# Caribou Hunters and Researchers at the Co-management Interface: Emergent Dilemmas and the Dynamics of Legitimacy in Power Sharing

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***Abstract:*** A crisis involving indigenous knowledge, caribou science and proposed oil development illustrates the dynamics of legitimacy in formal co-management. Co-management, while typically framed as an institution for power sharing, was also a force of change that affected the values and actions of those involved. Crisis conditions led hunters to express dissatisfaction to their co-management board, forcing board members to work towards regional consensus, which in turn led to a change in community perspectives. Co-management decision makers with multiple affiliations faced difficult dilemmas while seeking to maintain cultural traditions, protect sensitive wildlife habitat, and manage for the legitimacy of their co-management process.

**Keywords:** co-management, Porcupine Caribou, indigenous hunters, legitimacy, traditional knowledge, Arctic Refuge oil development, northern wildlife research

***Résumé :*** Une crise de cogestion impliquant les connaissances autochtones, la recherche sur le caribou et un projet de développement pétrolier illustre les dynamiques de la légitimité en cours au sein de la cogestion formelle. La cogestion, présentée de façon caractéristique comme une institution visant le partage du pouvoir, s'est également avérée une force de changement qui a affecté les valeurs et les actions des sujets impliqués. Les conditions de crise ont mené les chasseurs à exprimer leur insatisfaction auprès de leur conseil de cogestion, obligeant les membres du conseil à travailler en vue d'un consensus régional qui, à son tour, a entraîné une modification des positions de la collectivité. Les décideurs en cogestion aux affiliations multiples ont fait face à des dilemmes difficiles alors qu'ils cherchaient à la fois à préserver leurs traditions culturelles, à protéger un habitat faunique fragile, et à administrer de façon à légitimer leur processus de cogestion.

**Mots-clés :** cogestion, caribou de la porcupine, chasseurs autochtones, légitimité, connaissances traditionnelles, développement pétrolier de la Réserve de l'Arctique, recherche sur la faune nordique

> A member of my community] just put a burr in my pants....Someone is making some very negative statements, and too bad it happened behind my back. Now, there are some things I don't agree with that go on, but there's also a lot of things, a lot of good that comes from it [research]. Research is necessary."
>
> — Native Community Representative to a Caribou Co-management Board

> You take a group of Native people and you put them on a board and you give them the mandate to make decisions based on information, and they want damn good information. They want [science-based] information. I've seen this with the Porcupine Caribou Board, the Mayo Council, the [Yukon] Fish and Wildlife Management Board...once they're part of the management process and decision making process, they realize the importance of this information. But when they're outside of this process, they have some fundamental problems with it.
>
> — Government Agency Representative to a Caribou Co-management Board

## Introduction

Few conflicts of northern resource management are more contentious than those arising from the three-way intersection of indigenous peoples' traditional relations with animals, proposals for industrial development, and natural scientists' quest to advance knowledge of wildlife. Historical aspects of such conflicts are well articulated in the literature (Berger 1977; Freeman 1989a; Page 1986). The legacy of internal colonialism in the Arctic by nation states (Osherenko and Young 1989), differences in root metaphors that underpin conflicts of indigenous and science-based knowledge (Berkes 1999; Cruikshank 1981, 1998; Gamble 1986; Scott 1996) and the inseparable link between property relations, cultural views on control of nature, and power (Asch 1989;

Feit 1986; MacPherson 1978; Usher 1983) have been noted.

Twenty years ago, as northern peoples, scholars and resource managers assessed these conflicts, there was anticipation and hope about the potential benefits of establishing alternative institutions providing for community-government power sharing in wildlife management (Berkes 1981; Freeman 1981). As a part of that discourse, Berkes (1981), Usher (1971; 1986; 1987), Osherenko (1988a; 1988b), Feit (1973; 1986; 1988), Freeman (1989b), Freeman and Carbyn (1988) and others framed the problems as conflicts between "state" and "indigenous systems" of wildlife management, making explicit the assumption that institutions for the management of wildlife reflect culturally defined authority systems of property relations, practices, and beliefs affecting resources, resource users and their greater community (Bromley 1992a, 1992b). Considering the potential of community-state "power-sharing" alternatives, those advocating the implementation of co-management argued that more holistic insights into ecosystem dynamics would result from an integration of traditional and science-based knowledge, the self-regulatory features of indigenous systems would lower enforcement costs for the state, and indigenous challenges to the legitimacy of state claims to management would be resolved through a redistribution of rights and duties leading to greater community involvement in decision making. There were also questions and speculation about the ultimate shape of future systems of co-management. Anticipating problems in the integration of local and state approaches to management, Feit (1988) spoke of "dual systems of knowing" that could interact to resolve common resource management challenges. Pinkerton (1989), concerned about the forces of bureaucratization, asked if nascent co-management arrangements could remain resilient and accountable to local communities. Looking ahead, Berkes (1981) suggested the emergence of a "third system" of management, which drew on the respective strengths of differing cultural traditions.

Some three decades after the implementation of several legally based co-management agreements in Arctic Canada, there is an opportunity to move beyond speculation and reflect on experience to understand these processes and their underlying dynamics. Several scholars have advanced that effort (e.g., Caulfield 1997; Huntington 1992; Jentoft and Kristoffersen 1989, Kruse et al. 1998; Pinkerton 1989, 1992, 1994; Pomeroy and Berkes 1997), contributing to the interdisciplinary study of common property (McCay, and Acheson 1987; Ostrom et al. 2002). Most recently, students of co-management have focussed on the vertical and horizontal linkages important to institutional performance (Berkes 2002; Young 2002) and the capacity of power-sharing arrangements to facilitate human adaptation (e.g., Berkes and Folke 1998; Berkes, Colding and Folke 2003; Kendrick 2003), while others have focussed on the power imbalances that appear to persist well after the establishment of these arrangements (e.g., Nadasdy 1999; Spak 2002).

This paper adds to the study of co-management by focussing on the problems of legitimacy and emergent dilemmas of power sharing. Serving as the basis for the analysis is a critical incident of caribou hunters and researchers in conflict at a formal caribou co-management interface.[1] The critical incident of this paper, referred to as the "Caribou Co-management Crisis of 1993,"[2] is examined at a micro-level scale of individual and group interactions over a three-month period and at a decadal scale to explore the implications of management as a force for change. The resource regime in which the critical incident occurred involves governance of the internationally migratory Porcupine Caribou herd. This particular critical incident was documented while conducting research on the Canadian co-management of the Porcupine Caribou herd with field studies in the caribou user communities of Old Crow, Yukon and Fort McPherson and Aklavik of Northwest Territories (see Kofinas 1998).

"The Caribou Co-Management Crisis of 1993" arose from hunters' concerns regarding the on-going practice of biological research on caribou, and resulted in the community proposal of a two- to three-year moratorium on future caribou studies. In many respects, the interface of hunters and researchers in the 1993 Crisis challenged the legitimacy of caribou science, with the collaring of caribou calves being a symbolic flash point in the conflict. As a result of the crisis, the co-management board's members grappled with dilemmas and worked towards regional consensus by creating a new board-level policy regarding its role in supporting caribou studies and disseminating information on collared caribou. The new policy, in turn, reshaped locals' perspectives on caribou collars and reduced conflict about the one-time controversial practice.

## The Problem of Legitimacy in Co-management

As a construct, legitimacy is defined here as authority, rightfulness and/or truth that is in accordance with established or accepted forms or requirements. At its essence, legitimacy is a human perception that can be maintained, cultivated or eroded, and therefore is dynamic and subject to forces for change.

Common perceptions of legitimacy are an important ingredient of social capital (Coleman 1990), and thus essential to a co-management arrangement's capacity to achieve consensus among parties and translate consensus into collective action. I suggest that there are three interrelated dimensions of legitimacy that are important to co-management performance. These include:

1. the legitimacy of governing institutions (i.e., formal and informal rules, norms, conventions that define roles and shape human action), such as the legitimacy of a formal agreement that establishes a co-management partnership;
2. the legitimacy of knowledge and the underlying paradigm that guides the production of knowledge used in co-management decision making, such as the findings of a study project and the method used to derive its conclusion;
3. the perceived legitimacy of individuals or organizations that function as stewards of co-management institutions, such as the individuals who serve as community and state agency representatives on a co-management board.

The interrelationship of these dimensions of legitimacy requires that an analysis of co-management consider holistically the complex interactions of various levels of institutional processes, the diversity of views on knowledge and knowledge acquisition, and the authority of individuals and organizations involved. Moreover, it is important to examine how these various aspects of legitimacy interact with each other to shape values, opinion and behaviour.

The legitimacy of institutions has long been of concern in social science. Weber's (1947, 1960) theory of bureaucratization, with its focus on substantive and instrumental rationality, routinization of process, and the tendency of bureaucratic organizations towards goal displacement is a foundational consideration when addressing the problems of legitimacy. In her early analysis of these alternative arrangements, Pinkerton (1989) asked whether the emergence of co-management defies Weber's grand predictions about an ever-increasing scope of bureaucracy in society or if co-management is an incremental move in that direction. Her question points up the related question of whether informal local authority systems of resource management can sustain their legitimacy while nested within larger, more dominant institutional processes.

The conflicts of legitimacy that follow from differing epistemologies are among the most common topics explored in northern co-management studies, with the authority systems of people and their underlying notions of legitimacy commonly referenced as culturally defined paradigms of knowledge (e.g., Lévi-Strauss 1966; Nader 1996). Brody, (1981) Ridington (1990), Rushforth (1992) and others have described how the legitimization of belief among Athabascans is tied to individual experience, and how a hunter's access to power is achieved through dream world and intimate experiences with animals, land and community. Rushforth (1992) notes that the hunter's experience shapes the status of the individual within the community, and thus limits central authority. The skepticism of northern traditional hunters about Western scientific knowledge is sometimes expressed as the limited firsthand experience of scientists in the homelands of hunters, with conflicts arising as scientists regard indigenous rationality as "mystical" and "a-rational" (Burch 1995; Feit 1986).

It is hard to achieve meaningful community-government partnerships, given the tendency of conventional state wildlife management to marginalize traditional forms of knowing (Nakashima 1993). Achieving effective co-management (i.e., power sharing) is not simply a matter of communities asserting their legal rights, but depends on the role of state agencies helping to establish the legitimacy of traditional or informal local-level management systems (Pomeroy and Berkes 1997), a process that may require the socialization of biologists to indigenous culture (Kendrick 2003).

Over the last decade the use of the term "traditional ecological knowledge" has advanced the legitimacy of indigenous knowledge among state agencies and researchers (Berkes 1999), though the extent to which use of that term has resulted in substantively different policy decisions is less clear. Indigenous knowledge as a source of information in decision making does not, however, account for the role of knowledge in informing a process of governance (Nuttall 1998), with examples illustrating how indigenous approaches to decision making (e.g., use of consensus) have been incorporated into co-management procedural policies (e.g., Peter and Urquhart 1991). As noted by Jentotft and Kristoffersen (1989: 363), legitimacy in co-management is not just a result of a decision itself, such as its distributive effects, but also involves the perceived process by which a decision is reached.

There is also evidence that the direction of change as a result of co-management is two-way, as science-based approaches to wildlife management have been adopted by many at the community level (Usher 1995, 2000). While the framing of "indigenous systems" and "state systems" is helpful as a heuristic in the development of theory, it is inadequate in accounting for the complexity and diversity of current *in vivo* cases. What is needed in the development of a theory of co-management is to move beyond typologies and towards an understanding of the mecha-

nisms of change resulting from the interactions of individuals and groups.

The role and perceived legitimacy of the individual in northern co-management, the third dimension explored in this paper, raises another set of problems and is often underappreciated. Kofinas (1998: 174-258), Kruse et al. (1998) and Kendrick (2000) have addressed the community representation problem when the traditions of governance are based on local-level face-to-face interactions (also see Gallagher 1988). Studying co-management for minke whaling in Greenland, Caulfield (1997) notes the emergence of an incipient elite, a finding that has implications when considering the potential rise of oligarchic decision making in co-management. A co-management oligarchy suggests the potential for community co-management board members to lose touch with their constituents and be socialized and or co-opted by conventions of state management. Pinkerton and Keitlah (1990) seek clarity in the morass of these problems, noting how systems of accountability and extraordinary communication efforts are critical in maintaining the overall legitimacy of a co-management system, especially where a process is dependent upon a small group of experts. As we find in the critical incident of this paper, such efforts often come with hardship on the part of those individuals bearing the burden of co-management communications; and a need to grapple with dilemmas that follow when their own awareness of political process and research science is not clearly understood by those outside the immediate co-management interface. In this analysis, such dilemmas serve as indicators of the inherent conflicts of co-management and the limitations of power sharing available to local communities who are partners in these arrangements.

Situating the problems of legitimacy in co-management in a historical context is critical to understanding the turbulence arising in the 1993 incident presented in this paper. A long-term view also highlights processes of social learning and human adaptation not available in snapshot, micro-level analyses. Finally, the appreciation of history points to the larger questions of how, if at all, long-standing co-management arrangements have changed power relations between state agencies and caribou-dependent communities, and how these processes, in turn, changed local communities. To what extent does power sharing result from the implementation of formal co-management agreements and to what extent is it achieved through the voluntary actions of key individuals? Deciphering the intricacies of power relations as related to legitimacy is, at best, tricky business that requires enough detail to avoid attributing all actions to general statements about power inequities. Attributing behavioural change to institutional change is also difficult, especially when assessing the interaction of complex organizations of various scales and the internal dynamics of community.

In light of these theoretical and methodological problems, the 1993 Caribou Crisis is presented here as a detailed ethnographic account of co-management transactions—a set of unfolding multi-scale interactions at the local, regional, and international levels; and as an enterprise of individuals with multiple, and at times competing group affiliations who struggle through a complex and chaotic social drama to maintain both their immediate goals and sense of security for the future.

## A Context for Crisis: The PCH Co-management Arrangement

The Porcupine Caribou herd (PCH) is the eighth largest barren ground caribou herd (*Rangifer tarandus*) in North America, and the largest shared migratory herd of mammals in the United States and Canada. The regime for its governance is complex, involving two national states, three state/territorial-level governments, seven indigenous claimant groups, some 17 indigenous communities, and countless state management agencies and Native organizations.

The communities of Old Crow, Fort McPherson and Aklavik are Canada's three primary user communities of Porcupine Caribou, each with intimate cultural, spiritual and economic ties to the animal (Caulfield 1983; Fast 1998; Kofinas 1998; Slobodin 1962, 1981). Harvest levels for Porcupine Caribou for the past 30 years have been regarded by state managers as relatively low, and have not been of serious concern.[3] The most controversial issue of Porcupine Caribou management is the proposal for oil and gas development in the concentrated calving grounds of the Porcupine herd on the Coastal Plain of Alaska's Arctic National Wildlife Refuge, a proposal that has been formally opposed by all Canadian Porcupine Caribou communities, the Porcupine Caribou Management Board, and the Canadian Federal Government.

The controversy over proposed industrial development in Alaska's Arctic National Wildlife Refuge is the most recent of a long series of proposed economic development activities in the region, resulting in intensive research on caribou. The value of Porcupine Caribou to indigenous people and the potential impacts of hydrocarbon development were highlighted throughout the Berger Hearings of the 1970's. The subsequent Native rights movement that grew out of the Berger assessment, along with historic mistrust between state wildlife management and indigenous peoples, motivated the creation of a joint

co-management agreement for the PCH. Consequently, a Canadian agreement for management of the PCH was negotiated through the 1970s and signed in 1985 by the Canadian Ministry of Environment, the Ministry of Indian Affairs and Northern Development, the Yukon Government, the Northwest Territories, the Council of Yukon Indians, the Inuvialuit Game Council and the Dene Nation and the Metis Association of NWT.[4]

The Canadian Porcupine Caribou Management Agreement established a legal obligation by signatories to perform the following actions:

1. To co-operatively manage the herd and its habitat within Canada so as to ensure the conservation with a view to providing for the ongoing subsistence needs of native users;
2. To provide for participation of Native users in herd management;
3. To protect certain priority harvesting rights in the herd for Native users, while acknowledging that other users may also share the harvest;
4. To acknowledge the rights of Native users as set out in the agreement;
5. To improve communications between governments, Native users and others with regard to the management of the Porcupine Caribou herd within Canada (Canada 1985).[5]

The agreement is somewhat unique in its specific reference to "user communities." Through the terms of the agreement, user communities have special rights to hunt Porcupine Caribou without a licence or special fees, and in the event that a permitting program is necessary for conservation, permits would be issued locally.[6]

The Porcupine Caribou Management Board (PCMB), established by the Canadian Porcupine Caribou Management Agreement, is an eight-person body composed of native and government representatives.[7] By the terms of the Porcupine Caribou Management Agreement, the PCMB serves as a stage for discussions, deliberations and generation of recommendations on matters relating to caribou and PCH habitat in Canada. Its formal authority is advisory to government ministers, and thus, allows the board (and communities through its influence on the board) to recommend policy, but with no assurances that its recommendation will be followed. Thus to function effectively, the PCMB must cultivate and maintain its legitimacy in the management process, both with government ministers and government agencies, as well as with local user communities and other parties.

Two types of language determine the force of the agreement's terms—*shall* statements and *may* statements. *Shall* statements of the in-Canada Porcupine Caribou Management Agreement that direct the board's activities in involving communities in caribou research specify that:

> D.4 The board shall review technical and scientific information relevant to the management of the Porcupine Caribou Herd and its habitats and may advise the Minister of its adequacy.
> D.5 The Board shall encourage native users and other harvesters of Porcupine Caribou to participate in the collection of statistics and biological information.

With less directive language, the Porcupine Caribou Management Agreement also states that the board *may:*

> E.2.a Review and recommend development of Porcupine Caribou research proposals;
> E.2.b Review available information and recommend further research where there appears to be a need;
> E.2.c Review and recommend methods of data collection and presentation;
> E.3 b With respect to habitat protection, the board may identify sensitive habitat areas requiring special protection and recommend measures to protect such areas.

Elsewhere the Porcupine Caribou Management Agreement directs the PCMB to recommend the allocation of quotas if necessary, and thus, implicitly directs the co-management body to assume a role in monitoring and anticipating changes in the herd's total population. Directives for habitat management are provided in the agreement, although these and other provisions appear as recommendations that are advisory in nature.

The Porcupine Caribou Management Agreement's language has implications for the co-management body's authority in directing the work of wildlife management agencies and its mandate to involve communities in the studies of those agencies. With its limited access to financial and human resources, the PCMB and its user caribou communities are essentially dependent on government agencies to implement any caribou research directives that it may recommend. Thus, the PCMB functions within its management domain differently from government agencies (Urquhart 1995). The co-management board is charged with monitoring the status of a living resource's health while also making recommendations on the full array of other management functions (e.g., education, land-use planning, enforcement, human health, etc.), posing a considerable burden for the board, given its divided attentions.

By virtue of the herd's migratory characteristics, the Canadian PCH management is part of a bilateral regime,

with the Canadian approach to caribou management and indigenous rights differing dramatically from that of Alaska. As a result of the Alaska Native Claims Settlement Act (1971) and the absence of special aboriginal title to harvesting in the U.S. and Alaskan constitutions, Iñupiat and Gwich'in caribou user communities of Alaska have access to no comparable co-management body. Adding to the limited rights in management of Alaskan Native communities are protracted state-federal legal conflicts, resulting in co-ordination and co-operation problems between agencies of various land management jurisdictions and between agencies and communities.

The United States and Canada signed a bilateral agreement for conservation of Porcupine Caribou and caribou habitat in 1987, the result of a 20-year negotiation process that paralleled the co-management negotiations for Porcupine Caribou in Canada. While the agreement does set terms directing co-operation among parties and establishing a co-ordinating board of caribou users and agency representatives,[8] the international board has been largely inactive as a result of the vagaries of United States administrations that support oil development in the calving grounds of the Porcupine herd of Alaska Consequently, there have been problems associated with board membership and with the United States meeting its obligations to convene meetings on a regular basis (Kofinas 1998). One of the few products of the International Porcupine Caribou Board is a "Sensitive Habitats Report of the Porcupine Caribou Herd," (IPCB 1993), which was released during the critical incident addressed in this paper. It is within this context that the 1993 Caribou Crisis of the PCH occurred.

## The 1993 Caribou Crisis

### *Early Antecedents to the Crisis*

The Caribou Co-management Crisis of 1993 was preceded by a well documented history of concern and dissatisfaction by indigenous Porcupine Caribou hunters about the practices of caribou science and indigenous people's limited role in the wildlife management.[9] Therrien's (1988) early-stage analysis of the Porcupine Caribou co-management arrangement indicates that by 1986 (i.e., year-one of PCMB operations) there was dissatisfaction among community board members because the new agreement afforded the board few opportunities to influence a caribou research agenda.

A content analysis of PCMB meeting minutes from its first meeting to 1993 reveals a repeated pattern of communication in which Native hunters pose questions about the need for caribou research requiring the use of aircraft and collars and the handling of animals, and a response by agency managers to inform community residents about the value of collars in science and/or demonstrating their application. Never discussed openly at PCMB meetings was what the Gwich'in regard as a negotiated order of power-sharing arrangement between Gwich'in and caribou, established in the time before there was time, *nunh ttrotsit ultsui gwuno* (when the earth was first made), when caribou were people and people were caribou. As told through the stories of the Gwich'in elders, *nunh ttrotsit ultsui gwuno* (when the earth was first made) humans and caribou each experienced hardship. Recognizing their common needs, caribou and Gwich'in shared something of each other and struck an agreement, or as Mary Kendi, a Ehdiitat Gwich'in elder of Aklavik put it, "a deal" that would define future relations. At their separation, an agreement was made for mutual respect, yet the separation between Gwich'in and caribou would never be complete; part of humans' *tinji tthui* (human flesh) would remain in caribou.[10] The mention of this belief here is not to suggest that non-Native agency board members were unaware of indigenous views of caribou as sentient beings. The point is to highlight the absence of such topics in discourse at the co-management interface, and the belief of agency managers that if hunters could be fully educated about the use of collars, they would understand their value to management and therefore, support their use.

### *Catalyst for 1993 Crisis*

Community-level field research for this paper began in February of 1993, with the following summer-to-winter spent in Old Crow, Yukon. While conducting interviews, joining men on caribou hunts, and learning from the stories of elders, I also awaited the arrival of the PCMB, which had scheduled its next meeting for Old Crow in late November, 1993. A key objective of the research was to document if and how local-level concerns would emerge as board-level transactions.

During the summer-to-autumn season, I tracked the comings and goings of two teams of government caribou biologists.[11] Team #1 included a regional biologist and an assistant, and employed two local hunters as guides, hunters and boat drivers. This team travelled up the Porcupine River to collect samples of cow caribou for a study which involved monitoring body condition. The caribou body condition study of Team #1 had been described to me by agency managers as the hallmark of co-management co-operation because of its direct involvement of local hunters. Team #2, included a biologist team leader (also a member of the PCMB), two pilots, and two non-local technicians. Utilizing a helicopter, a fixed wing air-

craft, radio telemetry equipment and a net gun to capture radio collared calves, Team #2 arrived later in the season for a study focussed on the value of the herd's calving grounds to calf survival, using radio collared cow and calf caribou.[12]

Team #1 members were unlucky hunters. The 12 to 15 cow caribou needed for the collection did not avail themselves and the researchers departed the community with only four sets of specimens. As biologists departed for Whitehorse, I was visited by a local hunter who commented on the high expense of flying biologists to conduct fieldwork and asked why those who live in the community were not hired to conduct the body condition sampling on their own. Immediately after Team #1's departure, reports in town circulated that a lone calf orphaned by Team #1 had been seen on the banks of the river, and appeared "lost" and in danger of imminent death by a wolf. Later, a community member sought me out and spoke of his disapproval of those who "play with animals," citing "his religion" as the explanation for caribou's limited availability to the team. The hunter made his point by describing the coincidence of events in the year's observed autumn caribou migration; animals first appeared in large numbers early in the season, then disappeared during the period of the biologists' field study of body condition, and reappeared in large numbers immediately after the biologists' departure. Implicitly, the hunter was referencing his belief that inappropriate human actions affect the behaviour of caribou, and that when traditional rules governing relations with caribou are violated, caribou will not offer themselves to the community.

Team #2's activities began with the layover of a biologist/pilot who was completing an aerial relocation of collared caribou, the preliminary work for Team #2's recapture and measurement activities that would follow. In an effort to be helpful to local hunters with their autumn harvest, the biologist provided a map of collared caribou locations to the community's chief, and commented to the chief about his surprise that the relocations (as noted in the map) indicated a proportionally high number of mortality signals from collared calves.[13] Over the following week, the news of a high number of "dead calf caribou with collars" caused concern as it circulated among local residents and beyond, and residents of the region responded by phoning an elder and respected PCMB representative from an adjacent community seeking an explanation. The PCMB representative, in turn, called several agency biologists to acquire details about the report, but failed to receive details on the study.

The immediate response of the community residents about the "dead calves" provides an indication of community residents' awareness of their co-management system and its community representatives, and a sign that community members perceived the co-management arrangement as a legitimate and appropriate means for addressing concerns over caribou in a crisis situation.[14] The community board member's inability to gain access to information about the calf research project reveals a prior problem of non-co-operation among agency biologists, expressed as reluctance by some scientists to get entangled in a controversy caused by a biologist from another agency. These interactions also reveal a lack of prior discussion by the PCMB on the specifics of the calf research project, which several board members later attributed to unwillingness on the part of the lead biologist of Team #2 to disclose fully the details of his agency's caribou calf research to the board.

As the events concerning the "dead collared calves" unfolded, Team #2 arrived in Old Crow to set up its base of operations in a government-owned building at the edge of the village. The team's days were spent using aircraft to locate and recapture collared calves and their mothers. While in the village, the leader of Team #2 received word that the community chief requested a meeting with the biologist and, after several days of work, Team #2 departed without responding to the request. In an interview after the incident, the leader of Team #2 explained his actions as conflict avoidance:

> [T]he old adage is, if you don't want "no" for an answer, don't ask. So to go to [the community] to say that this is what I'm doing, what do you think? Somebody's gonna say that they don't like it. And then what do you do? Spend time trying to educate the community, I mean, it probably all stems from "I know what I'm doing and I probably know I'm right." Whether that's true or not, you know, if I felt uneasy at all about what I was doing in terms of having some conservation problem with the herd, maybe, I would be more apt to go and consult and sort of get concurrence and get their blessing to go on and do it.

The autumn's caribou research activities prompted wide discussion among locals about the limited utility of caribou research for management and the negative effects of scientific studies on caribou behaviour (i.e., changes in caribou migration patterns that are less concentrated than years ago, animals being more "skittish" and therefore harder to hunt). Hunters also reported that adult caribou with collars appeared to be shunned by other caribou of the herd, an assertion that indirectly challenged the legitimacy of the findings of Team #2's caribou research project.[15] In those discussions, "caribou studies"

were described as a by-product of industries' oil and gas development proposals, and not as a means of assessing oil development impacts on caribou. According to several community hunters, the goal of scientific caribou research was being undertaken for the advancement of professional careers, not for the acquisition of knowledge for management of the herd.

### *Community Response: A Proposed Moratorium on Future Caribou Studies*

After the departure of the research teams, three community PCMB representatives and the community's Chief expressed their support in separate interviews for instituting a two- to three-year moratorium on all caribou research in order to "Give caribou a rest." Calls for a two- to three-year moratorium on caribou research were also mentioned by other leaders, including a high-profile informal community leader (i.e., not elected and not on the PCMB) who drew on access to the media to embark on a campaign to advocate the moratorium. At several public events the informal leader publicly countered the PCMB chairperson who defended the need for scientific research (Buckley 1993a; 1993b). As a result, the PCMB chairperson and the informal leader found themselves in an awkward position of being allied in the fight to stop oil development in the concentrated calving area of Alaska's Arctic National Wildlife Refuge, yet at odds about the future of caribou research. As the stress of the situation surfaced at the co-management board level, community and government board members talked of the importance of maintaining good intra-group relations among the board's membership and the difficulties of sharing their understanding of caribou science with fellow community members. Several members talked of the strong bonds of loyalty and trust that had evolved between all PCMB members through their shared experience at meetings. One government PCMB member spoke to the group of his commitment to the co-management agreement, and how his membership on the board superseded his responsibilities as an agency manager.

The public debate on caribou research appeared to several board members as potentially threatening to the legitimacy of PCMB at a political level. Since the PCMB is an advisory co-management body, much of its political capital is accrued by maintaining its role in resolving difficult public policy issues in a manner that is perceived by government ministers to be reasonable. With concerns about the PCMB's future, non-native members talked about another wildlife management board of the region as a "renegade" or "run-away management board," meaning that it had deviated widely from the interests of senior bureaucrats, and its recommendations were no longer taken seriously by government. By maintaining and even cultivating its legitimacy, a co-management board provides elected officials the opportunity to hand off difficult decisions that might otherwise erode their political capital. For those at the co-management interface, cultivating a co-management board's legitimacy is an on-going balancing act that occasionally requires compromise by all, and at times, makes special demands of members who are the least powerful partners in the arrangement (i.e., communities). Complicating the problem of the board's legitimacy in this incident was the informal leader's attempt to influence decision making by bringing the debate to the public at large (vs. the internal confines of a board-level process) and thus, circumventing what most board members viewed as the perceived boundaries of the co-management process.

Contributing to the solidarity of the PCMB on a grander scale throughout the conflict was the external threat of proposed oil development on calving grounds in Alaska. As it happened, the media attention on the caribou research debate occurred as the International Porcupine Caribou Board met and agreed to publish its *Sensitive Habitats Report of the PCH* (IPCB 1993), a document identifying the PCH's calving and post-calving grounds (including the Coastal Plain in Alaska) as its most sensitive habitat.[16] Board members realized that the *Sensitive Habitats Report* would assist in the political fight to stop Arctic Refuge oil development. As well, community PCMB representatives were reminded that much of the data compilation, analysis and the overall conceptualization of the report was undertaken by their fellow PCMB member (and leader of research Team #2 involved with the calf study).

After the decision to release the *Sensitive Habitats Report,* community PCMB members supporting the idea of a moratorium on research abandoned that idea and aligned themselves with government board members. In the course of the shift, the informal leader who had publicly voiced opposition to future studies was then openly labelled by some board members as "the problem" and more privately, was vilified by the group for breaching the norms of the co-management process by publicly challenging the board. (See first quote at beginning of this paper.) An agency manager and PCMB member later explained the shift in opinion as part of a socialization process by which Native co-management board members' perspectives on science are transformed when serving on a joint management body. (See second quote at beginning of this paper.)

### *Voicing of Community Concerns to the Co-management Board*

The PCMB convened its scheduled fall meeting in Old Crow immediately following these events.[17] As a part of all the board's meetings, an open public meeting was held with members of the hosting community. The agenda of the public meeting, set by the PCMB, was focussed only on community involvement in the political lobby to stop oil development in Arctic Refuge and with no mention of the caribou research problem. As the PCMB chairperson brought closure to the public meeting, the community's chief (not a member of the PCMB) stood and spoke:

> One issue that is of concern, that comes up in the community is that studies have been going on long enough. The issue behind that is the collaring thing. Porcupine Caribou Herd research gotta stop messing with the young calves because they are growing and they get tired as they grow. That is one of the concerns this community has this winter. I think the Porcupine Caribou Board should put that into a resolution tomorrow. The community is concerned about that and I'm here to speak on that issue.

Following the statement by the Chief, local hunters expressed concern about the disrespect for caribou by researchers and the impact of repeated biological research. Several community members called for a two- to three-year moratorium on all PCH studies. One hunter shared his eyewitness account of caribou harassment by helicopters. Another asked why a method for capturing and collaring caribou swimming at caribou river crossings, previously used in the 1970s and employing local hunters with their boats, was no longer practiced. An elder talked about the confusion between what he understood to be a need for studies that ensure the herd's health and what appeared to be a wasteful allocation of research dollars for activities offering limited value to herd management. Recognizing that the Porcupine herd is the most studied caribou herd in the world, the elder asked, "Don't you know enough yet?"

All government members of the PCMB interviewed after that meeting stated that the public call for a moratorium was unanticipated by the board. Given the public debate before the meeting, their claims of surprise are not easily evaluated here, but likely follow from government board members' incorrect assumption that the informal leader's critique of caribou research via the media was part of a personal agenda and not a widely-held concern of residents of the communities. Another explanation is that board members hoped that the issue would dissipate, as it had in the past, and thus, focussed the public meeting on political lobbying. It is most surprising that Native community representatives had not adequately communicated the level of community concern about the caribou research to fellow board members, and together with them, explored ways of addressing those concerns directly.[18]

The leader of Team #2 responded to the community by presenting statistical evidence indicating that calves orphaned in the fall season are more likely to survive the loss of a mother than perish,[19] and thus, matched the earlier pattern of responding to local concerns with information. The meeting ended with the chairman reflecting publicly on the difficulties faced by the group, commenting, "You know, bringing traditional knowledge together with science has always been a hard one," and with community members expressing their dissatisfaction with the unwillingness of the PCMB to respond to their concerns.

### *Crisis Boiling Point to Board-level Consensus: Passing a Resolution to Support Future Caribou Studies*

Bringing the crisis to a flash point was the uninvited arrival of a delegation of Canadian government personnel to discuss Canadian Government plans to open gas and oil leasing rights for bid within the Canadian range of the Porcupine herd, which angered community leaders and board members alike. Needing a private stage to sort through the issues, the board called an in-camera (members-only) session, inviting the community chief who was leading the charge for a moratorium on caribou studies and not the oil industry-government delegation.[20]

The in-camera discussion began with a Native board member telling of his grandfather's rich but limited knowledge of caribou movements. The leader of Team #2 who was also a board member expressed frustration at being the target of repeated community attacks on caribou studies while community leaders selectively gleaned the benefits of his studies for management and lobbying. Having invested a career in studying the Porcupine herd, he presented the board with an ultimatum: he would conduct no future PCH research unless his research received full-board support. A manager noted that funding cycles for biological studies makes it difficult to cease and then re-initiate a well-supported caribou research program. Community board members discussed the value of scientific research in managing a caribou herd in the face of unknown contaminants, future impact assessment processes and fluctuating herd populations. The members pondered the dilemma and considered their choices.

On the one hand, there was a desire by community members to be respectful of and maintain local cultural traditions on caribou. On the other hand, there was a need to be strategic when confronting new environmental threats and interfacing with systems of authority in which the legitimacy of knowledge differs from that of the local indigenous culture.

The local chief listened, talked, and then concluded that he was "convinced" science would provide his community with a "bigger hammer" in its efforts to lobby against proposed oil development in Alaska's Arctic Refuge. The instrumental value of Western science was formally acknowledged and endorsed by all members of the co-management board as well as the community chief. The board achieved consensus, with the understanding that the calf-collaring project's funding would soon end. As a part of the consensus it was also agreed that all future caribou research would be reviewed and, if endorsed by the PCMB, would receive full public board support. Reconvening its regular meeting, the PCMB passed by consensus a formal resolution supporting future caribou studies. No one from the board or the community voiced concerns or critical comments about caribou research for the remainder of the meeting.

### *Post-Crisis Conditions: Changes in Research Review Protocol and a New Policy to Achieve Community Buy-in for Collars*

A government agency wildlife manager and member of the PCMB later described the board's resolution as an important policy shift in the business of Porcupine Caribou co-management. Admitting his own role in the crisis, the agency manager noted that prior to the crisis, government managers and community board members alike had found it convenient to sit back and watch as caribou biologists bore the burden of defending their studies to local community members. In the future, the manager proclaimed, the co-management board would change its strategy by being openly supportive of caribou researchers and more assertive when endorsing the legitimacy of caribou science. The new policy of the board also relocated review and approval of future PCH research projects from agencies to the Porcupine Caribou Management Board.

Four months later, the board met again and revisited community concerns regarding use of collars by endorsing a new communication strategy to achieve better "community buy-in" for the use of radio collars. The strategy called for maps of caribou radio satellite collar locations to be faxed to local renewable resource councils, tribal offices, hunters' and trappers' committees and schools as a way of making the data immediately available and useful to local hunters. The strategy would essentially extend the instrumental value of using radio collars for science to using radio collars for assisting in the harvesting of caribou. Soon after initiating the new program, local hunters began using the faxed maps when planning their hunts.[21] While community concerns about the caribou research activities of autumn 1993 remained high into the following year at the community level, statements of concern about collaring of caribou at subsequent PCMB meetings have been mostly absent since the implementation of the collar information sharing program. In its place, however, emerged a new issue concerning the appropriateness of using radio collar data as a means of locating caribou for hunting. In response, the PCMB passed a follow-up resolution directing agencies to delay the dissemination of collar locations to the public by two weeks.

The events of the crisis unfolded as agency managers and biologists began to grapple with implementing new land-claims agreements in Yukon that explicitly state that wildlife management "integrate the relevant knowledge and experience both of Yukon Indian People and the scientific community in order to achieve conservation" (e.g., Section 16.1.1.7 of the Yukon First Nations Umbrella Final Agreement). During the 10 years that followed the 1993 Crisis, caribou researchers modified their research program for the herd by employing hunters to intercept and collar caribou from boats at river crossings, a practice which had been common in the 1970s . A revised body condition monitoring study (i.e., a continuation of Team #1's study) was introduced, in which local hunters work independently of agency biologists. The program brought limited success initially because of hunters' unwillingness to "mess with animals" but later worked well. Another agency study was initiated to documented local knowledge related to disturbance of the Dempster Highway (Smith and Cooley 2004). Several other study projects incorporating community knowledge of caribou and caribou hunting were also undertaken starting in 1997, focussing on ecological monitoring and integrated assessment of change, with the former leader of Team #2 PCMB member being one of their strongest advocates.

## Discussion

The 1993 Caribou Crisis of the Porcupine herd differs from the now famous "Caribou Crisis" of the 1950s and 1960s, involving caribou herds to the east (Banfield 1956). Whereas the former Caribou Crisis was publicized by managers and biologists (Banfield 1950, 1956, 1964; Symington 1965) and followed from the findings of scientific studies assuming that unregulated Native hunting was a key driver in the apparent decline of barren ground

caribou populations (Kelsall 1968), the 1993 Caribou Co-management Crisis of the Porcupine Herd was prompted by local community members' perceptions that research activities were having a negative effect on caribou. The 1993 incident's reversed direction of causality (i.e., researchers rather than native hunters are perceived as having an impact on caribou), and the reversed perception of crisis (i.e., the community members see the crisis, not the researchers), is one indication of the dynamics of power sharing and the issues of legitimacy that can emerge.

### *The Function of Agreements*

Clearly, differing "authority systems" are at the heart of the 1993 incident. Everden's (1993) image of *paradigm as iceberg* is helpful, suggesting that while navigating the conflicts of culture and environment, focus is commonly placed on the above-surface features (i.e., actions and words), while the submerged elements (i.e., the unspoken assumptions) are hugely significant in understanding the problem. The weakness of formal caribou agreements, both the Canadian Porcupine Caribou Agreement and the International Agreement for the Conservation of Porcupine Caribou, also explains much of the cause of the 1993 Crisis. Both agreements were drafted and signed well before northern resource management had adopted the common use of the term "traditional ecological knowledge." While there has long been a self awareness of the legitimacy of indigenous knowledge by Native caribou hunters, the absence of terminology in the agreement making its legitimacy explicit resulted in local communities having limited involvement in research and monitoring. The recent recognition of knowledge integration in the Yukon Land Claim explains the more recent changes.

Had the establishment of the PCH co-management system changed the conditions of state wildlife management described years ago? The, "If you don't want 'no' for an answer, don't ask" adage espoused by the leader of Team #2 during the crisis illustrates how local communities can be ignored by agencies and the importance of voluntary co-operation on the part of agencies in a co-management process when the legitimacy of local knowledge is not made explicit (Pomeroy and Berkes 1997). It also shows us how communities and agencies can concurrently share political positions (e.g., being against oil development in Arctic Refuge) while at the same time be engaged in serious conflict about matters of culture. Yet the crisis also illustrates how co-management can serve as a stage for communities to voice their concerns publicly, and together with various groups, work through varying degrees of conflict to find common ground.

Clearly, the problems for the PCMB associated with proposed development of the Arctic National Wildlife Refuge and the limited effectiveness of the International Porcupine Caribou Board are critical to understanding how the Canadian "stand-alone co-management" arrangement is encapsulated as a part of an international geo-political debate, and how those greater political conditions can limit the options in a regional scale co-management processes.

### *Co-managers with Multiple Affiliations*

Yet, the problems of legitimacy in power sharing are apparent here not simply as struggles of authority systems, but as a set of challenges faced by individuals closely engaged in and affected by the co-management process. Those directly involved in the 1993 Crisis faced an array of dilemmas, especially when holding multiple affiliations in two or more organizations (e.g., community hunter and PCMB board member). The nature of the individuals' dilemmas differed, depending on affiliations. Several agency board members confronted the challenge of representing their home agencies, while at the same time seeking to retain the trust of user communities, by claiming allegiance to the agreement, not to their agencies. Native community board members faced the challenge of endorsing science-based research, while facing critical community leaders with limited understanding of science. Elsewhere, I have addressed the "cost of power sharing" in caribou co-management (Kofinas 1998), suggesting that the avoidance of costs, as opposed to a focus on the pursuit of benefits, helps to explain many of the patterns of interaction among participants in a co-management process. The 1993 caribou crisis illustrates how co-management, although fraught with problems, did facilitate the sorting out of dilemmas and prioritizing of concerns, and in the end arrived at a workable level of consistency.

The emergence of the co-management board as an independent social unit with its own sense of identity, allegiances and organizational development is an important variable in this assessment of community-state power sharing. In the 1993 crisis, PCMB members not only faced decisions regarding research and management of the herd, it also made decisions regarding how best to maintain its own legitimacy. Does the focus on the future legitimacy of the board represent a form of goal displacement, typical of other bureaucracies? It does not appear so. The effort to achieve congruency does, however, suggest the need for co-managers to balance the dual objectives of resource conservation and institutional legitimacy, which is neither simple nor easy, and at best comes with significant compromise.

Clearly, a key factor in the PCMB's strong performance has been the perceived presence of a unifying external threat to caribou—the proposal for development on the herd's calving grounds. The presence of this external threat functioned to confirm the board's solidarity, galvanize group members, and dissolve the critical differences. The emergence of the co-management board as a social unit with legal authority fulfills the visions of its founders, the communities, and many of its members—but it is also potentially problematic for communities that seek to influence board level recommendations. However, in this case I do not find the emergence of a co-management oligarchy. Instead, I observed committed individuals, translating the needs of the greater collective with an insider's appreciation of the problems.

### *Co-management as a Force for Change*

The 1993 Caribou Crisis marks an important moment in the history of the PCH co-management process and demonstrates how an arrangement can evolve well after the signing of agreements to enhance the role of communities and build a greater mutual understanding between researchers and hunters. Viewing the history of co-management as periods of pre- co-management, early-stage co-management, and developing co-management, we first find communities outside the caribou management process of agencies, then find them engaged with limited access and with frustration, and ultimately guiding agency and university research through the co-management body. We also observe changes at the individual level, including the transformation of the caribou biologist (leader of Team #2 and PCMB member) who moved from a preference for conflict avoidance to engagement as an advocate of local knowledge. Most important, these changes suggest the need for analysts to take a long-term view when analyzing co-management performance, rather than focussing on snapshot images at specific points in time.

It is, however, ironic that the 1993 Crisis with its ultimatum from a caribou biologist resulted in a commitment from board members to be more supportive of caribou research in the future. The acceptance by the local leader of caribou studies as a "hammer" in political battles against development, and the board's introduction of radio collars as a tool for caribou harvesting, raises questions about the consequence of co-management as a force for culture change. Should the dissemination of collar information be viewed as an intentional form of social engineering by the PCMB in an area in which communities had once resisted? Were the theories of cognitive dissonance (i.e., get them to do it and they will eventually support it) intentionally applied by those at the interface as part of the co-management process to achieve community buy-in? Are the actions of the PCMB to be interpreted as the co-option of communities to embrace the instrumental rationality of science? Will the long-term use of the constructs of science along with the current loss of native language ultimately lead to a greater dominance of the science paradigm? Will community acceptance of collars ultimately degrade indigenous forms of legitimacy, or are these changes simply part of a process of human adaptation that co-management is helping to facilitate? Clearly, understanding co-management as a force for cultural change and exploring the ethics of social engineering by co-management boards are topics worthy of future exploration.

## Conclusion

Power sharing arrangements and their attendant problems of legitimacy are neither simple nor are they a panacea for harmony. The co-management decision-making process documented in this incident involved conflicts of differing paradigms, the struggles of decision makers who had multiple and at times conflicting organizational affiliations, and the ambitions of caribou hunting people to sustain a preferred way of life. These conflicts were encapsulated within a greater controversy involving oil development in the Arctic National Wildlife Refuge. The ability of the co-management system and in particular, the PCMB, to achieve a workable consensus in the 1993 Crisis in spite of high turbulence, speaks well of the board's capacity to meet its obligations to protect caribou and provide security to caribou people. And while the arrangement's performance in achieving regional consensus is clearly impressive in this incident, its ultimate success will depend to a great extent on the ability of the board, caribou user communities, state agencies and others to balance the co-management institution's legitimacy with those of local authority systems.

The PCMB's decision to disseminate caribou collar data to local communities as a means of achieving better community buy-in for scientific use of collars raises important and outstanding questions. Answering these questions requires a framework that assumes formal co-management institutions and local cultures are highly dynamic. As a drama of unfolding events, the 1993 Crisis reveals an uneven, multidirectional, and ongoing set of processes of change, with legitimacy of knowledge, institutions and individuals as an interacting part of the dynamic. The 1993 Crisis represents a relatively early set of co-management transactions occurring only eight years after the signing of the Porcupine Caribou Management Agreement. The long-term durability of this

arrangement and the future of its local authority systems are unknown. Emerging from such processes are transformed authority systems, where the boundaries of indigenous and state authority systems are less defined. While imperfect, their ongoing and emerging paths are essential to caribou and local communities as strategies for the future.

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## Notes

1 Formal co-management arrangements are those based on legal agreements and differ from *de facto* power sharing (Acheson 1989).

2 Reference to the situation as one of "crisis" is taken from an agency board member's memo, written to the Yukon Director of Wildlife.

3 Total annual harvest generally ranges from 3 000 to 6 000 animals, which is well below 3% of the herd's total population. Population levels of the PCH are reported as having increased from 135 000 to 178 000 animals during the period 1983 to 1989, and there was a decline to 123 000 animals in 2001.

4 Because of a change in land claims status, the rights conveyed to the Dene Nation and the Metis Association of NWT are now assumed by the Gwich'in Tribal Council. The Canadian Porcupine Agreement differs from Canada's other long-standing co-management arrangement, the Beverly-Qamanirjuaq Caribou Management Agreement. In the Beverly-Qamanirjuaq agreement, native organizations signed as witnesses to the agreement being between territorial- and federal-level governments. The main driver behind establishing theses agreements also differ. Whereas the Beverly-Qamanirjuaq Caribou Management Agreement of central Canada grew out of conflicts regarding hunters' and managers' differing perceptions in populations levels, the PCH co-management agreement was the result of habitat issues that find their roots in the Arctic Gas and Mackenzie Valley Pipeline environmental assessment process of the mid-1970s, the land claims settlement in the Inuvialuit Settlement Region, and early attempts to negotiate an international caribou agreement.

5 The co-management agreement, while being a "stand-alone," (i.e., signed independent of land claims processes) is explicitly referenced in the Inuvialuit Final Agreements, the Yukon First Nation Umbrella Final Agreement, and the Gwich'in Land Claims Agreement, all of which are constitutionally entrenched.

6 Canadian Porcupine Caribou user communities are Old Crow, Dawson, Mayo, Fort McPherson, Tsiigehtchic, Aklavik, Inuvik and Tutktoyaktuk.

7 Terms of the Canadian Porcupine Caribou Agreement provide for membership to the PCMB by each of the signatories, as well as a provision for a Yukon-at-Large member and a member from Old Crow.

8 The PCMB Chairperson and agency members of Yukon government, the Canadian Federal Government, and Northwest Territories sit on the International Porcupine Caribou Board as the Canadian delegation.

9 Transcripts from the Mackenzie Valley Pipeline hearings document local hunters' concern regarding the intensive use of aircraft for surveying the seasonal movement of the herd and their effects on herd movement and local hunting. It is noteworthy that during this same era, caribou biologists commonly spent considerable time (i.e. months) working in communities conducting field work, hiring teams of local residents as research assistants at a level that is greater than the employment of caribou research in 1993. This period also predates the use of aircraft to capture caribou and affix caribou radio collars for tracking. Instead caribou were collared at river crossings with local hunters working along side researchers. While some elders talked fondly to me of their work with select biologists of this period, others also mentioned how their "old stories" were dismissed by some biologists.

10 Mary Kendi told me of the symbolic reminder of *tinji tthui* (human flesh) left from the caribou-human exchange. When bringing a caribou leg to John Vaneltsi, Alfred Francis and Mary Vittrikwa, each located the *tinji tthui ti* (human flesh) near the patella, with Mary Kendi noting that the symbolic reminder is in the rear leg of the caribou. As Roy Moses and Charlie Peter Charlie described it (in separate but consistent accounts), on the hind leg of the caribou and in front of that leg there is a piece of flesh extending from the top of the shank downward. Here is found the *tinji tthui (*human flesh), a part that is not eaten. See Slobodin (1981) for a different account of this story.

11 Research on the Porcupine Caribou herd finds its roots in the studies of Olaus Murie (1935), and resumed in the early 1950s with use of aircraft observations (Munro 1953). It intensified in the early 1970s as a part of the Mackenzie and Arctic Gas pipeline impact assessment processes (Jakimchuk 1975a, 1975b) and further concentrated with interest in oil development in the Coastal Plain of the Arctic National Wildlife Refuge (Griffith et al. 2002; Russell et al. 1992). As

a result of this well funded and on-going research program, Porcupine Caribou are regarded as the most studied herd of ungulates in Arctic North America.

12 Net gunning caribou from helicopters is a method of casting a large net on wildlife, and is employed to capture select animals. It has been developed, in part, to avoid the use tranquilizer drugs.

13 The aerial transect map was faxed to the community's Chief by the Alaskan PCH caribou researcher on September 28, 1993. The map's dotted lines trace the biologist's aerial flight path. Symbols show where caribou were located. "Mortality signals" (i.e., which indicates that the collar has not moved for an extended period of time transmit a unique signal). The map hung for a five-day period on the community's office building, with no written explanation.

14 These conditions stand in contrast to findings of Kruse et al (1998) whose research showed a lack of knowledge by Beverly and Qamanirjuaq caribou users of their co-management system and their co-management board representatives. One explanation for the difference is the relatively smaller size of the PCH region.

15 A traditional hunter's knowledge of caribou behaviour includes a detailed account of social relations among caribou and their collective behaviour to avoid predators. Shunned caribou, like shunned hunters of a former time, are less likely to survive. See Kofinas (1998: 120-171).

16 International agreements are notorious for creating ineffectual regimes because of an unwillingness of federal-level parties to implement their terms. See Young (1994). The International Agreement for the Conservation of Porcupine Caribou and the International Porcupine Caribou Board, established from it, suffer from the same problem.

17 PCMB meetings occur three times a year, rotating meeting location to different caribou user communities and regional centers.

18 Indirect patterns of communication by the public and a co-management board are explored in the Alaska context by Morrow, and Hensel (1992).

19 See Russell et al. (1991) for description of the study described.

20 The in-camera session is the only time in my work with the PCMB that I was excluded from observing its members' work. The events of the in-camera were reconstructed based on interviews with seven of the individuals who participated in the meeting and an internal memo filed by a PCMB government member.

21 Collared caribou locations have also been posted of the web, and local hunters with access to internet services regularly access the information when planning hunts.

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