Use of traditional knowledge by the United States Bureau of Ocean Energy Management to support resource management

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Abstract

Professionals who collect and use traditional knowledge to support resource management decisions often are preoccupied with concerns over how and if traditional knowledge should be integrated with science. To move beyond the integration dilemma, we treat traditional knowledge and science as distinct and complementary knowledge systems. We focus on applying traditional knowledge within the decision-making process. We present succinct examples of how the Bureau of Ocean Energy Management has used traditional knowledge in decision making in the North Slope Borough, Alaska: 1) using traditional knowledge in designing, planning, and conducting scientific research; 2) applying information from both knowledge systems at the earliest opportunity in the process; 3) using traditional knowledge in environmental impacts assessment; 4) consulting with indigenous leaders at key decision points; and 5) applying traditional knowledge at a programmatic decision level. Clearly articulating, early in the process, how best to use traditional knowledge and science can allow for more complete and inclusive use of available and pertinent information.

DOI: 10.5817/CPR2017-2-15

Key words: Adaptive process, consultation, decision making, environmental impact analysis, indigenous knowledge, mitigation, North Slope Borough, scientific research, subsistence

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Received May 30, 2017, *accepted* November 3, 2017.
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Acknowledgements: We thank Dee Williams and Michael Burwell for their contributions to BOEM's application of traditional knowledge. The authors thank Martin Bryne for his help in producing the figures; Emily Lindow and Timothy McCune of the BOEM International Office for their assistance in helping to arrange for the presentation of this paper at the Arctic Science Summit Week 2017 in Prague; Walter Cruickshank, Acting Director, BOEM, for reviewing the manuscript; and our BOEM scientists, analysts, managers, and decision-makers for their openness to use traditional knowledge. We thank BOEM for providing support and travel funding for James Kendall and Guillermo Auad to attend and present at the Arctic Science Summit Week 2017 in Prague. We offer a special thank you to our Alaska Native partners for their patience and understanding in helping us understand and appropriately use their traditional knowledge. The authors thank two anonymous peer reviewers for their helpful suggestions, which greatly improved the quality and readability of the manuscript.

List of abbreviations: ANCSA – Alaska Native Claims Settlement Act, BOEM – Bureau of Ocean Energy Management, EIS – environmental impact statement, ESP – Environmental Studies Program, GPS – global positioning system, ICAS – Iñupiat Community of the Arctic Slope, ICC – Inuit Circumpolar Council, MMS – Minerals Management Service, NEPA – National Environmental Policy Act, NOAA – National Oceanic and Atmospheric Administration, OCS – Outer Continental Shelf, OCSLA – Outer Continental Shelf Lands Act, USDOI – United States Department of the Interior

Introduction

Alaska Native peoples in the United States Arctic have voiced concerns regarding past and potential future effects of oil and gas exploration and development activities on subsistence resources and their way of life (*e.g.* Galginaitis 2016). They expressed concerns that anthropogenic noise from seismic exploration, vessel traffic, aircraft, and drilling disturbs whales and other marine mammals, causing them to deflect their movement patterns farther out to sea (*e.g.* Huntington et Quakenbush 2009, Galginaitis 2014). This can result in more expensive and dangerous subsistence hunting trips during which subsistence hunters may be exposed to greater risks due to rougher seas, shifting ice, shipping traffic, and stronger offshore currents (ICAS 2012). More time and fuel are expended for hunting at greater than usual distances. Alaska Native peoples are concerned that oil spills, even if the probability is low, could taint or damage wildlife resources used for subsistence purposes and cause hunters and fishers to avoid contemporary harvest areas (Braund 2013).

Resource professionals have combined traditional knowledge and science to monitor and manage marine environments (Thornton et Maciejewski Scheer 2012). In Alaska, Huntington (2000) described the bowhead whale population census, the Alaska Beluga Whale Committee, and monitoring herring recovery after the Exxon Valdez oil spill. However, residents of the North Slope Borough[1] have voiced concerns that their traditional knowledge of marine environments and subsistence resources is not regularly considered and applied to energy development decisions that can affect their lives.

Scientists and managers can be preoccupied with concerns over how and if traditional knowledge should be integrated with scientific information because traditional knowledge is grounded in an indigenous worldview and scientific knowledge in a western worldview (*e.g.* Nakashima 1990, Stevenson 1996). We see this as an unnecessary dilemma and debate over integration of relatively distinct knowledge systems. Similar to Stevenson (1996), the United States Bureau of Ocean Energy Management (BOEM) treats traditional knowledge and science as distinct complementary knowledge systems and equally valuable for informing management decisions. This conceptualization allows BOEM to move beyond the integration debate and firmly establish a practice of decision making for responsible development of the United States Outer Continental Shelf (OCS)[2].

The purpose of this paper is twofold: 1) describe how BOEM has defined traditional knowledge and 2) present examples of how traditional knowledge, with science, has been applied to inform BOEM's decision-making process. The expected outcomes of using both traditional and scientific knowledge include: improved decision-making through more complete and inclusive application of the available information and increased involvement of people in resource management decisions that may affect their way of life.

Background

The mission of the BOEM is to manage development of energy and mineral resources in the United States OCS in an environmentally and economically responsible way. The OCS off the coast of Alaska encompasses more than one billion acres in the Beaufort Sea, Chukchi Sea, Bering Sea, Cook Inlet, and Gulf of Alaska (*see* Fig. 1). BOEM's Environmental Studies Program (ESP) was initiated in 1973 to support the USDOI's decisions on oil and gas leasing (Williams 2009). Subsequently in 1978, the ESP was incorporated into law. Section 20 of the Outer Continental Shelf Lands Act (OCSLA) confirms BOEM the authority to develop and oversee research to inform environmental review, management, and policy decisions for development of resources of the OCS. Research supported by the ESP spans physical, biological, economic, and sociocultural disciplines (Williams 2009).

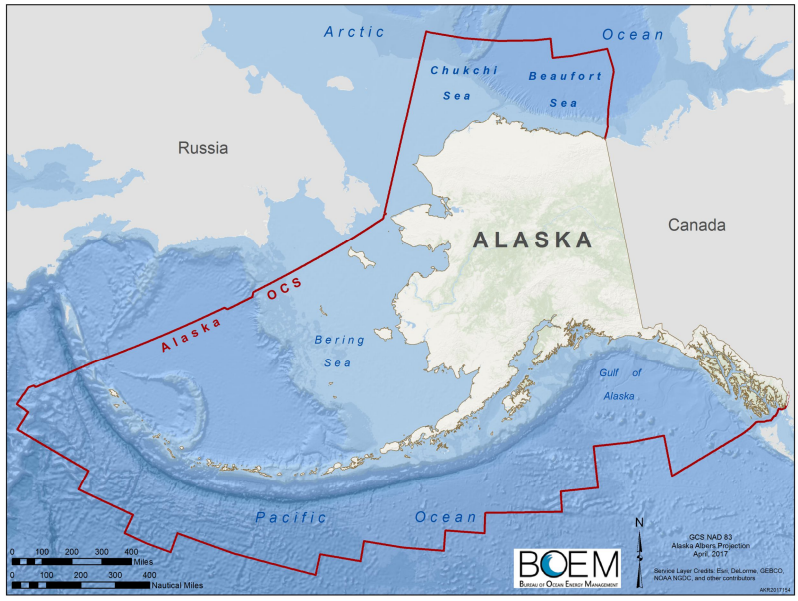

Fig. 1. The Outer Continental Shelf (OCS) off Alaska is vast. The extent of Federal jurisdiction is between the red line and three miles off the coast of the State of Alaska. The State has jurisdiction within three miles seaward of the coast.

To responsibly manage the development of the OCS, BOEM uses an adaptive, interdisciplinary, and integrated approach for making decisions. Because of the continuous production and use of information, BOEM's approach has evolved into an adaptive process with feedback loops (*see* Fig. 2). The process is used to implement BOEM's responsibilities to manage development of energy resources in the OCS and analyze potential environmental impacts of energy exploration and development activities. Through an adaptive process, BOEM continues to use traditional knowledge and scientific information even after decisions have been made through monitoring, collection, and analysis of additional knowledge, allowing for adjustments to management decisions when appropriate.

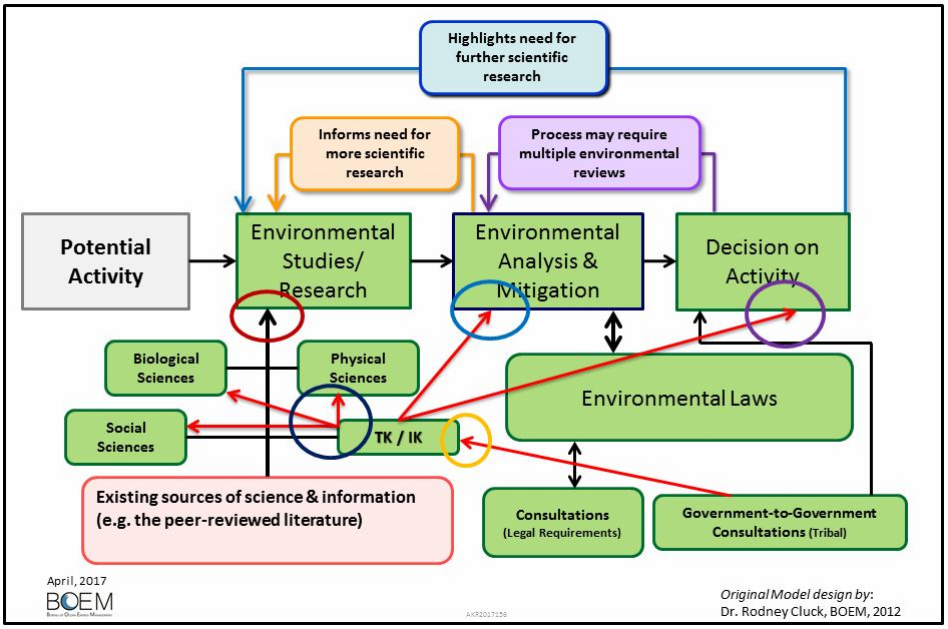

Fig. 2. Traditional knowledge (TK / IK) is applied in several areas of BOEM decision making. Circles and arrows show application of traditional knowledge in a process: 1) **black circle**, using traditional knowledge in designing, planning, and conducting scientific research; 2) **red circle**, applying data from both knowledge systems at the earliest opportunity in the process; 3) **blue circle**, using traditional knowledge in environmental analysis and mitigation; 4) **yellow circle**, consulting with indigenous leaders; and, 5) **purple circle,** applying traditional knowledge at a programmatic decision level.

Traditional Knowledge

BOEM has long been aware that traditional knowledge and cultural practices of Alaska Native peoples can provide important sources of information for managing human activities in the marine environment (USDOI MMS 2001, USDOI BOEM 2012a). BOEM has defined traditional knowledge as a body of evolving practical knowledge based on observations and personal experience of indigenous residents over an extensive, multi-generational time period (USDOI BOEM 2012a). BOEM's application of traditional knowledge to management decisions is guided by several properties of traditional knowledge, including:

- Traditional knowledge is expressed in specific environmental contexts in specific places; it is local and highly contextual rather than global and universal.
- As indigenous peoples develop technical mastery and environmental expertise to promote survival and well-being in a locale, they share such knowledge through kinship relations and household networks (*e.g.* Kofinas et al. 2016).
- Traditional knowledge is a dynamic rather than rigid approach to understanding the environment; it is based on experience rather than innate qualities, and it is unevenly acquired among indigenous residents of a place with some more

knowledgeable than others on specific topics of interest. Such expertise enjoys wide recognition and respect within indigenous communities.

- Traditional knowledge involves more than a collection of factual observations. It is an important sociocultural component that yields an understanding of the landscape and one's place in it, inspiring others and anchoring community values and identities.
- A traditional knowledge framework emphasizes a fundamental sense of unity between humans, natural resources, lands, and waters (*e.g.* Inglis 1993, Stevenson 1996, Huntington 1998, Carothers et al. 2013). In a traditional knowledge framework, people are viewed as part of the environment, not simply observers or controllers of the environment (Sallenave 1994).

For the purpose of application to management decisions, BOEM treats traditional knowledge and scientific knowledge as complementary knowledge systems with different methodologies that often ask different questions. Using both knowledge systems can provide a whole picture of what is occurring in the Arctic (Inuit Circumpolar Council Canada 2016[3]).

Application of Traditional Knowledge

Designing, planning, and conducting scientific research (Fig. 2, black circle)

Fishing for Arctic cisco (*Coregonus autumnalis*) under the ice of the Colville River is a vital subsistence activity for the village of Nuiqsut, Alaska (Fig. 3). Iñupiaq fishers were concerned Arctic cisco in the Colville River were less abundant than in the years preceding oil and gas development. Their concerns were heightened in the early 2000s because of the construction of the Northstar Production Facility, a man-made gravel island in the near-shore Beaufort Sea. Further, their concern was heightened because of another offshore production facility proposed for the Liberty project located east of Northstar.

Fig. 3. The North Slope of Alaska is a vast area. The North Slope Borough was established in 1972 as the local government with jurisdiction of the North Slope region. Areas and locations cited in the text include: Nuiqsut, Colville River, Prudhoe Bay, Northstar (artificial gravel island), Cross Island, Liberty (proposed artificial gravel island), Kaktovik (located on Barter Island), and the Mackenzie River in Canada.

To maximize input of local residents' traditional knowledge, BOEM held a workshop in Nuiqsut to identify factors that might contribute to observed variation in abundance and to recommend a study design to further examine the issue (USDOI MMS 2003). To ensure local expertise in identifying and prioritizing issues and concerns, BOEM invited a panel of seven local experts and seven scientific researchers to discuss Arctic cisco abundance, fishing success, stock exploitation, long-term climate-related changes, and stock genetics to determine source of stocks. BOEM demonstrated respect for local expertise by compensating the local experts and keeping the number of scientists in balance with the number of Alaska Native participants.

The panel of local experts presented their knowledge and concerns about Arctic cisco in their fishing territory. Then, scientific knowledge was presented by the scientists. The process involved facilitation methods to encourage input from the often more quiet Iñupiat experts who were speaking either in English (a second language) or their Iñupiaq language through an interpreter. Translation between English and Iñupiaq was provided throughout the workshop. Each participant in turn was asked to provide a single issue before any participant could provide further input. Local experts were provided the time necessary to respond.

Local experts posed a number of questions from their perspectives, including the need to understand more about the natural history of local Arctic cisco; historical population cycles; locations of cisco during different seasons and years; locations during high population cycles versus low population cycles; changes in the environment over 30 years; and the need to respect and care for fish during scientific studies. An outcome of the workshop was completion of two studies addressing multiple topics. Those studies included a multidisciplinary exploration and synthesis of existing data; an examination of growth and diet to test the hypothesis Arctic cisco have gotten skinnier over the last decade; using genetics to determine whether the total Colville River Arctic cisco stock originates in the Mackenzie River, Canada to assess the level of vulnerability of the stock to development activities; and identifying the location of larval fish during migration to the Colville River by examining otoliths (USDOI MMS 2007, USDOI BOEM 2014). Information provided by local experts and scientists in the initial workshop was applied to inform development of hypotheses about the causes of the variable, or possibly declining, Arctic cisco abundance in the Colville River and its tributaries.

Two unique aspects of the synthesis study were devised to include the insights provided by local experts about Arctic cisco. The panel of local experts reviewed and guided the scientists throughout the study. Scientists consulted the panel of local experts throughout the project to validate interpretations of the data and review plausibility and credibility of emerging patterns and interpretations of existing data. The panel provided feedback on the plausibility of hypothesized relationships among Arctic cisco, the physical and biological environment, and resource development projects. Local experts helped to identify alternative explanations not readily apparent to the scientists and suggested additional factors that could help to improve the interpretations and choice of variables for statistical analyses. Several of the issues considered would not have been realized without using traditional knowledge. For example, observations of skinnier Arctic cisco than in the past and the question of whether the diets of young-of-the-year fish had changed were new topics for future research (USDOI MMS 2007). Subsequent research in the Beaufort Sea determined growth of young-of-the-year Arctic cisco is variable due in part to changes in the magnitude of river discharge influencing both quality and type of prey this species consumes (Von Biela et al. 2013).

Applying both traditional and scientific knowledge systems (Fig. 2, red circle)

BOEM funded a 13-year study to assess contemporary bowhead whaling at Cross Island (*see* Fig. 3), which lies northeast of Prudhoe Bay and is used annually in the fall by subsistence whalers from Nuiqsut, Alaska (Galginaitis 2014, 2016). The bowhead whale (*Balaena mysticetus*) is considered to be the most iconic marine mammal by Iñupiaq residents of the North Slope. This is due, in part, to their great size, and because whaling vitally maintains the relationships of the Iñupiat to the ocean and marine resources. Whaling maintains the social relationships of the Iñupiat with each other by the communal nature of whaling and widely sharing culturally important foods produced from the harvest (Galginaitis 2014).

Cross Island whalers were provided global positioning system devices (GPS) to record hunting tracks, whale sightings, and whale strikes, which they shared with the researcher (Fig. 4). The study established a mobile weather station and communication with Prudhoe Bay to measure weather trends, particularly wind; recorded sea ice conditions, sea states, whaling effort, and length of hunts, which ranged from days to over a month; and documented accounts of whale landings, offshore interactions of whalers with industrial and commercial activities, whale butchering practices, and other whaling activities. Particular attention was paid to record changes over time, so observed changes could be analyzed in the future in relation to oil and gas exploration and development activities.

Traditional knowledge, based on multigenerational empirical observations by whalers, indicates bowhead whales are sensitive to anthropogenic noises. The study was designed to explicitly examine the question of anthropogenic effects of vessel traffic on Cross Island subsistence whaling. Four sources of anthropogenic noise were identified by the whalers including, oil and gas exploration activities; commercial (non-oil and gas) vessel traffic; non-commercial vessel traffic; and aerial surveys involving ocean transects.

During the study, all oil and gas exploration and development activities were subject to conditions and processes established collaboratively and agreed to by industry and the whalers. Oil and gas related vessel traffic was deferred in the vicinity of Cross Island until after the whaling season unless the whalers explicitly gave their consent. Researcher planes used for monitoring studies avoided flying survey transects in areas where subsistence whaling was underway to avoid adverse effects to the whales and subsistence whaling practices (NOAA 2016). These mitigation measures were based in traditional knowledge and were successful in reducing interferences with whaling practices.

The project did not document any direct adverse effects of oil and gas activities on Cross Island whaling. This is likely because the only exploration and development activity occurred at Northstar, which lies west of Cross Island; no activity occurred to the east of Cross Island. In the fall, the migrating bowhead whales travel from east to west in the Beaufort Sea, and did not encounter disturbance from oil and gas activities eastward. Industry vessels were compelled to communicate their location and transit times with Cross Island to avoid conflicts. The study found the greatest adverse effect on number of whales harvested was from non-oil and gas commercial vessel traffic (*e.g.* supply barges), as evidenced by reductions in the numbers of whales harvested during two seasons. Non-oil and gas, non-commercial vessel traffic (*e.g.* recreational boats) was rare and had no measurable effect on whaling.

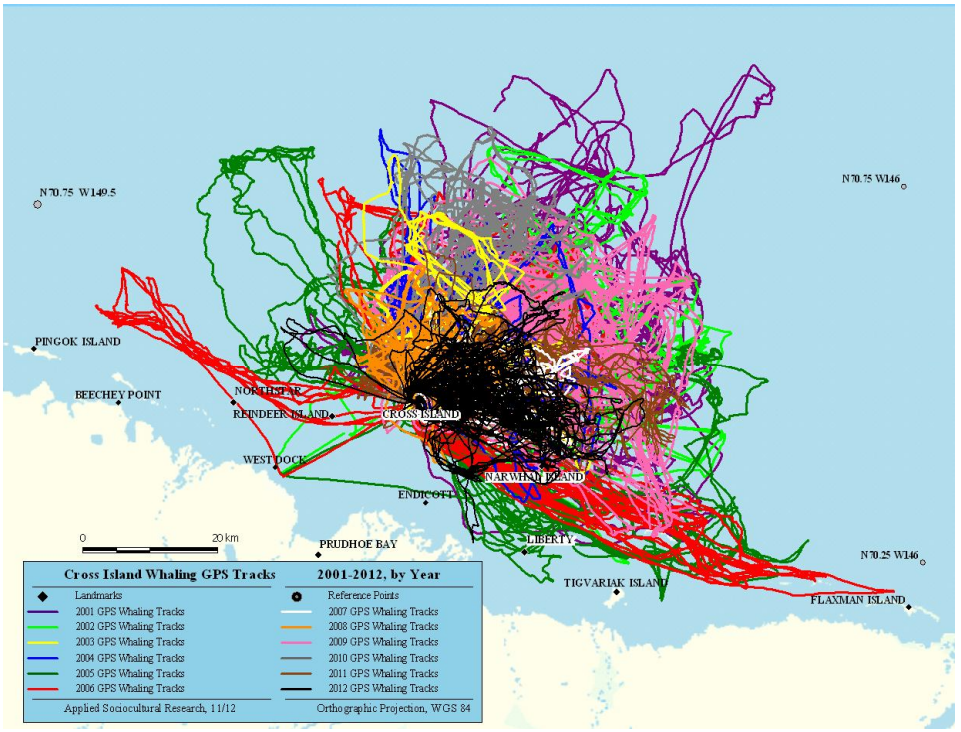

Fig. 4. Cross Island whaling tracks recorded with GPS technology, 2001-2012 (Galginaitis 2014).

Traditional knowledge in environmental impact analysis (Fig. 2, blue circle)

In each environmental analysis required by the United States National Environmental Policy Act (NEPA)[4], BOEM applies traditional knowledge from three primary sources: public comments, tribal consultations, and research (USDOI BOEM 2012b). Traditional knowledge is received in written letters and comments during community meetings, public hearings, and through discussions with indigenous hunters and fishers. BOEM analysts review social science publications for traditional knowledge findings and incorporate these in assessment documents where appropriate. BOEM, through its government-to-government relationship with Alaska Native tribes and Alaska Native Claims Settlement Act[5] (ANCSA) Corporations, formally consults with tribal and ANCSA leaders to hear their concerns and to gather traditional knowledge.

Applying traditional knowledge in NEPA environmental analyses helps BOEM understand where, when, and how communities hunt and fish, which helps the agency assess potential impacts to Alaska Native subsistence activities and harvest patterns. BOEM's environmental analysis process uses traditional knowledge to describe and delineate the affected environment, formulate alternatives, and design mitigation measures to avoid or reduce potential adverse impacts to the human environment (Ristroph 2012). Input from traditional knowledge holders about the potential effects of proposed projects helps BOEM and other agencies develop alternative actions for analysis. For example, Alaska

Native hunters have shared their knowledge with government agencies and industry about how to best position pipelines to avoid blocking routes of migratory wildlife. In the Kuparuk oil field, in the central North Slope, all pipelines are elevated a minimum of 1.5 m above the surface of the ground to allow caribou to pass through the field as they move to and from insect-relief habitat.

BOEM has released to the public a draft environmental impact statement (EIS) for the proposed Liberty oil and gas development plan (USDOI 2017). The proposed action includes building a gravel island approximately 10 km offshore in the Beaufort Sea. The local subsistence whaling community directly expressed concerns over the project to decision-makers. BOEM has continued these discussions with a host of cooperating entities, including representatives from the North Slope Borough. Working with its partners, BOEM has developed strategies in the draft EIS to further incorporate traditional knowledge and reduce and/or avoid impacts to subsistence activities and harvest patterns.

Consulting with indigenous leaders (Fig. 2, yellow circle)

The United States has policies and executive orders requiring Federal agencies to consult with tribes and ANCSA Corporations when an agency's actions have tribal implications (USDOI 2011, 2012). Agency actions include regulations, proposed plans, proposed legislation, or other policy statements that may have a substantial direct effects on one or more Alaska Native tribes, on the relationship between the Federal Government and Alaska Native tribes, or on the distribution of power and responsibilities between the Federal government and Alaska Native tribes. BOEM initiates consultation early in the decision-making process. In consultation, BOEM listens to, records, and considers traditional knowledge, experiences, and perspectives of tribal and ANCSA corporation partners to inform decisions.

BOEM's policy and practice is to take a leadership role in ensuring meaningful consultation with tribes and ANCSA corporations. Consultation is an elevated form of communication that emphasizes relationships, trust, and respect between sovereign entities and is incorporated throughout the planning process. Consultations occur when requested by a tribal government or ANCSA corporation or when they accept an invitation to consult with BOEM regarding a Federal action or proposal (USDOI 2011, 2012). Meaningful consultation is an open and free exchange of information and opinions between sovereign parties, which can lead to mutual understanding and trust between indigenous peoples and agency decision makers. Consultation is integral to a deliberative process that ensures application of traditional knowledge and results in more fully informed, inclusive decision making.

Traditional knowledge at a programmatic decision level (Fig. 2, purple circle)

Subsistence harvest is important to the cultural and spiritual way of life of Alaska Native peoples. Each coastal community in Alaska has its own, unique indigenous harvest patterns guided and constrained by geography, physical conditions (*e.g.* weather patterns, sea conditions), beliefs, traditions, and the migration patterns of fish and wildlife. Likewise, there are several stages of decision making at BOEM. For example, there are planning decisions to allow leasing or not, which are made at a

broad, national programmatic level. For its national oil and gas leasing program, BOEM considers these unique subsistence harvest patterns for each coastal community in each planning area. Where leasing is allowed under each five-year program can be influenced by where important subsistence harvest practices are conducted by Alaska Native peoples.

Indigenous people of Kaktovik (Fig. 3) have lived on Barter Island for hundreds of years. Barter Island was a major trade and cultural exchange center and was an especially important gathering place for Alaska Iñupiat and Canadian Inuit (Kofinas et al. 2016). Kaktovik hunters have pursued bowhead whales and other marine mammals during the open water season for many generations. Subsistence whalers from Kaktovik harvest bowhead whales in the fall (Huntington et Quakenbush 2009, Braund 2010). Most harvesting occurs within 40 km of shore, but may extend to as much as three times that distance depending on the conditions of ice and sea. Preference is given to locations where returning hunters do not have to fight currents to bring whales home (Braund 2010).

The potential effects of oil and gas exploration, development, and production activities in the OCS were assessed for BOEM's National Oil and Gas Leasing Program for 2012 through 2017. Working directly with the subsistence hunters, it was clearly evident how traditional knowledge informs the Iñupiat about the most productive areas for subsistence hunting for bowhead whales and seals (Braund 2010). These hunting areas were shown to be vital to the community's food security and broader sharing networks (Kofinas et al. 2016). In 2012, a programmatic decision was made to defer some critical areas off the coast of Kaktovik because of the potential for conflicts with subsistence hunting (USDOI BOEM 2012c).

Next Steps

BOEM decision-makers, scientists, and Alaskan indigenous leaders will continue to work towards a dynamic framework for applying traditional and scientific knowledge to resource management decisions. This will require organizational learning and increased flexibility to better enable adaptive resource management and account for an ever-changing environment. BOEM is currently working with the North Slope Borough to develop the study *Traditional Knowledge Implementation: Accessing Arctic Community Panels of Subject Matter Experts*. This multi-year study extends our work to recognize and apply traditional knowledge at all levels of governance, from inclusion in environmental impact assessments to policy decisions on energy and mineral resources. BOEM's objective moving forward is to make the best use of all available information to meet its responsibilities for managing development of the OCS.

Conclusion

BOEM's approach has evolved to apply traditional knowledge at all stages in the decision-making process (*see* Fig. 2). At BOEM, traditional knowledge informs decision-making; scientific research; planning for the National Oil and Gas Leasing Program; and environmental impact analyses for specific geological and geophysical applications, exploration plants, and development and production plans.

Clearly articulating, early in the process, how best to use traditional knowledge and science can allow for a more complete application of all available information. BOEM has learned applying traditional knowledge makes decision making more inclusive by generating mutual understanding between partners; creating understanding and acceptance among a wider group of partners and stakeholders; and enhancing respect for and understanding of indigenous perspectives and ways of life by scientists, resource managers, and decision-makers.

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Notes

[1] The North Slope Borough was established in 1972 as the local government with jurisdiction of the North Slope region of Alaska.

[2] The United States Government, Department of Interior administers the submerged lands, subsoil, and seabed, lying between the seaward extent of the States' jurisdiction and the seaward extent of Federal jurisdiction (*see* Fig. 1). Federal jurisdiction is defined under accepted principles of international law.

[3] The Inuit Circumpolar Council (ICC Canada 2016) uses the term indigenous knowledge rather than traditional knowledge. The ICC views indigenous knowledge as a system of knowledge based in the worldview of indigenous peoples. It can be distinctly different from the Western worldview and scientific knowledge system. While the two sources of knowledge may complement each other in many cases, they are not the same and should be appreciated for what each is able to bring to the table (ICC Canada 2016). In certain contexts, traditional knowledge may be a smaller subset of a broader indigenous knowledge system (*e.g.* Stevenson 1996). For the purposes of this paper, BOEM considers traditional knowledge and indigenous knowledge to be synonyms.

[4] The National Environmental Policy Act (NEPA) of 1970 is a United States environmental law that established the President's Council on Environmental Quality.

[5] The Alaska Native Claims Settlement Act (ANCSA) was signed into law December 18, 1971, constituting at the time the largest land claims settlement in Unites States history; ANCSA was intended to resolve long-standing issues surrounding aboriginal land claims in Alaska and stimulate economic development.

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