CHAPTER 7

A PLACE FOR TRADITIONAL ECOLOGICAL KNOWLEDGE IN RESOURCE MANAGEMENT

Micheline Manseau (Parks Canada & University of Manitoba)
Brenda Parlee (University of Manitoba)
G. Burton Ayles (Canada/Inuvialuit Fisheries Joint Management Committee)

INTRODUCTION

The Rise of Traditional Ecological Knowledge

As land claims are settled in the northern regions of Canada, further legislative, regulatory or policy requirements are established to ensure that the knowledge, practices, and beliefs of Aboriginal people are protected and included in resource management. It is a policy in Canada that traditional ecological knowledge (TEK) be considered and incorporated into resource management (Usher 2000). National, provincial, and territorial institutions have committed to the understanding and use of TEK (Posey 1999). In some cases the commitments aim to respect, preserve, and promote the use of TEK in managing natural resources (Canada 1995), and in other cases, the intent is toward the integration or harmonization of TEK with other sources of knowledge (Inuit Circumpolar Conference 1992; CFFS 1997).

New co-management institutions have also been created across the North and have the potential to be important vehicles for the inclusion of TEK in resource management (Pinkerton 1989, Berkes 1997). It is argued that such arrangements are key to a successful incorporation of TEK in providing opportunities for communities, governments, and other stakeholders to work together on an ongoing basis, facilitating communication and learning between parties that were conventionally in resource management conflict (Kendrick 2000, Berkes *et al.* 2001). Co-management institutions can be arenas for exchanges of ideas on natural systems, where interactive and mutual learning takes place (Kendrick 2000; 2003). They also often present a redistribution in the balance of power; departing from state-central structures for more equal partnerships, institutionalized

joint decision-making or legislated decision-making power at the local level. The change in power dynamics is often critical in the linking of state and especially indigenous knowledge systems (*e.g.,* McCay and Acheson 1987, Pinkerton 1989, Berkes *et al.* 1991, Pomeroy and Berkes 1997, Nadasdy 2003).

The use of traditional knowledge in resource management can bring significant changes to conventional, state management structures. It has the potential to affect the fundamental assumptions of science-based wildlife management (Berkes 1998). In contributing different values and perspectives, TEK can also influence management objectives. Traditional management systems or stewardship practices rarely aim at large-scale land changes, control, or fixed levels of animal population sizes. They place humans inside the unit being managed and incorporate random interconnections and the idea of time as cyclical into their management decisions (Tippett 2000). As a result, the rules and practices also often reflect and respond to the structure and distribution of an animal population rather than aiming at a finite number or toward a given population size (Acheson *et al.* 1998, Berkes and Folke 1998).

The cultural basis of traditional knowledge can also modify the structures and procedures prevailing in management institutions. While management responsibilities often reside with biologists or managers, specific regulation of activities making impacts on the environment is usually vested in traditional authority (Ruddle 1994). This varies according to the social organization, and authority can reside with family groups, senior hunters (Berkes 1998), secular or religious leaders, specialists or rights holders (Ruddle 1994). Indigenous 'management' is not a discrete function within indigenous societies but is practised within the context of the larger cultural system (Tippett 2000). These systems often show a high degree of unification of conception and execution (LaDuke 1994).

This chapter aims at documenting how the strong and high-level commitments to TEK made by Aboriginal groups, academics, and governmental and non-governmental organizations involved in natural resource management have led to an increased use of TEK in the decision-making process. We examine different initiatives from northern Canada to acquire some insights into the mechanisms by which traditional ecological knowledge is contributing to resource management. We explore the following questions:

1. What roles does legislation play in ensuring that TEK is used in resource management?
2. What roles do management institutions play in facilitating the communication, interpretation, and inclusion of TEK in decision making?
3. What roles do the communities play in capturing, collating, and converting TEK for the purpose of resource management?

The first initiative presented in the chapter is from the Inuvialuit settlement region, Northwest Territories; the Fisheries Joint Management Committee (FJMC) is a co-management institution created under the *Inuvialuit Final Agreement* (1986). The work of the FJMC provides useful information on how traditional knowledge is used in the management of fisheries and other marine resources by redefining marine health indicators and by influencing data gathering as well as the analysis and interpretation of results (Day 2002, Harwood *et al.* 2002). The second initiative is from Lutsel K'e, Northwest Territories; this case is a community-based institution established primarily to document and use TEK in resource management in response to local concerns about the environmental and socio-economic impacts of mining exploration and development in the region. Environmental assessment and regulatory requirements in place for the development of diamond mines provided the foundation as well as the resources for the community to carry out ongoing environmental and community health monitoring. The third initiative is from Quttinirpaaq National Park, Nunavut. In this case, legislative requirements for the co-operative management of the Park and the inclusion of traditional knowledge were set out in the *Nunavut Land Claims Agreement* (1993) and further defined in an Inuit Impact and Benefit Agreement (1999). The work of the co-management board reveals how trust between government officials and local community members creates a forum for sharing traditional and scientific knowledge to meet park planning and management goals. Other useful information is also found in the work of the Alaska Beluga Whale Committee, Alaska, and the forest management planning activities of the Wet'suwet'en First Nation in British Columbia and the Innu Nation in Labrador.

THE PLACE OF TEK IN RESOURCE MANAGEMENT – LESSONS FROM THE CANADIAN NORTH

Management of Wildlife Species – Canada/Inuvialuit Fisheries Joint Management Committee

Since the ratification of the *Western Arctic Claims Settlement Act* (Inuvialuit Final Agreement) in 1984, the fish and marine mammal resources of the western Arctic have been managed co-operatively by the Canada/Inuvialuit Fisheries Joint Management Committee (FJMC) with its partners the federal Department of Fisheries and Oceans (DFO), the Hunters and Trappers Committees of the Inuvialuit Settlement Region (Figure 5.1), and the Inuvialuit Game Council (for more information on the co-management process, see Bailey *et al.* 1995, Green and Binder 1995, Ayles and Snow 2002 and *http://www.fjmc.ca*).

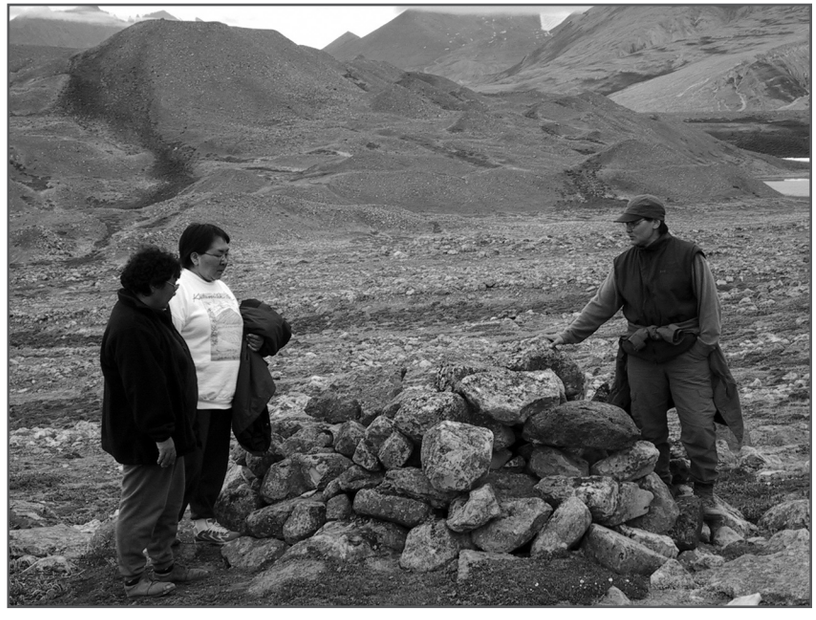
The Inuvialuit Final Agreement and the various acts and regulations that are under the aegis of the Minister of Fisheries and Oceans define the responsibilities of the FJMC. In general they are (1) to assist Canada and the Inuvialuit in administering the rights and obligations related to fisheries under the Inuvialuit Final Agreement, (2) to assist the minister in carrying out his or her responsibilities for the management of fisheries and marine mammals in the Inuvialuit Settlement Region, and (3) to advise the minister on all matters relating to fisheries in the region.

The establishment of the FJMC has led to significant changes in the co-operative management of fish and marine mammals in the Inuvialuit Settlement Region and the use of TEK in all aspects of decision making. The following sections describe how TEK and the knowledge of local resource users is being integrated into the ongoing activities of the committee, projects operated by the committee and in the long term strategic planning of the committee.

The FJMC is composed of two members appointed by the Inuvialuit, two members appointed by the government of Canada, and a chair appointed by the members. It is supported by a resource biologist and a secretariat that also provides support to the other Inuvialuit co-management bodies (Green and Binder 1995). The committee has five formal meetings annually and also interacts through regular conference calls, special projects, workshops, and meetings. Regular meetings are formally structured with agenda, minutes, and motions on decision items, but discussions and interactions are informal. The two Inuvialuit members are always currently active hunters or fishers or elders with significant experience on the land, and they bring those experiences to the meetings. The contribution of the two federal government members has primarily been to provide input from scientific and government resource management perspectives.

A recent study examining co-management in western Canada (Iwasaki-Goodman 2004) identified several key elements in the meetings: discussion until a consensus was reached; respect for differences in opinions among members; recognition of the importance of their own role in resolving conflicts in resource management between hunters and fishers and the government; a strong sense of alliance and friendship between committee members; and recognition that the goals of the FJMC are long-term. The relationships within the committee are extended to relationships with other individuals, communities, and agencies. The input of traditional knowledge by hunters and fishers and the contribution of their knowledge of the resource and plans for its use are ensured by winter meetings in the communities to discuss community problems and priorities for the upcoming year. In addition, traditional knowledge is brought to the decision-making process through workshops and meetings on specific issues and joint field projects that involve community members as well as outside researchers. Relations with DFO are maintained by having a DFO representative attend each meeting as an active participant in all discussions and by having DFO biologists, scientists, and managers regularly attend meetings to discuss science, fisheries management, and oceans management issues and to receive community input on TEK. Representatives from other government departments regularly come to the meetings, as do non-governmental organizations and industry.

Programs and activities operated or financially supported by the FJMC include: monitoring fish and marine mammal harvests; establishing management and fishing plans for key species, *e.g.,* Beluga whales (*Delphinapterus leucas*), inconnu (*Stenodus leucichthys*), Arctic char (*Salvelinus alpinus*), and developing population and stock assessments of Arctic char and other species in order to establish safe



L-R: Liza Ningiuk, Minnie Nungak (deceased) and Nancy Anilniliak visiting Paleo-Eskomo cache at Kettle lake near Tanquary Fiord, Quttinirpaaq National Park. Photo by Elizabeth Seale, Parks Canada, 2002.

harvest levels. The FJMC also carries out genetic studies to help identify stocks from different streams or areas, conducts studies of contaminants to ensure animals are not being harmed, and sets up traditional knowledge studies of many animals and areas. The most important area of TEK input is on resource harvesting issues. The subsistence harvest of beluga whales is a critical aspect of Inuvialuit culture and traditions. The Beaufort Sea Beluga Management Plan, first completed in 1991 and scheduled for revision in 2003, is a plan to ensure the sustainability of this harvest and is a priority initiative for the FJMC, the Hunters and Trappers Committees, and DFO (FJMC 2001). The plan addresses objectives for sustainable harvests, conservation, and protection, including the development of beluga management zones that provide guidelines for industry (primarily oil and gas) development activities, tourism as it relates to beluga, and the bylaws of the Hunters and Trappers Committees relating to beluga harvesting. The plan was developed with full input from hunters and fishers.

The beluga monitoring program is an important activity under the umbrella of the plan. It is based on the traditional knowledge of generations, but incorporates the evolving local knowledge of current conditions. The purpose of the program is to document the size and trend of harvesting activities and to obtain the data necessary to assess the health of the beluga population and the impact of the harvest on the stock. The present beluga monitoring program is a result of three decades of evolution and development, but it is based on at least five

hundred years of Inuvialuit harvests of beluga in the Beaufort Sea (McGhee 1974). Current monitoring takes place at seven locations along the Beaufort Sea coast and includes all traditional hunting areas and involves four communities. DFO and the FJMC provide the results back to the Hunters and Trappers Committees, schools, and community members through meetings, workshops, and posters. The results are also published in scientific papers (*e.g.,* Stern and Ikonomou 2001, Harwood *et al.* 2002) and exchanged with Alaskan hunters.

Despite the close co-operation between scientists, managers, and hunters and fishers, and despite legislation and mechanisms to facilitate the input of TEK into resource management decision making, conflicts do arise. Initial aerial surveys of beluga whales in the Canadian Beaufort Sea resulted in published estimates of only about seven thousand animals. Based on their personal observations over the years, the hunters were convinced that the population was much larger. The authors of the original report agreed that the number was an underestimate. They had been very careful to point out that their study results represented the number of whales in the onshore waters of the Mackenzie River estuary and had not been corrected for submerged whales that were not visible and that there were whales beyond those waters (Norton and Harwood 1986). Nevertheless, despite the hunters' concerns, the population estimate of seven thousand animals was published and repeatedly used in other fora. The estimate of 7000 animals ultimately became the focus of discussions on the health of the population (Weaver 1991). Based on these estimates, hunting quotas were proposed, opting for a close to harvest. It is probable that only the reality of the rights assigned within the Inuvialuit Final Agreement prevented the establishment of what would have been arbitrary quotas. The latest aerial survey was conducted in 1992. It gave an index of stock abundance of 19,629 animals, but again, this number did not account for whales under the water during the aerial counts or for whales outside the survey area (Harwood *et al.* 1996). Subsequent analysis has resulted in a population estimate of over 39,000 animals (Harwood and Smith 2002). In retrospect, the hunters' traditional knowledge was correct: there were many more whales than the original survey revealed.

Traditional ecological knowledge is also critical for the long-term planning of the FJMC. By the end of the 1990s, co-management was well established in the Inuvialuit Settlement Region. With its partners, the FJMC had addressed many of the initial challenges associated with the implementation of co-management arrangements, and the FJMC members began to consider future directions. The result was a vision and strategic plan to guide the committee's objectives over the coming decade (FJMC 2003). Inuvialuit members of the FJMC have used the process to ensure that their beliefs in both the way the committee should operate, and in the way that the fish and marine mammal resources should be managed, would be expressed and communicated to future generations. This is exemplified by one of the fundamental principles of the FJMC: "Committee actions will endeavour to ensure that fish and marine mammals are treated with respect during any harvesting, scientific study, or other use of the resource." Specific

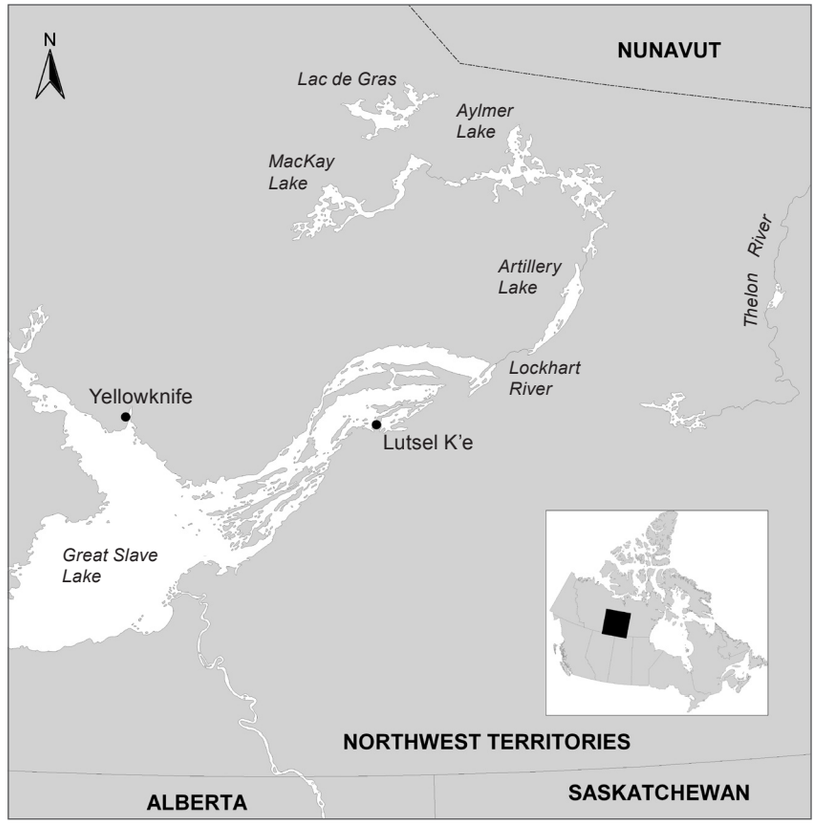


Figure 7.1 Lutsel K'e area.

reference to TEK is found in one of the vision statements: "In the FJMC vision for the future all marine, anadromous and freshwater fish, and marine mammals stocks of the Inuvialuit Settlement Region will be managed and conserved for the wise use and benefit of present and future generations through the use of sound scientific and traditional knowledge of the renewable resources of the Region and their ecosystems."

Management of Industrial Activities – Diamond Mining and the Lutsel K'e Wildlife, Lands and Environment Office

Since the turn of the century, the Lutsel K'e Dene First Nation (Figure 7.1) and other northern communities have witnessed significant non-renewable resource development in their territory, the result of Canadian government efforts to "modernize and develop" the region.

A legacy of environmental and social problems has resulted from many of these projects, including the Talston River hydroelectric project (Bielawski in

Collaboration with Lutsel K'e Dene First Nation 1992) as well as gold, uranium, and lead-zinc mining in the Great Slave Lake region (Parlee 1998). When indicator minerals for diamonds were found in the Lac de Gras area in 1989 and a mine proposed in 1995, government, mining companies, and communities hailed it as the beginning of a different period of industrial development. The recognition of Aboriginal rights under the Canadian Constitution in 1982 and the negotiation of self-government and devolution in the Northwest Territories had created new opportunities for Aboriginal people, including opportunities for integrating traditional knowledge into the assessment, planning, monitoring, and management of non-renewable resource development activities.

Some of these opportunities have been forged in negotiated contracts such as impact and benefit agreements between Aboriginal organizations and the corporations proposing industrial developments. Such contracts are "manifestations of the struggle to achieve balance between local and outside interests, they generally contribute to lasting local benefits, greater diversification of local economies, and better prospects for sustainability while minimizing the negative impacts of resource development" (O'Reilly and Eacott 1998). Multi-stakeholder initiatives were also developed such as the West Kitikmeot Slave Study Society – a five-year research program aimed at addressing gaps in scientific and traditional knowledge baseline information about environmental and community health issues in the region (*www.wkss.nt.ca*). Other opportunities were defined in Environmental Agreements between mining companies, the Federal and Territorial governments, and Aboriginal organizations. In the case of the BHP Billiton Diamond Mine and the Diavik Diamond Mine at Lac de Gras, the Independent Environmental Monitoring Agency and the Environmental Monitoring Advisory Board are responsible for ensuring that traditional knowledge is meaningfully used (*www.monitoringagency.net*; *www.ainc-inac.gc.ca*).

The vision, design, and implementation of many of these TEK initiatives have been spearheaded by local communities. The leadership and commitment shown by Aboriginal organizations and their representatives ensured that, in every way possible, traditional knowledge was given equal consideration as science, in principle as well as in practice. In Lutsel K'e, the overall vision was to develop a community-based approach to address the environmental and community health issues of greatest concern to the community. In order to achieve this vision, a significant investment in building community capacity was required. Funding and support was sought and received from a variety of sources, including universities, non-governmental organizations, foundations, government departments, and industry. Under the direction of the Wildlife Lands and Environment Committee and an elders' committee, local youth were trained in basic research methods, the use of geographic information systems and database management, as well as in their native *Denesoline* (Chipewyan) language. By working with their elders on the land, youth were able to learn and practise Dene traditions and knowledge as well as to document and apply this knowledge to address their concerns about the impacts of mining in the region. Over a period of eight years, Lutsel K'e was able to achieve significant progress toward this vision, as described by Florence Catholique:

> We are trying to relay the traditional knowledge so that the Elders will be used, and maintain the youth in the school system. It's all very complex. We've got to monitor, we've got to record traditional knowledge so the younger people can see it, so it's impressive to the young. The Wildlife Committee has more people employed than I have ever seen, it's an area where young people want to be, they're still interested in the land. But the next generation, if we don't keep our people out on the land, they're not going to [be interested in the land]. The community has to look at getting the people out on the land, to understand development. These things are being done with the Wildlife [Committee], that is their purpose. (Florence Catholique, Lutsel K'e, 2001)

Growing community capacity in Lutsel K'e paved the way for positive working relationships between the community, government, and industry. As a first step, the community sought to define its own indicators and baseline with respect to community and ecological health. Projects such as the *Traditional Knowledge Study on Community Health* and the *Community-Based Monitoring Pilot Project* provided a snapshot of health issues of concern to the community, including self-government, healing, and cultural preservation (Marlowe and Parlee 1998). A parallel project focused on *Denesoline* knowledge of ecosystem health resulted in the development of a range of indicators with respect to waterfowl, fish, caribou, and fur-bearing animals (Parlee and Marlowe 2001).

Baseline traditional knowledge studies have also been carried out on a site-specific basis. For example, a study in 1998 was carried out at *Gahcho Kue* (Kennady Lake), the site of a DeBeers Canada exploration project. In 2001, a similar study was carried out at *Na Yaghe Kue* (Snap Lake), where DeBeers Canada has proposed the development of Canada's third diamond mine. Both studies were aimed at documenting baseline information about plants, wildlife, and landscape features. Elders were also engaged in interpreting and predicting potential project impacts as well as developing recommendations for mitigation and management.

Monitoring based on traditional ecological knowledge, or "watching, listening, learning, understanding change in the environment," is a key theme in the work of the Wildlife, Lands and Environment Department (see the DVD in the back of the book). Between 1995 and 2003, the Wildlife, Lands and Environment Department established a monitoring system around a range of community-based socio-cultural and ecological indicators. These indicators aim at monitoring the cultural impact of mining activities on employees and their families, and on the quality of housing, health, and social service programs. Monitoring of caribou health and caribou movements based on scientific and traditional ecological

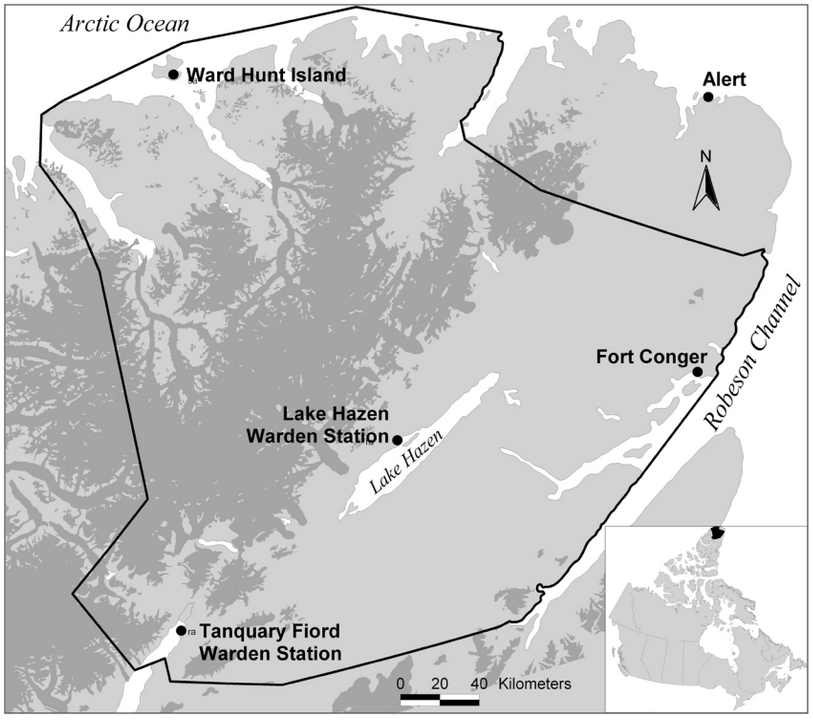


Figure 7.2 Quttinirpaaq National Park, northern Ellesmere Island.

knowledge has also been developed. It is hoped that the results of these projects can help the community better understand and deal with the effects of mineral resource development in their region. They are also using the information in the planning and management of their health and social service programs and self-government negotiations.

The work of the Wildlife, Lands and Environment Committee is an example of how local Aboriginal communities are building on the traditional knowledge and skills of their elders and developing a community-based resource management system.

Land management – Co-management of Quttinirpaaq National Park of Canada

'Quttinirpaaq' means 'top of the world' in Inuktitut, the Inuit language.

Quttinirpaaq National Park of Canada was established as a park reserve in 1986 to protect the integrity of an Arctic ecosystem. It is located at the northern end of Ellesmere Island in the Canadian Arctic Archipelago (Figure 7.2).

At 37,775 square kilometres, Quttinirpaaq is the second largest national park in Canada. The nearest communities are Grise Fiord, 640 kilometres to the south of the Park and Resolute Bay, 260 kilometres further south. Parks Canada has summer installations at Tanquary Fiord and Lake Hazen. The Department of National Defence has year-round military and research facilities to the south and north of the park, in Eureka and Alert. Although the park has been consulting the communities of Resolute Bay and Grise Fiord on an annual basis to discuss management and operational issues, it was not until the signing of the *Nunavut Land Claims Agreement* in 1993 that a joint Inuit/Federal Government management structure was established. The negotiations of an Inuit Impact and Benefit Agreement (IIBA) were completed in 1999 and provided detailed guidance on the co-operative management of Quttinirpaaq, Auyuittuq, and Sirmilik National Parks, all in Nunavut.

In order to help fulfill the purposes of the Agreement, a Joint Park Management Committee (JPMC) composed of three members appointed by the Qikiqtani Inuit Association and three members appointed by the Government of Canada was established for each park. As in most co-operative management arrangements in national parks under land claims, the JPMC of Quttinirpaaq advises the Minister of Parliament responsible for national parks on all matters related to park planning, management, and operation and on the means of accomplishing the park's goals. The JPMC oversees the development of park management plans, yearly work plans, budgets, research, and monitoring projects. It also helps the communities of Grise Fiord and Resolute Bay take advantage of the economic benefits associated with the park. A park management plan is required by the *Canada National Parks Act* and the IIBA. Although the processes for developing the management plan are similar in the Act and the IIBA, they are more extensive in the IIBA and require the additional involvement of organizations such as the Qikiqtani Inuit Association, the park's Joint Park Management Committee, and the Nunavut Wildlife Management Board. The Qikiqtani Inuit Association has official review functions, and the IIBA directs the association's president to write a foreword to the management plan. The management plans must be approved and recommended by the park's JPMC. The Nunavut Wildlife Management Board may also, at its discretion, approve any portion of the management plan that pertains to wildlife and wildlife habitat (F. Gertsch, pers. comm.).

The recent development of a park management plan highlights some of the "ways of working" adopted by the committee (Gertsch *et al.* 2004). Distance and means of communication between the communities hinder face-to-face meetings, so the work of the JPMC unfolds around one or two annual meetings and numerous teleconferences. Workshops are also organized to better comprehend the requirements of the IIBA, to learn about and further define the management planning process, and to understand some of the terminology used by Parks Canada (Gertsch *et al.* 2004). Time is spent on the land in the park to exchange views and observations about the area and to develop short and long-term conservation objectives. Although all meetings have simultaneous translation (English-Inuktitut) and all written material is available in both languages prior to the meetings, communication remains challenging. Time spent on the

Box 7.1
Inuit Qaujimajatuqangit

Inuit Qaujimajatuqangit refers to:
The knowledge and understanding of all things that affect the daily lives of the Inuit and the application of that knowledge for the survival of a people and the culture – a knowledge which has sustained the past, to be used today to ensure an enduring future (Government of Nunavut, Community Government & Transportation).

The six guiding principles of Inuit Qaujimajatuqangit are:

Pijitsirnjiq:	The concept of serving and providing for.
Aajiiqatigiingni:	The Inuit way of decision-making by comparing views or taking counsel.
Pilnimmaksarniq:	The passing on of knowledge and skills through observation, doing and practice.
Piliriqatigiingniq:	The concept of collaborative working relationships or working together for a common purpose.
Avatittinnik Kamattiarniq:	The concept of environmental stewardship.
Qanuqtuurniq:	The concept of being resourceful to solve problems.

land helps build trust between members of the committee, staff, and advisors, and iterative meetings provide time and space for adequate consultation with community members. Issues are repeatedly discussed at meetings and in the communities and Inuit representatives only make decisions after they have reached a good understanding of the issues and after listening and learning from knowledgeable members of the communities. This requires time, but is a key function of the decision-making process.

Both Inuit *Qaujimajatuqangit* ("Inuit Knowledge of Old," see Box 7.1) and scientific knowledge relating to ecological structures and processes are presented and primarily by oral means. The Inuit representatives consult with community elders and park staff consult with scientists. Summaries of the information are shared at the meetings. Along with park rules and regulations, Inuit values and perspectives are communicated through oral histories, songs, and prayers. This plays a significant role in key decisions pertaining to, for example, the story lines selected and communicated to the public, decision rules followed to allocate research permits, define monitoring activities, and make decisions about tourism and other access/use of the park area. The "ways of knowing" clearly include many aspects of the knowledge system. It is more than a line in a database or a polygon on a map. It is more than factual information about the environment or knowledge about past and current use of the environment; culturally and spiritually based information also provide explanations and guidance (Usher 2000).

As expressed by the JPMC, Inuit culture and knowledge is strongly reflected by the strong desire to base their decisions on consensus, by comparing views and taking advice from the most experienced individuals. Management decisions also reflect a continuously changing environment, associated with dynamic and ongoing (on-site) learning. A decision is never final and is never set in stone. Keeping an eye on ongoing environmental changes and being able to adapt one's actions or decisions based on the observed outcome is perceived as critical to ensure the long-term viability of those ecological systems.

The Alaska Beluga Whale Committee of Alaska; Wet'suwet'en First Nation of British Columbia; the Innu Nation of Labrador.

The resource management institutions represented below are further illustrations of co-management structures and local resource management initiatives. These examples will be referred to in the discussion section of this chapter along with references to the three cases described above.

The Alaska Beluga Whale Committee, Alaska, was established in 1988 by Alaska Native American beluga whale hunters, government biologists, and managers (Huntington 2000) to ensure that beluga whale stocks in Alaska remained viable and capable of supporting traditional subsistence harvests (Huntington 1992, Adams *et al.* 1993). The committee identifies data needs, establishes research priorities and methods, monitors hunter harvests of beluga, and makes management decisions as necessary. The committee meets annually; however, the research and monitoring activities continue throughout the year and often involve informal interaction between communities and members of the committee. At the annual meetings, hunters present the harvest reports and relevant observations about ice conditions and other environmental conditions. Researchers present the findings of previous years in language understood by all, yet do not avoid complexities and technicalities (Huntington *et al.* 2002). Interaction is encouraged and questions are asked by everyone to ensure understanding and generate new ideas. Traditional ecological knowledge is included through formal TEK studies and through interactions with hunters at annual meetings and when assisting researchers and managers in the field (Henry P. Huntington, pers. comm., June 2003).

The Wet'suwet'en First Nation of British Columbia (*www.wetsuweten.com*) has been using Geographic Information Systems (GIS) to map traditional land uses, wildlife habitat, and food sources. The Wet'suwet'en traditional social structure has five Clans, each of which is made up of thirteen Houses. Each House has a territory, usually based on watershed lines, which is the basis for mapping and managing resources. Using their knowledge, they are pursing economic opportunities for non-timber forest products. Black huckleberries will be the first product they attempt to manage and market. TEK has been used to identify areas of interest and potential management methods such as seven-to-ten-year rotational prescribed burning based on the House Territories. This project has

gained the support of government, fire management agencies, potential buyers, and forest companies (Russell Collier, pers. comm., June 2003).

The Innu Nation, Labrador, in collaboration with the Government of Newfoundland and Labrador, has recently completed an ecosystem-based forest management plan for 7.1 million hectares of boreal forest. A key feature of the plan is a protected area network that integrates conservation science, Innu traditional knowledge, and cultural land use data. The Innu Nation agreed that a minimum of 60 per cent of the land base needed to be set aside in order to adequately protect the ecological and cultural values of their homeland. An additional important aspect of this initiative was the establishment of an Innu forestry office and the hiring and training of Innu foresters and technicians. Their work consists of collecting field data, integrating Innu perspectives into forest operations, and ensuring on-going communication of their methods and observations to members of the community (Larry Innes, pers. comm., April 2003).

DISCUSSION

The initiatives described in this chapter provide insight into the current use of traditional ecological knowledge in northern Canada, the institutions that are involved, and how communities, governments, and others are working together to ensure that TEK is used in resource management decision making. The following discussion examines the role of legislation, management institutions, and communities in contributing to those changes.

Strong Legislative Guidelines, Policies and Acts – Long-Term Commitment to Using TEK in Resource Management

The different northern initiatives presented in this chapter clearly illustrate that legislated guidelines, policies, and acts are an important foundation for the inclusion of TEK in the management of natural resources. Legislated agreements such as the *Inuvialuit Final Agreement* and the *Nunavut Land Claims Agreement* provide a general framework for ensuring that local communities and their knowledge are part of resource management institutions. Such agreements are useful in defining the relationship boundary and ensuring that time and effort spent on a given project actually lead to concrete results (R. Collier, pers. comm., 2003).

Opportunities for including TEK in resource management can also be defined in impact and benefit agreements. The *Inuit Impact and Benefit Agreement* (1999) for example, provides details related to the structure and responsibilities of the co-operative management of National Parks in Nunavut and the protection of Aboriginal and intellectual property rights. It also presents opportunities for including TEK in all aspects of the work.

In cases where there is no land claim or legislative basis, the requirements for including TEK have no firm legal foundation. In the case of the Lutsel K'e Dene First Nation, for example, the environmental assessment processes of the diamond mining projects have been an important impetus and source of funding

Box 7.2
Species at Risk Act

The implementation of the recently proclaimed Canadian Species at Risk Act (2002) provides an interesting example of these new governance rules and the use of tek in management decisions. The purpose of the Act is *to prevent endangered species or threatened wildlife from becoming extinct or lost from the wild, and to help in the recovery of these species. It is also intended to manage species of special concern and to prevent them from becoming endangered or threatened* (Environment Canada website; *www.ec.gc.ca/EnviroRegs*). It also recognizes that Aboriginal people have an important role in conserving species at risk and that their knowledge should be considered in the assessment of which species may be at risk and in developing and implementing recovery measures. To the extent possible, recovery strategies, action plans and management plans must be prepared in cooperation with provinces, territories, Aboriginal organizations, landowners, and other affected parties. Along with the other claims-based co-management boards (Nunavut Wildlife Management Board, Gwich'in Renewable Resources Board and Sahtu Renewable Resources Board) the Inuvialuit challenged their "advisory" designation in regard to the implementation of the Act. Supported by their land claims settlements, the co-management boards have gained decision-making power in the process operated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). All relevant species status reports are to be reviewed by the relevant co-management boards before decisions are made. The process is so new that it is impossible to judge its success, but it is anticipated that it will be the co-management board's responsibility to ensure that tek is properly used, giving the communities that are home to tek control over the source and interpretation of the information and its relationship to other knowledge. Without these changes in the power structure, COSEWIC subcommittees would have consulted the northern co-management boards or involved them along with other stakeholders, but would not likely have recognized their legal responsibilities to ensure proper linkages with traditional knowledge-holding communities. With the legal agreements in place the use of tek is recognized as both a matter of ensuring that traditional knowledge *and* traditional management systems are part of the process.

for documenting and using traditional knowledge in many aspects of resource management. In the longer term, however, it is unclear what opportunities will exist for community members and their knowledge.

> There is a mistrust/distrust/lack of trust in whether anything will be done in providing information to the planning process. There is a lack of trust in participating unless one can demonstrate that governments are bound by some agreement to do something. (R. Collier, 2003)

In addition to the trust and commitment that comes with legislated arrangements, the new management arrangements present a redistribution in the balance of power (see Box 7.2). In some cases, there are changes of authority, from regional, provincial, territorial, or federal control to equal partnerships, institutionalized

joint decision-making or legislated decision-making power at the local level. Such changes of final authority are recent. They give people a voice in decision making, they provide a mix of social, political, and economic benefits (Berkes 1997), and several writers have proposed that such changes are necessary for the use of TEK (Pinkerton 1989).

New Management Institutions – TEK and Decision Making

Accomplishments achieved by the different northern initiatives suggest that for TEK to be used in management decisions, respect for different knowledge systems must prevail: a respect for the knowledge and the ways of knowing. Although this may appear to be a given, it is not, and it requires continual efforts. In deciding on the beluga whale survey protocol in the Canadian Beaufort Sea (Inuvialuit Settlement Region) or the caribou survey of the Beverly and Qamanirjuaq herds (who range into the Lutsel K'e traditional territory), lengthy discussions arose on the value of the survey results and the "best" methodology; whether the survey accounted for all important areas; whether the surveys were conducted at the right time of year; whether the parameters measured should be quantitative (estimating population size) or qualitative (time of migration, movement patterns of the animals). In developing their beluga whale management plan, the Alaska Beluga Whale Committee realized that a statewide plan could not cover the range of environmental variations and associated hunting methods. In order to better reflect the varied conditions and practices, they opted for regional management plans. As a result, the conservation objectives and the strategies to deal with the harvest strike and loss rates were more easily defined and better adapted to the local biological and cultural situations (H. Huntington, pers. comm. 2003).

These discussions are critical to developing trust in the data gathered and "better" management strategies as well as trust in their validity and applicability. Most often, traditional knowledge holders have more confidence in a methodology that includes diverse types of information, a preference for observations and management options that are based on multiple ecological or socio-ecological variables and taken at fine-grain temporal and spatial scales, providing a better understanding of regional variations in individual species and within the system as a whole (Parlee and Marlowe 2001, Kendrick 2003). Traditional knowledge holders also often insist on consulting with elders in the community, to compare their observations to knowledge gathered by many generations of people living and working on the land of all living and non-living components of the environment.

Information is provided to the management boards in both formal and informal ways. The experience of the Alaska Beluga Whale Committee indicates that when results of a study are published in the scientific literature, the voice of the hunters has more weight with researchers and managers than it would if the hunters were speaking from only their collective wisdom. Similarly, the voice of the biologists has more credibility within the communities because community

West-Side Working Group members discussing Yukon North Slope fishing locations. L-R: J. Archie (Aklavik Hunters and Trappers Committee (HTC)), D. Gordon (Aklavik HTC), B. Ayles (FJMC), and C. Arey (Aklavik HTC). Photo by Ed McLean, Fisheries Joint Management Committee, 2001.

members know that it was their own hunters that collected the data and the samples. People conversant in both knowledge systems are instrumental to this work. They require good listening and communication skills, objectivity on the issue, and cultural sensitivity. They are community members or individuals that commit significant amounts of time to the community and develop long-term relationships with the elders. They travel on the land and develop a sense of local identity. Over time, networks of people develop and form the necessary basis to facilitate the inclusion of different knowledge systems in resource management (R. Collier, pers. comm. 2003).

In the case of Quttinirpaaq National Park and the Canada/Inuvialuit Joint FJMC, it appears that co-management plays a significant role in fostering interactions between TEK holders and scientists, between professionals, administrators, and politicians. Co-management institutions can create a place and a space where people interact, where cross-cultural learning occurs (Kendrick 2003). Significant efforts are made at communicating, listening, and learning from all people interested or affected by the issues. A common understanding of the management objectives develops, and the gathering of additional information creates a sense of shared community (Gray 1985, Stevens 1997, Singleton 1998, Wondolleck and Yaffee 2000). The presence of a local office and the hiring of community members often allows for critical ongoing exchanges of information (Kruse *et al.* 1998), a place for formal and informal discussions. Professionals trained in Western science work closely with traditional knowledge holders, and over time understanding, respect, and trust of the 'other' knowledge system

takes place (Kendrick 2003). This presence of a space for mutual learning forces people to deal with language issues, to define their respective terminology, to interpret difficult concepts, and to understand the strengths and limitations of their knowledge system.

Communities Activities – TEK for the Purpose of Resource Management

The different initiatives introduced in this chapter exemplify an extraordinary level of creativity and adaptation within Aboriginal communities. In the case of co-management arrangements such as the Fisheries Joint Management Committee (FJMC) and Quttinirpaaq National Park, communities are using their knowledge to affect resource management decisions and policies at a regional, territorial, and potentially national level. In the case of the Lutsel K'e Dene First Nation and the Innu forestry Office in Sheshatshui, Labrador, communities are attempting to develop their own community-based approaches to resource management. These offices employ between five and ten people: an administrative assistant, biologists responsible for the research and monitoring programs, permit applications, and environmental impact assessment, GIS technicians responsible for all mapping, and data management and community researchers.

In all cases, Aboriginal peoples have been able to draw and build on their own community capacities. The documentation of traditional knowledge is one activity that enables communities to build on their existing capacities while at the same time learning new skills and approaches for sharing that knowledge in a resource management context. In Lutsel K'e, for example, students are audio and video recording the stories and experiences of their elders and community members and then transcribing those stories and experiences through the use of video, information databases, and GIS technology.

Over the last two decades, communities have been able to build on their existing resource management capacities and find new ways of bringing forward their traditional knowledge in a resource management context. In many areas of the North, communities have become key players in the design and implementation of resource management projects and the decision-making process; in the case of traditional knowledge research, they control what information is collected, how it is analyzed and interpreted, where it is stored, and how it is shared. These changes have resulted in additional community capacity and enhanced ownership and confidence in resource management institutions as well as the decisions made.

> It is tied to the aspirations of the community, self governance; it is part of the fabric of the community. It is bigger than we think. It is not a single issue. Any initiative here or at the political level matters the most in the community. There is so much dependence on a system that is foreign to us in aboriginal communities. We are so cut off from our traditional resources. (Traditional Knowledge Focus Group, Hudson Bay Ocean Working Group, June 2003)

Challenges of Using TEK in Resource and Environmental Management

Through the different initiatives, we have learned about the inherent differences between traditional and science-based knowledge systems. Significant time is spent listening and learning, defining one's terminology, exposing and communicating different worldviews. Significant efforts are made to adapt to the other culture, but making a place for TEK in resource and environmental management often remains a challenge. Where new institutions are created to meet new regulatory requirements as in the case of Lutsel K'e in the Northwest Territories, communities have to expend considerable effort on redefining the scope of the work, discussing the often predetermined biological indicators and monitoring protocol. In cases where we are experiencing a change in the management structure and strong linkages to a central authority (federal government), as with the Canada/Inuvialuit Fisheries Joint Management Committee and Quttinirpaaq National Park, there are comparable challenges. Communities have to invest significant amounts of time and effort at conveying their views of conservation (which often greatly differ from southern views), their approaches to resource management, and their overall understanding of the ecosystems, one of the main distinctions of which is having people as part of the system (Berkes and Folke 1998).

Aside from the redefinition of terminology and the discussion of resource management approaches and worldviews, questions are often asked about the validity of the information presented by traditional knowledge holders (a lack of trust in Western science is also true from the perspective of traditional knowledge holders). Western-trained biologists, scientists, and managers often have greater confidence in TEK results that are published or in TEK results that corroborate their own views and observations. The need for measurables, verification, and sound methodology is always sought even though traditional knowledge systems reside in very different rules and principles. There is more comfort when the information provided consists of empirical observations (or data; see Roots 1998). When the information provided consists of an assemblage of observations and some interpretation, confidence in the information is reduced and people search for a methodology to document the information as abstract data units. Efforts are continuously required to explain the fundamental differences between the knowledge systems, how information is obtained, retained, and validated. Respect usually prevails until a better understanding of the information presented is attained.

> When there is conflict between sets of information, it is accepted that there is a range of opinions, there is no confrontation and people move towards a conclusion without questioning one's credibility. (H. P. Huntington 2003)

CONCLUSION

The insights of this chapter are based on the work of many dedicated individuals, groups, communities, agencies, and governments across

northern Canada. As conveyed by the different initiatives, here are some key elements to success:

A process that takes place over time. From a political, economic, and knowledge perspective, the use of TEK in resource management requires long-term commitments. Agreements are often put in place to define and secure new management structures and ensure that sufficient funding is given for the development of new relationships and the establishment of new institutions. A long-term perspective is critical in documenting the knowledge base and putting in place the necessary protocols for the protection of Aboriginal and intellectual property rights, clearly stating how the information will be collected, analyzed, interpreted, archived, and used. Time is spent on the land gathering and sharing knowledge and skills; time is spent meeting with elders, seeking guidance and wisdom. New roles and capacity develop, people get to know and respect each other.

A space needs to be created for the meaningful participation of traditional knowledge holders. They need to be part of the decision-making process; testimony and documentation can only contribute to decisions if they are properly interpreted and communicated with respect to the specific issue. Such space, achieved through working on common issues, spending time on the land, and developing a common vision, allows for the meaningful interchange of information and respect for different knowledge and management systems. This leads to people becoming conversant in both knowledge systems, people who can act as translators and who are able to oversee the implementation of jointly developed management goals and objectives.

Significant investment in developing the *capacity of local communities* is also essential for the successful inclusion of TEK in resource management decision making. More than a local benefit, capacity building is based on a commitment on the part of communities and other agencies to expanding and advancing the role of TEK in resource management. While community-based approaches to resource management were never replaced by the state system, knowledge, practices, and beliefs were significantly eroded as communities of subsistence harvesters conflicted with and were overruled by government regulations. This erosion of harvesting rights continued largely unchecked until 1982, when constitutional protection was finally afforded to Aboriginal and treaty rights by way of Section 35 of the *1982 Constitution Act* (Donihee 2002). As land claims are settled in different parts of the North, opportunities must arise for communities to further document their knowledge and knowledge systems and to further advance their vision of TEK in resource management.

ACKNOWLEDGMENTS

The authors wish to thank Katherine Cumming for conducting interviews; the Wildlife, Lands and Environment Department of Lutsel K'e First Nation, Henry P. Huntington, Russell Collier, Frances Gertsch, Graham Dodds, and Larry Innes for sharing experiences and insights and for providing a wealth of ideas on the use of traditional knowledge in resources management.

REFERENCES

Acheson, J.M., J.A. Wilson, and R.S. Steneck. 1998. "Managing chaotic fisheries." In *Linking social and ecological systems: management practices and social mechanisms for building resilience*, F. Berkes and C. Folke, eds. Cambridge: Cambridge University Press, 390–413.

Adams, M., K. Frost, and L. Harwood. 1993. "Alaska and Inuvialuit Beluga Whale Committee (ABWC) – an initiative in 'at home management.'" *Arctic* 46:134–37.

Ayles, G.B., and N.B. Snow. 2002. "Canadian Beaufort Sea 2000: The environmental and social setting." *Arctic* 55: 4–17.

Bailey, J.L., N.B. Snow, A. Carpenter and L. Carpenter. 1995. "Cooperative wildlife management under the Western Arctic Inuvialuit Land Claim." In *Integrating people and wildlife a sustainable future*, edited by J. A. Bissonette and K. R. Krausman. Proceedings of the First International Wildlife Management Congress. The Wildlife Society, 11–15.

Berkes, F. 1997. "New and not-so-new directions in the use of the commons: Co-Management." *The Common Property Resource Digest* 42: 5–7.

———. 1998. "Indigenous knowledge and resource management systems in the Canadian subarctic." In *Linking social and ecological systems: management practices and social mechanisms for building resilience*, edited by F. Berkes and C. Folke. Cambridge: Cambridge University Press, 98–128.

———, and C. Folke. 1998. "Linking social and ecological systems for resilience and sustainability." In *Linking social and ecological systems: management practices and social mechanisms for building resilience*, edited by F. Berkes and C. Folke. Cambridge: Cambridge University Press, 1–25.

———, P. George, and R.J. Preston. 1991. "Co-management." *Alternatives* 18: 12–18.

———, R. Mahon, P. McConney, R. Pollnac, and R. Pomeroy. 2001. *Managing small scale fisheries*. International Development Research Centre, Ottawa.

Bielawski, E., in Collaboration with Lutsel K'e Dene First Nation. 1992. *The Desecration of Nanula Tue: Impact of the Talston Hydro Electric Development on Dene Soline*. The Royal Commission on Aboriginal Peoples, Ottawa.

Canada. 1995. *Canadian Biodiversity Strategy. Canada's response to the Convention on Biological Diversity*. Minister of Supplies and Services, Hull.

CFFS (Conservation of Flora and Fauna Secretariat). 1997. *Recommendations on the integration of two ways of knowing: traditional indigenous knowledge and scientific knowledge. http://www/grida.no/caff/inuvTEK.htm*

Day, B. 2002. "Renewable resources of the Beaufort Sea for our children: Perspectives from and Inuvialuit Elder." *Arctic* 55 (Supp.): 1–3.

Donihee, J. 2002. Returning wildlife management to local control in the Northwest Territories. Master of Laws thesis, University of Calgary.
FJMC (Fisheries Joint Management Committee). 2001. *Beaufort Sea Beluga Management Plan*. *http://www.fjmc.ca*
———. 2003. *Fisheries Joint Management Committee Vision: 2000 to 2010*. *http://www.fjmc.ca*
F. Gertsch, G. Dodds, M. Manseau and J. Amagoalik. 2004. "Recent experiences in cooperative management in Canada's northern-most national park." In *Making Ecosystem-based Management Work, Proceedings of the Fifth International Conference on Science and Management of Protected Areas,* Victoria, BC, May 2003, edited by N.W.P. Munro, J.H.M. Willison, T.B. Herman, K. Beazley, and P. Dearden. Wolfville, Nova Scotia: Science and Management of Protected Areas Association.
Gray, B. 1985. "Conditions facilitating interorganizational collaboration." *Human Relations* 38: 911–36.
Green, N., and B. Binder. 1995. "Environmental impact under the Western Arctic (Inuvialuit) Land Claim." In *Integrating people and wildlife for a sustainable future. Proceedings of the First International Wildlife Management Congress*, edited by J. A. Bissonette and K. R. Krausman, 343–45. The Wildlife Society.
Harwood, L.A., S. Innes, P. Norton, and M.C. Kingsley. 1996. "Distribution and abundance of beluga whales in the Mackenzie Estuary, southeast Beaufort Sea, and west Amundsen Gulf during July 1992." *Canadian Journal of Fisheries and Aquatic Sciences* 53: 2262–73.
Harwood, L.A., P. Norton, B. Day, and P. Hall. 2002. "The harvest of beluga whales in Canada's Western Arctic: Hunter-based monitoring of the size and composition of the catch." *Arctic* 55: 10–20.
Harwood, L.A., and T.G. Smith. 2002. "Whales of the Inuvialuit Settlement Region in Canada's Western Arctic: An overview and outlook." *Arctic* 55: 77–93.
Huntington, H.P. 1992. "The Alaska Eskimo whaling commission and other cooperative marine mammal management organizations in Alaska." *Polar Record* 28: 119–26.
———. 2000. "Using traditional ecological knowledge in science: Methods and Applications." *Ecological Applications* 10: 1270–74.
———, P.K. Brown-Schwalenberg, K.J. Frost, M.E. Fernandez-Gimenez, D.W. Norton, and D.H. Rosenberg. 2002. "Observations on the workshop as a means of improving communication between holders of traditional and scientific knowledge." *Environmental Management* 30: 778–92.
Inuit Circumpolar Conference. 1992. *Principles and elements for a comprehensive Arctic Policy*. Centre for Northern Studies and Research, McGill University, Montreal.
Iwasaki-Goodman, M. 2004. "Resource management for the next generation: Co-management of fishery resources in Western Canadian Arctic region." In *Indigenous use and management of marine resources*, edited by J. Savelle, and N. Kishigami. Senri Ethnological Studies, National Museum of Ethnology, Osaka, Japan.
Kendrick, A. 2000. *Learning conceptual diversity through caribou co-management*. The Eighth Conference of the International Association for the Study of Common Property, Bloomington, Indiana.

———. 2003. *Caribou co-management and cross-cultural knowledge sharing*. Ph.D., University of Manitoba, Winnipeg, Manitoba.
Kruse, J., D. Klein, S. Braund, L. Moorehead, and B. Simeone. 1998. "Co-management of natural resources: A comparison of two caribou management systems." *Human Organization* 57: 447–58.
LaDuke, W. 1994. "Traditional ecological knowledge and environmental futures." In Colorado Journal of International Environmental Law and Policy, *Endangered peoples; Indigenous rights and the environment*. Boulder, CO: University Press of Colorado, 126–48.
Marlowe, E., and B. Parlee. 1998. *Traditional knowledge of community health*. West Kitikmeot Slave Study Society, Yellowknife. *http://www.wkss.nt.ca*
McCay, B.J., and J.M. Acheson. 1987. *The question of the commons – the culture and ecology of communal resources*. Tucson: University of Arizona Press.
McGhee, R. 1974. *Beluga hunters: An archaeological reconstruction of the history and culture of the Mackenzie Delta Kittegarymiut*. Toronto: Canadian Museum of Civilization and University of Toronto Press.
Nadasdy, P. 2003. "Reevaluating the co-management success story." *Arctic* 56: 367–80.
Norton, P., and L.A. Harwood. 1986. *Distribution, abundance and behaviour of white whales in the Mackenzie Estuary*. Environmental Studies Research Funds Report 035, Indian and Northern Affairs Canada, Ottawa.
O'Reilly, K., and E. Eacott. 1998. *Aboriginal Peoples and Impact and Benefit Agreements: Report of a National Workshop*. Northern Minerals Programme Working Paper 7.
Parlee, B. 1998. *Community-based monitoring: a model for northern communities*. Master in Environment and Resources Studies. University of Waterloo, Waterloo, Ontario.
———. and E. Marlowe. 2001. *Community-based monitoring project: Final report*. West Kitikmeot Slave Study Society, Yellowknife. *http://www.wkss.nt.ca*
Pinkerton, E. 1989. "Introduction: Attaining better fisheries management through co-management - Prospects, problems and propositions." In *Cooperative management of local fisheries: new directions for improved management and community development*, edited by E. Pinkerton. Vancouver: UBC Press, 3–33.
Pomeroy, R.S. and F. Berkes. 1997. "Two to tango: The role of government in fisheries co-management." *Marine Policy* 21: 465–80.
Posey, D.A. 1999. *Cultural and spiritual values of biodiversity. United Nations Environment Programme*. London, UK and Nairobi, Kenya: Intermediate Technology Publications.
Roots, F. 1998. "Inclusion of different knowledge systems in research." In *Terra Borealis: Proceedings of a workshop on traditional and western scientific environmental knowledge*, edited by M. Manseau, 42–49. Labrador: Institute for Environmental Monitoring and Research.
Ruddle, K. 1994. *A guide to the literature on traditional community-based fishery management in the Asia-Pacific tropics, Fisheries Circular No. 869*. Food and agriculture organization of the United Nations, Rome, Italy.
Singleton, S. 1998. *Constructing cooperation: the evolution of institutions of co-management*. Lansing: University of Michigan Press.

Stern, G.A., and M.G. Ikonomou. 2001. *Temporal trends of organohalogen compounds in Canadian Arctic beluga*. Synopsis of Research Conducted under the 2000–2001 Northern Contaminants Program, Indian Affairs and Northern Development, Ottawa.

Stevens, S. 1997. *Conservation through cultural survival: indigenous peoples and protected areas*. Washington: Island Press.

Tippett, F. 2000. *Towards a broad-based precautionary principle in law and policy: a functional role for indigenous knowledge systems* (TEK) *within decision-making structures*. Master of Laws thesis. Dalhousie University, Halifax, NS.

Usher, P. 2000. "Traditional ecological knowledge in environmental assessment and management." *Arctic* 53: 183–93.

Weaver, P.A. 1991. *The 1987 Beluga* (*Delphinapterus leucas*) *harvest in the Mackenzie River Estuary, NWT*. Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2097.

Wondolleck, J.M., and S.L. Yaffee. 2000. *Making collaboration work: lessons from innovation in natural resource management*. Washington, DC: Island Press.