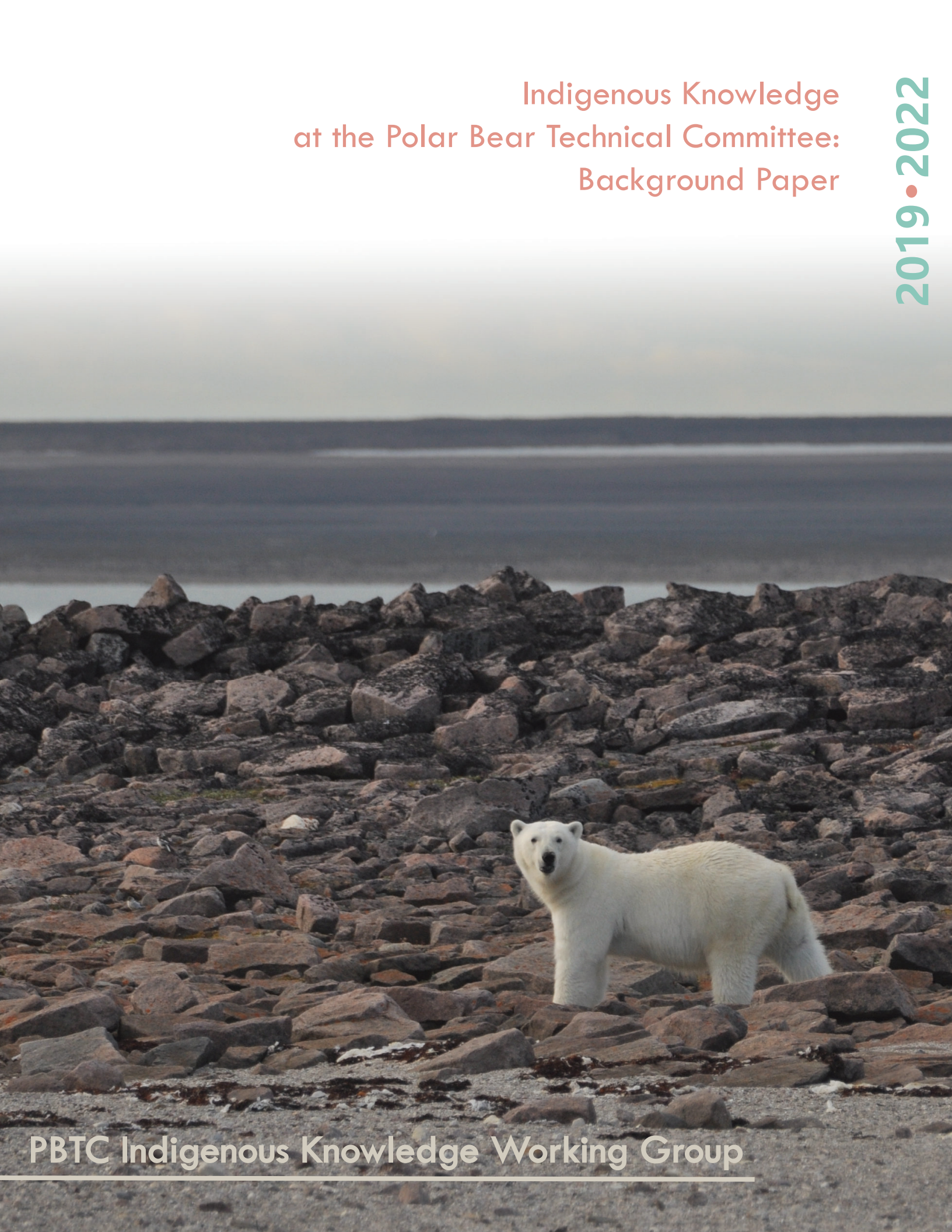
# Indigenous Knowledge at the Polar Bear Technical Committee: Background Paper

2019•2022



PBTC Indigenous Knowledge Working Group

# PRODUCTION NOTE

This background paper was developed by the Polar Bear Technical Committee (PBTC)'s Indigenous Knowledge Working Group (WG), over the course of 2019 and 2020. The original objective of this paper was to review and recommend to the PBTC ways by which the inclusion of Indigenous knowledge (IK) in its annual status report could be improved. To do so, the WG realized that there is a significant amount of background information needed to understand the current context of IK within the PBTC process. This background paper is meant to be a starting point for the WG's activities and the PBTC's discussions about improving how it includes and values IK. It highlights the work that the PBTC has done, before the formation of the WG, toward how Indigenous knowledge is recognized and valued by the PBTC and other species status assessment processes. We also want to thank Dominique Henri, research scientist at Environment and Climate Change Canada, for her thoughtful and substantive comments that have helped strengthen this paper.

This paper is authored by the PBTC Indigenous Knowledge Working Group and as such the ideas and recommendations do not necessarily reflect the opinion of all PBTC members.

Cover photo: East Bay Island, Nunavut (C) Frankie Jean-Gagnon

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# INTRODUCTION

The Polar Bear Technical Committee is a committee that provides technical advice and recommendations on the status of Canada's polar bear subpopulations. The advice and recommendations are provided to the Polar Bear Administrative Committee (PBAC) and pertain to: (1) design, collaboration, and conduct of polar bear research in Canada; (2) population and habitat issues or trends; (3) harvest levels proposed by jurisdictions; and, the need for management actions (PBTC, 2016). Furthermore, the PBTC Terms of Reference states that PBTC will "meet annually to review research and traditional knowledge…" One of the key outputs of the PBTC is an annual status assessment of all Canadian subpopulations, including harvest. This annual status assessment is based on Western science and traditional knowledge (TK) provided by member agencies.

In this paper, we look at how the PBTC can expand upon its previous work to include TK. Throughout the paper, we use the term Indigenous Knowledge (IK) as it is the term adopted by the PBTC in 2019. However, Traditional Knowledge (TK), Traditional Ecological Knowledge (TEK), and Traditional and Local Knowledge (TLK) are commonly used in the literature and in environmental management (Berkes, 2012; McGregor, 2008). Local Knowledge (LK) and Community Knowledge (CK) may also be used. We will use the term IK unless otherwise specified. There are many definitions of IK, but all include the understanding that IK is a system of knowledge, a way of knowing, and includes practices and beliefs. The PBTC uses the following definition of IK:

*"Indigenous Knowledge (IK) refers to a cumulative body of knowledge about the relationships of living beings with one another and with their environment, which is generated from the cultural practices, lived experiences and traditions of local and Indigenous Peoples." (PBTC, 2020)*

The recognition of the value of Indigenous knowledge to wildlife conservation and management has changed over time. Internationally, Canada is a party to *Convention on Biological Diversity* (1993), which recognizes (in Article 8(j)) the importance of Indigenous knowledge and ways of life in the conservation of biodiversity and recognizes the role of Indigenous land management in conserving biodiversity. The PBTC first discussed the value of Indigenous knowledge in 1995 – over two decades ago – and the PBTC has been formally including IK in its status assessments since 2009. In 2013 the Parties to the international *Agreement on the Conservation of Polar Bears and Their Habitat* (1973) made a declaration recognizing the value of Indigenous knowledge in polar bear management:

> "RECOGNIZE the importance and value of Traditional Ecological Knowledge in informing management decisions and ACKNOWLEDGE the need for the range states to develop a common understanding of what constitutes Traditional Ecological Knowledge and how it should be used in polar bear management decisions."

Today, it is widely recognized that bridging[1] IK and Western scientific knowledge (hereafter referred to as 'science') in the context of wildlife research and management can lead to an improved understanding of the entire ecosystem, often at multiple temporal and spatial scales, thus leading to improved decision making (Ban et al., 2018; Berkes, 2016; Bohensky & Maru, 2011; Eckert, Ban, Frid, & McGreer, 2018).

At the 2019 meeting of the PBTC, the Indigenous Knowledge Working Group (WG) was created. The mandate of the WG is to examine the current inclusion of Indigenous Knowledge within the work of the PBTC, including status assessments, and make recommendations on how this could be improved. In undertaking the background work to support this task, the IK working group has come to understand that, to do this work, it is important to situate the PBTC's relationship with IK in its own historical context, as well as in larger sociocultural, legal, and scientific contexts. In this paper we:

- review the history of Indigenous participation and inclusion of IK at the PBTC;
- Consider different sources of IK that are either being brought to the PBTC or are expected to be available to the PBTC in the near future;
- Examine some other fora where IK is used in species status assessment, with key considerations highlighted.
- Discuss some other important considerations in considering IK in species status assessment, particularly for polar bear;
- And present some preliminary recommendations for the PBTC and the WG consider when mapping out their future work.

The overall intent of this paper is that of a 'background paper' to lay the foundation for future work. The recommendations included should be considered preliminary.

The IK working group has also come to understand that the inclusion of IK in status assessment is inextricably linked to larger considerations and processes, like the overall representation of Indigenous Peoples and Indigenous Knowledge in wildlife species assessment, natural sciences research, and regional, national and international management and decision-making fora. This understanding is reflected throughout this paper, as the working group has tried to address its primary task while linking to larger considerations where appropriate. Furthermore, The IK working group understands its work to be situated within, and informed by, larger processes occurring at the national and international scale, including the Canadian Truth and Reconciliation Commission and the United Nations Declaration on the Rights of Indigenous Peoples, and more recent work to apply the principles of these large-scale processes to the natural sciences (TRC, 2014, United Nations, 2011, Wong *et al.*, 2020).

Beyond this background paper, the WG proposes to develop a set of recommendations improving how the PBTC adequately, appropriately and meaningfully includes Indigenous knowledge, above and beyond

[1] The terms 'Bridging', 'weaving', and 'braiding' IK and Western Science are used interchangeably in this paper; see Alexander *et al.* 2019 for further discussion.

the important work that the PBTC has already undertaken to achieve this goal. The working group hopes to facilitate a constructive and culturally sensitive dialogue at the PBTC table (building on past precedent and success in this area), one that appropriately and respectfully examines both the scientific and Indigenous knowledge being brought forward and the ways these types of knowledge are being valued and included in assessing polar bear population status in Canada.

## History of Indigenous Knowledge at the PBTC

This section provides an overview of how Indigenous representatives and organizations, and Indigenous Knowledge, have been incorporated at the PBTC historically and up to the present, as well as how Indigenous representatives and organizations have contributed to the work of the PBTC to date. This history highlights flexibility, change and co-management during a time when the value of Indigenous knowledge and Indigenous stewardship practices were not widely recognized in academia and government.

It is important to note that, in addition to this history, Indigenous Peoples have co-existed with polar bears since time immemorial and have diverse and complex stewardship practices and cultural norms related to polar bear management.

### Origins of the PBTC and development post-land claims

In this section, we present an overview of the creation of the PBTC and how it changed as modern final agreements were signed and implemented. It is beyond the scope of this paper to write a comprehensive history; here, we aim to provide the main points. Understanding the history of the PBTC, how it was formed and changed over time, provides context for understanding how the PBTC has included Indigenous knowledge thus far and can inform recommendations for the future.

In the 1950s and 1960s, there was international concern about the status of polar bears and the rapid increase observed in polar bear harvesting, which at the time was unregulated. Polar bear harvest quotas were established by governments in Canada in the late 1960s. In 1973, the *Agreement on the Conservation of Polar Bears and Their Habitat* was signed (Lyster, S., & H. R. H. Prince Philip, 1985). At this time, modern land claims had not been signed in northern Canada and Indigenous people were not involved in the development of quotas or the 1973 *Agreement on the Conservation of Polar Bears and Their Habitat*.

In preparation for implementing the 1973 agreement, in 1969, Canada created the Polar Bear Administrative Committee (PBAC). The PBAC coordinates polar bear management across Canada. In 1970, the PBAC created the Polar Bear Technical Committee. The PBTC's role was, and still is, to provide technical advice to the Polar Bear Administrative Committee (PBAC). The PBTC does not have management responsibility, and it has no direct input into polar bear research or the setting of quotas/harvest levels. The PBAC and the PBTC are both oversight committees which do not directly have

management authority. PBTC makes recommendations to the PBAC, which can be implemented through the appropriate jurisdictional authorities

In 1970, the PBTC was composed of representatives from federal, provincial, and territorial governments with polar bear management jurisdiction. The 1970 meeting produced resolutions related to harvest (tag regulation, enforcement, coordination, and administration between regions), as well as polar bear research (funding, coordination, priorities) and other diverse issues such as recommending to the PBAC that jurisdictions should take action to restrict or prohibit the harvest of cubs and mothers with cubs due to potential public and management concerns.

The PBAC oversees membership on the PBTC, based on management authority for polar bears. The signing of land claim agreements in the four Inuit regions in Canada (i.e., the Inuvialuit Settlement Region, Nunavut, Nunavik and Nunatsiavut) gave legal management authority (for polar bears and other wildlife species) to Inuit organizations and, co-management bodies, and laid out the legal requirements for inclusion of Indigenous Peoples and Indigenous knowledge in wildlife management and conservation. Currently, Inuit in Canada are represented by five comprehensive land claims agreements: the James Bay and Northern Quebec Agreement (*James Bay and Northern Quebec Native Claims Settlement Act*, 1977), the Inuvialuit Final Agreement (*Western Arctic (Inuvialuit) Claims Settlement Act,* 1984), the *Nunavut Land Claims Agreement* (1993), the *Labrador Inuit Land Claims Agreement* (2003), and the *Nunavik Inuit Land Claim Agreement* (2008).These agreements lay out the role of the Inuit, and Indigenous Knowledge, in wildlife management.

The PBTC and the PBAC considered participation from Indigenous organizations and wildlife management bodies during the 1980s and 1990s, given the now-legal basis for the consideration of Indigenous knowledge and inclusion of Indigenous Peoples in wildlife management and conservation. The PBTC minutes from this period reflect a time of rapid change. The understanding of contributions from Indigenous Peoples and co-management bodies in 1985 was framed as “management and political concerns”; by 1995 the PBTC recognized that “Aboriginal participants at meetings of the polar bear technical committee … might add useful perspectives to some of the discussions and possibly aid the development of co-management arrangements” (PBTC, 1985). This changing understanding of the contributions of Indigenous knowledge to wildlife conservation occurred in step with expanded inclusion of Indigenous organizations and co-management bodies in at the PBTC. The 1987 meeting of the PBTC included the first recorded Indigenous representation, according to past minutes. At that meeting, representatives from Anguvigaq Wildlife Management Inc. and Makivik Corporation attended as observers (PBTC, 1987). In 1990, the Wildlife Management Advisory Committee (WMAC (NWT)) requested attendance and a discussion was held on the presence of Inuit groups at the PBTC (PBTC, 1990). It was determined that co-management groups with an interest in polar bears would receive copies of the PBTC minutes and be invited as observers (PBTC, 1990). Discussions regarding attendance and membership of Indigenous groups continued for several years, according to the PBTC’s minutes.

In 2008, the PBAC approved the PBTC Terms of Reference recognizing the co-management boards from the four Inuit land claim areas as members, based on their management authority for polar bears (PBTC,

2008). The Terms of Reference also require an annual status report on polar bear subpopulations in Canada, which is produced by the PBTC and sent to PBAC for acceptance. This status report has taken the form of the PBTC Status Table and accompanying narratives for each subpopulation.

In addition to Inuit, Cree also harvest and interact with polar bears in Quebec and Ontario, as they have historically. Other First Nations and Métis also have a history of polar bear harvest; fulsome consideration of this history is beyond the scope of this paper. Cree are represented in the James Bay and Northern Quebec Agreement (*James Bay and Northern Quebec Native Claims Settlement Act*, 1977), by *The James Bay Treaty*, and by the *Eeyou Marine Region Land Claims Agreement Act* (2011). Cree in both provinces have initiated collection of their Indigenous Knowledge (Cree *kiskayndamowin*) of polar bears, and they have consistently advocated for the recognition of their knowledge and participation in polar bear management (Laforest *et al.*, 2018; Washaho Cree Nation/Centre for Northern Studies/KORI, 2010). In February 2020, the PBAC approved the membership of the Eeyou Marine Region Wildlife Board, which represents Eeyou Itschee Cree (offshore).

The PBTC is not governed by legislation or an international agreement. The Committee's work to date to include Indigenous knowledge reflects its priorities, which are set by the membership (which is determined by the PBAC. Understanding how and when Indigenous organizations and co-management boards became members of the PBTC contributes to our understanding of how PBTC has included IK in the past and what recommendations can be made going forward.

## Indigenous Knowledge and the PBTC

With the inclusion of Inuit groups and co-management partners, the PBTC has had many discussions concerning Indigenous Knowledge (previously termed 'Traditional Ecological Knowledge' (TEK) or Aboriginal Traditional Knowledge (ATK)). These conversations covered IK study methodology, validation, and more broadly how to appropriately include IK at the PBTC, specifically in the annual status report that is produced for the PBAC. In this section, we reflect upon the discussions and efforts made to date to include IK at the PBTC. The working group's aim is to be informed by, and build upon, the work that the PBTC has undertaken over many years.

In 1995, the term "traditional knowledge" appeared for the first time in the PBTC minutes, in a discussion about a workshop in Iqaluit that had been held between Inuit groups for cooperative polar bear management. The following is recorded in the PBTC minutes as an outcome of interest from the Iqaluit workshop: "All Inuit groups want TK recorded, used, and acknowledged in publications" (PBTC, 1995). The PBTC's 1995 meeting minutes include a discussion of "Aboriginal participants at meetings of the polar bear technical committee" with "the hope that this might add useful perspectives to some of the discussions and possibly aid the development of co-management arrangements" (PBTC, 1995). From 1996 onward, the attendance of co-management groups at annual meetings of the PBTC meetings was consistent, based on the PBAC's endorsement of the PBTC's perspective about adding insight to discussions and enhancing co-management.

In 2005, the term "Inuit Qaujimajatuqangit[2]" (Inuit traditional knowledge; IQ) first appeared in the PBTC minutes, when Gabriel Nirlungayuk, representing Nunavut Tunngavik Inc., noted that the "PBTC uses the best scientific information, but the Inuit of Nunavut want input from Inuit Qaujimajatuqangit to assist the committee" (PBTC, 2005). Nirlungayuk explained that IQ can inform and improve scientific methods. In the PBTC context, this is the first time that IK was presented as a form of expertise that can inform research and which should be included as part of the best available information on polar bears.

The first year there was a separate IK column in the PBTC's annual status table was 2009 (PBTC, 2009). The column was called the "Local Knowledge Assessment" and it was defined as: "Local knowledge may include information from traditional knowledge social science studies, recorded public comments and information provided by hunters, elders and the public at community consultations or interviews."

Around this time a number of discussions were occurring at the national and sub-national level about including and valuing IK in wildlife management and conservation biology. These discussions had both direct and indirect links back to the PBTC. Examples of forums where discussions took place include: the 2009 National Ministerial Roundtable on Polar Bear Management (Environment Canada, 2009), the 2011 Inuit Tapiriit Kanatami-Environment Canada workshop entitled "Gathering and Use of ATK in Polar Bear Management and Decision Making" (ITK, 2012), and the 2015 North Slope Conference (WMAC NS, 2015 unpublished material). A brief summary of these events follows.

[2] In Nunavut, Inuit traditional knowledge is referred to as 'Inuit Qaujimajatuqangit' (IQ). Inuit Qaujimajatuqangit reflects Inuit extensive knowledge and experience shared across generations. IQ incorporates cultural values, practices, ethics, and ontologies (Wenzel, 2004; Tester and Irniq, 2008). According to Karetak, Tester and Tagalik: "[IQ] is an ethical framework and detailed plan for having a good life. It is a way of thinking, connecting all aspects of life in a coherent way" (2017:3). Tester and Irniq also define IQ as "the Inuit way of doing things, and includes the past, present and future knowledge of Inuit society" (2008:49)".

***Environment Minister's Roundtable on Polar Bear Management* (Environment Canada, 2009[j]*:*** This roundtable included representatives of the territories and provinces, wildlife management boards, Inuit and other Indigenous participants, as well as polar bear researchers. Inuit Tapiriit Kanatami (2012) reported that a primary outcome of the workshop was to identify a need for an annual status report on Canada's polar bear subpopulations that was based on both scientific and traditional knowledge. The roundtable also identified a need for comprehensive collection of traditional knowledge relating to polar bears (ITK, 2012).

***Gathering and Use of Aboriginal and Traditional Knowledge (ATK) in Polar Bear Management and Decision-Making workshop, ITK and Environment Canada* (ITK, 2012)*:*** This three-day workshop included representatives of Inuit organizations, co-management, provinces, territories, and the federal government. One of two key outcomes of the workshop was a "decision to move forward to work cooperatively to create national level processes for (a) better linking ATK and western science, (b) better utilizing ATK, and (c) strengthening the conduct of ATK research and studies to aid polar bear management decision making." (ITK, 2012). Participants were supportive of an initiative to develop a national-level protocol for improving the "use and integration of ATK and science for polar bear conservation and management." The need to interrogate the tensions between scientific and traditional knowledge in a culturally sensitive, meaningful and constructive manner was recognized.

***Traditional Knowledge Day at the 2015 North Slope Conference (*WMAC NS, 2015 unpublished material*):*** The 2015 North Slope Conference was themed "Best Practices in the Use of Aboriginal Traditional Knowledge in Resource Management". A one-day workshop, titled "Questions to Consider in Assessing Confidence in Scientific & Traditional Knowledge Lines of Evidence" (WMAC NS, 2015 unpublished material) was added on to the conference to discuss the use of IK in polar bear management, specifically. This workshop included brainstorming of general principles to guide better use of IK in research and decision making, and generation of a set of questions that the PBTC could consider for establishing confidence in available information for decision making, for both science and IK.

***"TK Workshop" at the 2016 Polar Bear Technical Committee meeting* (PBTC unpublished material):** This one-day workshop included a series of presentations on topical issues and case studies, and a discussion of next steps. One outcome of the TK workshop was a working definition for TEK and draft TEK trend assessment criteria. As a result of this workshop, at its 2016 meeting, the PBTC adopted official criteria for the "TEK Assessment" column in the status table. (See text box). The PBTC status table has a row for each subpopulation and a number of columns for different status indicators, such as population estimate, historic trend, annual removals, etc. The definitions and instructions related for the already existing PBTC status table indicators were amended to reflect whether or not TEK may be used as a line of evidence in assessing those indicators.

In 2019, the PBTC adopted the use of the term 'Indigenous Knowledge' and accepted a definition of the term: "Indigenous Knowledge (IK) refers to a cumulative body of knowledge about the relationships of living beings with one another and with their environment, which is generated from the cultural practices, lived experiences and traditions of local and Indigenous Peoples." The PBTC weighs the value of IK information according to the rigor of study methodology, execution and analysis and the professional experience and judgments of Indigenous Knowledge Holders (IKHs).

As of 2019, the PBTC status table was structured with a row for each subpopulation and a number of columns for status-related information. There is a column for "IK Assessment"; the steps to fill in the "IK Assessment" as of 2019 are described below. In 2019, PBTC considered 'Future Trend' which included IK and Western science, but this category no longer exists. The other columns in the status table do not include IK. The "IK Assessment" column is directed to have a time frame of the past 15 years, or 'within the lived experience and memory of the TKHs[3].'

From the PBTC 2019 Status Table and Definitions:

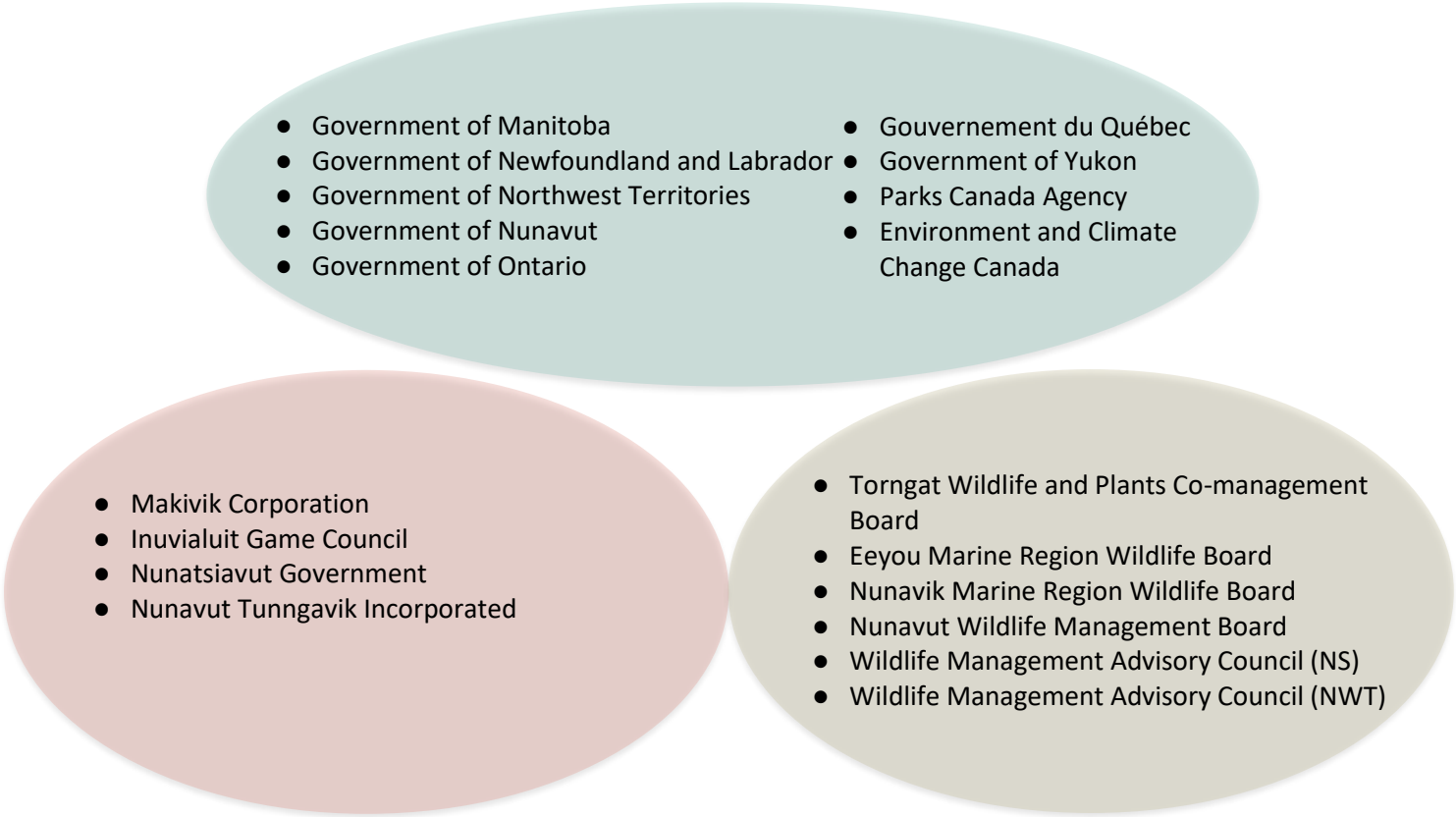
4.1 Steps for IK-based Assessment of Status

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

Compare the current IK-based population assessment of status with previous IK-based assessments (within a 10-20 year period). When a current assessment is directly comparable to a previous population assessment utilizing a consistent data collection protocol and methodology, a designation without any qualifier is made (i.e., reduced, stable or increased). If the current assessment of status is not directly comparable to the previous population assessment because of differences in study area, population attributes, methods, or is outdated, a comparison may still be made as the basis for inference. Changes from the previous assessment may include qualification (i.e., likely reduced, likely stable, or likely increased). When there is insufficient information or lack of confidence in available information to make an assessment of changes in status, the sub-population is assessed as uncertain.

[3] Traditional knowledge holders.

As of 2021, the PBTC is composed of members representing:




While co-management and Inuit membership bring IKHs to the PBTC, the use of IK in a status assessment is a wider and more complex process. More than the input of individual representatives of co-management boards, IK is a system of knowledge that is generally shared and transmitted orally, and which can be recorded, documented and shared using various methodologies. The following section explores the formats in which IK is available to PBTC and the various approaches employed to gather and document IK.

# SOURCES OF IK BEING BROUGHT TO THE PBTC TABLE OR THAT ARE EXPECTED TO CONTRIBUTE TO THE PBTC IN THE NEAR FUTURE

Across Canada, IK is increasingly being documented. Inuit organizations, in partnership with the federal government are establishing monitoring and Guardian programs that can provide real-time, invaluable climate, habitat and biological information that can inform the status of polar bear subpopulations. Different studies and programs involve different methodologies, assumptions and validation techniques. Given the threat of climate change and rapid changes to sea ice conditions, annually collected observational data provided by IKHs will become increasingly important, alongside the information that the PBTC currently considers. In order for the PBTC to include different types of IK appropriately, it is important to understand these considerations and reflect on how the Committee can accommodate a growing breadth and depth of information pertinent to understanding the status of polar bears across Canada.

The goal of this section is to provide a brief summary of the sources of polar bear-related IK collected across Canada and how this information can contribute to PBTC's annual status table. Future work may involve further analysis of the considerations relevant for PBTC associated with each category of IK study and the development of a process or structure to facilitate inclusion of IK. The Canadian Wildlife Service also keeps a comprehensive table of all IK polar bear studies conducted to date per subpopulation, as part of work conducted under the TEK Range States Working Group[4].

## COMPREHENSIVE INDIGENOUS KNOWLEDGE STUDIES

A number of comprehensive Indigenous Knowledge studies of polar bear have been completed to date. Recent examples include the Nunavik Marine Region Wildlife Board's Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears of the Davis Strait sub-population (NMRWB, 2020) and *Nunavik Inuit Knowledge and Observations of Polar Bears: Polar bears of the Southern Hudson Bay sub-population* (NMRWB, 2018), the Joint Secretariat's *Inuvialuit and Nanuq* (JS, 2015), as well as the *Labrador Polar Bear Traditional Ecological Knowledge Final Report* (York et al., 2015). These studies aim to capture the knowledge of a representative sample of polar bear experts from one or many communities, and generally involve interview and mapping methodology. They can address the types of questions that PBTC is interested in, such as historic population trend, current population trend, changes in polar bear habitat and behaviour, etc. Some of these comprehensive studies are geared specifically toward increasing the use of IK in polar bear management and decision making.

The methodology used in comprehensive IK studies varies depending on specific study priorities and objectives (e.g., studies aiming to inform management decisions versus those oriented toward heritage

[4] Available at https://polarbearagreement.org/working-groups/traditional-ecological-knowledge-tek

and cultural transmission), the individual(s) designing the study, and, in some cases, the region's IK policies or guidelines (ITK & NRI, 2006; Armitage & Kilburn, 2015). Thus far, these studies have typically involved targeting locally-identified experts to be interviewed, as well as validation by the IK holders themselves. Examination of the methods used in comprehensive IK studies is a discussion that has occurred in the past at the PBTC and warrants further exploration by this working group in future years.

It is worth noting that these studies are expensive and time consuming (a pervasive issue in polar bear research affecting Western science studies as well), which is a limiting factor which constrains the ability to have the information regularly updated by new interviews. In some studies, IKHs have expressed 'interview fatigue', which can arise when a small community, especially if it has a smaller focus group of Elders and active harvesters, is interviewed repeatedly by several organizations on the same subject, resulting in fatigue or reduced time to engage in their lives and cultural practices (for examples, see Ball & Janyst, 2008 and Pulsifer *et al.,* 2012). Coordinated deployment of large, intensive traditional knowledge studies should thus be strategic, and efforts may mitigate this effect. An additional complexity is that the organizations undertaking these studies often have limited budget and capacity.

Smaller-scale work can also occur in collaboration with academic institutions. For example, Lemelin *et al.* (2010) interviewed fifteen Cree knowledge holders on their polar bear expertise, on the direction of the Washaho Cree Nation at Fort Severn. Many university researchers conduct Indigenous knowledge work in the circumpolar regions, but their research priorities may differ from co-management needs. The research community is shifting their approaches to conducting social science research, guided, for example, by the Inuit Tapiriit Kanatami research strategy (ITK, 2019). It is possible to direct academic researchers toward co-management needs, especially as there are more regional and local efforts deployed to build guides for best practices when it comes to research conducted in Indigenous community.

### COMMUNITY-BASED MONITORING AND GUARDIANS (OR SIMILAR) PROGRAMS

Community-based monitoring (CBM) programs refers to the monitoring of indicators that are relevant to local objectives and are carried-out by local people (Thompson *et al.*, 2020). Indigenous Guardians programs (which include community-based monitoring activities across the globe) are positioning Indigenous peoples as community-based environmental stewards; Indigenous Guardians are responsible for a variety of functions, including design of environmental management plans, intergenerational knowledge sharing, and monitoring activities occurring in their lands and territories (Reed et al., 2020). These programs are generally designed, implemented and evaluated by IK holders, providing a more holistic integration of IK and a program design that is respectful and meets the management needs of the Indigenous authorities and their management partners. These programs collect and can provide "data" to management authorities and species assessment processes (of which PBTC is the latter) It is important to note that these programs provide more than just data – they are multifaceted and represent an ongoing connection between Indigenous peoples and the land.

On-the-land monitoring and stewardship programs are increasing in Canada's North. All four Inuit regions received funding in 2019 through Canada's Indigenous Guardians Pilot Program programs. Another example is the SmartICE program (https://www.smartice.org/) implemented in Canada's North, which allows Inuit to measure sea ice conditions in real time using a measuring device mounted on a sled. The SIKU (https://siku.org/about) mobile app and web platform is created by and for Inuit; it provides tools and services for ice safety, weather, and wildlife monitoring, all while prioritizing language preservation. Inuit groups may also have new or ongoing harvest studies, and, in the past, harmonization of the data being collected by these harvest studies across the Inuit regions has been brought forward at the PBTC table as a way to improve their contribution to polar bear management.

The programs that were funded in 2019 under Canada's Indigenous Guardians Pilot Program range from monitoring environmental disturbances and wildlife species, to training and support for young harvester development, as well as supporting community and visitor engagement in conservation efforts.

It is expected that some of these community-based monitoring and Guardians programs will provide annual reporting that can contribute to the PBTC's annual status report. There is a wide range of information that could contribute to our understanding of polar bear status – observations of bears themselves, species that bears interact with, climate and habitat observations, reporting on human-bear conflict, etc. The collection of this information will likely rest with Guardians/CBM staff who are trained in social science methods, but the scope of the work can vary depending on local priorities and capacities. SmartICE and other environmental monitoring efforts may contribute to a complementary source of data to remotely sensed data, to help the PBTC understand recent changes to, and trends in, polar bear habitat. As these programs evolve and expand across Canada and the world, the quantity and quality of data they store will continue to improve.

The specific programming and methods used for these community-based monitoring programs vary by region. Therefore, the important considerations for IK brought to the PBTC from these types of programs will be context-specific. A thorough examination of important considerations related to community-based monitoring programs will be an important piece of work for this working group, and the PBTC, to explore in future years. Preliminary considerations include:

- The IK being collected through these programs must be validated and shared in culturally appropriate ways that will be specific to each region and program;
- The information collected by these programs will be driven by information needs and priorities set by regional Inuit management authorities and management partners; this context will be important for how the PBTC incorporates these data; e.g., what is the geographic and temporal extent of data being collected, if information is being gathered on productivity, is it differentiating between cubs of the year and yearlings, etc.
- The PBTC has the opportunity to consider how data (both scientific and IK) collected through various community-based monitoring programs fits into the structure of the annual status report, and if changes are needed to better accommodate this type of information.

### APPROACHES THAT INVOLVE BRIDGING OR COMBINING INDIGENOUS KNOWLEDGE AND WESTERN SCIENCE

It is widely recognized that bridging[5] IK and Western scientific knowledge (hereafter referred to as 'science') in the context of wildlife research and management can lead to an improved understanding of the entire ecosystem, often at multiple temporal and spatial scales, thus leading to improved decision making (Ban et al., 2018; Berkes, 2016; Bohensky & Maru, 2011; Eckert, Ban, Frid, & McGreer, 2018). That said, there are also notable difficulties in respectfully, appropriately, and effectively using or applying the two sources of knowledge in co-management systems (Bohensky & Maru, 2011; Henri, 2012; Huntington, 2000; Nadasdy, 1999, 2003). One example of an approach to braiding IK and Western science for polar bears is York *et al.* (2016), which compares the IK and Western science available for various polar bear subpopulations. It is beyond the scope of this paper to provide a fulsome discussion of approaches to bridging IK and Western science, however a preliminary reading list is included in the Appendix 2.

Recently, there have been increasing efforts to include IK in polar bear population models, a framework based in Western science. This is not the same as bridging the two knowledge systems for one outcome. Rather, this approach explicitly targets bringing IK into a Western science space. For example, a pilot study was conducted for the Chukchi Sea polar bear subpopulation, wherein IK was gathered with the specific intent being included in an integrated population model;. We refer readers to the discussion sections of Braund et al. (2018) and Regehr et al. (2018) for further information. Efforts are ongoing to take what was learned from this pilot study and apply it to the Southern Beaufort and Northern Beaufort subpopulations.

### PUBLIC HEARINGS, CONSULTATIONS AND COMMUNITY MEETINGS

Opportunities for Indigenous knowledge holders and communities to comment on impending wildlife management decisions or provide IK in a public forum can provide an additional source of IK to the PBTC when meeting records are made readily available. There are different contexts for soliciting public feedback – community meetings, public hearings, and consultations by government are three common examples.

Depending on the forum and context, different considerations are important for the PBTC when using this type of IK. Generally, information volunteered in a public forum is not validated in a formal way, but there may be informal validation by other individuals present. Selection bias is another important consideration – who attends these meetings and who volunteers to speak. Individual comments cannot be expected to represent entire communities or regions, and there is variation in the information presented depending on who organizes, facilitates and attends the meeting. Whether the meeting is focused on polar bears or wildlife in general, and what questions are being asked of the attendees, are all relevant pieces of context.

[5] The terms 'Bridging', 'weaving', and 'braiding' IK and Western Science are used interchangeably in this paper; see Alexander *et al.* 2019 for further discussion.

A benefit of the PBTC considering meeting/hearing records is that information provided can be more up to date and recent than information included in studies that sometimes take years to be published. Meeting/hearing records will likely need to be considered on a case-by-case basis, and the organization/jurisdiction submitting that information to the PBTC can help guide the discussion about validation, although ability to do so is limited because only the PBTC membership attends the closed session where the status table is populated. Below, we provide a brief treatment of the three examples of meetings/hearings listed previously:

- *Canadian Wildlife Service community meetings to consult on proposed changes to the Species at Risk Act:* Individual and community levels of trust in government may influence participation and what type of information is shared. The context for these meetings is how proposed species at risk legal listings (e.g., the polar bear as a species of 'special concern') may impact community members and rights-holders. These meetings are not aimed to be ecological information gathering exercises, although valuable IK may be shared.

- *Public hearings:* Public hearings are part of some land claim structures, and may be a more formal venue for information sharing and gathering. Hearings may be on a wide variety of topics, including wildlife ecology and management or on a very specific issue, e.g., a Total Allowable Take for a given polar bear subpopulation. When used in an appropriate way, information from meeting records can also guide further questions for both IK and scientific research studies, and meaningfully advance knowledge. Understanding the context for the hearing is therefore essential to appropriately use the information and IK shared amongst the parties to the hearing by any organizations including the PBTC.

- *Other community meetings:* Co-management Boards, Inuit organizations, government and others may hold community or regional meetings to solicit recent environmental observations. As above, understanding the context of the meeting is an important consideration when assessing whether and how to use meeting records as relevant sources of IK.

## EXAMPLES OF STATUS ASSESSMENT PROCESSES THAT INCLUDE IK

The PBTC's most important annual output is the status report. While the PBTC status reports are less extensive than the examples below, it can be helpful to review how other processes incorporate IK. This section describes other status assessment processes which also formally include both IK and science. This could provide examples for the PBTC to follow, or pitfalls to avoid, when considering its inclusion of IK. Each example is split into a summary of the process and key takeaways for the PBTC. This is a preliminary treatment, and further consideration is warranted by the IK working group, and the PBTC.

### INTERNATIONAL EXAMPLES

A number of international assessments relating to climate, environment and biodiversity have made efforts to incorporate IK. It is out of the scope of this paper to summarize and present takeaways from these international assessments. We instead provide references to reviews of the application of IK in these assessments.

- The **International Panel on Climate Change** includes IK in its assessments. Ford *et al.* (2016) provided a critical review of IK incorporation into the fifth IPCC assessment.
- The 2014 **United States National Climate Assessment** included IK. A review by Maldonado *et al.* (2016) assessed the incorporation of IK and provided broad recommendations for inclusion of IK in future climate-based assessments.
- The **Convention on Biological Diversity** and **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services** both aim to weave IK and local knowledge with Western scientific knowledge. Tengo *et al.,* (2017) wrote a critical review of the inclusion of IK in these fora.
- The **International Union for the Conservation of Nature** undertakes science-based status assessments for species globally (the IUCN 'Red List'). In recent years they have considered how to better incorporate Indigenous knowledge. The Traditional Knowledge and Community Engagement working group[6] is undertaking this work.

[6] https://www.iucn.org/commissions/commission-education-and-communication/our-work/traditional-knowledge-and-community-engagement

## Committee on the Status of Endangered Wildlife in Canada

**Summary:** Under the federal *Species at Risk Act* (2002) the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) is mandated to assess the status of species through an independent and transparent assessment process, using the best available scientific knowledge, community knowledge, as well as Aboriginal and Traditional Knowledge (ATK; legal term employed by the COSEWIC and used instead of IK in this subsection). The Act outlines that all sources of knowledge, including ATK, must be used when they are available. There are two ways that Aboriginal Traditional Knowledge can be included in COSEWIC status assessments:

The first is through the Aboriginal and Traditional Knowledge Subcommittee (ATK SC), comprised of six to ten members and two co-chairs. The two co-chairs are voting members on COSEWIC. In addition, a member of the ATK SC sits on all of the other specialist subcommittees. The ATK SC has limited capacity and only searches for all available ATK information for selected species (COSEWIC 2019). The ATK SC also reviews the ATK included in the assessment to ensure that it is relevant for the assessment and is properly and accurately included in COSEWIC status reports (COSEWIC 2019). There are COSEWIC ATK process and protocols guidelines for gathering ATK from communities, but there is not usually the funding and capacity for the ATK SC to collect new ATK using these protocols, certainly not for the vast majority of species (IGC, 2019, p. 15).

The second way that ATK is included in status reports is through the status report review process. In the authors' experience, Wildlife Management Boards (WMBs; which the *Species at Risk Act* defines to include co-management boards established by lands claims, and all-Indigenous management organizations such as the Inuvialuit Game Council and Renewable Resource Councils) may be aware of IK sources that were previously missed, especially for species of high cultural value.

### Key Takeaways:

- COSEWIC status reports weave ATK and science information into one report, at the authors' discretion. Similar to the PBTC, the COSEWIC process brings ATK into a scientific framework for reporting and assessment, and the authors of COSEWIC status reports may lack training in ATK gathering methods or expertise in writing about ATK.
- The question of what exactly are ATK methods or how to appropriately include ATK is, of course, a question that has been discussed for years by the PBTC and is the reason this working group exists. COSEWIC and other groups are grappling with this issue as well. See Cross et al. (2017) and Appendix 1 for other relevant sources.
- COSEWIC status reports rely upon 'available' ATK which generally means accessible published studies. However, much ATK is not in this format; it may take the form of audio tapes, unpublished transcribed interviews, databases with strict data sharing protocols, etc.
- The COSEWIC process is very time consuming both for COSEWIC members and WMBs. Appropriately and adequately involving WMBs in the species assessment process has been an ongoing issue with capacity struggles for both the ATK SC and WMBs. Capacity for WMBs is an ongoing issue that affects their contributions to the PBTC as well.

## Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea

**Summary:** The Inuvialuit-Inupiat Polar Bear Management Agreement in the Southern Beaufort Sea is a user-to-user agreement that was signed in 1988 between the Inuvialuit in Yukon/NWT and Inupiat in Alaska. The objectives of the agreement are to: maintain healthy viable polar bear populations; manage polar bear on a sustainable yield basis; provide increased protection for females; minimize detrimental effects of human activities; identify research priorities; and make recommendations for research and management. The Commissioners of the agreement are appointed by the Inuvialuit Game Council in the Inuvialuit Settlement Region and the North Slope Borough in Alaska. The Commission meets annually. The meeting includes an open session which includes the Commissioners and technical advisors (including co-management, government scientists and other experts). After this, the Commissioners meet privately and generate a list of recommendations for the Southern Beaufort Sea subpopulation. These recommendations refer to research, monitoring, harvest monitoring, and management.

### Key Takeaways:

- In this model, the Commissioners rely on their own IK expertise, IK collected by their organizations, and consider the presentations from technical TK and scientific experts to formulate a set of management recommendations.
- In this user-to-user agreement, the roles of TK and scientific knowledge are significantly different than other co-management situations: the Commissioners retain the decision-making authority, and are informed by scientific information upon request. Scientific knowledge is valued for the insight it provides, but it is not the first line of evidence for assessing the population status and health of Southern Beaufort polar bears. There is emphasis on how the animals are valued, used, and observed by the user groups.
- This is one of the few examples available where scientific information is incorporated into a traditional knowledge system to develop management recommendations. The Inuvialuit-Inupiat Commissioners develop their recommendations as they see fit, without written protocol.

## Species at Risk Committee for the NWT

**Summary:** Legislated under the *Species at Risk (NWT) Act*, the Species at Risk Committee (SARC) is the independent body of experts which assesses the status of NWT species. The SARC members are nominated by the Government of Northwest Territories (GNWT) and the WMBs in the NWT. As a result, SARC is made up of a mix of IK/CK experts and those with scientific backgrounds (GNWT 2013b; Indigenous and Community Knowledge [IK/CK] is the term employed by the SARC and is used instead of IK in this subsection). The *Species at Risk (NWT) Act* requires that the SARC carries out its functions "on the basis of the best available information, including Aboriginal traditional knowledge, community knowledge and scientific knowledge" (reference for quote?).

The SARC follows the same general process as COSEWIC, where a status report is developed and reviewed by WMBs and others before SARC ultimately assesses a species. The species status report is meant to capture the "best available information", and all assessments are made on the basis of the information contained in the report. Where SARC diverges from COSEWIC is that species status reports are prepared in two separate components when enough published TK/CK information is available. There is the scientific component, and the IK/CK component. Separate contractors with specific expertise are hired for each component, and each component has its own set of content guidelines, although the broad topics are the same. SARC status reports also separate TK/CK and scientific knowledge in the executive and technical summaries. The IK/CK component primarily relies on published research, but also regularly cites communications with expert IK/CK holders, as well as other documents such as meeting notes from wildlife co-management bodies, minutes from hearings, etc. There is a provision for SARC to use sensitive IK/CK in its assessment that is not included in the publicly available species status report.

SARC completed a major revision to its Indigenous and Community Knowledge guidelines in 2020 (SARC, 2020). The IK/CK guidelines now include more room for information that the previous guidelines may have left out, including biocultural information and

### Key Considerations:

- Separating all IK/CK information has its benefits, but also drawbacks. Unlike the PBTC, SARC status reports seek IK/CK on the same broad topics as the science component of the report (e.g., population, distribution, habitat, threats, search effort, etc.). In the status table, the PBTC summarizes the information in one 'holistic' IK column and includes further IK information with scientific information in the subpopulation narratives. The PBTC could consider assessing different indicators (e.g., those listed above) of polar bear status using IK, within the status table or in a separate narrative format.

- It is also worth noting that a key factor in separating IK/CK information from scientific information in the SARC status report is that that the information from the different knowledge systems is not compared and contrasted within the text. Doing so carefully could lead to highlighting similarities, complementarities but also gaps and differences across knowledge systems – a process that can be useful for supporting status assessment. The SARC ultimately bridges the IK/CK during the species assessment. It's important to ensure that the bridging step is conducted with caution and sensitivity.

specific information on relationships with people and other species. Rather than strictly mirroring the scientific guidelines, the 2020 guidelines attempt to structure the report in a more Indigenous-specific (and flexible) way. The IK/CK reports are now expected to take a “biocultural approach” in accordance with Article 8(j) of the Convention on Biological Diversity, which recognizes the importance of Indigenous knowledges and ways of life in the conservation of biodiversity and recognizes the role of Indigenous land management in conserving biodiversity.

## Key Considerations:

- There may be limitations in the inclusion of IK, and bridging it with Western science, if there is a lack of published IK/CK information. Sometimes only one status report component is present because there is insufficient information in one or the other knowledge system. Since IK/CK is, in many cases, a set of oral knowledge systems, the fact that it must be translated into published data and a written report is an inherent barrier common to status assessments everywhere. Insufficient published IK information does not necessarily reflect a lack of knowledge in communities.

- Ultimately, the SARC assessment process is still incorporating IK/CK into a science-derived framework, and even with separate ‘components’ there is the risk of losing valuable contextual information.

## Advisory Committee for Cooperation on Wildlife Management

**Summary:** The Advisory Committee for Cooperation on Wildlife Management (ACCWM) was established to "exchange information, help develop cooperation and consensus, and make recommendations regarding wildlife and wildlife habitat issues that cross land claim and treaty boundaries" (ACCWM, 2014). The committee includes the Chairpersons (or alternate appointees) of six Wildlife Management Boards in the NWT and Nunavut, with technical support provided by the GNWT.

In response to reported population declines, the ACCWM developed a plan for the Cape Bathurst, Bluenose-West, and Bluenose-East barren-ground caribou herds – *Taking Care of Caribou* (ACCWM, 2014). *Taking Care of Caribou* established an agreed-upon framework for assigning a population status to each herd and recommending management actions based on the status. The ACCWM meets annually to discuss the status and management of the three herds and at this meeting the best available scientific, traditional, and community knowledge is presented.

At the annual ACCWM meeting, each member organization has the opportunity to present information to the ACCWM. This presentation often includes TK/CK collected over the past year by the co-management body. The GNWT also presents scientific information collected about the three herds from the past year. Unlike other examples in this section, the public can attend certain parts of the ACCWM Annual Status Meeting and provide comments. The ACCWM uses all information presented to decide upon a status for each herd. Following the meeting, an Annual Status Meeting Report is produced which reports upon the information used to decide the status. The 'status table' summarizes this information using separate columns for scientific information and TK/CK. The Report also includes the ACCWM's status assessment, reasoning, and management recommendations (such as determination of a total allowable harvest for each herd when appropriate). The ACCWM does not yet have published guidelines for the annual collection of TK/CK and its inclusion in the Annual Status Meeting and Annual Status Meeting Report.

### Key Considerations:

- The TK/CK information included in the Annual Status Meeting and following Report is geared toward observations from the past year made by harvesters and other users of the land that encounter these caribou. If this information is collected in a repeatable, standardized method by the participating Boards, it provides an ongoing record of recent change to the caribou herds and environment. When considering its own inclusion of community-based monitoring data, the PBTC could look to ACCWM for how they incorporate this type of information and the considerations they apply.

- The ACCWM uses both sources of information equally, according to the Taking Care of Caribou Management Plan. However, there is not yet a standardized method for how exactly the information is weighed and reviewed during the Annual Status Meeting in order to lead to one status assessment for each herd.

- The ACCWM generates a written record to document the supporting information, and reasoning for their annual status assessment. This is in line with other status assessment processes and is a best practice for species assessment.

# Discussion and Considerations

Although we have summarized the types of IK available (or anticipated to soon be available) to the PBTC, as well as others that are incorporating IK and science as lines of evidence (formally or not), there are some important considerations that the authors felt deserved their own treatment. The PBTC itself is a committee formed by the PBAC, during a time when the western scientific tradition was dominant and, before the settlement of modern-day land claims. This occurred before IK was broadly recognized and valued as a stand-alone knowledge system by academia and government. For a number of years, the PBTC consisted only of scientific experts. Indigenous knowledge experts regularly attend the PBTC meetings now, along with representatives from co-management and Indigenous organizations, who may or may not be IK experts or trained in social science methods. While representatives from Indigenous organizations cannot represent all the knowledge of their communities, their input and perspectives come from expertise in a knowledge system which is different but of the same caliber as the expertise of experienced individual researchers (natural and social scientists included). Since the knowledge systems differ, effort must be made by all parties to learn about and value the expertise of the other. With appropriate inclusion of the diverse forms of knowledge being brought, the PBTC status table can lead to a more holistic understanding of the status of Canada's polar bear sub-populations and can strengthen the advice provided to PBAC. The rest of this section presents a set of overarching considerations for PBTC's inclusion of IK in its annual status reporting process. This section is meant to be a starting point to foster discussion.

## Concept of Multiple Lines of Evidence

Scientific research and IK studies can, and often do, ask the same questions, but go about seeking answers in vastly different ways. The answers are not always in agreement. It is important to treat both lines of evidence (provided the methods and validation are sound) as "complementary or parallel rather than fundamentally incommensurable" (Bohensky & Maru, 2011, p. 6). This means that, rather than comparing the IK information with Western scientific information in order to assess its 'validity', it is important to understand that IK work has its own culturally appropriate norms and forms of validation, and it should be considered as a separate, and equally valid, line of evidence with different methodologies, approaches, and benefits (Snively and Corsiglia, 2016). Misunderstandings of this concept can lead to situations where IK is included only superficially to confirm scientific findings, or when it fits easily into the scientific structure (Huntington, 2000). Rather than using the two knowledge systems to cross-validate one another, a 'triangulation' approach can be used, to examine where the common ground may be and explore what may be causes of difference (Kutz and Tomaselli 2020; Mistry et al. 2016; Tengo et al. 2017).

Rather than using the two knowledge systems (Western Science and Indigenous Knowledge) to cross-validate one another, a 'triangulation' approach can be used, to examine where the common ground may be and explore what may be causes of difference (Kutz and Tomaselli 2020; Mistry et al. 2016; Tengo et al. 2017).

IK can contribute directly to polar bear management as a unique source of knowledge (Henri et al., 2010). If scientific findings and IK do not match in a particular situation, it does not necessarily mean that one source is incorrect; it could mean that the perspectives, lines of evidence, research questions, or spatial and temporal scales from which ecological observations are derived are different. Differences between science and IK can, in fact, illuminate areas of particular ecological complexity that require further investigation, thus improving methods, refining questions, and, if followed up on, expanding overall knowledge of an ecosystem or species (Turner, 2018; Schmidt and Stricker, 2010; Kutz and Tomaselli, 2019). These types of observations can help Western scientists plan for population surveys. One example of this is IKH observations of changes in polar bear distribution (e.g., as recorded in Dowsley, 2005 and York *et al.,* 2015), which can help Western-based scientists plan for future abundance estimates. There are many other ways that IK can provide important ecological insight. Bohensky & Maru (2011) discuss this issue in much greater detail, and state that "[a]n understanding of similarities and differences between IK and scientific knowledge, and the benefits and challenges of integrating these different knowledge systems, is considered by some to be a prerequisite to knowledge integration" (2011, p. 4).

Differences between science and IK can, in fact, illuminate areas of particular ecological complexity that require further investigation, thus improving methods, refining questions, and, if followed up on, expanding overall knowledge of an ecosystem or species (Turner, 2018; Schmidt and Stricker, 2010; Kutz and Tomaselli, 2019).

As noted above, there is also a suite of ever-developing methods for appropriately and effectively bridging the two sources of knowledge. Arguably, the PBTC, like many other assessment bodies which combine several knowledge sources, would benefit from regularly revisiting a basic understanding of the two knowledge systems the Committee is now working with, or approaches for weaving them. There are multiple ways to go about weaving, or bridging, IK and Western science. Presenting the two bodies of knowledge side by side is a first step in a sensitive, complex process. Further to this, a second step involves weaving the two bodies of knowledge together to come up with a unified decision on status (such as the NWT Species at Risk Committee does). This is a much more delicate and complex exercise, involving 'weighing' of evidence (implicit or explicit). The PBTC currently does the first step; the PBTC could very carefully consider its capacity, responsibility and willingness to undertake the second step. There are benefits and drawbacks to both approaches. Their designation as 'first' and 'second' steps only refers to the degree of weaving involved, not whether one is better than the other. As always, appropriateness is context-dependent. The appendices to this paper provide a preliminary reading list that can further illustrate this discussion.

## MULTIPLE KNOWLEDGE SOURCES AND APPROACHES TO VALIDATION

As described previously, there are multiple methods to gather and mobilize Indigenous knowledge. When considering recorded IK, it is important to consider the methodology that was used to gather and interpret that knowledge. For example, an extensive and rigorous Indigenous knowledge study, heavily verified and grounded in social sciences methodologies and community verification, is quite different than individual comments captured in meetings or consultation reports. While both sources are valid, relevant, and useful, it is important to consider how the information was collected, the sample size, the timeframe and location of observations, and the methods of validation and interpretation. It is also important to keep in mind that social sciences mobilized toward the production of IK studies have protocols, practices and methods that may differ from the natural sciences – there are different assumptions, sources of bias, and ways to evaluate the rigour of a specific social sciences study (and these considerations warrant an expanded treatment that is outside of the scope of this paper). Furthermore, IK should not be evaluated based on scientific paradigms; rather, "it requires engagement in meaningful dialogues that enable different knowledges to interface" (Kutz and Tomaselli, 2020, p. 1136; Bohensky & Maru 2011; Gratani et al., 2011; Mistry et al., 2016). When weaving multiple lines of evidence and working with diverse knowledge systems, validation or evaluation of knowledge should occur within rather than across the contributing knowledge systems (Tengö et al., 2014). The PBTC has discussed the issue of validation in the past; recommendations on this topic were generated from the 'Traditional Knowledge Day' at the 2015 Yukon North Slope conference – for now, we refer the reader to that report.

While social science methods to gather Indigenous knowledge have their own rigorous set of protocols and peer review processes, it is important to also consider that IK is a complete oral knowledge system which itself includes peer review. The information itself has been gathered through repeated, systematic observation in a fulsome biological context, and verified as an oral knowledge source in each community it arises from. As with all knowledge systems, there is variation between and among communities and cultures. Indigenous knowledge can be verified through storytelling, rituals, practice, and other methods (Tengo *et al.,* 2017). An expert who gathers IK is not the same as an IK holder, and both are essential in this process of braiding knowledge types for status assessment. Social science methods like grounded theory and inductive analysis are growing in the field; these methods allow for themes to emerge during interviews from the more complex whole that a knowledge holder shares, rather than the interviewer or interpreter targeting for specific pre-determined themes or questions. Recording and documenting IK as a practice has its own protocols and best practices, separate from how IK itself is generated, verified and transmitted.

## INUIT CONCEPTS OF PREDICTION

Many species status assessment bodies (e.g., IUCN and COSEWIC) consider not just explanation of past trends and present conditions, but also future prediction. In 2019, the PBTC also considered 'future trend' but has since removed this aspect of its annual status assessment. Much of current focus of the Western scientific community involves developing predictions given appropriate assumptions and adequate data.

Indigenous cultures approach the concept of future prediction in unique ways that are non-homogenous. In some ways, prediction is a central part of IK – for example, IKHs make predictions about where to find bears when they participate in harvest activities, and they also employ prediction in choosing safe travel routes throughout the year. Yet, at times, IKHs may be reluctant to predict the future for polar bears. One example we can provide comes from the book Inuvialuit and Nanuq (JS, 2015). Inuvialuit IKHs interviewed in this book expressed caution about predictive and speculative statements about the future of polar bears. From their perspective, these statements did not sufficiently acknowledge the complexity and interaction of factors affecting polar bear ecology. A brief exploration of certain Inuit philosophies surrounding planning, prediction and uncertainty, and how those concepts resist being pulled into Western scientific models, is provided in Bates (2007) based on his experience with Inuit in Cambridge Bay.

The above paragraph shares limited examples of a very complex subject. The PBTC can take its experience considering 'future trend' for polar bears that has been informed by careful consideration of the available science and apply these valuable considerations when considering how IK may or may not speak to future prediction. The PBTC has had numerous discussions about how to include IK, as noted in the History section. The PBTC's decision to stop assessing future trend in the status table, while not solely made in consideration of Indigenous biocultural understanding of prediction, was a respectful way to acknowledge that, in both knowledge systems, prediction with regards to polar bear populations is very complex and has limited feasibility for many different reasons.

### BARRIERS

In addition to the above considerations, there are a number of barriers to the appropriate inclusion and valuation of IK at venues like the PBTC and other assessment processes. These barriers include not only what occurs at the PBTC, but what might prevent IK from making it to the PBTC for consideration. A list of potential barriers includes the following:

- ***Participation****:* inclusion can be a barrier to inclusion of IK in status assessment and other frameworks. The individuals and organizations that decide upon attendance in wildlife species assessment forums can use this power to decide who gets a voice, which influences how IK is framed and discussed, and how much weight is—implicitly or explicitly--given to different ways of knowing. The PBTC has included Indigenous voices (as members or observers) since the 1980s and as discussed in the history section, expanded participation has occurred in step with discussions of the contribution of IK to the PBTC and to wildlife conservation more broadly. The PBTC still regularly discusses participation, indicating a desire to listen to a diversity of voices and sources of knowledge relevant to polar bears. Participation is an ongoing matter of great importance in wildlife species assessment and other similar frameworks (e.g., see Zurba & Papadopoulos, 2021 for further discussion), and the PBTC is an example of how participation can legitimize and bring recognition to the strengths of IK.

- ***Funding:*** To date, funds have been insufficient for comprehensive and ongoing IK research programs across Canada, despite a shared acknowledgement of their importance (ITK, 2012). This limits the availability of IK for use by the PBTC and other polar bear management/assessment bodies and processes. Funding can also limit the participation of Indigenous Knowledge holders at the PBTC, because the PBTC does not have funds to pay travel costs; this can limit the participation of invited specialists such as IK holders.

- ***Capacity:*** Indigenous and co-management organizations often lack capacity, whether it is funding, staffing, or both. As Indigenous and co-management organizations (as well as IK holders themselves) are increasingly being included in sub-national, national and international processes, the workload for these organizations grows. Often this growth has outpaced these organizations' requirements for increased funding to accommodate the new workload. With limited capacity, staff and Board members must make difficult decisions about where to invest their time, money and effort.

- ***Language barriers:*** For many IK experts, English is not their first language. Some Elders with valuable knowledge may not speak English fluently. This language barrier, for meeting attendees, can result in a reluctance to speak up. Overcoming a language barrier in IK studies and to support the meaningful involvement of IK experts in polar bear status assessment processes involves an added cost. As well, it is important to ensure that not just the language is translated, but that the meaning itself is appropriately conveyed when translating IK from Indigenous languages to English. A second language-related barrier is the technical language used when talking about polar bears. Polar bear science has its own set of technical terms that may or may not translate well into Indigenous languages (e.g., the concept of 'subpopulations'). Similarly, IK is rooted in Indigenous languages and IK experts employ very specific polar bear terminology that requires care and resources in order for full meaning and context to be translated and conveyed into English (see Joint Secretariat, 2015 for an example of this).

- ***Legacy of harm:*** As addressed in ITK's National Inuit Strategy on Research (2018) and numerous other fora, there is a legacy of harm done by outside researchers and institutions accessing, interpreting, and publishing Indigenous Knowledge without Indigenous informed consent, clear communication of how the knowledge will be used and disseminated, and permission (CIHR, NSERC and SSHRC, 2018). This legacy alone can leave Inuit and other Indigenous peoples disillusioned with and reluctant to take part in IK research projects or share their IK in other fora. It can also leave Indigenous governance organizations wary of sharing their data with government and other institutions based in western structures of knowledge. The principles of access, ownership, and control of data which underlie Indigenous data sovereignty require discussion (First Nations Information Governance Centre, 2014). Governments, Indigenous organizations and researchers are increasingly taking action worldwide to put the management of Indigenous knowledge back in the hands of Indigenous peoples and organizations and implement Indigenous data sovereignty (ITK, 2018).

## CONCLUSION AND SUGGESTED PATH FORWARD

In this paper, we provided context for the inclusion of Indigenous participants and IK at the PBTC, discussed various sources and formats of documented IK, considered how IK is being used in different species status assessment processes, and presented overarching considerations. The aim of this paper is to provide relevant background information for understanding how the PBTC has included IK thus far and to lay the foundation for future work. The background information includes considerations of inclusion of Indigenous organizations and wildlife co-management bodies at the PBTC, as representation and structural context are intertwined with how different ways of knowing are recognized and included. Representation has also changed over the many decades since the PBTC was formed, and as the membership expanded, so did the topics of discussion covered in historic meeting minutes of the PBTC. Representation is also critical for understanding what the PBTC can do going forward to build upon how it currently includes and considers IK.

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# APPENDIX 1. ADDITIONAL RELEVANT SOURCES

*The following list presents some additional relevant references specifically on the topic of Indigenous knowledge & knowledge bridging:*


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