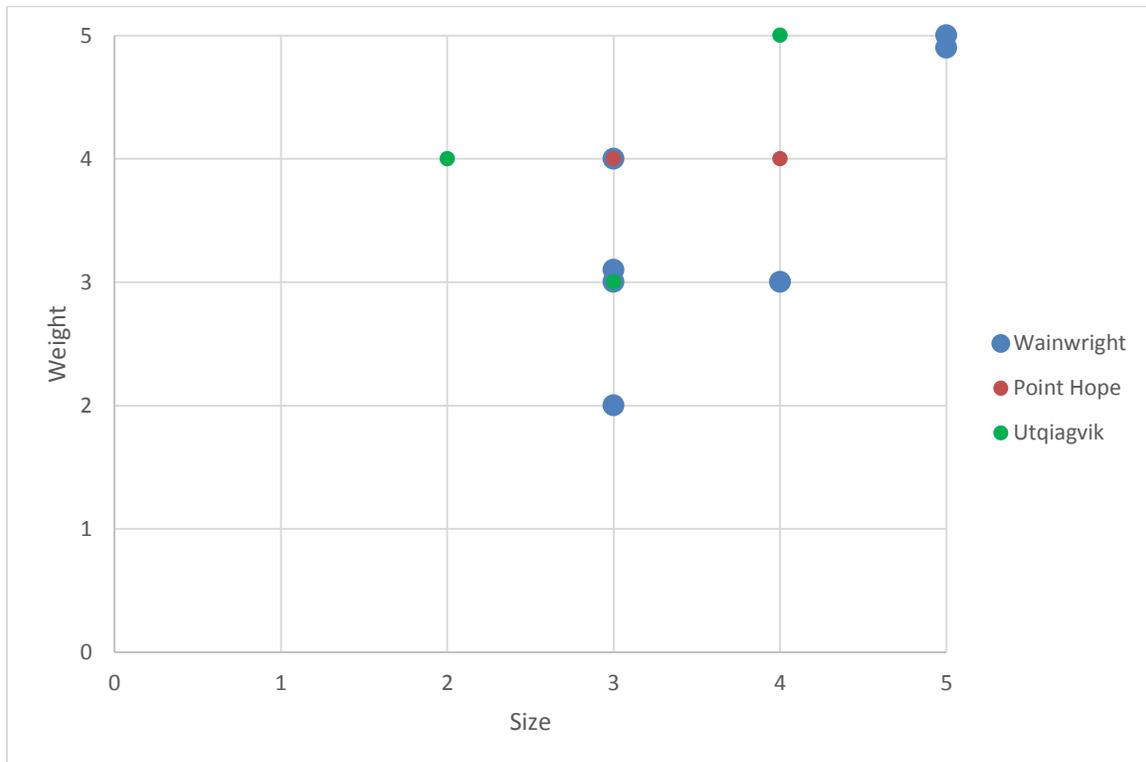


Figure 4: Size and Weight Ratings of Harvested Polar Bears

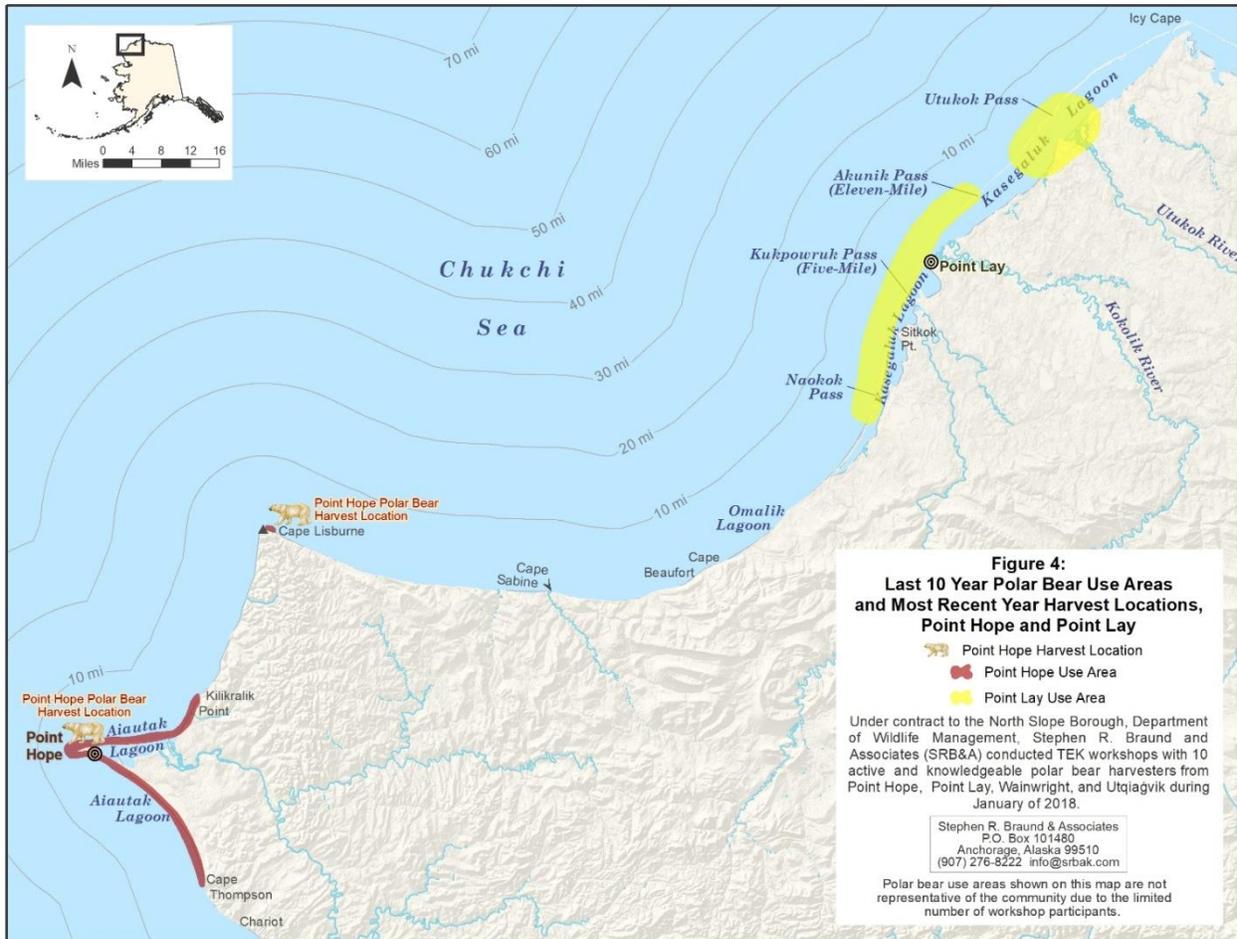


Figure 5: Last 10 Year Polar Bear Use Areas and Most Recent Year Harvest Locations, Point Hope and Point Lay

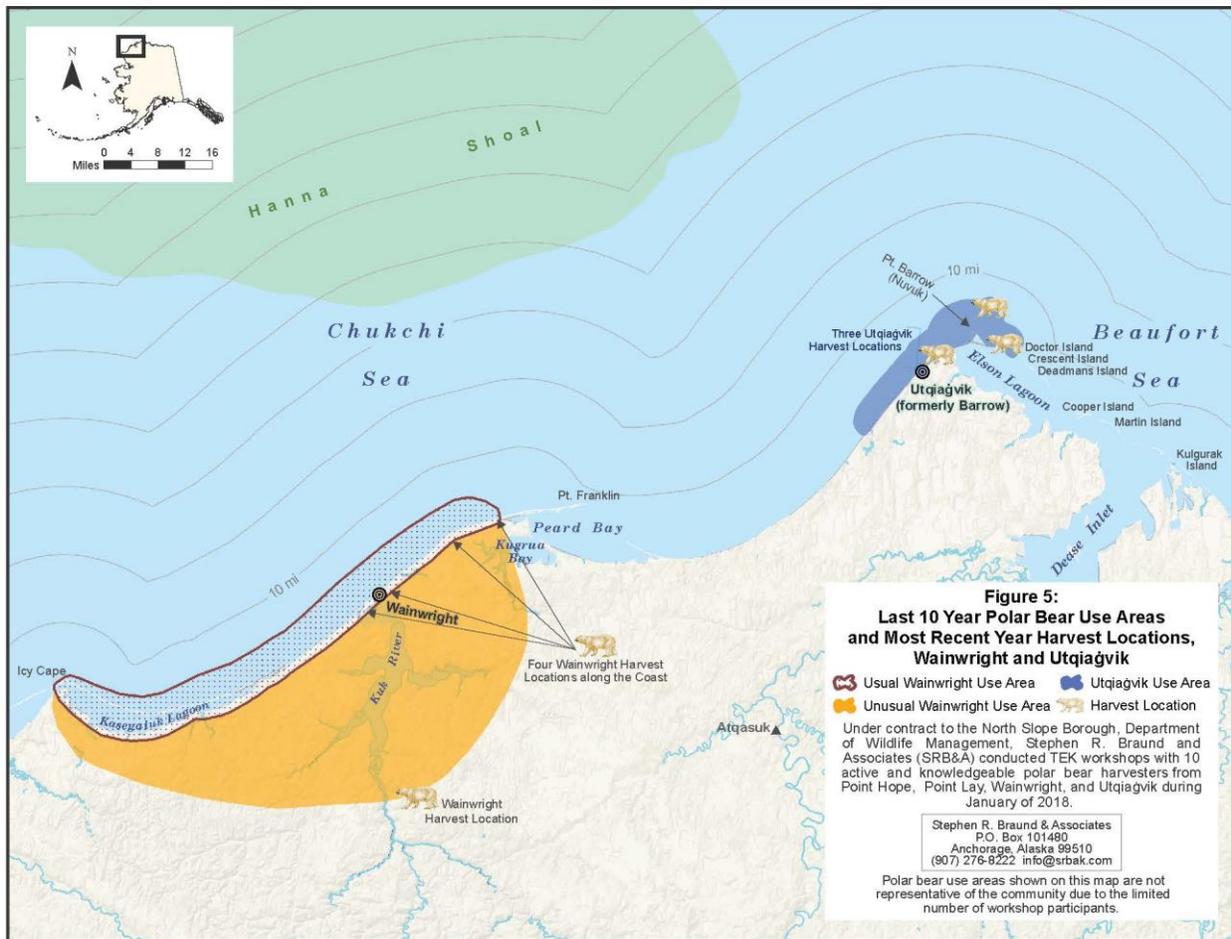


Figure 6: Last 10 Year Polar Bear Use Areas and Most Recent Year Harvest Locations, Wainwright and Utqiagvik

HABITAT, ABUNDANCE, DISTRIBUTION, AND HEALTH

This section of the workshop focused on the habitat and distribution of polar bears with an additional section on abundance and health. Follow-up questions in this section focused on changes from the past and variations from year to year.

3.3.1 Habitat

Table 9 provides a summary of the answers provided to the primary habitat questions asked during this portion of the workshop. The clear response among workshop participants regarding polar bear movement and habitat was that the patterns of movement are tied to their ice habitat. There was a general consensus that during the winter the females will den and have their cubs and emerge in March while the males will generally stay out on the ice throughout the winter and continuously hunt. Dens are usually found onshore, including barrier islands, and Utqiagvik participants reported that when conditions are just right the females can also den on the ice when it is grounded and secure. One Utqiagvik individual went on to state that there is increased denning on land:

Now we see they use the islands and banks a lot more now. Even when ice floes are big enough to use, it is the time of the year when there is a lot of snow during November, December, and that is when we see a lot of snow come around. Even if the snow is not dropping, it is drifting. That snow is drifting into areas where they have to put a den. You could see hardly any snow in one area when you go outside, but snow has accumulated enough for use. We see a lot of that happening now. By March they know where to go when they come out of their dens. (SRB&A Utqiagvik Workshop, January 2018)

Inland bluff locations are also possible areas of denning. As one elder noted through a translator,

He indicates there are more bears starting to den using the land. Some bears are denning in low, flat areas where snow can build over time in that area. They are starting to look for other places to den other than mostly the ice. (SRB&A Wainwright Workshop, January 2018)

Specific locations of denning habitat that were mentioned included Cape Sabine, Teshekpuk Lake area, and a number of barrier islands. When asked to describe sea ice conditions in 2017 related to polar bear habitat using a scale of good, average, or poor, eight of the workshop participants described it as good; one as average, and one elder did not provide an answer because of his lack of observations in 2017.

Table 9: Summary of Polar Bear Habitat Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|----------------------------------|---|--|---|
| V.3 | What sea ice conditions are ideal for polar bear habitat? | Thick ice and pressure ridges | Seals, lots of leads, and pressure ridges | Seals and pressure ridges | Seals and leads |
| V.3 | What sea ice conditions are poor for polar bear habitat? | Thin or slush ice | Thin ice or no ice | Thin or slush ice | Thin or slush ice |
| V.4 | What types of prey abundance make for good polar bear habitat? | Seals - ringed, spotted, bearded | Seals | Seals - ringed and bearded; walrus; and beluga | Seals - ringed, spotted, and bearded; walrus; beluga; and dead whales |
| V.5 | What trends in sea ice and sea ice timing have you observed? When did you first notice this? | Varies but no trend | Later ice formation and less thick ice | Later ice formation; less thick; and earlier break up. 1990s | Later ice formation and less thick ice. 1990s |
| V | Condition of sea ice for polar bear habitat in 2017? | Good | Average | Good | Good |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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3.3.1.1 Ideal and Poor Sea Ice Habitat Conditions

Workshop participants identified three primary conditions that provide ideal sea ice habitat for polar bears (Table 9). Specific to the ice, polar bears need (1) thick ice with pressure ridges and (2) ice that has open leads. Thick ice with pressure ridges not only provide cover for polar bears that are sneaking up on their prey, but also draw in seals for their own denning purposes. Seals also feed near open leads, and, in general, resources are more abundant at these locations and thus is a contributing factor to ideal polar bear habitat. The third condition relates, not directly to ice, but to the presence of seals. The ice habitat must have an abundance of seals or the polar bears will not be there. As one individual explained,

Polar bears have a wide range. They should not be Chukchi or Beaufort [subpopulations]. They travel all over. Their territory is where the seals are (SRB&A Utqiaġvik Workshop, January 2018).

These conditions were described in more detail during the workshops as follows:

Participant 1: *Ice conditions are where the abundance of seals are. Known seal haul outs. Food sources that are nearby.*

Participant 2: *If sea ice is deep enough for seals to have their lairs out there. Polar bears just off beach jumping and getting into the seal lairs and eating them. If ice conditions are right and pups do their pupping. Does not have to be an open lead.*

Participant 1: *Known seal haul outs and data show that then that is where the polar bears will be. They will be there feeding. Hannah Shoal. Food resources they eat. Ideal ice conditions. Majority of predators will be higher in that area. (SRB&A Wainwright Workshop, January 2018)*

I am thinking not too thick, not too thin, with a lot of water [leads]. Yeah lots of leads. Kind of broken ice where the polar bears are more likely to catch seals if they have a place to hide and sneak up on them... Pressure ridges or sneak up to them swimming. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *Places where seals make lairs.*

Participant 2: *They need snow to make lairs. Maybe three to four feet.*

Participant 1: *Maybe two feet. They [polar bears] like to move between shore fast ice and pack ice and that sheer zone they like to travel on and hunt in that area. We [see] lots of bear tracks accumulated in those areas.*

Participant 2: *It is like their highway between land and open lead.*

Participant 1: *They follow the food. They have access to water where there are seals right near the edge. (SRB&A Utqiaġvik Workshop, January 2018)*

One elder [speaking through a translator] encapsulated the types of ice that are best for polar bears based on his lifetime of observation saying,

When the young ice that we call siguliaq is older, young ice that has gotten thick over time, and it starts to ridge and it gets long and go for quite a ways. A lot of ringed and bearded seals look for that kind of condition so they can live in there year round. There is enough snow for a lair, so they do not have to move away so much. The bears are looking for that type of ice to hunt in. The puktaagraaq are large multi-year or large chunks of ridged up ice. Icebergs. Puktaaq. Single large piece of heavy ice. Bears like that area too. They like to be on the thin stuff too. Siguliaq [thin ice]. (SRB&A Wainwright Workshop, January 2018)

Conversely, participants described poor ice conditions for polar bear habitat as those in which the ice is too thin or slushy, or where there is no ice at all (Table 9). One person reported that polar bears need at least two inches of ice so that they can move about freely.

Siguliaq [thin ice] and muġaliq [brash mushy jagged ice] they cannot find seals in that stuff. (SRB&A Wainwright Workshop, January 2018)

No ice [is poor for polar bears]. We have had that for last few years. Real poor. We almost could not find a good spot to pull up a whale for whaling. Thin ice conditions. That is how it has been till middle of winter till our ice finally good enough to travel on. Or no ice [is poor conditions for polar bears]. (SRB&A Point Lay Workshop, January 2018)

Slush ice. Really thin. Mostly slush ice and thin ice. Lot of them avoid areas, and when they go into slush ice it is hard to get out of. They can go on two inches of ice. They spread all four of their legs without breaking the ice. (SRB&A Utqiaġvik Workshop, January 2018)

While seals were clearly the primary reference in terms of prey abundance that makes for ideal polar bear habitat, participants also identified walrus, beluga, and whale carcasses as important prey species for the polar bear and its habitat (Table 9). Of the various types of seals, ringed seals were mentioned most frequently followed by bearded and spotted seals.

3.3.1.2 Trends in Sea Ice

Except in Point Hope, workshop participants described trends in sea ice characterized by later ice formation in the winter, thinner ice throughout the winter, and earlier breakup in the spring (Table 9). These changes began occurring in the 1990s and have continued to this day. Those in Point Hope identified that in some years these types of changes are occurring in their community but in other years the ice may come early, may be thicker, or may stay later. To these individuals it was a variation from year to year but not signal of a larger identifiable trend. Participants indicated that the location of Point Hope so close to a primary ocean current and on a pinnacle of land may not experience the changes that other communities are experiencing because the currents are quick to bring in ice to the community. In addition to general questions on abundance, health and distribution, workshop participants were asked if any of these trends or changes in sea ice affected the polar bears abundance, cub production/survival, health, or distribution (see discussion below).

3.3.2 Abundance

3.3.2.1 Overall Abundance

Regarding abundance, participants in all communities replied that the polar bear population today is either stable or increasing (Table 10). Both Wainwright and

Utqiagvik noted the polar bear population really began to increase following the cessation of polar bear sport hunting by non-Natives and the protections afforded under the Marine Mammal Protection Act (MMPA) of 1972. When asked about specific polar bear abundance in 2017 on a scale of poor, average, or good, five of the workshops participants described it as good, four as average, and one elder did not provide an answer because of his lack of observations in 2017.

Table 10: Summary of Polar Bear Abundance Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|---|-------------------------|-----------------------------------|---|----------------------------|
| V.11 | Abundance of polar bears? | Stable Not declining | Stable, just distribution changes | Increasing since 1972 MMPA. Stable today | Increasing since 1972 MMPA |
| V.13 | Are you observing an increase or decrease in the number of older polar bears you encounter? | Stable | Stable | Increase | Increase |
| V.14 | Are you observing an increase or decrease in the number of cubs? | Stable | Do not Know. Have not Observed | Stable | Increase |
| V | Polar bear abundance in 2017? | Good/Average | Average | Average | Good |
| V | Prey abundance in 2017 | Good | Good | Good | Good |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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All participants acknowledged the difficulty in characterizing overall abundance versus possible changes in local distribution. However, several individuals provided their rationale for why the overall polar bear population is either stable or increasing. These reasons included the abundance of other prey species, the observed adaptability of polar bears, wider distribution, and the overall healthy condition of polar bears:

Healthy [abundance] of their prey [lead to more abundance in polar bears]. We see more bowhead whales. Walrus now they haul out on the beach and that is a food source. They are able to recognize what they need to hunt during summer too. Walrus are there and more carcasses on beaches. Sustains them through lack of ice. Also hunting fresh walrus and [Name] would tell you really good story about polar bears where there are ringed seals in this area of land where he camps [Smith Bay] and polar bears were [there] for seals to come near him, and they thought it was ice and when close it grabbed seals. String of polar bears out there waiting in that fashion. (SRB&A Utqiaġvik Workshop, January 2018)

So, I ask him [an elder] after 1972 when the sport hunting stopped hunting if population grew or not. He said a lot more bears on ground, on land, staying on land and moving inland, so possibly more. Because if more bears now and less ice that bears are traveling more on land too. He thinks the population is a lot more than what it used to be after the guided hunts stopped. (SRB&A Wainwright Workshop, January 2018)

Participant 1: *Their numbers are up, they are not receding. Females and cubs are nice and fat. Once in a while you will run into a skinny one but not very often.*

Participant 2: *A lot of that [skinny condition is due to the bear's] poor hunting skills. I do not think it has to do with the climate.*

Participant 3: *We have not seen a decline in numbers of bears. The health of them we look at them in that perspective. Every now and then there is a bear that has gotten sick. Like humans they get sick too. (SRB&A Utqiaġvik Workshop, January 2018)*

Speaking on whether sea ice changes had affected polar bear abundance, participants gave similar answers as above. They stated the changes had either not affected the bears abundance or did not know the answer. Several participants spoke to the adaptability of polar bears with some already asserting that the polar bear have adapted to recent changes. Others pointed towards uncertainty indicating that there may be unseen benefits to the warming trend or that it could eventually negatively affect the bear's population:

With warming there is good for some animals, like whales there is a lot more bowhead whales, and they are everywhere now. It could mean it is also good for polar bears and other animals. The negative side is when polar bears are seen

dead on beach. We have seen some of those. The timing of the ice forming again. Like right now it is starting to form, and they use that ice that young ice and they are able to travel long distance and look for food sources. Timing of use of ice is very important. (SRB&A Wainwright Workshop, January 2018)

Participant 1: Maybe they all start declining if global warming is a high rate of speed. Maybe cubs will no longer be able to swim ashore. Or find any food out on the ice pack.

Participant 2: Not trying to give an answer, it could be looked at both ways. A little warmer, and it is possible polar bears have more time to interact. Polar bears being born and food sources are easier to catch. The animals will react to abundance of food and plan birthing or around the abundance of resources. Food will be caught. At the same time, it could be looked at the lack of ice is more stress on bears and higher mortality, and more stress and possibly a decrease in the long term. But during slow change, there may be an increase, the warmer weather making it easier catching of food at that time. I do not know I cannot say which way. (SRB&A Wainwright Workshop, January 2018)

Later in another portion of the workshop, the Point Lay participant stated that a complete lack of ice could affect the polar bears and their ability to successfully harvest seals. He said,

No, all I have really seen is the ice conditions changes. A polar bear could almost never catch a seal in the water. It just will not get it. They are not fast enough. Not agile enough. It is a lot harder for them to catch a seal in the water than on the ice. (SRB&A Point Lay Workshop, January 2018)

Other questions that the study team asked of respondents as proxy indicators of possible change in polar bear abundance included whether residents were observing an increase or decrease in the number of older bears (more older bears possibly indicating good habitat and health), increase or decrease in the number of cubs (more cubs indicates growing population), and changes to other species in terms of abundance (fewer prey resources could strain polar bear population) (Table 10).

3.3.2.2 Abundance of Older Bears

Older bears were noted as increasing in number by Wainwright and Utqiaġvik and stable by the other two communities. Wainwright reported they were seeing larger bears in the last 10 years, which indicated an older population to them. No reasons were given for the increase in older bears. Two individuals discussed the increased presence of older polar bears saying,

Participant 1: Yes, we got one trying to go inside the tent it had crumpled up teeth. More [older bears].

Participant 2: Yeah, I think we see quite a few more older bears. About to die. Elders say they come to Barrow for a reason to be killed.

Participant 1: Just more, surviving more. (SRB&A Utqiaġvik Workshop, January 2018)

3.3.2.3 Abundance of Cubs

Similar to older bears, participants reported the number of cubs seen each year is stable or increasing. In Wainwright it was typical to see one cub with the mother, whereas in Point Hope and Utqiaġvik, two cubs are the typical number seen with the mother. Point Lay had only limited observations of mothers with cubs, so they did not want to comment on an overall trend or pattern. Most communities also did not know the age of mothers with cubs indicating that this was not an observation of which they took special notice. However, in Utqiaġvik the discussion among the participants was that younger polar bears are having cubs, and this was a sign of a growing population. They also added that ice conditions may be leading them to see more cubs on land, but that this has not affected their survival rates:

Participant 1: I think ice conditions are allowing polar bears to congregate more on land [and hence we are seeing more cubs]. Within the spring time in moving ice where crashing and breaking up a lot more, they tend to be more on shore ice, and we see them more. They feed on whale meat, and when it is real flimsy out there and when cracking up, more unforgiving. We know the polar bear can go through thin ice, but if it is all over the place they can go to one floe that is stable.

Participant 2: *In past five years, it seems like we see cubs that are surviving in the summer. We see them in different ages. First year cubs and second year cubs, and they look healthy and every now and then you might see a young mother that might have a young cub with her.*

Participant 1: *I am glad you said that. I see a lot of young polar bears with cubs. Almost like teenage pregnancy. I hate to see it but when I see smaller polar bears with cubs it use to be the big ones but now you see smaller ones.*

Participant 3: *[Because] bigger population of bears.*

Participant 1: *Warmer climate. Seals come up where less ice.*

Participant 2: *Could mean more prey abundance for them and when there is more we see lots of seal and we see maybe we make more babies [lots of seals]. It is the same way for humans like if you look way back when they were catching lots of whales there were more people. More babies being born when good abundance of food. (SRB&A Utqiaġvik Workshop, January 2018)*

3.3.2.4 Changes in Prey Species

Workshop participants in Wainwright, Point Hope, and Point Lay did not identify any changes in prey species that would affect polar bear health or abundance. Wainwright and Point Hope participants identified stable populations of prey species and believed there were no resulting effects to polar bears. Utqiaġvik participants identified that other prey species were increasing in number and this likely would mean an increase for other animals, such as polar bears.

One individual explained,

Just like bowhead whale count they are rebounded and producing 3-4%, and just this past aerial survey they did during fall time they say 800 calves. That stuff going on there will probably be increase in other animals (SRB&A Utqiaġvik Workshop, January 2018).

When asked about prey abundance in 2017 on a scale of poor, average, or good, all nine participants responded that prey abundance was good; one elder did not provide an answer because of his lack of observations in 2017.

3.3.3 Distribution

On the broadest level, polar bears arrive near the community in the late fall/early winter with the arrival of ice and leave the community in the spring with the retreat of the ice (Table 11). Individuals in Point Lay and Utqiaġvik identified that the largest bears will stay farther away from the community while it is the younger more curious bears that often wander into town and encounter humans. Point Lay, Wainwright, and Utqiaġvik noted that polar bears are sometimes stuck on land during the summer after the ice retreats.

Table 11: Summary of Polar Bear Distribution Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiaġvik |
|--------------------------------|--|-----------------------|--|-----------------------------|---|
| V.1 | What are the general seasonal movement patterns of polar bears in your area? | Tied to ice movements | North in fall; with ice in winter | Tied to ice movements | Tied to ice movements; more seen in summer. |
| V.1.d | Changes in sea ice and sea ice timing affected distribution of polar bears? | Varies but no trend | Yes, move to different areas, more on land in summer | Yes, more on land in summer | Yes, more on land in summer |
| V.8 | Have these changes in the sea ice and sea ice timing affected your harvests? | No | Yes, harvested one in summer for food | No | No |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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Workshop participants described these overall patterns of movement as follows:

They live on the ocean 365. They hunt seals whenever there is thick enough ice. I have not heard of them having any seasonal known migratory route, like, for example, geese. In my 42 years I have not come across anything about which way they come from. They come in with the ice and go back out on the ice. When they are stuck on land, they find a food source and try to make it through the summer and then go back out on the ice. (SRB&A Wainwright Workshop, January 2018)

They come in with ice mainly from the north In January-February. In October or November, they come from the west. Ocean in... Tied with ice. (SRB&A Point Hope Workshop, January 2018)

In fall time they are moving north. Almost every polar bear coming near Point Lay in the fall is moving north. That is the only time I notice polar bears and the movement of them. The one I encountered in the lagoon was traveling north. The one that caught a walrus was traveling north. In the fall time, I notice every polar bear I have seen is traveling north. [In February and March] yeah they are just going out to the ice and water. When I do encounter tracks, there is no trail, it is just back and forth with no specific direction. [In spring or summer] I never notice any migration pattern. Maybe I just have not seen enough or have not seen them. When I do notice they are traveling north in the fall. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *We see polar bears every summer now...*

Participant 2: *Generally, bears start coming from the east when the lagoons are freezing. In September and October they come from north with ice then they get on the ice with the beach. In the winter time, with the west wind, they come onto the shore fast ice. In the spring time, they know where to go; they know it is whaling season and know they will have food to eat. You see that pattern with almost all of the whaling villages; they know how to learn when it is time to go whaling and go to those places. The seals are moving too with the seasonal migration happening and belugas and walrus with the floating ice. The timing is important for animals migrating and with those migrations are going to be the predators (SRB&A Utqiagvik Workshop, January 2018)*

Participants from Point Lay, Wainwright, and Utqiagvik all had noted a trend toward decreasing sea ice (Table 9) and when asked what effect this trend is having on the distribution of polar bears, all three communities noted more bears were being seen on

land in the summer. Point Hope, which had only noticed variations in sea ice, indicated that the polar bear distribution varies as well according to the annual changes in sea ice. Speaking on the trend toward decreasing sea ice and resulting effects to polar bear distribution:

We see them in the summer time along coast and along the land. We did not see them in the summer time back 15 years ago... Yeah more in summer than we usually did back when I was growing up and learning to hunt... I think somewhere else. Our area of the ocean and our land how it is formed our ocean moves a lot and pushes ice in and moves so much with our prevailing east and west winds keep moving it. I think our area is rich in food; it is just the weather. We get storms that last a few days, and it is usually out of east. I am thinking there has to be bears out there, but with the ice conditions diminishing, they must be distributed differently than how they were when we had more ice. (SRB&A Point Lay Workshop, January 2018)

When you reach the ice, you reach the animals and polar bears out there but now that is no more. Now we see polar bears onshore in summer and hang around dead whales and beached walruses along the coast. We have no more real ice. (SRB&A Wainwright Workshop, January 2018)

Point Lay went on to explain that these changes in sea ice and resulting increase in bears on land in summer led the community to harvest a bear in the summer for food. This was an unusual circumstance and indicated to the Point Lay participant a potential shift in the community's hunting patterns given the changes in polar bear distribution:

Yes. That one we did harvest in summer. That regularly would not be harvested in the summer. That one was walking down the coast and walked right up into our camp site. We ate it but we usually would not catch in the summer... They cannot swim all life so they come to shore. That summer bear was a very healthy bear. It seemed like it was on land for a while because its white [fur] was kind of brownish. It was almost stained brown. It had been on land a while. Its fur was so brown like gravel. (SRB&A Point Lay Workshop, January 2018)

All other communities responded that the changes in sea ice and ice timing have not affected their polar bear harvesting patterns (Table 11).

3.3.4 Health

The consensus among all communities was that polar bears are healthy and there have been no changes to their overall health or body condition (Table 12). Words used to describe the health of polar bears included fat, round, and white. When asked to describe polar bear health in 2017 using a scale of good, average, or poor, seven of the workshops participants described it as good; two as average, and one elder did not provide an answer because of his lack of observations in 2017.

Table 12: Summary of Polar Bear Health Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|--|---------------------|--|---------------------|
| V.12 | Have you noticed changes in the health or body condition of the polar bear population? | No changes. Health is related to seals | No changes. Healthy | No changes. Health is related to seals | No changes. Healthy |
| V | Polar bear health in 2017 | Good/Average | Average | Good | Good |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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Individuals reported that they do see sickly or thin polar bears from time to time, but this has not changed noticeably from the past. Changes in sea ice (discussed above in Section 3.3.1.2) were also noted as not influencing the health of polar bears to date. Both Wainwright and Point Hope stressed that it was the health of the seals (as opposed to the state of sea ice) that in their minds was the best indicator of the future health of the polar bears:

Goes back to circumstances. When we see them, what time of year? How long onshore? What resources do they have? We come across nice ones, healthy ones, and average ones, and sometimes we take ones that are sick. They have been average lately. The ones that we caught all had fat and were not emaciated. Like [Name] said, the seals are really healthy this year, and the polar bears will directly benefit from that. (SRB&A Wainwright Workshop, January 2018)

Some villages think because of ice it is not. It is the seal... That food is the kitchen. They see so many polar bears there and in Kaktovik you see them. (SRB&A Point Hope Workshop, January 2018)

Two individuals added that just because you see an exhausted and tired bear that has just swam ashore, does not mean that they are in poor health. According to these participants, the bears need rest after which they will recover; this pattern has been observed for some time:

Participant 1: *Elders told us when they swim ashore you have to let them rest, and let them get their land legs back. People think they are injured, but really they have to rest and acclimate themselves to being on shore and rest a couple days and do their bear thing again.*

Participant 2: *That has been seen before by lots of elders too. They stay a day and a half on beach and rest. Once they get land legs, they are off. (SRB&A Utqiaġvik Workshop, January 2018)*

3.3.5 Effect of Overall Changes

The overall theme reflected by many of the workshop participants was that there are changes that are occurring to the environment, especially in terms of sea ice, and that these changes have the potential to effect polar bears. Several expressed that changes could bring negative or positive effects to polar bears, and that it was too early to tell what the ultimate effects would be. Many individuals highlighted two key characteristics of polar bears they believed would allow them to survive in spite of changing environmental conditions. These included the adaptability of polar bears and the fact that polar bears are regarded as highly intelligent animals:

Participant 1: *They are adapting; already we see that by the polar bear being here.*

Participant 2: *By the mid-1990s, we started to see that change when there were many, many bears that came to shore that one fall. It was a little shock for us and them to see a whole lot of them like that. They made their changes fairly quick.*

Participant 3: *They adapted real quick.*

Participant 2: *They are a lot smarter than we think. (SRB&A Utqiagvik Workshop, January 2018)*

I think they are really going through changes right now, and if they are not able to go through the changes right now, I think it will be hard for them to catch up and adapt to no ice. I think the polar bear will be able to adapt. When it comes down to survival it will be their instincts that will have them looking for an alternative source of food. With a lot of other animals that are smart in the hunt, I think they will adapt. (SRB&A Point Lay Workshop, January 2018)

Point Hope maintained a consistent message that the changing environment had no specific pattern or trend but varied from year to year and the polar bears were still thriving in this type of environment.

3.4 POLAR BEAR MANAGEMENT AND CO-MANGEMENT

This section of the workshop focused on polar bear management, including knowledge of existing management organizations and programs, views regarding Alaska Native input and representation into management decisions, views on the status of polar bears in the Chukchi Sea, and views on the necessity and efficacy of polar bear management. Table 13 provides a summary of the answers provided to the primary questions in this section.

Table 13: Summary of Polar Bear Management Characteristics

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|--|--|---|--|
| VI.4 | Do you believe scientific information is helpful in making polar bear management decisions? What types of information? | Yes, when accurate. Population counts, migration/distribution, health assessment. | Yes, when accurate. Diet samples, fat content, health assessments. | Yes. Health assessments, population counts, habitat studies. | Yes and no. Population counts, migration/distribution, health assessment. |
| VI.5 | Do you believe polar bear harvests need to be managed to ensure future harvests? | No. Communities can self-manage. | Yes. Not to control harvests, but to monitor populations for future. | Yes, but more information is needed to inform how they should be managed | Yes, with local input. |
| VI.6 | Do you believe that Alaska Native hunters have adequate representation and input into management decisions? | Yes, with NSB. No, with outside organizations. | No, but improving. | Do not know - need to be more informed. | No. |
| VI.7 | What are the most important things that Native and federal co-management partners can do to ensure that harvest management of the polar bear population is successful for both people and bears? | Incorporate traditional management practices; equal authority in management decisions. | Communication between local hunters and managers. | Update scientific information, incorporate traditional management practices | Local input, ecosystem management, local (rather than outside) enforcement |

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|--|-------------|-------------|---|
| VI.8 | In your view, is the current population of polar bears too high, about right, or too low? | About right | About right | About right | About right |
| VI.9 | In your view, is the population of polar bears in the Chukchi Sea changing? | No | No | No | Yes, increasing. No hunting from airplanes. |
| VI.10 | Do you believe that Alaska Native harvests are having or could have a negative impact on the polar bear population? | No | No | No | No |
| VI.11 | If management organizations believed it was necessary to protect harvests in the future, would you be willing to reduce your harvests in the short-term? | Yes, if supported by science and local TEK | Yes | Yes | Yes, if supported by local TK |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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3.4.1 Need for Polar Bear Management

In general, workshop participants indicated that they had little knowledge of past or existing agreements related to polar bear management (Table 14). While all communities were aware of the 1972 Marine Mammal Protection Act and its implications for Alaska Native marine mammal harvests, only one respondent, from Point Lay, reported having knowledge of the other three major agreements the International Polar Bear Agreement of 1973; the Inuvialuit-Inupiat Polar Bear Agreement of 1988; and the U.S.-Russia Bilateral Polar Bear Agreement of 2000. Utqiagvik participants said they were aware of the U.S.-Russia Bilateral agreement but only after it had been signed. In addition, while most individuals were aware of the Alaska Nanuq Commission (ANC), only one was aware of its successor organization, the Alaska Nanuut Co-Management Council (ANCC), of which this person is a member of the new council.

Table 14: Summary of Awareness Regarding Current Agreements

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|------------|-----------|--------------------|-----------------------------------|
| VI.1 | Marine Mammal Protection Act 1972? | Yes | Yes | Yes | Yes |
| VI.1 | International Polar Bear Agreement 1973? | No | Yes | No (not in detail) | No |
| VI.1 | Inuvialuit - Inupiat Polar Bear Management Agreement 1988? | No | Yes | No (not in detail) | No |
| VI.1 | U.S.-Russia Bilateral Polar Bear Agreement 2000? | No | Yes | No (not in detail) | Yes, but only after it was signed |
| VI.2 | VI.2. Were you aware of the Alaska Nanuq Commission (ANC) and its role in helping polar bear management? | Yes | Yes | Yes | Not Ascertained |
| VI.3 | Are you aware of the new ANC successor organization the Alaska Nanuut Co-Management Council (ANCC)? | No | Yes | No (not in detail) | No |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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All communities agreed that scientific information can be helpful in making polar bear management decisions—but with some caveats. All four study communities agreed that information related to resource health (e.g., fat content, diet samples, etc.) was valuable. Workshop participants from Point Hope, Wainwright, and Utqiaġvik also cited population counts as useful scientific information. However, several individuals also questioned the accuracy of past population counts and noted problems with current methodologies for estimating polar bear populations, such as avoiding communities where polar bear concentrations tend to be high.

Respondents from Point Lay and Utqiaġvik observed,

I think [scientific information] is helpful, but it can be hurtful without [considering] the people who live in the region... Science can be helpful and it can also hurt—not the polar bear, but the people that live around them or off of them. But I think science can help polar bear. It can help management. It does help management, although I do not agree with every population estimate that they give... I am not in agreement with the census and their count of them. It is hard to believe an average or estimate can account for population. You cannot take pictures like you can for caribou [and count a bunch]. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *Last year there were some aerial surveys with digital cameras and infrared cameras, and I think things can be made better if they are going to do scientific research. They covered a large area from Russia to here and [in the] Beaufort Sea... They avoided those areas where there are communities. They used a big scale like 30 miles away from town. The reason why those communities were made hundreds and thousands of years ago [was because of the abundance of resources]. That is where the polar bears go to hunt. I know that they missed a lot of bears [by avoiding the communities]. Sometimes the whaling captains and associations and the AEWG and other organizations, sometimes they need to allow that airplane to count near the communities if we are going to try to get an accurate count because airplanes fly in and out of Barrow every day whether we like it or not. That is almost like shooting ourselves in the foot if we want an accurate count. But the timing has to be right [to get an accurate count]. Sometimes we restrict oil companies, and if you want to do an accurate count, you allow them to count where there are a good number of bears in those areas—in Barrow, especially around the point, Kaktovik, Point Lay, Chukchi in Point Hope and Wainwright. There are a good number of bears near the communities. And you have to do it not just one time, if you want a good accurate count.*

Participant 2: *It takes a year [of counting] every day to get a good, decent count.*
(SRB&A Utqiaġvik Workshop, January 2018)

While respondents acknowledged the value of scientific research in informing management decisions, they also stressed that such research should either involve local residents, or be considered in combination with TEK when making polar bear management decisions:

I have to make a point that when the AEWK [Alaska Eskimo Whaling Commission] was first starting, a lot of scientific information was getting tossed around, and the [North Slope] Borough had [their] own [data] and the feds had their own and people had their own, and when they all started working together on the research and the money was made available from NOAA, the issue was more positive... When people are involved in the research and co-management of it and AEWK is managing their own hunting and people doing their own management and [discipline those that do not follow within], it works better.
(SRB&A Utqiaġvik Workshop, January 2018)

When asked whether polar bear harvests need to be managed to ensure future harvests, a common theme across the communities was that Alaska Natives have successfully managed wild resources for thousands of years, without the interference of outside entities. Not a single respondent from the four communities believed that Native harvesters are having a negative impact on polar bear numbers. Thus, responses related to the need for polar bear management often prompted a discussion about which entity should be responsible for managing harvests:

There seems to be already some sort of management in place in each community by elders and hunters. For example, if you get a polar bear in October, and someone else gets one in the middle of October, and it adds up to eight or nine or 10 [are harvested], and by April they [community harvesters] only want to get a few. From early on until February, we stop and wait for whaling—there will be another opportunity to get bears that are fresh meat for those months. By April and May, that is like the end of hunting polar bears [for the season]. By that time, maybe [we have harvested] 15 or so, and everyone in the village kind of feels like we have enough polar bears for this year. The hunters know what is going on in the village. They kind of look at it in that way—that [community] management system is embedded in each community. That is feeling that we have as Natives. We locally manage. (SRB&A Point Hope Workshop, January 2018)

Another individual from Point Lay believed that while monitoring of polar bears health and abundance is necessary for determining the necessity for harvest management should the population ever decline, management of polar bear harvests on the North Slope is unnecessary at this time. The respondent noted that North Slope communities generally do not meet their annual quota for polar bear harvests, saying,

I do not believe so, for up here on the North Slope where we have subsistence hunting for them. From my observations for recent years we just—they have set the quota, and we do not reach that quota up here on the North Slope. Maybe down in the southern area of hunting. At least for my village and area, we do not even get close to the quota that was set... I think they should have to be managed now—not to keep control of the population [manage harvests], but to keep track of the population to ensure you have enough to sustain subsistence. (SRB&A Point Lay Workshop, January 2018)

Finally, Wainwright respondents indicated a need for better scientific information—including reliable past and present population estimates—before making any decisions related to harvest management. They also stressed the need for involving local residents in management decisions:

More specifics need to be understood, like “What is the past estimated population? What is current estimated population?” Once we get more informed on that, it would be good [enough] to say what number is allowable, but not before we get that information. Getting those data will help make a decision on what possible number would be allowed without affecting polar bear [population] growth. It needs to be managed, but more information needs to be provided to the community; to subsistence harvesters in all of these communities...We need better science; we need to be more informed on what the census was. Have the numbers decreased significantly to where they need to be managed? What we take throughout the year, the population estimates [over time], and the updated estimates on the population are needed [to make a decision]. That will greatly add to the discussion of “Do they really need to be managed?” (SRB&A Wainwright Workshop, January 2018)

3.4.2 Native Representation in Management

In general, the four study communities agreed on the issue of Native representation and input into polar bear management decisions. While some workshop participants noted improvement in recent years—especially on a regional basis—Native representation and input into federal or “outside” management decisions were, for the most part, viewed as inadequate. Participants reported a general lack of communication on the issue of polar bear management, noting that more regular communication from outside entities would encourage local involvement. The lack of community involvement has been exacerbated by the dissolution of the ANC in recent years; while a successor organization (the ANCC) is under development, it is not fully operational. Point Hope workshop participants noted the central role that the NSB has taken in representing local interests to outside managers in recent years. However, despite actions taken by the NSB to promote local involvement, workshop participants believe that outreach from outside organizations is lacking. One Point Hope participant observed that the lack of regular meetings results in community members and outside managers having to “start over” at every meeting. Another noted that many community residents, whose knowledge is based on their experiences on the land, do not have the scientific background to fully understand the presentations given at community meetings. This individual noted that presentations should be geared toward these individuals in order for meetings to be more productive.

Workshop participants reported a lack of Alaska Native input into specific management decisions, particularly when it came to the U.S.-Russia Bilateral Polar Bear Agreement, in which Alaska Natives reported unknowingly losing their previous exemption related to polar bear hunting. Respondents noted that the communities were not given adequate information or consultation before the U.S. entered into the agreement:

Participant 1: We were always protected from issues like these when the Arctic Ocean was covered in ice and the Brooks Range stop transportation from land. All those years we were isolated and did our thing until they followed the bowhead to our region, and then they found out this was beautiful land and animals, and then they found oil, and we are up to this date and people want to

take over and control what we do in our life and now they are making international agreements without our input or knowledge or consent, whether we need it or not. We learn how to comply with international whaling issues but for everyday life and animals that come to our region, why do we need to spend our time asking a completely different nation [for permission?]. Why did other Natives approve [this agreement] for us?

Participant 2: *By agreeing to this agreement we lost our Native exemption, and a lot of people did not know about that, and there are still a lot of people who do not know what it meant. There was not enough consultation before it was acted on. Only a very few people made decisions for us without us knowing. If we knew that was going to happen, we would have done [things] differently. (SRB&A Utqiaġvik Workshop, January 2018)*

They took away our Alaska Native exemption for hunting polar bears. They have taken away from Alaska Natives that exemption to hunt polar bears. We did not know that they were taking it off. There was no communication about that. They did not tell us that our Alaska Native exemption was going to be disqualified. (SRB&A Point Lay Workshop, January 2018)

A Point Lay workshop participant expressed the belief that while Native representation in management decisions has begun to improve, adequate co-management of polar bears has not yet been achieved:

I really believe that [Native representation] is moving in that [positive] direction, and I believe that all the meetings that I go to, and I go to most of the subsistence meetings around North Slope, and we have been getting our voice out. It seems that the final decision-making of what has been put on paper is really what the regulators and law makers think, and there have been times that the subsistence users and users of the region are not consulted... Right now, for polar bear, we are not totally there yet to co-management. It will get where we will be co-management. Cooperation between entities for agreements and guidelines. It is hard for lawmakers to take info from someone they do not know versus a biologist or geologist that had gone to school for four years. They finally caught up to asking [us] questions about what we know. (SRB&A Point Lay Workshop, January 2018)

When asked for recommendations about what Native and federal co-management partners could do to ensure successful harvest management, workshop participants pointed to improved communication; equal decision-making authority among Native and

federal co-management partners; incorporation and consideration of traditional Native management practices; incorporation and consideration of TEK when making management decisions; implementation of local (rather than state or federal) enforcement of harvest management agreements; and consideration of the entire ecosystem when making management decisions:

They need to communicate and understand the communication between them. I think that is the most important part of successful co-management and ensuring that there is going to be a population in the future. Communication. If you have the right communication flowing between the entities, everybody knows what is going on, and they will have their mind in the decision-making processes. It has to be communication that is the most important thing we could do as a management side. Communication between hunters, between hunters and management and there has to be communication. That is what I think it is. (SRB&A Point Lay Workshop, January 2018)

It always comes back to the science. The specifics of scientific information: trends; spikes; reductions; noted changes in the polar bear population. The most important thing that needs to be done is to try to get an accurate updated census estimate. Then look at what would be an allowable take on that population depending on the population size... All could work or fall into place after that question is answered: do you feel they need to be managed. Without new information regarding the population, that is just an argument waiting to happen—making a decision on false information. (SRB&A Wainwright Workshop, January 2018)

Participant 1: *If we go over the quota, the federal government fines [us], and their punishment to the individual is too great for Natives. And the tribal organizations can create punishment just like AEWC does. They [should] have a dispute panel.*

Participant 2: *Indigenous people have rights that cannot be taken away. They have misinterpreted law of the land.*

Participant 1: *We can see the federal government is breaking those laws as they wish to punish someone. We have already had a person punished that did not know about taking a mother with a cub and [they were] fined way too much money. [We need to] get that to where the tribal creates a dispute panel where it is up to the local community. We set our own punishments here by doing community service and outreach. (SRB&A Utqiaġvik Workshop, January 2018)*

3.4.3 Current Polar Bear Status and Management

Workshop participants from the four study communities agreed that the current polar bear population is “about right,” in that it has not changed substantially from the past and is adequate to provide for local communities. While participants acknowledged that changes in ice conditions have affected the distribution and behavior of polar bears, they did not believe these changes had affected populations negatively:

Over last 10 years, it has been normal, the amount of polar bear we see each year. We recently take five to 10 a year. We see about 20 each year, and that has been normal. Ice conditions play a big part in how changing over last year 10 years. It has to have a direct effect on polar bear. Hardly any ice stresses them on having to go farther for animals they are trying to catch. They are having to stay on land and weather the summer due to the lack of ice. [However, population is] normal; I have not seen any changes in population. (SRB&A Wainwright Workshop, January 2018)

While participants from Point Hope, Point Lay, and Wainwright indicated no change in polar bear populations over time, Utqiagvik participants noted an increase in polar bears, citing both a lack of sea ice bringing polar bears closer and decreased harvests since the high harvests of the 1960s, when harvest management was minimal.

Regardless of their views regarding the need for polar bear harvest management today, workshop participants from all four communities agreed that if polar bear populations declined in the future, and these declines were strongly supported by both scientific research and local observation, their communities would agree to temporarily reduce their harvests of polar bear.

I feel it is necessary to safeguard polar bear. If we have to take less next year to help, we can do that. Understandably, that is way to go. Still, with knowing we can be able to harvest later when it is recognized there is a population increase. An allowable take would be okay... That would be agreed on by majority of community as long as we can return back as long as numbers indicate positive change. (SRB&A Wainwright Workshop, January 2018)

Yes, for a short term, with all necessary studies that should happen to make this decision. With all of the scientific and traditional knowledge in place, I would be in favor of a short term reduction of polar bear harvests. I think our community would follow that too. With our subsistence activities, it really affects our community because lots of our community members are subsistence users, and I know the community would follow along with regulations if they were set with local management and the USFWS. Our community is really nice to regulations if they are set forth in the right way. (SRB&A Point Lay Workshop, January 2018)

We would reduce the number of take if we thought there was a problem with the animals. We did that with caribou. We were concerned about caribou, and we made a calendar that said no calves at this time of year, no bulls at this time of year, and it went along with our traditional and cultural ways of harvesting caribou—the bulls go to rut in October and we stop hunting bulls till July or late June, and no hunting of pregnant females December to June. And we put those [guidelines] into an outreach program. (SRB&A Utqiaġvik Workshop, January 2018)

3.5 LOCAL PARTICIPATION IN RESEARCH AND MANAGEMENT ACTIVITIES

This section of the workshop focused on local participation polar bear management, including current levels of participation in reporting programs, willingness to participate in reporting of polar bear harvest data, views regarding a community-based polar bear monitoring and management program, and likelihood of community hunters to follow the guidance of outside management organizations. Table 15 provides a summary of the answers provided to the primary questions in this section.

Table 15: Summary of Local Participation in Polar Bear Research and Management Activities

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|--|--|---|--|--|
| VII.1 | Have you participated in any reporting of data related to polar bear harvests or observations? | Yes | No (but willing if were to harvest a polar bear) | Yes | Yes |
| VII.5 | Do you believe polar bear harvests need to be managed to ensure future harvests? Why or why not? | Yes. Improved communication, adequate compensation | Yes. Communication with local tribal governments. | Yes. Improve existing programs, sampling kits for hunters. | Yes. Involve NSB, equal representation of hunters rather than politicians. |
| VII.6 | How likely are hunters in your community to follow guidance of outside management organizations? If unlikely, what would it take for hunters to follow outside guidance? | Somewhat likely. Monetary or other compensation | Very likely, if supported by science and TEK. | Very Likely | Somewhat likely, if temporary and supported by TEK and science. |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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A majority of workshop participants had participated, or knew of other community members, who had participated in reporting of data related to polar bear harvests and observations as part of the USFWS tagging program. In all cases, and for all types of information (harvest numbers, harvest location, health and body condition, litter size, and cub survival), workshop participants indicated they would be willing to participate in reporting programs:

I am a polar bear and walrus tagger. We get informed each year on what changes there might be on what is necessary and what samples must be taken and the tagging of polar bear hides. All of the measurements that need to be taken and teeth that are removed and sent out. The only thing about that in the past is they need to find a better way for us to collect and keep samples and send in timely manner before they become useless. I believe lots of specimens or things are taken so they can do research on its health or age the information from blood and sample. We need a better way to get those [to USFWS]. (SRB&A Wainwright Workshop, January 2018)

Whoever catches a polar bear would get a tag. Everyone knows whoever catches a polar bear must get a tag. The hunters know that they have to get the tag. We have a Native village FWS person [we report to]. If you put three to four other communities combined with us, we are highest [in terms of polar bear tags]. (SRB&A Point Hope Workshop, January 2018)

My nephews are in the fish net study and polar bear studies. I have not been personally involved. No, I cannot think of anything that would keep me from giving my perspective. I think I would [participate]. I would with my wolverines. Me and community are willing to follow tags and guidelines. If they are going to be out there hunting, they usually do participate in study or questionnaires. (SRB&A Point Lay Workshop, January 2018)

While all workshops participants indicated they currently participate or are willing to participate in the tagging program, recent studies have shown that some polar bear harvests still go unreported/untagged, which in part can be due to the lack of local polar bear taggers in a community and not just noncompliance (Schliebe et al. 2016).

Additional interviews and workshops beyond this pilot study would be necessary in order to identify reasons that others may be less willing to report (or do not have adequate access to polar bear taggers) and avenues of improvement.

Workshop participants from all communities believed that a community-based polar bear monitoring and management program would be successful. However, they also had suggestions for how to ensure such a program's success. Several individuals indicated the need for improved sampling and data documentation methods—for example, an adequate number of sampling kits which would facilitate the taking of samples in the field and the transfer of samples to the appropriate entity.

Wainwright participants also noted that adequate training should be provided:

Participant 1: *The only improvement would be a specimen ready to go box or sample kit that has the vials or necessary things to cut the tissue sample, and it is clean and ready to go.*

Participant 2: *In Canada they have a kit for the hunters... It is up to [the Fish and Wildlife] service to travel to villages and [do a] workshop and training session to have these kits assigned to polar bear hunters.*

Participant 2: *It could be better. That is what I have always indicated.*

Participant 1: *There needs to be so many kits.*

Participant 2: *They need to not be large or bulky. (SRB&A Wainwright Workshop, January 2018)*

In addition, workshop participants believed that adequate compensation or incentive to hunters would encourage participation in a community-based monitoring program. Several individuals noted similar programs in Canada, where hunters are paid for each completed sample kit. A Point Lay participant stressed the need for coordination with local or tribal governments when implementing the monitoring program

Yes, I do think it would be successful. We could not manage other communities, but we would make it successful in managing the subsistence takes. Yeah, we would be in compliance. Keeping in communication with our local tribal government is the best way with our community. It is through our tribal government that entities communicate and go to meetings such as this. Be in communication with our local tribal government. The other villages might say city or representative with cell phone. But our Native village is really good with spreading information to the community. (SRB&A Point Lay Workshop, January 2018)

Workshop participants in Utqiaġvik pointed to a monitoring system in place through the NSB Wildlife Department as a model for future similar programs in North Slope communities. In particular, they noted that having a single regional entity overseeing a community-based monitoring program would ensure that communities have the necessary support system in place and would ensure consistency when there is turnover within a community.

Workshop participants from Point Lay and Wainwright believed that residents from their communities would be very likely to follow the guidance of outside management organizations, while participants from Point Hope and Utqiaġvik indicated that residents would be somewhat likely to do so. Participants from Point Hope noted that some hunters avoid interacting with individuals from outside entities, especially when it comes to sharing harvest data. They noted that some sort of incentive, such as gas or ammunition, may increase the likelihood of harvesters to follow the guidance of outside management organizations. Workshop participants noted that community residents will be more likely to follow guidance from outside organizations if that guidance is supported by strong science and consultation with local residents:

Our community is really good about following guidelines and restrictions and we are so small and we lean on each other. They want to keep doing it [harvesting polar bears]. They will follow guidelines set forth. But if it is just someone saying "You do this" without out good information and consultation, then of course we are not going to listen. (SRB&A Point Lay Workshop, January 2018)

3.6 COMMENTS AND CONCERNS

This section of the workshop focused on comments and concerns related to polar bears and polar bear harvesting. Workshop participants were asked to share their primary concerns related to polar bears and polar bear harvesting in their communities, in addition to the greatest threat to their community's future ability to harvest polar bears. Table 16 provides a summary of the answers provided to the primary questions in this section.

Table 16: Summary of Primary Comments and Concerns Regarding Polar Bears

| Protocol Question (Appendix A) | Question | Point Hope | Point Lay | Wainwright | Utqiagvik |
|--------------------------------|---|------------|----------------|------------|---|
| VIII.1 | What are your primary concerns related to polar bears and polar bear harvesting in your community? | Quota | Hunter safety | Quota | Quota |
| VIII.2 | What do you believe is the greatest threat to your community's future ability to harvest polar bears? | Quota | Climate change | Quota | Offshore oil development, increased marine traffic, discharges and oil spills |

Notes: Roman and Arabic numerals in headings correlate to the protocol questions provided in Appendix A

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When asked about their primary concerns related to polar bears and polar bear harvesting in their community, three of four communities cited a polar bear harvest quota; when asked about the greatest threat to their community’s future ability to harvest polar bears, two of the four communities provided the same response. Harvesters noted that a quota would not only limit their potential harvest for what they need; but it could also affect hunter behavior and potentially result in more polar bear being harvested than if no quota were in place. Workshop participants believed that their communities do not always reach the quota limit that has already been set for the Alaska Chukchi Sea communities, which demonstrated the communities’ ability to self-manage. If a strict quota were to be set, hunters may feel the need to harvest that quota number every year due to competition and fear of being perceived as not “needing” as many polar bears if they were to take less in a certain year. Utqiagvik workshop participants noted that greater efforts toward educating younger hunters about

traditional management techniques would reduce the need for a quota. Regarding the potential threat of a polar bear quota to their subsistence lifestyle, workshop participants observed:

Giving the community a quota [is my primary concern]. all of the hunters are worried about that. I am talking for all of the community. Not just Point Hope. It is all over. The Native way. [A quota is] a hurtful thing to hear. (SRB&A Point Hope Workshop, January 2018)

Quota and quota. That is the thing [that concerns me]. There is no set quota and [there are] a few bears taken each year, but we are not limited by quota. But if they made a quota each [year], it becomes a target number. Rather than just shoot them away [they would feel they have to meet quota]. Usually it is circumstances. We try to scare them away first. [Polar bear harvesting is] not as big as it was prior to the MMPA. Prior to MMPA it was economy. Today, we would rather shoo [the polar bears] away, but we still take them regularly for consumption—whatever meat [is harvested] is given freely. (SRB&A Wainwright Workshop, January 2018)

Participant 1: *I think it is [a concern about] a low number of quota that might be enforced by federal law agencies.*

Participant 2: *Just making sure that young new hunters know what to harvest and what not to harvest. Like not harvesting females and cubs. If you see a den or nest, do not harvest a bear that is in there, because 90 percent of the time it will be female with cubs. Education. Educate the hunters before they go hunting. (SRB&A Utqiaġvik Workshop, January 2018)*

A participant from Wainwright specifically discussed the potential impact of a quota on Alaska Native communities, particularly if a single quota is applied to all communities who harvest polar bear, noting that a low quota could result in high rates of criminal enforcement and unfair punishments. This individual noted the importance of consulting with local residents regarding a realistic quota:

We have to know which communities will have a quota. What will the numbers be? If the numbers are too conservative, then nobody can agree to that. Only conservationists who are too extreme are going to agree with that... A quota will affect communities. We have to find out who the communities are going to be [that the quota applies to]. If it is from Barrow all the way to St. Lawrence Island,

we are talking about over 20-something communities. If you have only 29 to harvest in a year, then that brings a lot of concerns that will come up, like enforcement—criminal enforcement, which is very unfair. If they slapped us with that, it would create a lot of hardship. We already experienced that with the [bowhead whale] moratorium. Those are the feelings hunters have. Hunters are very silent in their communities. They do not take very well to people who are on the outside and not having consultation with that community and then coming back and saying you are going to be allowed only X polar bear in these communities. (SRB&A Wainwright Workshop, January 2018)

Workshop participants noted that the methods for counting polar bears are not perfect and that any effort to manage harvests should be based on solid science and traditional knowledge. One workshop participant recalled a similar situation from the past, where the IWC implemented a low quota on bowhead whale based on inaccurate population counts:

They think polar bears are going extinct. But they should have better information, good science, like the example for the bowhead whale. There were only a few biologists that counted [whales] for federal government, and they counted with their eyes and they were not using traditional knowledge, and they counted only a few hundred whales and slapped us with a quota. Then, through using good science, with [NSB scientist] and elders around the community who have passed away, the real population was believed to be around 6,000 instead of a few hundred. That changed everything, and by doing constant science and censuses and looking at the health of animals and production of calves each year, we are now up to 20,000 whales. And that model with the Alaska Eskimo Whaling Commission and the quota that is used now, I think the communities are stable with the numbers that are allowed in each community. (SRB&A Wainwright Workshop, January 2018)

In addition to concerns about the quota, workshop participants from Point Lay and Utqiagvik also expressed concerns related to polar bears and hunter safety, climate change, and the potential for offshore oil development (and potential oil spills and discharge):

Just the safety of subsistence hunters is what worries me. I do not worry about anything else... One of my cousins told me when he was taking a ride he passed by polar bear den and the mom came out and tried to defend the den and was trying to get my cousin; he had a sled and he started his snowmachine and the polar bear grabbed the sled and had its claws on the sled and the snowmachine

could not go. And once the noise stopped, the polar bear stopped and tried to run up to the snowmachine. When he did go, he almost fell off. It is safety. (SRB&A Point Lay Workshop, January 2018)

[Greatest threat is] Safety, weather, and our climate. I do not think it will be rules and regulations. It might stop us for a little while; we might have a temporary stop, but I think it will be the climate or change of the weather that will affect us the most. (SRB&A Point Lay Workshop, January 2018)

Participant 1: *[My concern is] the oil companies getting oil from ocean. What if they got the okay, and they have a big oil spill?*

Participant 2: *It could be a number of things—we have got so much more tourists and people who want to come up here in big ships and their wastewater discharge could be polluting our oceans with more disease to ringed seals. And that is a threat to the polar bears' food. New diseases that may come up with warmer waters. Warm waters already have brought a big shift from international areas, and we just do not know what that could mean. Those are the things that are happening already. More bigger traffic out there now on the increase, adding on to the possibility of having a big spill... And some of the biggest threats is putting wrong information about polar bears [related to] climate change on television. It is giving wrong information to 300 million other Americans who can change who our people are that live up here. (SRB&A Utqiaġvik Workshop, January 2018)*

4 DISCUSSION

4.1 CONCURRENCE BETWEEN TEK AND WESTERN SCIENCE

While this study did not try to provide an in-depth comparison of TEK findings with western science regarding polar bears, a qualitative evaluation of TEK documented for this pilot study, along with recent western science publications, suggests many of the findings showed overall concurrence. Areas identified as showing general concurrence included the following:

- Abundant population of seals is key for good polar bear habitat (Table 9) (Rode et al. 2014, Crawford et al. 2015, Rode et al. 2017).
- Later ice formation and less thick ice (Stern and Laidre 2016, Serreze et al. 2016)
- While western science does not have strong data to estimate earlier polar bear population size, it is possible given the high harvest levels pre-MMPA that the abundance has increased since 1972. Furthermore, preliminary analyses (Moscow February 2017 SWG Meeting, (Regehr et al. *In review*)) seem to also concur on a suggested relative stability in polar bear densities on the west coast of Alaska between the 1980s and 2008-2016.
- Stable reproductive metrics (i.e., stable or increasing number of cubs) (Rode et al. 2014).
- Movement patterns are tied to sea ice and there is a relatively high probability of polar bears coming back to western Alaska year after year (Wilson et al. 2014, Wilson et al. 2016). TEK and western science also show a larger proportion of the Chukchi Sea subpopulation is spending a longer time on land each year (Rode et al. 2015).
- Overall good health and body condition for Chukchi polar bears (Rode et al. 2014)

4.2 POTENTIAL USES OF TEK IN THE IPM AND HARVEST RISK ASSESSMENT

This section focuses on the potential uses of TEK as inputs into the Bayesian IPM and harvest risk assessment. Table 17 and Table 18 provide a list of the parameters of the IPM and harvest risk assessment that the study team has preliminarily identified as potentially informed by TEK. These tables provide the definitions of these parameters, the related TEK protocol questions and results (see Section 2.0 Results) and preliminary review of their applicability to the IPM or harvest risk assessment.

One finding that emerged from the review with western science on this TEK-IPM/harvest risk assessment pilot study was that certain information from TEK potentially could be used as data or as constraints on demographic parameters. However, at present, TEK was not included in the IPM in this manner due to the lack of sufficient spatial (e.g., more communities) and temporal (e.g., more observations over time) coverage in TEK observations, and need for additional consideration of the linkages between TEK observations and model parameters. For example, local TEK knowledge regarding the abundance of polar bears could potentially be directly incorporated into the IPM as a constraint indicating stability in the population/abundance parameter estimation (N), with additional observations over time and space to increase the chances that the TEK observations were related to population abundance overall and not just local abundance in the vicinity of the study communities. Similarly, this could be done for Young-of-the-Year Litter Size Parameters (l_{L0}) if there were more specific quantitative observations in time and space related to litter size of first year cubs. Prior to incorporating TEK directly into parameter estimation models, we suggest that collaborative efforts between TEK holders and western scientists continue to determine whether/how different types of TEK may relate to different model parameters, given that many of these relationships are likely indirect and condition on other factors.

Table 17: IPM Parameters, Definitions, and TEK Applicability to IPM

| Parameter | IPM Definition | Related TEK Protocol Questions | Potential TEK Applicability to IPM |
|-------------------------------|---|---|---|
| $\phi_{sex\ and\ age\ class}$ | Survival probability. The probability that an individual polar bear will survive, and not permanently emigrate from the study area, from year t to year $t + 1$. Survival probabilities can be sex- or age-specific. Survival probabilities can be “total survival”, which reflects all forms of mortality; or “un-harvested survival”, which only reflects mortality from sources other than human-caused removals. | <p>Most Recent Harvest</p> <ul style="list-style-type: none"> • ~ Age • Sex • Size Rating (1-5) • Weight Rating (1-5) <p>See</p> <p>Table 8: Characteristics of Most Recent Polar Bear Harvests</p> | These questions if asked on a regular basis (e.g., annually) in more communities could provide sufficient distribution of observations of trends in time and space to serve as potential TEK input for IPM regarding nutritional condition and sex and age composition, both of which can provide information relevant to survival under some conditions. |
| | | <p>V.12 Have you noticed changes in the health or body condition of the polar bear population?</p> <p>See Table 12: Summary of Polar Bear Health Characteristics</p> | Potential TEK input for IPM regarding nutritional condition, which studies have found can be related to survival probability. |
| | | <p>V. Polar bear health in 2017?</p> <p>See Table 12: Summary of Polar Bear Health Characteristics</p> | Given that body condition and health can fluctuate from year-to-year, observations of positive health in 2017 are less useful to the current IPM. However, if this question were asked on a regular basis (e.g., annually) in more communities, it could provide sufficient distribution of observations of trends in time and space to serve as potential TEK input for IPM regarding health status, which may be related to survival probability. |

| Parameter | IPM Definition | Related TEK Protocol Questions | Potential TEK Applicability to IPM |
|--|--|---|---|
| $\phi_{LC0 \text{ or } LC1}$ | Litter survival probability. The probability that at least one member of a litter survives from year t to year $t + 1$. Litter survival probabilities can be for cubs-of-the-year (C0) or yearlings (C1). | V.13 Are you observing an increase or decrease in the number of older polar bears you encounter? See Table 10: Summary of Polar Bear Abundance Characteristics | Potential TEK input for IPM regarding number of older bears encountered, which can relate to polar bear survival under some conditions . More older bears can mean either (1) bears are surviving more, or (2) bears are having fewer cubs |
| $\psi_{sex \text{ and age class}}^{OO}$ $\psi_{sex \text{ and age class}}^{II}$ | Movement probability. The probability an individual outside the study area at year t is outside the study area at year $t + 1$. Movement probabilities can be sex- or age-specific. Movement probability, as defined here, depends on the details of the capture-recapture model structure. Various modeling structures may define movements differently. | Most Recent Harvest <ul style="list-style-type: none"> Month See Table 8: Characteristics of Most Recent Polar Bear Harvests | This question if asked on a regular basis (e.g., annually) in more communities could provide sufficient distribution of observations of trends in time and space to serve as potential TEK input for IPM regarding movement patterns and distribution (e.g., more harvests in summer could indicate changing trend in distribution), which may relate to specific movement probabilities included in parameter estimation models. As currently defined in the IPM, this parameter has a specific definition related to moving into or out of the IPM study area, and in its current form TEK can provide information on movements but does not directly fit with the IPM parameter. |
| | | V.1 What are the general seasonal movement patterns of polar bears in your area? V.1.d Changes in sea ice and sea ice timing affected distribution of polar bears? See Table 11: Summary of Polar Bear Distribution Characteristics | Potential TEK input for IPM regarding timing and distribution of bears, but would be difficult to incorporate into modeling given that TEK does not identify individual animals, and that the spatial and temporal scopes of TEK observations versus movement data from radio collars are different |

| Parameter | IPM Definition | Related TEK Protocol Questions | Potential TEK Applicability to IPM |
|----------------------|--|--|---|
| $B_{age\ class}$ | Breeding probability. Conditional on survival, the probability that a female without cubs or a female with age-two cubs at year t will breed and have at least one C0 that survives until year $t + 1$. Can be age-specific. | | |
| l_{L0} l_{L1} | Average litter size of C0 litters. Average litter size of C1 litters. | V.14 Are you observing an increase or decrease in the number of cubs? See Table 10: Summary of Polar Bear Abundance Characteristics | Potential TEK input for IPM regarding trends in litter size |
| λ | Population growth rate. The rate at which the number of individuals in a population changes. A value of $\lambda = 1$ would correspond to a stable population. | V.11 Abundance of polar bears? See Table 10: Summary of Polar Bear Abundance Characteristics | Potential TEK input for IPM regarding population trend. |
| N | Population size. The total number of individuals in the population of interest. The definition of population size requires consideration of management boundaries, animal movements, temporal effects (e.g., seasonal changes in habitat or movements), and other factors. | V. Polar bear abundance in 2017? See Table 10: Summary of Polar Bear Abundance Characteristics | This is challenging to input into a model due to year-to-year changes in environmental conditions (e.g., sea ice distribution) that could strongly influence local polar bear abundance variations in any given year even if the size of the biological population was relatively stable. However, if this question were asked on a regular basis (e.g., annually) in more communities, it could provide sufficient distribution of observations of trends in time and space to serve as potential TEK input for IPM regarding population size. |

Table 18: Harvest Risk Assessment, Definitions, and Applicability to IPM

| Parameter | Definition | TEK Protocol Questions | Potential Applicability to Harvest Risk Assessment |
|-----------|---|---|---|
| K | Carrying Capacity. The number of individuals of a particular species capable of surviving in a particular environment over long periods of time, and dependent on the effects of the limiting factors | V. Condition of sea ice for polar bear habitat in 2017? See Table 9: Summary of Polar Bear Habitat Characteristics | This question if asked on a regular basis (e.g., annually) in more communities could provide sufficient distribution of observations of trends in time and space to serve as potential TEK input for the Harvest Risk Assessment regarding trends in habitat. |
| | | V.5. What trends in sea ice and sea ice timing have you observed? When did you first notice this? See Table 9: Summary of Polar Bear Habitat Characteristics | Potential TEK input for Harvest Risk Assessment regarding trends in habitat that affect the ability of the environment to support polar bears |

For some TEK questions, such as sea ice conditions and prey status, the current iteration of the IPM did not model temporal variation in vital rates/environmental conditions (e.g. variation in survival rates from year to year). However, if future IPM iterations were to include long-term monitoring in vital rates, which would capture temporal variation, then TEK questions about sea ice and prey status could potentially be used to inform the model. Similarly, if future IPMs were seasonally explicit, then TEK observations on polar bear land use in summer could also be directly incorporated.

Other TEK that could not provide a direct input into the IPM are still important to western science in that they confirm overall interpretations, identify areas requiring further investigation (e.g., in TEK and science appear to disagree), or serve as informative priors (pre-existing evidence which is taken into account). For example, TEK observations that prey abundance was good in 2017 concur with western science studies that suggest abundant and relatively productive seal populations in the Chukchi Sea region (Muto et al. 2017). This finding, together with general concurrence between

TEK and results from scientific studies, were important to the interpretation of the status of the Chukchi Sea subpopulation, and was considered consistent with use of informative priors on survival of independent bears. Regarding polar bear health, the use of informative priors was in part justified on the basis of concurring observations of health and good body condition from both science and TEK. For example, if TEK had observed large negative trends in body condition and health, it may not have been justified to hypothesize that survival rates for Chukchi Sea bears were similar to the range that has been estimated for other subpopulations across the Arctic, and therefore may not have been justified to use informative priors on survival. In other instances where science and TEK concur, the effects of directly integrating TEK could be to reduce uncertainty in estimated parameters, but not to cause an important change in the magnitude of the vital rates (and their interpretation relative to population status).

Regarding the harvest risk assessment, U.S. harvest data were not directly incorporated in the IPM due to the low number of individually-marked bears known to be harvested. This could be due to a combination of (1) likely relatively low harvest rates (Regehr et al. 2018), and (2) incomplete harvest reporting (Schliebe et al. 2016); if harvest reporting were known to be closer to 100 percent, then harvest returns may have been incorporated, allowing direct estimation of harvest mortality, which could be very useful to the harvest risk assessment. Other ways, though, in which TEK could be used in the harvest risk assessment include informing management objectives and risk tolerances relative to meeting those objectives, harvest strategies, vital rates and abundance estimates (see discussion above for IPM), and the effects of sea-ice loss on polar bear population status. For example, for the harvest strategy component of the harvest risk assessment, TEK could inform the number of bears that communities in a region wish to take, the appropriate ratio of male-to-female harvests, whether there is a preference for bears of certain age, ways to improve harvest reporting, and how harvests should be allocated across communities.

4.3 IÑUPIAQ VIEWS ON WESTERN SCIENCE AND TEK

The efforts of this pilot study to document TEK among Iñupiaq polar bear hunters has highlighted several important aspects of Alaska Natives' knowledge regarding polar bears and the biological topics of habitat, abundance, distribution, and health. These are topics that are at the forefront of current biological research efforts for polar bear today. As mentioned above, while it was beyond the scope of this pilot study to compare TEK with the findings of western science, it was apparent to the study team that the Iñupiat believe that certain previous information being put forth by the scientific community (e.g., earlier population estimates) and the broader management agencies (e.g., need for a quota) are not in line with the observations and knowledge of the Iñupiat. In general, Iñupiat view polar bear today as healthy and abundant, and while there may be changes to their distribution due to changes in sea ice conditions, polar bear prey are still abundant, and polar bear were viewed as having the ability to adapt to changing environmental conditions. Furthermore, based on polar bears intelligence and ability to adapt, there was hesitation among the Iñupiat to predict too far into the future regarding the effect of a changing environment on polar bears. While scientific information was viewed as valuable in certain contexts (e.g., health surveys, population counts), workshop participants insisted that local input and TEK was vital to helping guide research efforts, interpreting results, and management decisions.

Iñupiat provided insight into their polar bear harvesting characteristics including why they harvest, when they harvest, how many they harvest, and the conditions that cause them to sometimes have to harvest nuisance bears. While the cultural need of Iñupiat to harvest polar bears was beyond the scope of this pilot study, polar bears are a culturally significant subsistence resource that provide a traditional food and fulfill food cravings; provide useful skin, fur, and claws for many practical purposes; and represent a significant element of the cultural identity of Iñupiat. Across the board, all participants viewed a quota negatively and asserted that their traditional management practices are adequate to manage polar bear harvests at this time. Participants explained that successful management with outside agencies would only occur when **communication**

was made a priority, TEK was **adequately** included in decisions, **local** enforcement was emphasized, the **entire ecosystem** was considered, and when Natives had **equal** decision-making authority (and not just input).

4.4 FUTURE WORK

Finally, as stated throughout the report, this study is a pilot study that occurred among a relatively small number of participants from a subset of communities that subsist from the AC population of polar bears. The conclusions or findings presented in this report are from a pilot study with a relatively small sample size. As such, additional TEK workshops should occur in these communities and in other Chukchi Sea communities, to add to and confirm findings. These workshops should be conducted with cooperation and leadership from the ANCC to help ensure their success. The communities should be given an opportunity to review and comment on these findings prior to the finalization of results. Future studies efforts could also review and draw on the results of earlier studies focused on polar bear TEK for additional insight regarding how TEK might contribute to the modeling and management efforts being undertaken pursuant to the Agreement.

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6 APPENDIX A: FIELD PROTOCOL

Polar Bear TEK Protocol **Stephen R. Braund & Associates (SRB&A)** **North Slope Borough**

Community: _____
Interviewers: _____
Workshop ID: _____
Date: _____
Start Time: _____
Protocol QCd: _____

SECTION I: RESPONDENT INFORMATION

Collect the following information for each individual completing the workshop

| | A | B | C | D | E |
|-----------------------------------|---|---|---|---|---|
| Respondent Name | | | | | |
| Respondent ID (post field) | | | | | |
| Gender | | | | | |
| Birth Year | | | | | |
| Residence at Birth | | | | | |
| Years in Study Community | | | | | |
| Residence History Notes | | | | | |

SECTION II: POLAR BEAR HARVESTING CHARACTERISTICS

1. Overall, how many polar bears does your community harvest in a typical year?
 - a. Does this amount vary substantially from year to year?
 - b. What factors affect your annual polar bear harvest levels?
2. How many polar bears do you believe is enough for your community on a yearly basis?
3. Is your community able to harvest enough polar bear?
 - a. Has this changed from the past? If so, why?

SECTION III: HUNTING PURPOSE AND TIMING

1. What is the main reason you harvest polar bears in your community?
2. What is the primary use of harvested polar bears in your community? Food? Fur? Nuisance? Native Crafts? Other?
3. Do many people hunt polar bear, or is it a more specialized activity among a smaller number of hunters?
 - a. Has this changed over time? If so, why?
4. What is the typical timing (months) of your polar bear harvesting?
 - a. Has this changed from the past? If so, why?
5. When you harvest polar bears are you usually actively searching for them or are you harvesting them during other subsistence activities?
 - a. If other, what types of other subsistence activities?
6. Do you ever take a nuisance bear? If so, where and in what situation are these nuisance bears encountered?
7. How many aggressive or nuisance bears did you encounter last year? Is this typical?
8. What was the condition of the aggressive bear (sex, age, body condition)?
9. What steps do hunters in your community take to reduce unplanned polar bear harvests (e.g., nuisance bears)?
 - a. Would you be willing to consider alternatives (e.g., polar bear patrols, non-lethal shells/bean bags, electric fencing, assistance with whale parts) to lethal take to address the issue of nuisance bears?
10. How often are polar bears wounded and not recovered? If so, how often and describe.

Never

Rarely

Sometimes

Often

SECTION IV: USE AREA MAPPING AND HARVEST LOCATIONS (Last 10 Years/Most Recent Harvest Year)

1. What sea ice conditions are ideal for polar bear hunting? What sea ice conditions are poor for polar bear hunting?

HARVESTER OVERVIEW - For each respondent ask the following questions based on the most recent harvest year:

| Respondent # | Have you tried to harvest polar bears in the last 10 years? | Did you try to harvest polar bears last year? If not last year, when most recent year? | What were the sea ice conditions in terms of hunting in most recent year? | How many days did you try to hunt in most recent year (note if opportunistic only)? | How many days were you successful? | How many did you harvest in most recent year (including nuisance bears) | Is this number you harvested typical of past years? If not, why? |
|---------------------|--|---|--|--|---|--|---|
| A | | | | | | | |
| B | | | | | | | |
| C | | | | | | | |
| D | | | | | | | |
| E | | | | | | | |

LAST 10 YEAR MAPPING - Map areas where respondent tried to harvest polar bears between 2008 and 2017. For each use area record the following:

- RESPONDENT #
- MONTHS
- ACCESS TRAVEL METHOD
- SEARCH TRAVEL METHOD

Use a different color for each harvester. Map use areas as polygons (e.g., POLY A1, B1, B2, E1 etc.)

- Is there an area where polar bears typically congregate? Map if so and why there?

SECTION V: HABITAT, ABUNDANCE, DISTRIBUTION, AND HEALTH

Habitat and Distribution of Polar Bears

1. What are the general seasonal movement patterns of polar bears in your area?
 - a. Spring? Summer? Fall? Winter?
 - b. Do these patterns differ based on the age or sex of the polar bear?
2. Do habitat areas differ based on the age or sex of the polar bear? If yes, how?
3. What sea ice conditions are ideal for polar bear habitat? What sea ice conditions are poor for polar bear habitat?
4. What types of prey abundance make for good polar bear habitat?
5. What trends in sea ice and sea ice timing have you observed? When did you first notice this?
6. Have these changes in the sea ice and sea ice timing affected the following:
 - a. Abundance of polar bears? If yes, how?
 - b. Cub production and survival? If yes, how?
 - c. Health of polar bears? If yes, how?
 - d. Distribution of polar bears? If yes, how?
7. How do you think these changes will affect polar bears in the future?
8. Have these changes in the sea ice and sea ice timing affected your harvests? If yes, how?
9. Have any changes in polar bear distribution and behavior affected your community's whaling practices? If yes, how?
10. Have your whaling practices affected how you harvest polar bears? If so, how?

Abundance and Health of Polar Bears

11. Have you noticed changes in the abundance of the polar bear population? If yes, why? When did you first notice this?
12. Have you noticed changes in the health or body condition of the polar bear population? If yes, why? When did you first notice this?
13. Are you observing an increase or decrease in the number of older polar bears you encounter? Is that related to any noticeable environmental/ice condition?
14. Are you observing an increase or decrease in the number of cubs? Is that related to any noticeable environmental/ice condition?
15. How many cubs do you typically see with a female bear? Has this changed over time? If so, how?
16. What is the youngest age you have observed of a female with cubs? Has this changed over time? If so, how?
17. Are there changes to other species (e.g., ringed and bearded seals) that have had an effect on polar bear health and abundance?

2017 Habitat, Abundance, and Health Observations

- For each respondent record overall habitat/abundance/health characteristics for 2017.
- Respondent describes sea ice conditions, abundance, and health and study teams asks if respondent considers those conditions to be POOR, AVERAGE, or GOOD in terms of polar bear habitat for 2017

| Respondent # | What were the sea ice conditions in terms of polar bear habitat in 2017? | Polar Bear Abundance? | Prey Abundance? | Overall Polar Bear Health? |
|---------------------|---|------------------------------|------------------------|-----------------------------------|
| A | | | | |
| B | | | | |
| C | | | | |
| D | | | | |
| E | | | | |

SECTION VI: POLAR BEAR MANAGEMENT

1. Are you aware of current agreements that affect polar bear harvests?

| Respondent # | Marine Mammal Protection Act 1972 | International Polar Bear Agreement 1973 | Inuvialuit - Inupiat Polar Bear Management Agreement 2000 | U.S.-Russia Bilateral Polar Bear Agreement 2000 |
|---------------------|--|--|--|--|
| A | | | | |
| B | | | | |
| C | | | | |
| D | | | | |
| E | | | | |

2. Were you aware of the Alaska Nanuuq Commission (ANC) and its role in helping polar bear management?
3. Are you aware of the new ANC successor organization the Alaska Nanuut Co-Management Council (ANCC)?
4. Do you believe scientific information is helpful in making polar bear management decisions? If so, what types of information?
5. Do you believe polar bear harvests need to be managed to ensure future harvests? Why or why not?
6. Do you believe that Alaska Native hunters have adequate representation and input into management decisions? Why or why not?
7. What are the most important things that Native and federal co-management partners can do to ensure that harvest management of the polar bear population is successful for both people and bears?
8. In your view, is the current population of polar bears too high, about right, or too low?
9. In your view, is the population of polar bears in the Chukchi Sea changing? Not changing? If changing, why?
10. Do you believe that Alaska Native harvests are having or could have a negative impact on the polar bear population? Why or why not?
11. If management organizations believed it was necessary to protect harvests in the future, would you be willing to reduce your harvests in the short-term?

SECTION VII: LOCAL PARTICIPATION IN MANAGEMENT

1. Have you participated in any reporting of data related to polar bear harvests or observations? If not, would you be willing?
2. Which of the following would you be willing/unwilling to report to management organizations?

| Respondent # | Harvest Numbers | Harvest Location | Health and Body Condition | Litter Size | Cub Survival |
|--------------|-----------------|------------------|---------------------------|-------------|--------------|
| A | | | | | |
| B | | | | | |
| C | | | | | |
| D | | | | | |
| E | | | | | |

3. If not willing, why not? Fear of exceeding quota? Fear of enforcement? Discontentment or frustration with quota?
4. If not willing, is there anything that would make you more likely to participate?
5. Do you think a community based polar bear monitoring and management program would be successful in your community? If yes, do you have recommendations for how to make such a program successful? If no, why not?
6. How likely are hunters in your community to follow guidance of outside management organizations? If unlikely, what would it take for hunters to follow outside guidance?

SECTION VIII: COMMENTS AND CONCERNS

1. What are your primary concerns related to polar bears and polar bear harvesting in your community?
2. What do you believe is the greatest threat to your community's future ability to harvest polar bears?
3. Any other comments or concerns you would like to express today?

OTHER WORKSHOP NOTES/OBSERVATIONS

END TIME: _____

CUE CARDS

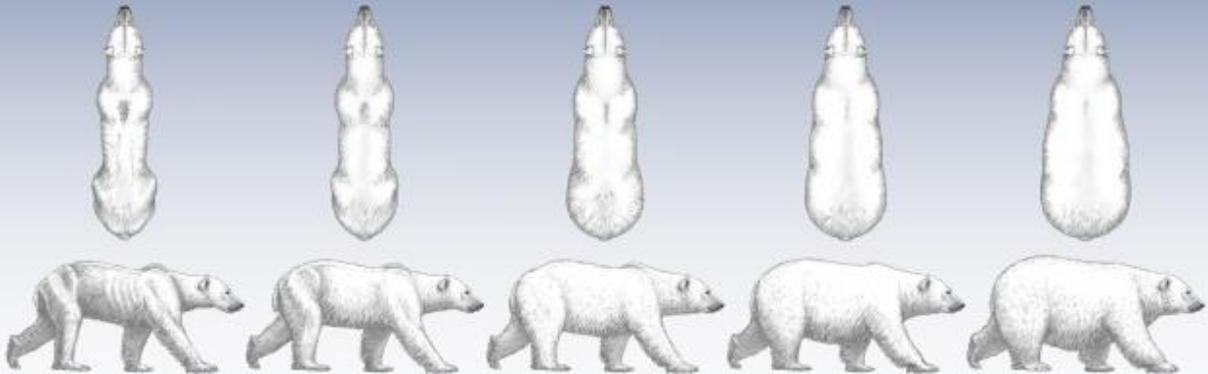
| SIZE SCALE: | WEIGHT SCALE: | SEA ICE CONDITION SCALE: | ABUNDANCE & HEALTH SCALE: |
|--------------------|----------------------|---------------------------------|--------------------------------------|
| 1 - Very Small | 1 - Skinny | 1 - Poor | 1 - Poor |
| 2 - Small | 2 - Thin | 2 - Average | 2 - Average |
| 3 - Average | 3 - Average | 3 - Good | 3 - Good |
| 4 - Large | 4 - Fat | | |
| 5 - Very Large | 5 - Very Fat | | |

WEIGHT SCALE



Polar Bear Scorecard: A Standardized Fatness Index

Illustrations by Emily S. Damstra



SKINNY

Skinnny; emaciated appearance; vertebrae, ribs, and hip bones externally visible without palpation; no fat palpable between skin and muscle over the dorsal body, hips, or lower rump.

THIN

Thin; vertebrae and hip bones (but not ribs) partially visible, easily palpable under the skin; little/no fat between skin and muscle over the back; small amounts of fat detectable on lower rump.

AVERAGE

Average; healthy appearance; vertebrae and hip bones not visible; upper 1/3 to 1/2 of the spinal column can be felt under the skin; detectable layer of fat between skin and muscle over rear half of body, thickening slightly but detectably over lower rump.

FAT

Fat; vertebrae and hip bones not visible; palpation reveals fat deposited over upper vertebrae; hip bones difficult to feel through fat; fat thick over rump; a hand rubbed above the rump will initiate ripples in the skin over the fat layer.

VERY FAT

Obese; vertebrae and hip bones undetectable by palpation; thick layer of fat is apparent between skin and muscle 2/3 of the way up the back & over rump; a hand rubbed on lower back above rump sets off waves of rolling fat, possibly jiggling.

This is a subjective determination of a bear's body condition based on assessment of body fat. Source: I. Stirling, G.W. Thiemann, E. Richardson. 2008. Quantitative Support for a Subjective Fatness Index of Immobilized Polar Bears. Journal of Wildlife Management 72(2): 568-574.