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Towards a protocol for community monitoring of caribou body condition

Gary Kofinas[1], Phil Lyver[2], Don Russell[3], Robert White[1], Augie Nelson[4] & Nicholas Flanders[5]

[1] Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska 99775-7000, USA (ffgpk@uaf.edu).
[2] Natural Resource Institute, University of Manitoba, Winnipeg, MB.
[3] Environment Canada, Canadian Wildlife Service, Pacific and Yukon Region, Whitehorse, Yukon.
[4] Kotzebue IRA, Kotzebue Alaska.
[5] Environmental and Social Development, International Finance Corporation, Washington, DC. Formerly with the Institute of Arctic Studies at Dartmouth College.

Abstract: Effective ecological monitoring is central to the sustainability of subsistence resources of indigenous communities. For caribou, Arctic indigenous people's most important terrestrial subsistence resource, body condition is a useful measure because it integrates many ecological factors that influence caribou productivity and is recognized by biologists and hunters as meaningful. We draw on experience working with indigenous communities to develop a body condition monitoring protocol for harvested animals. Local indigenous knowledge provides a broad set of caribou health indicators and explanations of how environmental conditions may affect body condition. Scientific research on caribou body condition provides a basis to develop a simple dichotomous key that includes back fat, intestinal fat, kidney fat and marrow-fat, as measures of body fat, which in autumn to early winter correlates with the likelihood of pregnancy. The dichotomous key was formulated on "expert knowledge" and validated against field estimates of body composition. We compare local indigenous knowledge indicators with hunter documented data based on the dichotomous key. The potential contribution of community body condition monitoring can be realized through the continued comparative analysis of datasets. Better communication among hunters and scientists, and refinement of data collection and analysis methods are recommended. Results suggest that specific local knowledge may become generalized and integrated between regions if the dichotomous key is used as a generalized (semi-quantitative) index and complemented with other science and community-based assessments.

Key words: local knowledge, traditional ecological knowledge (TEK).

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Introduction

There is a need to advance the methods of Rangifer monitoring to address the potential impacts of global change (i.e. climate change, industrial development, culture change) and build cooperative programs of resource management that involve agency managers, indigenous and non-indigenous resource users, and research scientists (Russell et al., 2000). The objective of this paper is to move that effort forward by exploring the potential of a Rangifer monitoring program based on body condition assessments of caribou harvested by indigenous hunters. We present three dimensions of the problem by examining local and traditional knowledge perspectives on caribou body condition, introducing a research-based analysis of caribou body condition that produces a simple dichotomous key for assessing caribou body condition, and exploring practical and theoretical challenges associated with implementation and synthesis of a community-based body condition monitoring program.

The material of this paper is drawn primarily from three experiments in caribou body condition monitoring involving local communities and graduate research on body condition of caribou (Adamczewski, 1987; Allaye-Chan, 1991; Gerhart, 1995). The Caribou Traditional Knowledge Project of the Western Arctic Herd in Alaska, undertaken in coop-

Table 1. What Old Crow, Fort McPherson, and Aklavik hunters perceive as the best source of information on body condition, caribou migration, and the Porcupine herd's population.

Body condition	n=105	*Migration*	n=106	*Population*	n=114
local hunters	38%	elders	37%	biologists	15%
self	13%	don't know, its a mystery	12%	PCMB member by name	14%
elders	10%	PCMB member by name	10%	A wildlife officer	12%
				Hunter's local organization	12%
				PCMB	11%

eration with hunters of Kotzebue and Kiana, Alaska; the Arctic Borderlands Ecological Knowledge Co-op (Kofinas et al., 2002a) which involves Porcupine Caribou user communities of Alaska, Northwest Territories, and Yukon; and the Łútsël K'é Study of the Bathurst Caribou Herd, undertaken with Łútsël K'é hunters and the Lands, Wildlife, and Environment Committee of that community contributed indigenous knowledge. Transactions of the Body Condition Monitoring Technical Workshop, held in Whitehorse, Yukon on February 16-20, 2000, provided scientific expert knowledge on body compositions (Kofinas et al., 2002b). The workshop recommended that community-based systems for monitoring caribou that track individual and herd well-being, detect change in environmental conditions, and contribute to the co-managed assessment of possible futures be established (ibid.). This community monitoring objective is a component of the new circumpolar monitoring initiative of the Conservation of Arctic Flora and Fauna (CAFF) working group, which seeks to draw on local and scientific knowledge to develop a broad set of indicators of Human-Rangifer Systems that will track change and allow for comparison between regions. This goal addresses the current necessity to move beyond broad and abstract discussions about the definition and value of traditional ecological knowledge, and towards the implementation of management systems that benefit from local knowledge as well as the more conventional approaches to the science of resource management (Stevenson, 1996; Berkes, 1999; Elkin, 1999; Berkes et al., 2000; Usher, 2000).

Rationale for exploring the potential of community monitoring of caribou body condition

Several factors motivate us to explore if and how community caribou monitoring of body condition can be undertaken. On the individual animal level, research findings show that caribou body condition is an important indicator of environmental conditions (Dauphiné, 1976; Reimers et al., 1982, 1983), integrating weather conditions, forage quality, and the reproductive history of a cow (Cameron et al., 1993; Chan-McLeod et al., 1995, 1999; Gerhart et al., 1996, 1997; Russell & White 2000). In autumn to early winter, body weight and condition of female caribou contributes to the likelihood the individual will become pregnant (Cameron et al., 1993, 2000) and the embryo retained (Russell et al., 1998). However body condition of calving females is indicative of the over winter effects and also correlates with milk production (R. White unpubl.), which is important to calf survival (Griffith et al., 2002). How individual cow caribou body condition relates to herd level productivity is less well understood. We hypothesize that a measurable decrease in herd fecundity resulting from a change in climate conditions and/or forage quality would be reflected in body condition monitoring and a general decreases in body condition could be the harbinger of change.

Traditional indigenous caribou hunters have a strong knowledge base in the area of caribou body condition and many indigenous hunters perceive themselves to be most knowledgeable in this area of caribou health and condition (Table 1). When asked to identify the best information sources on caribou body condition, caribou population levels, and causes of caribou migration patterns, most Porcupine Caribou hunters interviewed (n=105) perceived themselves as the best source of information on caribou body condition, with elders perceived as the knowledge holders on migration, and biologists, co-management board members, and wildlife officers as the best information sources on herd population (Kofinas, 1998: 262).

We suggest that hunters' monitoring of caribou body condition may serve to resolve some of the problems associated with agency-based body condition monitoring. While offering good precision in their assessments, agency-based caribou body condition monitoring programs are typically limited in sample size and plagued with costly field logistics

Table 2. Gwich'in, Iñupiaq, and Chipewyan language examples reflecting traditional knowledge of caribou body condition. (Sources: Gwich'in - Mr. Roy Moses of Old Crow Yukon; Dënesųłine (Chipewyan) - Łútsël K'é elders.

Gwich'in	
–Chikkyi	(New-born calf)
–Vutzuih njo	(Cow without calf in winter)
–Dazho k' eilik	(Small-antlered bull; two years old; considered a trouble maker)
Iñupiaq	
–Kulavagruitchiak	(Very old, skinny cow)
–Nuggailak	(Cow without calf)
–Tunusisak	(Hard covering of small stomach)
Dënesųłine (Chipewyan)	
–Tsi	(Unborn calf/ fetus)
–Besdzi?azé	(Calf less than one year old)
–Ts'udaí	(Young cow yet to breed)
–Dãbe	(Mature breeding cow)
–Déyath?azé	(Young 2-year old bull)
–Besdzichogh	(Mature 4-5-year old bull)
–Yáguzé	(Prime 6+-year old with the large rack of antlers).

that result in incomplete data. Between-year and between-population estimates of summer habitat condition can be assessed from the early winter of spring calves (see Valkenburg report p. 11 in Kofinas et al., 2002b), but the collection of calves as a method is regarded as unacceptable to many traditional hunters. We sought a method that addresses the problem of sample size and field cost that are often associated with agency-based monitoring methods, methods that are typically not compatible with community harvesting practices because of their high demand in technical sampling expertise or involve too long handling time to implement in a widespread community monitoring program. Hunter harvests of caribou, on the other hand, represent a potentially enormous sample size. For example the annual harvest estimates of Bathurst caribou are 14 000 to 18 000 animals and the Western Arctic caribou approximately 25 000 animals. The potential of using hunter harvest data can be seen from the array of publications addressing environmental concerns over Norwegian red deer populations, where 2000 to 5000 individual measures contribute annually to a database since the 1960s (Langvatn & Albon, 1986; Mysterud et al., 2001).

Therein lies our challenge – to develop a body-condition monitoring program that benefits from large numbers of harvests using sufficient warning indications of change, and which is comparable with the knowledge systems and harvesting practices of local indigenous hunters.

Local and traditional knowledge of caribou body condition

Indigenous hunters of caribou traditionally have been acutely aware of caribou body condition as an important indicator of meat quality and overall animal health. Traditional knowledge on caribou body condition is embedded in the language of indigenous northern caribou hunters, as is the case with Gwich'in (language of Athabascan or Dëne people of northeastern Alaska and the Western Canadian Arctic), Iñupiaq (language of Iñupiat or Eskimo of Alaska), and Dënesųłine (also referred to as Chipewyan language of the Dëne people of Northwest Territories, Canada, Table 2). For example, the Dënesųłine term for cows which have yet to breed and are usually in better condition than the other animals, is ts'udaí. Ts'udaí are generally targeted in spring. Nał?ás is a general term used to describe caribou migrating north to the calving grounds in spring. (Note that "?" is a full glottal stop in Dënesųłine) ?enįł?ás refers to caribou returning from the north. These are usually small caribou (yearlings) or "running caribou" which are first to arrive ahead of the cows. The people would say, "The caribou are coming" during this time. Nelyá is an expression used for bulls in the fall, which have returned south and are in good condition having built up fat reserves over summer. Ts'énajá or thenájá refers to the skinny bulls, which have finished and survived the rutting period. If at all possible, these bulls will not be harvested because of their poor condition and meat is considered tainted from rutting.

A hunter's assessment of caribou body condition is generally undertaken with a set of visual indicators when selecting an animal for harvest, and in the post-mortem phase, when ensuring that the harvested animal is fit for human consumption. Łútsël K'é hunters were asked for their description of preferred animals. In the pre-harvest assessment of a female caribou, a hunter generally looks for what they colloquially describe as a "pretty" animal. The characteristics that define this type of animal are: (i) large antler size, the shape, and the abundance of points; (ii) the manner in which the animal moves (i.e. "walks with a swagger"); (iii) straightness of the back and a fullness through the abdominal and rump regions. Hunters target "short" cows which is a reference to the length of the cow rather than its

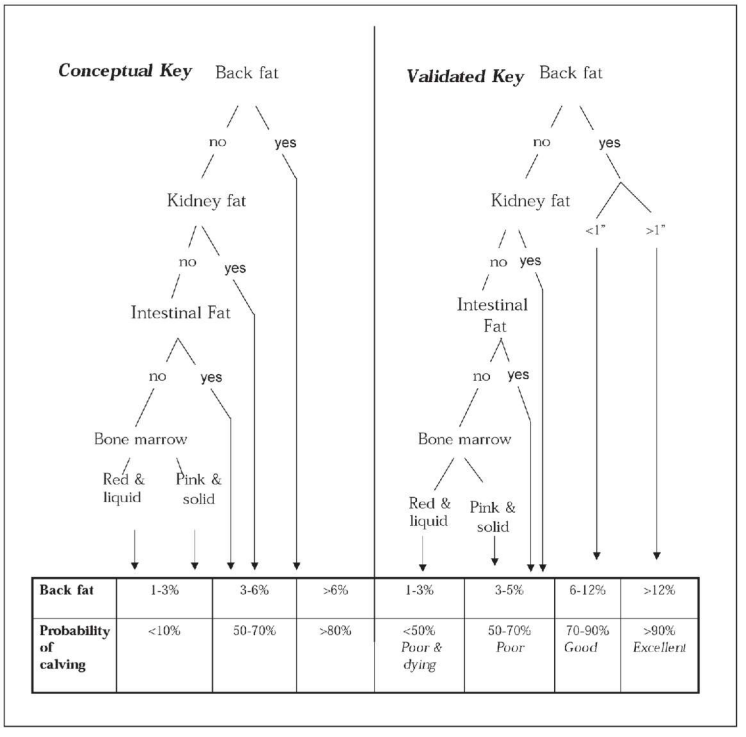
Table 3. Indicators of good caribou body condition and overall health, and reported by indigenous Porcupine Caribou hunters (Kofinas 1998: 166).

Indicators hunters look for when selecting caribou	• Size of rump • Gait or waddle of walk • Whiteness of mane • Size of rack • Symmetry and overall shape of rack • Number of configurations or points on rack • Size and shape of shovel • Grayness of rack • Social role of individual in group • Posture of animals when moving
Post mortem indicators of caribou health	• Quantity of "backfat" (i.e. rump) • Quantity of stomach fat • Color of marrow • Tone and color of lungs (e.g., lungs stuck to chest indicate poor health) • Color of kidneys and liver • Absence of pus bags on kidneys • Absence of "water" in muscles ("water being produced when animals is worked) • Contents of stomach (e.g., grass-filled indicate may be sick animals) • Presence of parasitic larvae in kidneys

height. A fat cow gives the impression it is shorter in length; (iv) the coloration of the hide. Hunters target those cows with prominent white stripes along their sides and under-bellies. A prominent mane is also indicates a better quality animal and; (v) the length of tail protruding from the rump. If the cow has a lot of rump fat the tail has the appearance of being short. Porcupine Caribou hunters of Old Crow, Aklavik, and Fort McPherson hunters were asked to list the indicators used visually to assess animals before shooting. (Table 3) Lútsël K'é and Inupiaq hunters of Kiana and Kotzebue use indicators similar to those of the Dënesųłine. The majority (87%) of surveyed hunters in Łútsël K'é (n=30) use antler size and formation to assess the body condition of a live female caribou. Fullness of rump and abdomen (43%) and hide coloration (33%) were the next most common assessment characteristics used by the hunters. Porcupine Caribou hunters also reported post-mortem indicators of "good" caribou. (Table 3) Of these indicators, Łútsël K'é hunters noted the quantity of brisket fat, back fat, kidney fat, stomach and intestinal fat, and to a lesser extent the color of marrow. Levels of parasitism in organs and flesh tissue were also assessed by Porcupine Caribou and the Łútsël K'é hunters.

Hunters provided explanations for what they perceive to be seasonal, annual, and special variability in caribou body condition. As would be expected, hunters stated their awareness of seasonal variability (e.g., "Bulls in the fall are the best," "Cows are best in spring."), with some also noting patterns of variability within a single season. For example, Kotzebue and Kiana hunters of the Western Arctic herd find that caribou migrating in August, and after the initial groups have passed their hunting grounds, tend to be fatter than the first migrants, with some hunters speculating that the difference is because later animals have more time to forage on calving grounds.

Hunters gave mixed reports regarding their perceptions of year-to-year variability in caribou body condition. Of over 100 Kiana, Kotzebue, Old Crow, Fort McPherson, Aklavik, and Łútsël K'é hunters interviewed, less than half stated that they noticed year-to-year variation in body condition, although several elders commented on decadal changes and year-to-year trends in body condition. Hunters did mention spatial variability in the body condition of groups of caribou. For example, in 2000, hunters of Łútsël K'é observed that caribou south of the community around Nonacho Lake were in better condition than the ones towards McKinley Point and Yellowknife. Disturbance from hunters and traffic,



Back fat	1-3%	3-6%	>6%	1-3%	3-5%	6-12%	>12%
Probability of calving	<10%	50-70%	>80%	<50% *Poor & dying*	50-70% *Poor*	70-90% *Good*	>90% *Excellent*

Fig. 1. Development of the Dichotomous Key to predict body condition in Caribou. Conceptual key as based on the presence and absence of fat in caribou (proposed by R. G. White, 2000, see Kofinas et al., 2001). The conceptual key was validated against datasets of body composition (Fig. 2) and modified to make linear the response noted in the Validated Key.

pollution, and poor quality of feed were theorized as the causes for the poorer body condition of the animals in the Yellowknife/McKinley Point area. Kotzebue hunters provided reports of spatial variability, attributing the difference to the effects of hunting activities in easily accessible areas and groups of caribou in other locations being harassed by wolves. Hunters also talked about variability among individual caribou. As an elder of Kiana stated, "Caribou are like people, some are just fatter than others." No discussions by hunters documented in our research indicated explicit knowledge of the relationship between body condition and pregnancy success, although it was clear from the hunters that pregnant cows encountering difficult travel conditions (deep or ice snows) to calving grounds would be less likely to be successful in raising a calf.

In summary, these findings support the assertion that community hunters bring a unique and rich knowledge base to a body conditions monitoring program.

Dichotomous Key for the assessment of body condition

In developing our monitoring protocol, we needed a sampling method of assessing body condition that would be easily employable by community hunters as a part of their regular subsistence harvesting. Drawing on the gestalt impressions and expert knowledge (e.g. Ringberg et al., 1981a,b), a dichotomous key assessing body fat in areas of caribou commonly observed by hunters was developed (Fig. 1). The key uses the presence or absence of back fat, intestinal fat, kidney fat and femur marrow fat in a hierarchical decision tree leading to each animal being classified into body-fat categories, with those categories corresponding to a relationship between fat levels and the animal's overall percentage of body fat. For cows harvested in fall to early winter, this relationship is extended to predict the probability that the cow was pregnant (Gerhart et al., 1997).

We validated the dichotomous key with two data sets (Chan-McLeod et al., 1995; Gerhart et al., 1996) that had the closest approximation to individual observations of reproductive condition, body fat

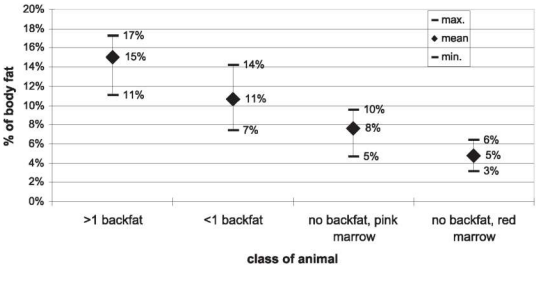


Fig. 2. Validation of Body Condition Class Structure using PCH Data

level and measured (or deduced) values for variables in the dichotomous key. We conducted a Pearson correlation analysis to determine within what fat

Table 4. Determinants of community monitoring effectiveness.

- Desire of community/hunters to participate
- Compatibility with hunting
- Sensitivity to cultural values
- Use of hunters' existing methods and knowledge
- Cost (labor and material)
- Amount of special training required
- Extent to which continuity of individuals is needed
- Contributions to regional monitoring
- Capability of providing a physical assessment of harvested animals while providing annual trend information on the population as a whole
- Extent to which the system is predictive
- Compatibility with the existing local systems of community members and local biologists' methods
- Contributions/additions to assessing food quality for communities (i.e. human health implications relating to the consumption of meat)

ranges each of these fat depots were dynamic (Fig. 2). Femur marrow fat was linearly related to whole body fat below about 9 % body fat ($r=0.80$, $P<0.0001$). Back fat was uniform below 9% body fat but linearly related above 9% ($r=0.77$, $P<0.0001$). Intestinal fat ($r=0.80$, $P<0.0001$) and kidney fat ($r=0.70$, $P<0.0001$) were linear throughout the range of body fats in the sample. A SAS program was developed to classify individuals into four body-fat categories using the dichotomous key approach (Fig. 2). In order to refine the body fat estimates we found it necessary to include the additional criterion of the presence of back fat greater than 1 inch in depth.

Hunters' Questionnaire

The success of a hunter-based body condition monitoring program would be determined by many factors (Table 4). After discussing the body condition monitoring program with local hunters in the initial phases of the project in Kiana and Kotzebue, we came to the conclusion that on-site assessments of animals would not be undertaken unless hunters were specially trained and hired to undertake the work. In an attempt to obtain the greatest harvest sample size as possible from the communities, we designed a questionnaire based on recall, which included variables in the Dichotomous Key plus an additional set of variables that place the key into a broader context. The questionnaire asks hunters about fat levels (i.e. Dichotomous Key measures), sex, lactation, pregnancy, reason for targeting animals, abnormalities/unusual observations, general location of harvest, date of harvest, other noteworthy environmental conditions. The questionnaire also asks hunters to make a general assessment, which is their own overall evaluation of each animal harvested. Terms for the general assessment were developed by Phil Lyver, who worked with Lútsël K'é hunters to identify ordinal measures that rank-order caribou condition using familiar words of hunters -- "skinny," "not so bad," "fat," "really fat." We later modified the questionnaire to include photographs of organs with and without fat. Other questions have been added periodically to address specific issues, such as perceived long-term changes and general concerns about caribou health.

Local associates of the Kotzebue IRA and the Kiana Traditional Council have administered the questionnaire since 1999. Hunters report on each form up to 5 animals per hunt (the legal daily limit for rural hunters in that region of Alaska), and are required to make their report within 7 days of harvesting the animals. Hunters were provided an honorarium of US$ 50 per form (i.e. per hunt) regardless of the number of animals harvested.

Since initiating the Western Arctic Project, the condition of over 450 individual animals has been documented, with the majority of the data collected during the fall. Initial data collection efforts have been focused on modifying the questionnaire and educating local hunters to its use. After several years of implementation, a group of hunters in each community are now aware of the program. They consciously keep a lookout for the indicators included in the questionnaire and seek out local research associates in order to report their findings immediately after their hunts. In Lútsël K'é, and with the Arctic Borderlands Ecological Knowledge Co-op program a different method has been followed. Hunters are asked to make a general assessment of all animals harvested at the end of the season. In the Lútsël K'é study, Lyver and locally trained people have accompanied local hunters in the field during hunts and asked them to provide their impression of each animal (i.e. skinny, not so bad, fat, really fat) harvested. Assessments of female caribou body condition made by hunters in the field were similar to hunters' general impressions at the end of the 2000 ($\chi^2=3.772$, d.f= 3, $P=0.293$) and 2001 ($\chi^2=1.414$, d.f= 2, $P=0.493$) seasons (Fig. 3a, b). The number of degrees of freedom was less in 2001 because the "really fat" category was omitted from the analysis. No hunters reported female caribou in this body condition category in interviews and only 1 female caribou was designated as "really fat" by hunters in the field.

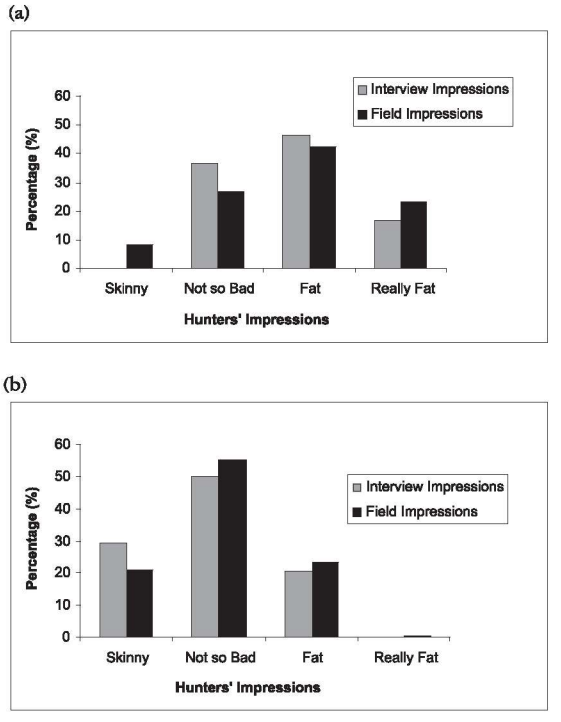


Fig. 3 Łútsël K'é hunters' impressions of female caribou body condition recorded in interviews at the end of each season, and for each animal harvested while in the field during spring (a) 2000 (n=30 hunter interview responses; n=87 field impressions), and (b) 2001 (n=44 hunter interview responses; n=176 field impressions).

Discussion

Our experience developing and implementing a protocol for community monitoring of caribou body condition has provided insights into both the potential and challenges associated with such an endeavour. From the outset, we worked on the assumption that a detailed and highly precise system of body condition assessment, as proposed by Chan-Mcloed et al. (1995), is not practical for hunters undertaking a body condition monitoring program while completing regular subsistence activities. We recognized that it would be difficult, if not impossible, to obtain individual reports on each animal harvested. Rather, we relied on hunters' memory recall and in some cases, hunters' recall of the season's harvest as a whole, rather than individual animals. Aware of the tradeoffs between a highly precise assessment method and one that is compatible with traditional hunting, which still offers a meaningful contribution to caribou monitoring and assessment, we sought a workable balance point. For example, a comparison between hunters' impressions of caribou body condition immediately after they cut-up an animal in the field and in interviews at the end of the spring hunting period were not dissimilar (Fig. 3a,b). This indicates that hunters' impressions of body condition could be recorded in short interviews at the end of a season reducing time and monetary costs immensely, and the imposition to hunters.

In all three of the monitoring programs, community hunters have been interested in participating. Not only do local hunters see value in the caribou monitoring program, they view their participation as an important means to include community understandings of caribou ecology in future management considerations. It is essential that the hunters understand and accept the reasons why the assessment is important if the program is to persist in the long-term. At the local level, the strong endorsement and good continuity in participation by local administrators and research associates has been key to these programs' success. It was evident from two of the programs that having one or a number of local people trained and employed to collect data from the hunters was advantageous. Their employment facilitated immediate access to the hunters, provided an opportunity for employment and capacity building within the community, a means to surmount barriers between the researcher and hunters. Moreover, these people's role provided important feedback to the program from hunters and the wider community. There has, however, been hesitation and resistance in participation by some hunters. Initially, problems arose when Kiana and Kotzebue hunters were asked to harvest and report on cows in the autumn. These problems highlight the need for flexibility in protocol, especially in the early phases of the monitoring program's development; we subsequently modified the protocol to include all animals harvested.

Regional variation in caribou physiology can also create differences in monitoring regimes between programs. In the Łútsël K'é study, it may be possible to monitor Bathurst female caribou in the spring when hunters specifically target these animals because a similar body condition-pregnancy relationship exists in Beverly caribou (Thomas & Kiliaan, 1998). However, that relationship has not been tested for the Porcupine and other herds in the spring, although there is an established relationship for the autumn (Cameron et al., 1994., Gerhart et al., 1995), when hunters prefer to harvest bulls. A modification to include bull caribou in the monitoring program, in turn, creates a demand for researchers to understand more clearly the seasonal weight (i.e. fat/protein) dynamics of bulls and the implications of seasonal condition of bulls to the population as a whole.

Hunters' unwillingness to participant has been because of concern for how monitoring findings may affect subsistence harvesting. These concerns have been most acute in Alaska (as compared to Canada), where indigenous hunters do not have specified harvesting rights to caribou hunting or formal caribou co-management arrangements, and consequently feel vulnerable to the actions of resource management. As corroborated with many other co-management experiences, an effective community-based monitoring protocol is dependent on the trust of resource users who are involved in the process. Communities need to understand why the assessments are being conducted and feel that they are in control of the information generated. As well, participating local communities need to be aware of how findings may be used to benefit caribou and their community.

These critical logistical challenges add to the basic science questions regarding the appropriate contribution of community-based body condition monitoring. Participants of our Technical Workshop debated whether body condition monitoring of caribou should be regarded as predictive, as suggested in the relationships of Dicotomous Key (Fig. 1), or whether it should simply serve as part of regular status reporting (Kofinas et al., 2002b). Several associated confounding issues follow from hunters' reports on the high spatial variability of body condition as well as biologists' understanding of these conditions (Thomas & Kiliaan, 1998), including weaning strategies of cows (Russell & White, 2000). These issues raise the applied research question of how a body condition monitoring program can account for variability between various areas within the range of a herd. In one effort to address this problem, the Traditional Knowledge Project of the Western Arctic herd has invited additional communities to be partners, thus providing a broader geographic scope and an opportunity to integrate monitoring results from several regions. These methodological questions raise the greater issue of whether monitoring body condition of caribou is sensitive enough to be indicative of change at the population level. In short, this is a problem of scale -- moving from an understanding of individual animal physiology to herd-level population dynamics (see Langvatn & Albon, 1986). To resolve this issue, we suggest research that examines on-going body condition monitoring results during periods of population increase and decline. Further analysis of data collected by the Yukon Renewable Resources Porcupine Caribou monitoring program (D. Cooley, unpubl. obs.) offers such an opportunity, given the last decade of population changes for the Porcupine Herd (Griffith et al., 2002).

Another potentially confounding aspect of the community-based monitoring system is hunters' bias for harvesting the best quality animals available. Many local hunters reported that being selective is a skill of the most experienced and that only a few of today's hunters have that ability. We suggest that hunter bias is not a problem in the protocol sampling, given that hunters' selection criteria are consistent. It should be remembered that a community-based monitoring technique may not offer an absolute body condition assessment, but rather a relative evaluation between years.

Conclusion

The development and implementation of community-based monitoring of caribou body conditions represents a departure from a previous paradigm in which hunters only supply data on harvest numbers, and towards an effort to engage local communities in dialogue about caribou ecology. Community monitoring of caribou body conditions is not an ideal approach in its precision to measure individual animals, but it does offer the opportunity to engage hunters in a monitoring program that generates a large sample of animals and meaningful results. Clearly, there is much work to be done to realize the full benefits of community-based body condition monitoring. Given the prospects for global change (i.e. climate changes, industrial development, new infrastructure, etc.), its possible effects on caribou, and the increasing restrictions in agency funding, it is important to advance this approach to body condition monitoring. The potential success of this monitoring will be realized through further comparative analysis of datasets, better communication among hunters and scientists, and the refinement of data collection and analysis methods.

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