

New caribou crisis – then and now

Robert A. Ruttan

Box 42, Rural Route 2, Tawatinaw, Alberta, Canada T0G 2E0 (rsuttan@telusplanet.net).

Abstract: The reported decline of the Bathurst herd has caused considerable concern and has raised rumours of a “crisis” in which there is a possibility of extinction. This paper reflects on relevant lessons learned from the officially declared “crisis” of population decline in 1955/56 and a second crisis of overpopulation identified by the author a decade later.

Key words: Barren ground caribou; Bathurst caribou herd; Canada; crisis, management history; population decline; resource management; traditional knowledge.

Rangifer, Special Issue No. 20: 85–102

Introduction

The recently estimated declines in the Bathurst herd and other migratory caribou has become a matter of grave concern to the governments of the Northwest Territories (NWT) and its neighbouring jurisdictions. With Bathurst herd estimates of more than 100 000 in 2006 descending to about 32 000 in 2009 (NWT Environment and Natural Resources, 2009), concerns have escalated to a point where the Bathurst herd at least is said to be threatened with extinction¹. In my preliminary review of information pertaining to the current condition of the Bathurst herd, I found a disturbing similarity between the conditions associated with the alleged Bathurst herd decline today and that of the mainland herds some 60 years ago. Wisely, the term “crisis” has been avoided in official documents; however the sense of anxiety that has pervaded meetings, press releases and documents has brought about proposals for measures to stop the decline and/or bring about a recovery of the herd that, as in the 1950s, were ill-informed, premature and inappropriate and could be harmful to caribou in the future.

My objective in this paper is to explain how the lessons I learned during the 1950s and 1960s might be relevant to the management of the Bathurst herd. Then as now, knowledge of the status and condition of caribou herds was a quagmire of conflicting reports, differing perspectives and great lacunae in the management data available. I want to offer a cautionary tale about the earlier conceptions of crisis, and discuss lessons that might be used to avoid inappropriate crisis management actions in future caribou resource decisions.

This paper reflects on methods in understanding caribou population dynamics and harvesting as two critical aspects of caribou management. I begin by providing a brief description of my own scientific and experiential formation in order to properly situate my perspective. Subsequent sections reflect on two contrasting management scenarios that emerged from distinct census approaches in the 1950s and 1960s: the officially declared crisis of declining caribou populations in the 1950s, and my own argument put forward in the 1960s that there was an impending crisis of caribou overpopulation, and that contrary to the prevailing view, harvesting could play a positive role in caribou conservation.

¹ “The proposal concludes that if hunting continued at the 2008/09 levels, that the herd may be eliminated in 4 years” (Gunn, 2010).

From classroom to field experience

The first so-called caribou crisis was defined by leading biologists in the 1940s and early 1950s, coming to a head, so to speak, in 1955/56. This was based on the assumption, ill-founded in evidence, that the migratory caribou populations of the mainland NWT were in serious decline brought about primarily by indigenous hunters engaged in “wanton slaughter” of caribou and by wolves. It was argued that this situation would inevitably lead to the extinction of those caribou, if not controlled immediately. This author hypothesized a contrary kind of crisis ten years later (Ruttan, 1966), arguing that burgeoning populations (especially of the Bathurst herd and augmented by the Beverly herd) would soon exceed the carrying capacity of their range and “crash” if not quickly reduced by systematic hunting of 100 000 or more animals for several years.

I argue that the prevailing conception of crisis during the 1950s and 1960s focused on maximizing populations and minimizing hunting without adequate regard to the complex factors affecting population dynamics. This situation, in my opinion, is still operative with regard to the Bathurst herd..

I have not been directly involved in caribou research or management in the NWT since 1969, but was an observer of the so-called crisis of the 1950s and an active participant in the crisis of the 1960s. Unfortunately, my extensive personal files pertaining to that period were lost, although at the time I submitted full reports of my findings to the Canadian Wildlife Service (CWS). I have to rely on my vivid memories of the period in these reflections, leaving archival and scientific verification to a younger generation of researchers. Moreover, my own training and experience during the 1950s and 1960s is the window through which I view caribou ecology. It is not within the scope of this paper to compare my perspective with recent theoretical and applied developments in caribou population and conservation science.

I bring a unique historical perspective to the complex topic as a result of my dual grounding in wildlife management and ecology, and traditional indigenous knowledge as it was practiced by people still living on the land 60 years ago. It is my experience that the two areas of knowledge enrich each other and together they provide a clearer picture of the interaction of land, people and animals that we are seeking to learn about. As there are few living today who have these memories, it is my modest hope that my experiences from an earlier era might shed light on management approaches in addressing current concerns about declining caribou populations.

Since my perspective concerning the cause of the alleged decline of the Bathurst herd and the response of governments to it may differ noticeably from that of the government biologists, I believe that I should describe the two key aspects of my training and experience that have shaped my point of view, including formal science-based management training and field experience.

I received my academic training and a Bachelor of Arts and Sciences degree at the University of Saskatchewan in 1950, where development of my credentials for caribou management included informal training in wildlife management with D. S. Rawson. I was one of his research assistants in a regional study of the suitability of impoundments for the introduction of pond fish (Rawson & Ruttan, 1952)². Rawson was a specialist in limnology; moreover, his knowledge of ecology and of the management of renewable resources was of the highest order. While his knowledge and insights were wide-ranging, several key principles he espoused have remained with me and guided my approach to wildlife management throughout my professional life: *Get the data before you come to a final conclusion; it is all right to speculate, if you do not confuse speculation with fact; and, do not overlook an anomaly in the data simply because it is not statistically significant – it may be of great importance.*

Most of my training in caribou ecology, however, was through hands-on experience as a hunter and observer of caribou and of indigenous hunters that began with my first observation of barren ground caribou near the Churchill River at Buffalo Narrows in the winter of 1951/52. Subsequently, I served six years as a fur and game management biologist for the province of Saskatchewan and participated in frequent reconnaissance flights followed by systematic aerial censuses of moose and deer upon which management recommendations were made. I also participated in the 1955 re-survey of caribou (Kelsall & Loughery, 1955)³ and became one of its severest critics.

As a fur management biologist, my work often put me in close contact with Cree, Métis and Chipewyan trappers who were also hunters of barren ground caribou. I often camped and hunted with Saskatchewan Dene in such locations as Scott Lake, Wollaston Lake

2 I had the privilege of co-authoring this work with Dr. Rawson while an undergraduate, doing all the field work during this two year study and sharing the lab analysis (Rawson & Ruttan, 1952).

3 T.A. Harper and I conducted the Saskatchewan portion of the aerial resurvey while J.P. Kelsall and Saskatchewan Game officer F.W. Terry conducted the Northwest Territories portion.

and Stony Rapids, Black Lake and Cree Lake, and through their tolerant and patient teaching, gained an understanding of traditional ecological knowledge (TEK) that few academic students have access to. Subsequently I spent more than four years as an outfitter (and part-time logger and trapper) whose hired guides were Cree trappers from Canoe Lake. These guides also introduced me to woodland (boreal) caribou and boreal caribou ecology, sharing knowledge that I drew upon in 1960 in a three month study of winter ecology (Ruttan, 1961).

Between 1962 and 1969 I also spent time with Inuit hunters who had survived the relocation programs of the 1950s and was able to observe their hunting practices and use of caribou. I found their relationships with caribou differed little from those of Dene, except in their often greater dependence on them as their primary source of nutritious winter food and beautiful winter clothing.

I continued with intermittent field studies of woodland caribou, moose and furbearers in Saskatchewan until 1962 when I was selected by the Administrative Committee for Caribou Preservation (a Federal/Provincial organization with a strongly political orientation) to be the only officially designated barren-ground caribou management biologist for the mainland Northwest Territories and northern prairie provinces. The position was to be administered by the CWS. My mandate was to study the status and condition of caribou populations and how they were being utilized by indigenous people. Prior to my appointment as Caribou Management Biologist for the CWS, I had developed a reputation as a critic of the department's operations. During an interview I mentioned this to Dr. David Munro, director of the Service, and he hastened to reassure me by saying that "The Service could use new blood." I was pleased with this response and went ahead with my work on June 1, 1962, believing that my findings would be accepted, even welcomed by the service. As a management biologist I understood that a primary determination of the status and distribution of the caribou herds should be done. To this end I conducted many reconnaissance flights, several systematic aerial surveys and ear tagging programs that together identified four major herds, and their basic migration patterns.

In preparation for field work, I spent several days at CWS headquarters in Ottawa where I studied many files and reports, particularly those by W.A.F. Banfield and J.P. Kelsall, that might provide me with guidelines and allow me to proceed with field work without duplication of their efforts. Upon arriving in the field, I was startled at the variance between what

the literature led me to expect and the actual conditions I found.

Until I went north, Banfield's 1954 report caused me to believe that the migratory barren-ground caribou existed as 19 distinct herds (to which he gave names). It was soon apparent to me that several of those herds were only segments of large herds, sighted at different times and in different places, during the first caribou surveys that Banfield conducted in 1949 and 1950. In addition, Kelsall's description of unusual movement and change of range by a large herd between the summer of 1956 and winter 1957/58 turned out to be a series of consecutive sightings of three large herds, the Beverly, Bathurst and Bluenose (once called the Coppermine herd). The first sighting was of the Beverly herd in the summer of 1956, followed by the Bathurst and ending with the Bluenose in the winter of 1957/58⁴. I often wonder if this was the origin of the frequently suggested concept of migration between herds since it was cited several times by Kelsall in his 1968 monograph, a document of considerable influence among students of caribou ecology.

I have explained my eclectic background in unusual detail because it provided me with a foundation for developing a perspective on caribou research and management that often diverged from that put forward by more conventionally trained caribou biologists. Certainly it was not always a comfortable path, but the reward was to gain important insights and understanding of caribou and their interaction with indigenous people. I feel there is still merit in the approach I was taught, which emphasized the need for, hands-on collection of information; avoidance of forming unsupported conclusions; awareness that errors are an omnipresent possibility, being willing to correct them and, finally, the dangers of oversimplification.

The logistics required to fulfill the obligations inherent in my mandate, however, were complicated by the immensity of the study area that included the mainland Northwest Territories and the Prairie Provinces, the divisions of migratory caribou populations and their seasonal ranges, and the concurrent spring and fall migrations, which at that time were not fully documented. In addition, there were limits and uncertainties to the availability of and funds for experienced pilots and survey aircraft, so it was both difficult and arduous to describe and record seasonal distribution and other behaviour patterns, much less

4 I often wonder if this was the origin of the frequently suggested concept of migration between herds since it was cited several times by Kelsall in his 1968 monograph, a document of considerable influence among students of caribou ecology.

conduct estimated herd size, composition and productivity, which are prerequisites for management. Aside from aerial observation, I spent a great deal of time and energy tracking caribou movements on the ground and personally identifying range conditions, behaviour patterns and calving ground locations. Many of the problems inherent in caribou study remain difficult and costly to this day, modern technology notwithstanding.

The first caribou “Crisis”: A new conservation strategy

Crisis: a state of affairs in which a decisive change for better or worse is imminent; now applied esp. to times of difficulty, insecurity, and suspense in politics or commerce. (Oxford English Dictionary Online)

The term “crisis” refers to a balance point in which the fate of a population such as the caribou is determined; to survive or not to survive. Since the response to a “crisis” is frequently a heroic effort to shift the balance point in a positive direction, the declaration of a “crisis” is a call to arms to mobilize all resources in support of this effort. It can also create a sense of urgency which can give rise to inappropriate reactions. In my experience the coupling of the term “crisis” with any game management issue, and particularly the barren ground caribou, sets off alarm bells that may detract from effective caribou management. Moreover, my experience in the 1950s and 1960s shows that management measures hastily developed in the context of crisis may persist without adequate review of their effectiveness long after the crisis is over.

The crisis of the 1950s has been thoroughly researched and described by Sandlos (2007), Usher (2004), Tester & Kulchyski (1994), and Kulchyski & Tester (2007). I will make no attempt to add anything to their excellent work. Instead, I will only extract and highlight certain facts concerning the development and outcomes of the crisis that was announced in 1955 and published in 1956 by Banfield, and my own involvement in it.

Although an impending crisis was not clearly identified prior to the 1940s, concern for the future of caribou populations and their use by indigenous people in the north were manifested in regulations governing seasons, bag limits and the uses of caribou, and from contradictory reports of “wasteful slaughter” of caribou at Fort Fitzgerald (Sandlos, 2007), by the “caribou eaters” (Usher, 2004), by Inuit of the eastern arctic mainland (ibid), and by other Dene

of the Northwest Territories (which then included Nunavut) and the prairie provinces.⁵

The perception of a crisis in the caribou population began to develop in 1949 and 1950 from an extensive aerial survey by W. A. F. Banfield of the mainland caribou populations (between Hudson’s Bay and the Mackenzie River) wherein the total population of the migratory barren ground caribou was estimated at about 680 000 (Banfield, 1954, as cited in Kelsall, 1968 and Sandlos, 2007). Previous estimates, based mainly on an assortment of anecdotal reports and yarns from explorers, white trappers, missionaries and even the RCMP, ranged up to 30 million, as suggested by naturalist and author Ernest Thompson Seton (1911; 1929) who visited Contwoyto Lake in 1907 during the annual August migration⁶.

Although Seton’s estimate was not accepted by everyone, Banfield’s estimate of 680 000 was, and so the alarm bells began to ring. However, this perceived decline was not declared a crisis until 1955 following a “range wide resurvey” (Kelsall & Loughery, 1955), in which I was involved⁷, that estimated a total population of 278 900 animals, less than half of Banfield’s previous estimate some 5 years earlier. The re-survey estimate was seriously flawed, however, having been

5 Usher contends that this concern “arose in the 1920s with expansion of the fur-trade and the influx of white trappers.” White trappers dominated trapping areas of northern Canada throughout the 1930s and 1940s, often to the exclusion of indigenous trappers who were wholly dependent on the wildlife for their survival. Many of those white trappers occupied the winter ranges of caribou especially the barren lands (tundra) and tree line regions east of Great Slave Lake until the 1950s where they killed many caribou for themselves, their dog teams, and bait for arctic fox, wolves and other fur bearers. One of the last of those trappers was Mr. Fred Riddle who continued as predator (wolf) control officer and trapper until the mid-1960s. During the tagging programs on the Thelon River in 1963, 1964 and 1965, Fred Riddle was employed as our camp cook and tagging helper.

6 I can understand Seton’s reaction on seeing the Bathurst herd in its August migration past Contwoyto and Pellatt Lakes. I witnessed this migration in 1963, 1964 and 1965 and again in 1969 when a dense and seemingly endless column of caribou marched by the Pellatt Lake camp for hours on end and then spread out to pasture on a huge tundra area that extended to tree line at the headwaters of the Coppermine River. To Mr. Seton the world must have seemed filled with caribou.

Note: Kelsall states that Seton’s estimate of 30 000 000 was a “clear impossibility” (1968, 144). That figure, however, appeared on the cover of *Tuktu*, a CWS authorized and edited publication (Symington, 1965) linked to an article by Fraser Symington. Symington was a writer not a wildlife biologist and the information in *Tuktu* was supplied by CWS in support of the caribou conservation program.

7 The resurvey was not “range wide.” Large portions of the winter range, particularly in Manitoba, Alberta, and the NWT were not included in the re-survey. Kelsall lists the resurvey in his literature cited, but does not describe it in his 1968 monograph.

8 T.A. Harper and R.A. Ruttan conducted the Saskatchewan portion of the aerial re-survey.

obtained by an early spring survey when caribou were beginning to migrate north and when many were hidden while feeding under the forest cover. Although transects approximately 20 miles apart revealed widespread distribution on the winter ranges in Saskatchewan, they did not provide sufficient coverage for census purposes. Also, our estimate of the Saskatchewan portion of the herd was reduced and a large correction factor developed by Harper, Kelsall and myself⁹ was omitted from the final report by its authors (Kelsall & Loughery, 1955)¹⁰. Had the correct Saskatchewan estimate and the correction factor been included in the re-survey results, the total population estimate would have been much higher and the crisis management measures might not have been justified.

When the incorrect estimate came to our attention, both T. Harper and I protested through the Saskatchewan Game Branch. Our protest may have found its way to the Administrative Committee for Preservation of the Barren Ground Caribou by way of the Saskatchewan Game Branch Commissioner, who was a member of the committee. However, no change in the estimate occurred. As far as wildlife agencies and officials were concerned, the caribou decline was real and the reports of excessive and wasteful hunting by indigenous people and predation by wolves were factual causes. When combined with an estimated total kill of 86 000 to 100 000 caribou per year attributed to indigenous hunters and a great deal of adverse publicity concerning indigenous hunting practices (Sandlos, 2007), the official reaction was a demand for immediate action—any action to prevent extinction of the caribou. Although other natural mortality factors were identified, they paled in the eyes of the wildlife officials when compared with predation by humans and wolves.

Nevertheless the false estimate from the re-survey and the caribou crisis reported by Banfield in *Beaver* magazine were accepted immediately by administrations involved with caribou, and the response was swift.¹¹ This was all the excuse that was needed

for rapid expansion of a conservation program that ranged from conservation education (Kulchyski & Tester, 2007)¹² to the enforced relocation of the Sayisi Dene of Duck Lake in Manitoba (Code, 1993)¹³ and their Inuit neighbours in the Kivalliq Region (formerly referred to as Keewatin) in 1956 (Tester & Kulchyski, 1994)¹⁴. The wolf poisoning program was also intensified as were other conservation measures designed to reduce hunting pressure.

Even though the Saskatchewan government did not willingly accept the false estimate, they went along with much of the conservation program.¹⁵ For example they allowed wolf poisoning, continued to ban sport hunting and feeding caribou to dogs while encouraging fishing for dogs. Along with Indian agents they tried (unsuccessfully) to persuade indigenous hunters, who were protected by Treaty Rights, to accept hunting licenses and a small quota of caribou per hunter. I didn't witness the reaction of indigenous trappers in the NWT until after 1962, but saw little difference in attitude or action on the part of Dene or Inuit. The production of fish in many tundra lakes and streams is not enough to support a dog team for very long, even in summer ice-free periods. Even in the western arctic the number of productive fishing lakes is limited by their depth and by 6 to 8 feet of ice. Trappers who fed fish were often forced to haul them long distances to their camps.¹⁶

"almost every major hunt was accompanied by an officer of one agency or another, and many hunts were strictly supervised." (1968, 202)

12 Kulchyski & Tester (2007) cite the caribou conservation education pamphlet published by the Canadian Wildlife Service entitled *How To Save the Caribou*, published in the 1960s. This was incredibly paternalistic, bordering on insulting.

13 Directed by Alan and Mary Code. *Mary was a child in 1956 and became a survivor of this relocation. The film depicts traditional life and the consequences of the disruption of the lives of the people.*

14 Tester & Kulchyski (1994) describe the relocation of the Kivalliq inland (Keewatin) Inuit. In August 1962 Tommy Duck, a Sayisi Dene now a resident of Tadoule Lake Manitoba, told me that all of his people were moved on very short notice to the Hudson's Bay coast during August 1956. He said he had been away working to get money to buy a canoe and/or "kicker" but when he returned he found "everyone was crying" as they waited for the airplane. This relocation of the Dene in August was designed to prevent another "slaughter" and must have caused them to miss most if not all of an important harvest of caribou, thus adding to their suffering through loss of this customary winter food supply for the winter of 1956.

15 There are several possible reasons for "going along with" the conservation program, but I expect that if the Saskatchewan commissioner did protest it was too late, or he was outvoted by the majority of the members of the Administrative Committee or it was not considered to be politically expedient given the financial support provided by Federal Government through Federal/Provincial Agreements such as the fur program.

16 This problem was offset in the 1960s by the use of snowmobiles, which were expensive to own and operate. When I asked one Dene trapper what he thought

9 The correction factor was designed to obtain a measure of the error in transect counts of caribou on forest range, when numbers of caribou remain hidden under the forest cover until the census plane has disappeared. Only those caribou that are resting on lakes and open muskegs are counted. The extent of error was obtained by having two planes with their observers fly one behind the other a mile or more apart along the same transect. Both crews only counted those caribou that were in the open but the following crew counted significantly more than the lead plane.

10 The deliberately reduced and false estimate was only published in Banfield (1956).

11 Kelsall provided no details of the resurvey but stated, "The results of the 1955 resurvey stimulated immediate administrative and enforcement action . . . for the first time many native hunters had enforcement and conservation officers watching their field activities" In the Fort Rae, Fort Reliance and Yellowknife areas

After 1956, the publicized estimate of the total herd was only 200 000, despite reported increases in increments, calf crops and in the size of some herds in the late 1950s. In fact I found that the frequently reported estimate of the total mainland population remained at about 200 000 until 1964 or 1965, despite increased estimates by Kelsall and my findings during my sojourn as caribou management biologist. The publicly reported total harvest also remained at 100 000 caribou per year, although estimates of total kill were much reduced in some areas. One might excuse such errors or omissions by the fact that the results of Kelsall's studies after 1955 did not become public knowledge until 1968 and publication of his monograph.

Indigenous hunting continued to be regarded as the principal cause of caribou decline while other mortality factors such as predation, low conception rates and poor survival of calves were noted (Kelsall, 1968)¹⁷, but not considered as seriously as hunting. I suspect that management agencies had lost interest in data collection related to populations, conditions and other factors, or did not recognize the complexity of environmental conditions that affect the production and survival of caribou calves.

Barren ground caribou occupy a staggeringly large range in the course of their annual and seasonal migration during which they access many discrete environments, numerous ecological regions and countless plant communities in their daily search for nutritious food. Throughout their lives they experience the widest range of temperatures and other weather extremes that typify the arctic, and traverse the dangerous rivers, lakes and diverse land forms. They also endure the afflictions of insects, disease, parasites and predation from several sources, and are affected by fires and human activities on the landscape. Drowning is also a common hazard to migrating herds, especially in early winter when caribou attempt to cross thin ice which is hidden and insulated by a layer of snow¹⁸.

about skidoos he replied, "They (are) okay for hauling, but are like hunting with a bell around your neck" (John Carmichael, pers. com., 1967). John Carmichael was a resident of Inuvik and a highly successful trapper of the Anderson River region, who used snowmobiles and charter aircraft for hauling freight. His son Freddie, who I hired from time to time for reindeer census in 1967 and other wildlife surveys, was the owner and chief pilot of Reindeer Air Services.

17 In 1955-56 and 1956-57 the percentage of calves (short yearlings) that Kelsall observed was 6.9% and 8.0% respectively. His estimates of increment data before and after the two year period were significantly higher but in all cases were based on small and widespread samples.

18 In the mid-1950s I witnessed such an event, after the fact, on Cree Lake Saskatchewan. A band of caribou had fallen through the ice and perished. The floating carcasses had frozen into the ice which thickened to several feet. Wolves,

The specific impacts of indigenous harvesting and associated co-factors prior to and following the introduction of guns are not well understood. Throughout all phases of the first crisis, hunting with firearms was a recurring theme. For many of the earlier non-Dene observers, the use of guns became the catalyst for the "wanton slaughter" concept¹⁹ and its supposed effect on the caribou numbers.

Over time I have also come to believe that "mass slaughters" with modern rifles that have been reported were rarely if ever perpetrated by subsistence hunters, at least in the first half of the 20th century. Until the 1960s few Dene and Inuit hunters could afford high calibre guns and ammunition, even when they were available. This is not to deny that large numbers of caribou were killed, dried and turned over to trading posts along the Mackenzie River and probably other areas as well at the behest of the Hudson's Bay Company. There are several possible scenarios: they could have been the result of widespread harvests; accumulated gradually by individual hunters or groups and then traded; or collected by "trading captains" who had been given guns and other presents as inducement to collect furs and dried meat from the hunters. In 1965 when I first visited the Bathurst Inlet Post where CWS believed a very large number of caribou were 'slaughtered' each year, I found that most of the local Inuit hunters were equipped with only old 303 army rifles that Father Lou Menez O.M.I., the resident missionary priest said were "more dangerous to the hunter than to the caribou"²⁰. It appeared that the only good rifle belonged to Father Menez who used it to finish off caribou that were wounded or crippled as a result of using inaccurate rifles.

foxes and wolverines had found the site and the feast had lasted most of the winter. When I visited the site, the bodies had been consumed except for lower legs, hooves, hair and antlers. Another drowning occurred at the east end of Lake Athabasca, where caribou of the Beverly herd customarily crossed the ice in southward migration soon after the rut. In this case a period of unusual warm weather and water from the tributary river at the east end of the lake had opened a channel at the crossing, leaving shelves of hanging ice along each shore. The opening was many metres wide and required a long swim in icy water between the shelves of shore ice. Dene witnesses said that most of the victims were calves and "big bulls" that perished from fatigue and chill or were too weak to climb out on the south shore. Viewed from the air, it appeared that hundreds died there.

19 From my association with "professional" white trappers and their negative attitudes toward indigenous trappers, I suspect that they contributed to the "wanton" slaughter notion. At the same time, the effect of white trappers who dominated northern Canada from the 1920s through the 1950s was not seriously considered. By the time of the caribou "crisis" of the 1950s, many had either retired, passed away, or quit trapping because of changes in the fur market.

20 Fr. Lou Menez O.M.I. Oblate Missionary served over 40 years in the north. He was posted to Bathurst Inlet from 1954 to 1964. He returned to Lyon, France for health reasons, and died in 2006. He shared his experiences with me in 1963.

I am disgusted by the estimates of crippling losses of caribou that I believe are unfounded and grossly exaggerated, but which have nevertheless been published in "scientific" papers and reports such as Kellsall's 1968 monograph. Among traditional hunters it was an offence against the Creator and the caribou to allow a wounded animal to escape. In my experience with Dene and Inuit hunters loss of a wounded animal was rare, and if it did occur, was disapproved of. It was also common practice for many Dene and Inuit trappers to include one or more dogs in each team that could be turned loose to track and hold a wounded animal until the hunter was able to complete the kill.

My caribou studies in the 1960s

My first work in the NWT as a caribou management biologist involved a twofold mandate: first, to assess the status of migratory caribou, and second to monitor the utilization of caribou by indigenous people. On my arrival in NWT in June 1962, I worked with Don Thomas and Quinangnaq, an Inuit hunter, on the Thelon River between Beverly and Aberdeen Lakes, a traditional crossing point for barren ground caribou, recently called Box Crossing. We tagged several hundred caribou from the Beverly herd while it was crossing the river, in northern migration after the June calving period. This ear-tagging program was repeated under my direction in 1963, 1964, and 1965 with the able assistance of Inuit workers Quinangnaq, Qaqimat and Tuluqtuq²¹ as well as Saskatchewan conservation officer Ted Jonasson and Ducks Unlimited biologist Tom Stirling²² and an Indian Affairs officer, Bill Reis. I also assisted the Manitoba Government biologists and tagging crew during the Qamanirjuak herd's August migration across Nejanilini Lake which lies across the migration route to Little Duck Lake, the former home of the Sayisi Dene who were relocated on the shore of Hudson's Bay in 1956.

21 I was given to understand that, Quinangnaq (English name Samson), was a Back River or Chantry Inlet man who was living at or near Schultz Lake, and later moved to Baker Lake. Thomas Qaqimat was a year round resident of Aberdeen Lake, who later moved to Baker Lake. Tuluqtuq was a younger man who had lived at one time in the area of Henik Lake, Emdadai Lake and Padlei until the relocation, but was now the adopted son of Kingilik who camped on an island in Aberdeen Lake near Qaqimat's winter camp.

22 Tom Stirling who is retired and living in Victoria was the D. U. Biologist for Saskatchewan. He came several times to the Thelon River to band Canada Geese when they were moulting and flightless in July. While waiting for the moult to begin he assisted me and Ted Jonason and my Inuit crew tagging caribou. When that was over, my crew and I assisted in his goose banding program.

Although a total of some 6700 Beverly herd caribou were ear tagged over the four year period, the tag returns were disappointing. I believe it was less than 1% in any one year starting after 1962. However, the returns did identify the winter range of the Beverly herd in the Mackenzie District and in Saskatchewan and Manitoba. At least one tag was collected near Yellowknife and one in the Churchill Region, indicating overlap of the Bathurst on the west and Quamanirjuak herd's winter range on the east by the Beverly herd. Another tag from the Quamanirjuak herd was collected near Stony Rapids, Saskatchewan that was taken as evidence of overlap of the Beverly and Quamanirjuak herds on the Saskatchewan winter range. However, on at least one occasion I saw separation of these herds during the early stages of spring migration from winter range. At that time it was not unusual to see groups or columns of caribou moving in opposite directions on the same lake. The tag returns showed no overlaps of summer ranges or permanent migration between herds during the summer.

The tagging program on the Thelon River confirmed the existence of the Beverly herds' calving grounds somewhere south of the Thelon River, not north as reported in at least one unpublished report (Gunn, Fournier & Nishi, 2008)²³. I cannot recall the exact location and size of the calving ground but I think it was around Mosquito Lake near tree line, west of Dubawnt Lake and covered a wide area. A few days after the June 1st to 21st calving period, a segment of the herd, complete with many cows with very young calves, began to cross the Thelon River which was now open but not always totally ice free. The calving segment of the herd (sometimes referred to as the "calving herd") also included a few adult and sub-adult males and all of the yearlings that had migrated to the calving grounds with their mothers.

A few days after the calving group had crossed the river, a very large contingent of adult and sub-adult males, barren females and their yearlings approached from the southwest and crossed over in small groups or dense columns of several hundred individuals. This segment of the herd, which I called the "non-breeders," had remained more or less stationary in a large area near the junction of the Clarke and Thelon Rivers throughout the calving period. In the summer of 1964 a few cows with calves crossed the Thelon River near Beverly Lake after the non-breeder

23 This paper provides a composite map of calving ranges of the Beverly herd from 1957 to 1997, all of which are shown to be north of the Thelon river, including 1962 and 1965 the first and fourth of four consecutive years when calving took place south of the Thelon river.

movement.²⁴ The phenomenon of separation of calving and non-breeder segments of the herds during the calving period also occurred with the Bathurst and Quamanirjuak herds. Although I was directed to the Beverly calving area by Don Thomas in 1962, I found and identified the non-breeder segment of the Quamanirjuak herd by following the spring migration trails from wintering areas in Saskatchewan and northwestern Manitoba to the tundra. There the non-breeders left the calving herd trails and went to the area around Ferguson Lake while the calving herd went to the east side of Quamanirjuak Lake. I did not find the calving and non-breeder areas of the Bathurst herd by following the migration trail from wintering areas, but only by searching both sides of Bathurst Inlet after the June calving season. The breeders of the year (and their new calves) were occupying a separate range than the non-breeding part of the herd. After completing the Thelon tagging program in early July of 1963, I found many non-breeders west of Bathurst Inlet and north to Arctic Sound, but hundreds of cows with calves east of the Inlet²⁵. These segments of the herd joined in late July to become the August migration through the Contwoyto Lake/Pelatt Lake area.

During the Thelon portion of the tagging program, I conducted an aerial survey estimate of the Beverly herd at least twice. On one occasion it was only the calving herd and the second was both the calving and non-breeder segments. I remember the calving herd estimate on one occasion was about 139 000 based on transects that provided approximately 12% coverage. I can't recall the non-breeder estimate but it was at least as large as the calving herd estimate.

²⁴ This is the terminology I customarily use to avoid confusing caribou groups.

Portions of herds, or segments, have sometimes been designated as herds, leading to substantial errors. Banfield identified as many as 19 segments as herds, and gave them names. The confusion lasted for years. A migratory herd retains its membership over a yearly cycle, even if it separates into groups or segments for periods during yearly round. For example, segments such as the commonly named "calving herd" are composed of parturient females and their offspring, with few exceptions. Realizing this assists interpretation of census data. Caribou that normally live year around on the tundra year around do not migrate as an identifiable unit but shift southward in small groups as far as tree-line in winter. Those observed in the western part of Nunavut have been called the Abiak herd.

²⁵ For many years prior to my visits in the 1960s the Bathurst herd was known to calve east of the Inlet, a condition that continued until at least 1967. Since then contemporary biologists have come to believe that the herd now calves west of the inlet, the primary evidence being radio-collared females being found west of the inlet during the calving season. Since the non-breeder segment of the herd commonly includes all or most of the barren females plus a few parturient females, is it not possible that the radio-collared female was barren? If there were sightings of females and new born calves on the west side is it not possible that they were latecomers to the inlet and did not cross to the east side before calving.

In 1963, 1964 and 1965, I also noted tracks and then later individuals and small groups of caribou that had crossed the Thelon River before breakup. These must have been part of the year around tundra dwelling caribou population identified by Ann Gunn as the "Ahiak" herd, which had wintered as far south as tree line. (Gunn, Adamczewski & Nishi, 2008). Near the end of July in 1963, 1964 and 1965 I extended the tagging program to Contwoyto Lake where three Inuit (Simon Kadlun, Henry Algona and Simon's son Joseph Niptinatiuk) assisted me in tagging a small number of caribou from the Bathurst herd during their August migration.²⁶

My observations indicated that the status of the Beverly and other herds I worked on were not as catastrophic as widely feared. On the contrary, I warned of an impending crisis of overpopulation that might be addressed through increased harvesting. However, my results were greeted with extreme incredulity by some officials and generally had little impact on the accepted wisdom of the day that conservation measures imposed in the 1950s should be maintained.²⁷

Indigenous utilization

The other aspect of my mandate allowed me to continue my association with Dene and develop new relationships with Inuit hunters. In the process I was able to deepen my understanding of Inuit cultures and the use of caribou by both eastern and western Inuit. I worked with them and found them to be friendly, co-operative peoples who maintained a deep respect for caribou. They were absolutely not wilful or mindless slaughterers of caribou or any other game. On the contrary I found that they, like their Dene counterparts, regarded caribou as gifts from the Creator, which offered themselves to people as long as the hunter obeyed a number of spiritual and practical laws, among which respectful hunting practices and sharing of the gift were paramount. Waste was disapproved of.

I have long been troubled by inadequately documented and self-referenced reports by Kelsall of wasteful hunting and selective consumption of embryos by the people of Stony Rapids in the Spring of 1957, and blatantly ethnocentric judgements he offered as objective data.²⁸ I believe such statements

²⁶ One late summer I also provided Simon, Henry and Joseph with tags and tagging equipment, but I don't recall the results. Don Thomas had also tagged a few there in 1960, as mentioned by Kelsall (1968).

²⁷ For details of government response to my investigations, see Kulchyski & Tester (2008), who describe it at length some 45 years after the fact.

²⁸ Kelsall (1968:216). Kelsall cites himself (Kelsall, 1960), repeating unsubstantiated rumours, at best speculations.

should be disregarded by contemporary researchers or students of caribou management because they make it impossible to view objectively the relationship between indigenous hunters and caribou populations at that time.

As a personal observer of and occasional participant in spring hunts of Saskatchewan caribou, I find such reports totally inaccurate and preposterous. In the hunts I observed and /or participated in at Stony Rapids and Cree lake, I found that unborn calves were collected and given, for the most part, to pregnant women and respected elders who did not participate in the hunt. At that time of the year the caribou were gathering and resting on lakes and open muskegs or feeding and moving under forest cover. Both the hunters and caribou tended to be scattered over a wide area, the exception being settlements such as Stony Rapids, Black Lake, Fond du Lac and Uranium City. The spring hunting Chipewyans in the Stony Rapids region were roughly divided into two groups; those who resided or trapped near the settlements and outlying areas, and those who had gone with members of their families to hunt and trap in the NWT as far north as tree line and who now were drifting back to their homes in Saskatchewan. There they met the vanguard of the spring migration that was composed primarily of pregnant cows with their calves (now short yearlings) and a smaller number of bulls, two years old and older. The harvest included pregnant females as well as those young bulls that were often in better condition than other members of the herd.

The numbers of caribou killed in the spring hunt varied widely among hunters but rarely exceeded the number required to feed the hunter, his family and dogs for more than a few days. By this time his ammunition supply was low and he was often anxious to get home before warm weather and break-up made travel difficult if not impossible. As spring approached both the migrant hunters and resident hunters began to encounter non-breeder (barren) caribou cows that had begun migration days or weeks after the pregnant females and if their wintering range had been productive, many would be suitable for eating, with quantities of subcutaneous and internal fat that was an essential part of the hunter's diet. A hunter who had killed a few caribou while travelling or near his home community would usually remove the tongues while they were easy to remove, but if his travelling camp or home was nearby he might load the carcass on his toboggan that he had left with his dogs in the forest. Then he would remove heart, lungs, liver, kidneys and any internal fat and portions of the viscera such as the rumen (which in the 1950s would most

likely be fed to the dogs) and the reticulum, omasum and abomasums that even today are considered to be delicacies by elder Dene. While camped with Dene (Gwich'in) on Old Crow Flats one spring in the 1970s I was treated to fried small intestine and brain that had been lightly boiled. One of my hosts, Charley Thomas an elder who has since passed away, jokingly called the brain "Indian potato".

During the spring hunts most hides were discarded because of the many warble fly larva holes. They were not left carelessly about but were often fed to the dogs or buried in deep moss beneath the late snow. I often noted that skins were left on large portions (e.g. the "hams") of the butchered carcasses until they were cut up and cooked or made into partially dried and smoked meat (called wet dry meat in English), or totally dry meat that was often prepared and dried in tents wherever people camped. To state that only the tongues, embryos or lower leg bones were used and that the lean muscle meat was commonly fed to the dogs or left to rot (Kelsall, 1968) is ridiculous and untrue. In fact, when I examined reported kill sites only hours after a successful group hunt, I rarely found anything but blood spots and hair. As a rule, all edible meat was consumed along with the marrow from the long bones and only inedible portions were discarded.

The role of caribou as "staff of life" to past generations of indigenous people living on the land cannot be overstressed. All trappers, indigenous or not, and early settlers such as missionaries, RCMP and government employees relied on caribou as a vital source of protein that could not be found elsewhere. However, the reality is that until the 1960s there were few other adequate sources of food in caribou country, especially during the winter. Moose were often rare and small game such as ptarmigan, spruce grouse and hares were rarely taken in quantity sufficient to feed a family for any extended period. Trading posts in NWT, at least, contained very little food even in the 1950s and early 1960s, and some were only open for short periods during the winter months, even for other trade. On my earliest visits to Fort Good Hope and Bathurst Inlet I found that the stores often closed for long periods and contained very little food, especially in spring before the first barge arrived at Fort Good Hope (Joe Masuzumi, pers. comm., 1963)²⁹ or the ship came to Bathurst Inlet in mid-summer (John Stammers pers. comm., 1963)³⁰.

²⁹ Joe Masuzumi, an elder resident of Fort Good Hope, was a major informant during a traditional knowledge study conducted in that community (see Johnson & Rattan, 1993).

³⁰ John Stammers was the last manager of the original H.B. Co. post at the south end of Bathurst Inlet which closed in 1964.

From the beginning of my assignment in the NWT, I was aware that rumours and stories of excessive harvesting abounded, but the sources and whatever foundation there might have been was unknown to me. Many stories made their way to the CWS, and occasionally I was asked by contact officers to investigate them. Subsequently I personally followed up on several reported incidents of excessive harvests, thought by the CWS officials to be 5000 or more caribou for the Coppermine and Bathurst Inlet communities. But when I visited Bathurst Inlet during the spring hunt in 1963, I only saw verifiable evidence of approximately 50 harvested animals. Although there were doubtless more, the numbers were hardly the 5 000 reported years later (Kelsall, 1968). The Fond du Lac Saskatchewan Dene were also accused of killing 5000 or more caribou. However when I visited them at Scott Lake at the behest of Ward Stevens I found a band of 75 people and many dogs near starvation, as the fall migration of caribou had stalled some 60 miles north, and the fish in the lake had been heavily harvested by commercial fishermen during the previous summer. They had only 2700 rounds of ammunition in several calibers, as verified by the Indian Agent at Stony Rapids in Saskatchewan, but were very pleased because this was the largest amount that had ever been issued to them at one time. Clearly it would not have been possible to kill 5000 caribou with 2700 rounds.

Hunting and food handling practices by indigenous people varied widely among ethnic groups and were usually incompletely observed, inaccurately reported, and almost always misinterpreted by outside viewers. In the interest of bringing a clearer perspective to this subject and to correct some of the misinformation widely circulated at that time, I wish to relate some of my own experiences and observations. They were part of the information I gathered as I conducted my field studies and were an important part of my mandate. While the activities I was privileged to witness and to share are important in themselves, the underlying beliefs and cultural values are even more significant, as they are the foundation of the survival of indigenous communities for countless years in a challenging and rigorous landscape.

When large herds of caribou were located, which might be only once or twice each year, it was essential that enough be harvested to sustain life for an indeterminate time, especially in winter. Usually, they took as many as possible at the time, as there might not be a second chance for several months. On being asked how many caribou he cached in autumn, one Inuit elder said "enough". The number of caribou a hunter required for feeding himself and his family

for several months was a matter of judgement that varied with the size and needs of each family, and the uncertain availability of alternate foods such as fish, ptarmigan, and the carcasses of assorted fur-bearers. A mistake commonly made by non-indigenous people was to think that a large number of animals could not be processed, stored and used quickly enough to avoid spoilage, and therefore must be wasted. Observers would be astounded to see how quickly a group of indigenous hunters and their wives can skin, butcher and process a season's harvest of caribou that are accumulated on a lake or lake shore, and to understand that all of it will be consumed within a few months.

In northern Saskatchewan in the 1950s and when I went north in the 1960s, I found that the heads of a family were not the only hunters that took part in the hunt and different individuals killed different numbers, which might be shared with several families. I found that it was impossible for me to learn the actual numbers harvested by an individual, much less a group. However, this did not prevent some researchers from obtaining precise harvest information from interviews with the hunters. Hugh Ungungai, a Baker Lake resident and interpreter once described to me such an interview³¹ which I have paraphrased as follows: When the informant did not respond to the researcher's request for harvest information with a number (because he could not count) the researcher asked "Was it 50?" The informant answered "imaa" (yes in the Kivalliq dialect). Then the researcher said "Maybe it was 100?" The hunter agreed "imaa". This form of questioning continued until the informant said "imaa, 125." And so it was that the estimated kill of "125 per head of family" became the accepted norm for Inuit and at least the northern Dēnesuḷīne (Chipewyan) who were the primary caribou hunters.

I also found that even experienced non-indigenous observers tended to over-estimate the number dead caribou or parts of caribou that they saw on one area. On one occasion I was directed by Ward Stevens to go to Brochette, Manitoba, to observe a reported slaughter of 500 caribou on Lac du Brochette. I arrived at the site, a few days after the reported kill, to find only blood spots where each animal had fallen. It was fortunate that the event occurred while there was snow on the ice or it would have been nearly impossible to gather any information on such a large lake. I spent at least an hour of flying time over the lake, in which

³¹ Hugh Ungungai could not remember the researcher's name. It may have been either Kelsall or Banfield, who conducted studies of caribou numbers and utilization during the 1950s. See Banfield (1954) and Kelsall & Banfield (1956, cited in Kelsall, 1968).

time I counted less than 200 blood spots. While this is not as precise as could be wished, it sufficed to demonstrate that 500 animals were not harvested or the additional blood spots would have been evident.

On another occasion I landed at Stony Rapids to find a patch of ice that was covered by parts of caribou that had been unloaded only minutes before we arrived. My pilot was disgusted by the sight and made some very uncomplimentary remarks about Dene hunters and how they killed so many caribou, needlessly. I asked him to tell me how many caribou were involved, and then I counted all the body parts and estimated 12 caribou, a number much smaller than my pilot had stated. Later I spoke to the pilot who had hauled the animals, who confirmed my count of 12. They were the result of an authorized community hunt. I became convinced that precise "counts" of the community harvest as reported in documents such as Kelsall's monograph (Kelsall, 1968) were either hear-say stories, products of the author's imagination or attempts to discredit indigenous hunters.

The storage of meat in stone caches during warm August weather for cold weather use also seemed unbelievable to researchers, hence the reports of wastage that pervade some documents. Cache meat is rather strong smelling but is a totally edible and nourishing winter food which I have shared, and been grateful for it and the generosity of my hosts. The practice of allowing whole caribou carcasses to become buried under snow, and retrieved and used months later also seemed unbelievable to non-Dene observers at Duck Lake, Manitoba. On the Thelon River I also saw skinned carcasses submerged in the cold water to avoid blow flies.

I also observed imaginative methods of handling meat for immediate use. For example, the hide, legs, and head would be removed from the caribou carcass, and the internal organs removed through a transverse cut across the abdomen just forward of the pelvis. The abdominal flap would be hooked over the *symphysis pubis* to seal the abdomen against blow flies, and to provide a place where valuable food items such as the tongue and internal organs might be stored temporarily. This was called the "drum" by some indigenous hunters. Blood or body fluids were not washed, but were wiped so that the surface of the flesh would dry quickly and form an impervious surface for preservation to occur. In cold weather the head might be removed, and the tongue cut out so the head (a valued delicacy) could be frozen indefinitely. Removing the tongue was only one step in conventional butchering, although it too was considered a treat. I sometimes laugh when I read that only

the tongues were used, since I found, to my embarrassment, that consuming too much rich tongue in an otherwise empty stomach can have unwanted gastric consequences.

Other treats include the reticulum, omasum and abomasum (3 of the 4 parts of the stomach), even portions of the stomach contents, aged and fresh marrow bones, kidneys, the small intestines and other parts of the gut tract, and even the warble fly larvae; salty morsels. Most of these items that were unfamiliar to outside observers supplied essential vitamins and enzymes that were missing from store bought foods. Fat was always highly valued, as it was absolutely essential for digesting the lean meat when carbohydrates and other fats were not available.

Another subject that used to elicit unfavourable comment was the feeding of caribou meat to dogs. Dogs were the only beasts of burden, providers of transportation and hunting helpers for indigenous people, long before white men came to the Arctic, and trappers continued to use dog teams for many years. They were not pets and were not pampered, although some individuals took special care of their teams. On the other hand, in some parts of northern Saskatchewan, dogs were turned loose to survive as best they could in the summer months and then recaptured and reconditioned in the autumn. In other places some dogs ran free on islands during the summer, and were fed fish periodically. Others were tied to stakes or trees at the water's edge, so that they could submerge themselves for protection from heat and mosquitoes, between feedings, commonly of fish. The role of dogs in the survival of northern people and their cultures was critical, and remained so through the 1950s. In extreme circumstances they could even be eaten, a last ditch survival strategy that was not uncommon.

Of course, any domestic working animal must eat, and their owners must provide the food. No one begrudged a pack horse its forage, yet some observers were outraged when sled dogs were fed caribou meat. During my visits to both the Dene and Inuit camps I found that the people avoided the use of good caribou meat for dogs, if alternatives were available. More specifically, the paunch, entrails, bones and scraps and even skins were often fed. Old caribou bulls, unfit for human consumption for some time after the October breeding season, also fell to the dogs. Fish also were common dog feed in northern Saskatchewan and other forested areas in NWT. They also nourished the people who owned them. It is worth noting however that the food value of fish as a sole source of nutrition was considered inadequate for hard working dogs in eastern arctic winters. The

Northern Service Officer at Baker Lake, Tom Butters, noted that dogs that were not feed meat could not work well, and frequently did not survive the winter³². Whatever the people ate, so did the dogs. Were it not for the dogs and their extraordinary labours, far fewer humans could have survived.

Crisis of overpopulation

Most of the foregoing observations were derived from my activities during the 1950s and early 1960s and relate more to the circumstances of the officially declared crisis of 1955/56 than to the crisis of overpopulation that I warned of ten years later. However, I believe the latter crisis was one product of the so-called conservation measures that were developed to prevent extinction of the caribou.

But first, let me provide some background information leading up to the crisis that I believed was imminent in the 1960s. I was not involved directly with barren ground caribou research from 1955 until 1962 so for details, I must depend on materials from the secondary research of Sandlos and Usher, and the primary research of Kelsall, who was still active in that period, and who describes the results of his and other CWS research in a comprehensive monograph (Kelsall, 1968). However when reviewing his published information for this paper, I am troubled by inconsistencies and contradictions regarding the stated size of the total caribou population between 1955 and 1961, and uncertainties in the status and trends.

In exemplum: Although an increase in the estimated size of some herds, notably the Beverly herd was documented (Kelsall, 1968), the publicized estimate of the total population was still 200 000. In the words of J.P. Kelsall: "No range-wide census was taken after 1955, but several independent population estimates based on partial census and extrapolation indicated that the population in 1958-59 was approximately 200 000 animals. It is believed that the population increased, but only slightly, in 1961. It may have increased since that time" (Kelsall, 1968:282). His highly speculative and somewhat pessimistic comment also seemed to extend the perceived low status and net productivity until at least 1958/59 based on losses of calves due to severe winter conditions, which might have limited the annual increment. He provided no convincing data but credited the increase in the 1957/58 estimate of the study (Beverly) herd to

an influx of caribou from the Quamanirjuak and Rae herds³³ when they may have overlapped the Beverly winter range. This assertion was not supported by direct observation or by tagging (a technique that was not used until the 1961-1965 period).

In 1962, I observed and reported substantially larger estimates of the Beverly herd than the 148 500 population reported for 1957/58³⁴. This line of discussion is to show that before 1962 no one seemed to have any clear idea of how many caribou there were, how many were being harvested, and of course no one had any clear knowledge of the population trends at that time. However, I contend that in the late 1950s there were considerably more than 200 000 caribou on the land as my Saskatchewan colleague and I found during the 1955 resurvey. If the publicized estimate had been correct, we would have been fortunate if we observed *any* caribou in the vast range.

In his monograph (Kelsall, 1968) he cautiously noted that beginning in the late 1950s, the population trend appeared to be towards an increase in herd size, although he supplied very little supporting evidence. I believe the abrupt reduction in hunting pressure and predation of some herds, particularly the Bathurst and Beverly herds which may have been held at or even below the carrying capacity of their habitat until 1956 by professional white trappers and indigenous hunters, probably allowed a pronounced increase that would have continued upward until the carrying capacity was reached or exceeded. Kelsall (1968) describes the response of governments to the false estimate obtained in the re-survey, which advocated severe "people management" measures that included relocations (previously described), policing of hunting and hunting communities and movement of indigenous hunters from the land to the settlements. In addition, a series of milder winters after 1962 probably contributed to the enlargement of some herds since more calves survived to increase net productivity and annual increments in both the Beverly and Bathurst herds. I have no surviving survey notes to support this, however I remember that they were much higher than that of the Quamanirjuak herd which was about 10%, and probably high enough to stabilize the population near the 150 000 mark. The total mainland population east of the Mackenzie River also included an unknown number of Bluenose caribou as well as those that remained on

32 Sandlos (2007) cites comments by Tom Butters, then the Northern Services Officer at Baker Lake, to the Regional Administration concerning the low value of fish for feeding dogs. Butters subsequently became editor of *The Drum*, an Inuvik newspaper that published several of my articles.

33 The "Rae herd" were the caribou that were hunted by the people of the Fort Rae region and could have been part of either the (present) Bathurst or Bluenose herd.

34 Kelsall's results are critiqued in Sandlos (2004). Kelsall found an increase from 79 354 in 1955 to 142 500 in 1957/58, but by tortuous logic he found an overall decline.

the tundra the year around and came to be known as the Ahiak herd.

In the meantime, however, the total area of the accessible winter range continued to decline as a result of fire alone, without considering other factors such as mining development. George W. Scotter, a CWS lichen specialist, addressed the problem of annual losses of winter range due to fire and found them to be very significant (Scotter, 1964)³⁵. The Saskatchewan government maintained a limited fire control program in the Uranium City region during the early 1960s, but I am unaware of any comparable fire control program in the Northwest Territories. In fact, I understand that a request to implement fire control in NWT made by South Slavey residents was rejected on the grounds that fire was a natural factor in forest development³⁶.

In addition to losses of habitat through wildfire I noted that the summer and early fall tundra ranges appeared to be drastically overgrazed, although I did not understand the implications of the overuse of tundra at that time. At some point, however, I noted the abundance of lichens and other vascular plants on islands where no grazing had recently occurred. That observation was in marked contrast to the remainder of the range being utilized during the summer.

Although I was concerned about shrinking winter habitat, there were no conclusive Bathurst population data until the late Archie Mandeville³⁷ and I completed a Bathurst census in August 1965. After searching for about nine days Archie and I, accompanied by Dr. Joseph Shoman, Director of the Nature Centres division of Audubon Society³⁸, found the herd when it was nearly stationary and spread over an area of about 16 square miles near Mara Lake between Bathurst Inlet and Contwoyto and Pellatt Lakes. Immediately

after its discovery the herd moved toward Pellatt and Contwoyto Lakes, then spread out over a wide area and began foraging everything edible including mushrooms that appeared almost daily during early August. The mosquitoes and sand flies were very bad at the time although they did not appear to have lasting effects on the caribou³⁹. However, when a cold wind began to blow from the northwest the herd coalesced into a long column and began to move rapidly upwind toward the end of Contwoyto Lake. This provided the first opportunity to make an estimate of the herd size so Archie and I immediately began our count (estimate) of the herd, which was then about 30 km long. We obtained our estimate by flying along the column at low level while counting and recounting segments of the herd. This method might have produced questionable results, but fortunately another biologist came by with a good camera and the presence of mind to photograph the whole herd. He confirmed our estimate of 250 000 which did not include calves of the year. Not long after the estimate was made, the caribou spread out over a wide area that extended southward as far as Little Marten Lake and the headwaters of the Coppermine River.

With the burgeoning caribou population and the shrinking winter habitat I feared that a catastrophic population crash was imminent. Therefore, in 1966 I published an article warning of a "New Caribou Crisis." The Bathurst herd had exceeded 250 000 in 1965, the Beverly herd was at least as large and probably still growing, and my estimate of the Quamanirjuak herd was 148 667. The Bluenose herds were part of the total, which I had estimated conservatively at 700 000 in 1965. In the article I also recommended that 100 000 caribou be harvested immediately to prevent severe overuse of the reduced habitat and prevent a crash decline and great loss of caribou. In my opinion such a harvest was not unreasonable, divided among three or four herds, and representing less than 15% of my total population estimate of 700 000.

However, given that the estimated annual mortality (mainly from hunting) of about 100 000 caribou in the years prior to 1956 had been touted as a major threat to the survival of the mainland population, my recommendation was not well received. The only

35 Scotter concluded that "there is little doubt that forest fires have been one of the principle causes of (the decline) of barren-ground caribou." As noted by Kelsall (1968).

36 Clayton Burke, pers.comm. 2010. Mr. Burke, a resident of Fort Smith NWT and a fire control officer in 1969 told me that in a meeting to discuss fire control in the South Slave region, respected forest ecologist Dr. Stan Rowe advised against fire control on the grounds that it was a natural factor in forest development and that fire control would not benefit caribou.

37 Archie Mandeville, who passed away in 2010, just prior to his 99th birthday, was born in the NWT in 1911 where he resided until his retirement from government service, an Assistant Game Officer in the NWT. I met him in 1962, and during the next three years he often assisted me as co-observer on aerial surveys and ground studies.

38 Dr. Joseph Shoman, Director of Nature Center Division of Audubon Society came to my camp on the Thelon River a day or two after all the caribou had finished crossing, so I invited him to come to Contwoyto Lake where he witnessed the spectacular August migration of the Bathurst herd. He later described the event in a memoir titled *Beyond the North Wind* (1974).

39 I often observed caribou feeding calmly on a sedge meadow in the midst of a cloud of mosquitoes and black flies or sand flies, and even lying down after feeding. Then they might suddenly spring to their feet and race to the top of the nearest windy hilltop, where they would crowd together shaking their coats and kicking and stamping for hours at a time. But it is a fact the caribou are under constant attack by mosquitoes and biting flies throughout the "fly season" that lasts from mid to late June, until mid-August but the cumulative effect on the growth and health of the animals is unknown.

positive response to my article was from the NWT Commissioner Stuart Hodgson, who invited me to Yellowknife to discuss my article and my unsolicited proposal to develop a management program for the mainland caribou population. The only noticeable outcome of that proposal that I perceived was some relaxation of hunting regulations and the introduction (or resumption) of licensed commercial hunting. The latter was a low priority, but was intended to utilize those caribou that exceeded the needs of indigenous hunters and licensed residents.

In fact my article was dismissed by at least one member of the Administrative Committee for Caribou Preservation as "being full of dangerous information" (Administrative Committee on Caribou Preservation, 1965, cited in Sandlos, 2007)⁴⁰. It is interesting to note that while I had estimated the total population at about 700 000, a subsequent survey with timing (late winter and early spring), scope and methodology similar to the 1955 re-survey was conducted by CWS Biologist Don Thomas who estimated the total mainland population at 387 000 despite the fact that the entire range was not covered in his census. He argued that an increase from 200 000 in 1958 (Kelsall's dubious figure) to 387 000 in 1967 would require either the "extremely high" recruitment rate of 17.6% or would indicate that "the 1958 population was larger than 200 000" (Thomas, 1967, cited in Kelsall, 1968)⁴¹. Thomas has made my point exactly. Certainly there were more caribou in 1958, and just as certainly the 1967 survey result was very limited, predetermined by study design.

My recommendation to harvest 100 000 caribou was derived from my management experience in Saskatchewan and my understanding of the role of harvesting as a management tool. Although many interested observers will insist that hunting with rifles is the root cause of population decline, one can argue to the contrary (as I did in the 1960s) that population control by hunting is the most common management technique and is beneficial where it reduces competition for food and space, and prevents the overuse and depletion of the habitat. Furthermore, if the population does not exceed the carrying capacity of the habitat, harvesting can maximize herd productivity. In Saskatchewan, these concepts were demonstrated with other species, notably muskrat and moose.

It was common knowledge among wildlife managers that an uncontrolled (i.e. unharvested) population of herbivores will increase until it exceeds the ability of its habitat to support it. Then it will either crash dramatically (as happens with the varying hare) or decline more slowly until it reaches the carrying capacity of the habitat, or descends below it. The concept of overpopulation of habitat followed by decline was first applied to caribou by Biologist C.H.D. Clarke in 1939⁴² although it was probably common knowledge among indigenous hunters long before Europeans arrived (Johnson & Ruttan, 1994). At the time I wrote the article, however, I was not aware of Clarke's research. The slower decline as a result of overuse of habitat is more common with large herbivores such as deer, moose or caribou that are mobile and are able to utilize a greater variety of habitats and habitat conditions.

Although I left the CWS in 1965 to teach Wildlife Technology and Management at the Saskatchewan Institute of Applied Arts and Sciences (S.I.A.A.S.), I returned to the NWT during the summers of 1967 and 1969 under contract and spent a few days in early August collecting herd composition data from the Bathurst herd while it was moving past Pellatt Lake. With the assistance of Joseph Niptanatiak and his sister Mimilena I recorded the sex and age composition of a large sample of the herd⁴³ which revealed high percentages of both long yearlings (at 14 months of age) and young calves. I was informed by the Wildlife Division that the yearly increment had also been high in 1966. Thus the herd must have increased considerably beyond my 1965 estimate, which had been the basis for my 1966 recommendations to harvest 100 000 from the total caribou population, not just the Bathurst herd. By this point the total population might conceivably have been one million or more.

In the years following the great increase in the Bathurst herd that I had estimated in 1965, I can find no record of an assessment of the degree to which the range was damaged by years of grazing and trampling or loss to wildfire, nor of the scope and effect of the development of human communities and the mining industry upon it. In retrospect, there may have been parts of the range I did not see that were not overused, and that might have reduced the pres-

⁴² Clarke's results were published in 1940.

⁴³ In order to randomize the sample that included four sex and age categories (bulls, cows, long yearlings, and calves of the year) in the massed moving column of caribou, only those that passed through the field of a fixed spotting scope were identified by Joseph, who had been taught the English designations. They were recorded by Mimilena. The sampling continued until the column of caribou had passed our observation point.

⁴⁰ Until I read about this in Sandlos, I was unaware of the extent of the paranoia induced by my activities and writings. Actually I am not displeased, but I have yet to search out the reference for myself.

⁴¹ This study is significant because with all its flaws, it points to the validity of the 1965 Bathurst survey figures.

sure and prevented the more precipitous decline that I had feared. Hunting pressure and other mortality factors may also have acted as brake as well. It is also possible that over the centuries the caribou have developed resistance to the stresses brought about by overpopulation. Such speculation is tempting, but unproductive. Apparently the Bathurst herd gradually became smaller over the next three decades.

A slow decline from serious overpopulation, nonetheless, is every bit as catastrophic in the long run as a crash decline. If the population is in decline for a long time, the range will be even more heavily damaged by prolonged over-use, and probably take longer to recover. Keeping this in mind it is not surprising that there has been no noticeable recovery of the caribou populations to the numbers that I observed in the 1960s. When I predicted a crash decline, I thought the use of the phrase evoking crisis would get the attention of the wildlife administrators most effectively and that positive action would follow. A tactical error, no doubt, for I got the attention but not the action.

Although I had received a positive response from Commissioner Hodgson, I was disturbed by the failure of other administrators to respond positively to the overpopulation that I found so alarming. I was not the first to have made such an argument. As early as 1939 C.H.D. Clarke, then a respected biologist, warned that too many caribou were just as bad as too few and an increase in caribou over the carrying capacity could result in a disaster. Clarke had been conducting studies in and around the Thelon Game Sanctuary while herds of caribou were present and identified the importance of hunting and predation in maintaining the caribou at or below the carrying capacity of the habitat. However, in the mid-1960s the CWS clearly did not agree that overpopulation was a problem, and were not interested in considering evidence that contradicted their strongly advocated program of conservation that emphasized a reduction in hunting, and continued wolf control. From the point of view of management, this was a recipe for disaster.

The Bathurst problem: Is this another crisis?

There has been a drastic decline in the estimates of the Bathurst herd during the past decade or more and with it, as with the alleged crisis of the 1950s, there seems to have been a sense of panic and corresponding management actions have been undertaken. It is perhaps useful to consider the current situation in light of the two perspectives on crisis that emerged in the 1950s and 1960s.

Having no access to the truth and panicked by the publicized crisis, government agencies in the 1950s rushed to implement conservation policies and programs that in hindsight were cruel, self-serving and damaging to indigenous cultures and of questionable value to the barren ground caribou that could now increase beyond the carrying capacity of their habitat. The crisis of the 1960s that I hypothesized was based on empirical data concerning the increases in the Bathurst and Beverly herds and reductions in the winter range, which I believed could bring about a crash decline and the loss of many caribou. But the data I was drawing on was inadequate. An inventory and evaluation of the existing range and its carrying capacity would have been more convincing to government managers. My message in the 1960s was and still is that too many caribou are just as big a problem as too few, as Clarke warned back in 1939. The deliberate reduction that I suggested could have spared the habitat some of the damage incurred by continued overpopulation. However the Bathurst herd, at least, appears to have gradually deflated like a slow leak in a balloon, rather than a sudden bang, while the range possibly suffered substantial damage as a result of prolonged overpopulation.

Is the current condition and status of the Bathurst herd the result of over-population of habitat that has also been reduced by expanding industrial and community development, in addition to natural factors such as fire? Is it also possible that the herd has finally become adjusted to changing conditions and has ceased to decline?

In 1955 it was assumed that the alleged decline was caused by over-hunting, although no incontrovertible data were provided to support that assumption. In 1966, I recommended that a large harvest might prevent a population crash, with no published precedent to support the recommendation. The common feature of both scenarios was lack of data that would support assumptions concerning the status and trend in the herds and the impact on them of hunting, predation or range conditions. Are the mistakes of the 1950s and 1960s being repeated in decision-making based on unverified assumptions concerning the causes and extent of decline with very little supporting data?

In my assessment of census figures to date I see no evidence that the Bathurst herd is in immediate danger of extinction, although the herd is threatened by annual losses of habitat and by industrial development and increases in human population. But now I think there are reasons to believe the history of the 1950s is starting to replay. Now as then the numerical status and composition and productivity of the herd are unclear and I have seen no conclusive data

concerning the condition of the range or impacts of industrial or human development upon it or to the population that it supports. Yet recommendations to "help the caribou" to increase have been developed and are being tested for validity (Joint Proposal, 2011). They feature a reduction in the hunting of cows and an increase in the hunting of bulls, measures which are intended to increase calf production and recruitment rate. These recommendations have been promoted for the neighbouring Bluenose herds as well without data to support their value.

Some Dene harvesters have made it known that they are concerned about such an approach. Their objection may be based on the fact that more cows than bulls have been harvested in winter for many generations without seriously affecting the herd size or productivity, and an increased harvest of bulls could remove prime breeding bulls that would otherwise maintain a high conception rate.

Notwithstanding the caribou research that has doubtless been made since the 1960s, I suspect many would agree that there remain great risks and uncertainties in assessing the status of caribou herds and identifying factors driving population dynamics. For example, a focus on the numbers of parturient cows on the calving grounds errs in not including those barren cows, their calves of the previous year (now yearlings) and most of the adult and sub-adult males that are some distance from the calving grounds during the calving period and the census. Inclusion of this group which I call non-breeders may have been a factor in the sudden "increases" in the 2010 estimates of Bluenose East and Porcupine herds as it did with the Quamanirjuak herd back in the 1960s⁴⁴. Will such an "increase" be found in the next census of the Bathurst herd? And, if so, what will the response of governments be to it? It is also possible that the recorded or estimated total kill could have included caribou from both the Bluenose East and Beverly herds because of their mixing with the Bathurst herd on its the winter range. Moreover, the calf- (short yearling) to-cow ratio that has commonly been used as a basis of the increment does not provide a correct calculation of the annual increment. The more accurate annual increment is calculated on the ratio of yearlings: adults of both sexes.

Another common assumption that may lead to error is that a reduced number of parturient females

observed on the calving grounds are the consequence of too many females, especially pregnant females, being harvested. From my personal experience and knowledge acquired from Dene hunters, the number of parturient females on the calving ground is more dependent on conception rate than on mortality of females during the winter. Experienced Dene and Inuit hunters know that not *all* females return every year to the calving area where they were born. Most barren females do not (Kendrick, 2003). The conception rate is subject to many variables one of which is the range of circumstances under which females in oestrus and prime breeding males contact each other during the short breeding season. One autumn, I observed the "rut" of the Beverly herd when it occurred at treeline near Damant Lake, the site of a traditional Chipewyan hunting camp. A severe snow storm interrupted the breeding season on the tundra and drove the Beverly herd past tree line and deep into the forest where they dispersed over a large area making it difficult for prime bulls to find all cows that were in oestrus.

The window of opportunity for mating is about three weeks, and thus timing is critical. If snow storms should occur in that time that would drive the animals beyond tree line, or for some indeterminate reason the males and females were too widely dispersed or separated during the breeding season, conception would not be optimal in that year. This separation of the sexes was observed by Kelsall (1968).

It is also common knowledge among mammalogists that good condition of the female is essential for conception and the survival of embryos until birth and weaning time. It follows that the condition of the females depends on the food supply prior to breeding. For a very long time I equated the health and reproductive success of caribou with the condition of the winter range, but recently I came to realize that the summer range is probably as important for the following reasons. During July, August and September the breeding bulls put on body fat that they lost during the previous breeding season and did not fully regain during the ensuing winter and spring, while the cows recover and retain much of the health and vigour required for conception and survival of the embryo through birth and the first year of life.

I reported my concerns about winter range conditions and their role in the dynamics of the Bathurst herd in 1966 (Ruttan, 1966), however no studies to inventory and/or evaluate range conditions, or determine carrying capacity, were ever implemented. I have found no definitive study of the Bathurst herd range or of its carrying capacity in the literature since they were briefly discussed in Kelsall's 1968 monograph, but I often wonder if the underlying

⁴⁴ See Sandlos (2007) which refers to a survey that Art Look and I conducted in 1965 that increased the herd estimate to 148 677 from a much lower estimate based only on the calving herd. During our survey the non-breeders were found and estimated while they were in the Ferguson Lake area more than 80 km west of the calving grounds.

cause of the decline was over-population of a reduced and degraded range. Is it not also possible that the gradual decline, rather than a population crash, is the Bathurst herd's natural response to deteriorating range conditions through a reduction in productivity?

Required action

Although certain components of the data are readily available, the creation of a complete picture of the dynamics of the herd and factors affecting them is a daunting project that requires a great deal of painstaking investigation. Given the enormity of the task, those scientists and indigenous harvesters who attempt to assess the herds now merit great respect. The herd is a moving target as many of the components are frequently changing.

The herd is almost constantly on the move while feeding, growing, reproducing, being harvested and dying of other causes. The vegetation communities encountered in their travels and on which they depend are broadly divided into forest and tundra, where plant communities that typify them are growing, being eaten, trampled, burned, frozen or fragmented by seismic lines and transportation corridors such as the ice road from Contwoyto Lake to Yellowknife and other roads between communities and mining developments. Both the caribou and their habitat are subject to often extreme climate and weather variations. However, with patience, persistence and attention to detail, it will be possible to find certain consistencies, constants of you like, that extend beyond those of the timing of migration, breeding or calving. Herd behaviour during spring and fall migration, or, before, during and after calving are good examples.

Such constants are features of the traditional knowledge that served the indigenous hunter so well. Variations will occasionally be observed in such normally consistent activities as migration, such as when the herd fails to pass through or near a traditional hunting camp or area. In the past such unforeseen situations have caused starvations, but did not necessarily mean the herd size had decreased. Such events cannot be avoided but if the herd is kept under surveillance or frequently observed or monitored via direct observation and radio telemetry, uncommon variation in movements by the herd (or portions of the herd) can be detected. Serious errors have been made in the past that would not have occurred if the caribou herd had been kept under observation.

A feature of the Bathurst herd's "picture" is the productivity of the herd that can be calculated each year from the herd composition and expressed as the ratio of yearlings to adults (of both sexes) just before

or during the June calving period. When combined with reasonably accurate estimates of the total population, the allowable harvest can be calculated. Since the 1960s biologists have been most concerned with the ratio of calves to cows on the calving grounds, or of short yearlings on the winter range which are interesting but of little value when calculating productivity. That requires a clear knowledge of sex and age composition of the entire herd. An inventory and evaluation of both winter and summer range are also an important part of the "picture" required as a basis for effective management proposals.

Achieving a comprehensive view of the Bathurst herd and the factors that affect it will be complicated by the fact that the herd seasonally occupies portions of two large political jurisdictions: Nunavut in spring and summer and the Northwest Territories in winter and early spring. (As an additional complication, Bluenose and Beverly caribou frequently occupy portions of the Bathurst's traditional winter range). The Bathurst herd is also utilized by several Inuit and Dene communities as well as residents of the city of Yellowknife. Since the herd occupies and is shared by all these jurisdictions, a fully developed co-management system based on a clearer knowledge of the status and condition of the herd and its habitat combined with respectful dialogue that brings science together with the traditional and acquired knowledge of Dene and Inuit peoples will be best situated to bring about positive results in caribou stewardship.

Acknowledgements

Although this paper is largely a personal memoir, its production has been made possible by the co-operation of two people; my wife and colleague Shirley, and my unflinching editor Deborah Simmons. I want to thank them both: my wife for careful documentation of relevant information that she gleaned from my frequent accounts of earlier observation in the 1950s and 1960s and my frequent rants, concerning the condition of caribou and their management in that era; and Deborah, who started the publication ball rolling, and whose patience and encouragement never wavered.

I would also like to thank the reviewers of the paper, Walter Bayha, Ken Caine, John Sandlos, Doug Urquhart, Peter Usher, as well as Micheline Manseau, for their thoughtful and constructive criticisms and suggestions that significantly improved the document. And finally (and of great importance) I want to show my appreciation of the ecological knowledge imparted to me by aboriginal hunters of northern Saskatchewan, the original Northwest Territories, and the Yukon. It is my belief that their teachings, including traditional principles and hunting practices, are the secrets of their cultural survival. They must also be maintained for the stewardship and survival of caribou in the future.

References

- Administrative Committee on Caribou Preservation.** 1965 (July 15). Unpublished meeting minutes. RG 85, acc 1997-98/076. Box 68, file 401-22-5-1, pt. 2, National Archives of Canada.
- Banfield, W.A.F.** 1954. Preliminary investigation of the barren-ground caribou. – *Can. Wildl. Ser.* 1, Nos 10A and 10b.
- Banfield, W.A.F.** 1956 (Spring). The “Caribou Crisis.” – *The Beaver Outfit* 286: 3-6.
- Clarke, C.H.D.** 1939 (January 16). Address on Caribou given at the Provincial-Dominion Wildlife Conference RG 22, Vol. 4, file 13, National Archives of Canada.
- Clarke, C.H.D.** 1940. *A Biological Investigation of the Thelon Game Sanctuary.* Nat. Mus. Can. Bull.96 (Biol. Ser. No. 25).
- Code, A. & M. Code.** 1993. Sayisi Dene Nu Ho Ni Veh (Our story), Greg Nosaty, Ed. VCR/CD
- Gunn, A.** 2010 (March). *2009 Tłı̄ch̄o Government and Government of Northwest Territories Joint Proposal on Caribou Management Actions in Wek'èezhìi: an independent technical review for the Wek'èezhìi Renewable Resource Board.* Yellowknife: Wek'èezhìi Renewable Resources Board. <http://www.wrrb.ca/public-information/public-registry/project/2009-bathurst-caribou-joint-proposal>. Accessed April 21, 2011.
- Gunn, A., J. Adamczewski, & J. Nishi.** 2008. *A Review of Concerns Expressed by Outfitters between 2003 and 2007 about the Bathurst and Abiak Herds.* Manuscript report No. 178. Yellowknife, NWT: NWT Department of Environment and Natural Resources.
- Gunn, A., B. Fournier, & J. Nishi.** 2000. *Abundance and Distribution of the Queen Maude Gulf Caribou Herds, 1986-1998.* Yellowknife, NWT: NWT Resources, Wildlife and Economic Development.
- Johnson, M. & R.A. Ruttan.** 1993. Traditional Dene Environmental Knowledge: a pilot project conducted in Fort Good Hope and Colville Lake NWT. Hay River, NWT: Dene Cultural Institute.
- Kelsall, J.** 1968. *The Migratory Barren-ground Caribou of Northern Canada.* Canadian Wildlife Service Monograph 3. Ottawa: Queen's Printer.
- Kelsall, J. P. & A.C. Loughery.** 1955. *Barren-ground caribou resurvey 1955.* Can. Wildlife Serv. Rep c 277 Mimeo.
- Kendrick, A.F.** 2003. Caribou Management and Cross-Cultural Sharing. Doctoral Thesis U of Manitoba, Appendix 7.
- Kulchyski, P. & F.J. Tester.** 2007. *Kiumajut (Talking Back) Game Management and Inuit Rights, 1900-70.* Vancouver: UBC Press.
- Northwest Territories Dept. of Environment and Natural Resources.** 2009. *Interim emergency Measures conserving the Bathurst Caribou herd.* Fact sheet
- Rawson, D.A. & R.A. Ruttan.** 1952. Pond fish studies in Saskatchewan. – *J. Wildlife Management* 16 (3): 283-288.
- Ruttan, R.A.** 1966 (November). “New Crisis for the Barren – Ground Caribou”. – *Country Guide* 85 (11): 24-25.
- Ruttan, R.A.** 1961. Winter ecology of woodland caribou in Saskatchewan. Saskatchewan Wildlife Branch Report. Unpubl.
- Sandlos, J.** 2007. *Hunters at the Margin: Native Peoples and Wildlife Conservation in the Northwest Territories.* Vancouver: UBC Press.
- Scotter, G.W.** 1964. Effects of Forest Fires on the Winter Range of Barren-Ground Caribou in Northern Saskatchewan. – *Wildlife Management Bulletin*, Series 1, No. 18. Ottawa: Canadian Wildlife Service.
- Seton, E.T.** 1911. *The Arctic Prairies.* Harper and Rowe, New York
- Seton, E.T.** 1929. *The Lives of Game Animals* Vol. 3 Pt. 2. (Garden City) Doubleday
- Shoman, J.** 1974. *Beyond The North Wind.* Cranbury NJ: Barnes and Co.
- Symington, F.** 1965. *Tuktu: The caribou of the Northern Mainland* (Ottawa: The Queen's Printer)
- Tester, F.J. & P. Kulchyski.** 1994. *Tamarniit (Mistakes) Inuit Relocation in the Eastern Arctic, 1939-63.* Vancouver: UBC Press.
- Tłı̄ch̄o Government and Government of Northwest Territories.** 2009. *Joint Proposal on Caribou Management Actions in Wek'èezhìi.* Submitted to Wek'èezhìi Renewable Resources Board. Yellowknife: NWT
- Tłı̄ch̄o Government and Government of Northwest Territories.** 2010. *Revised Joint Proposal on Caribou management actions in Wek'èezhìi* submitted to Wek'èezhìi Renewable Resources Board. Yellowknife: NWT
- Thomas, D.C.** 1969. *Population Estimates of Barren-Ground Caribou, March to May, 1967,* Canadian Wildlife Service Report Series No. 9 (Ottawa: The Queen's Printer, 1969).
- Usher, P.** 2004. Caribou crisis or Administrative crisis? Wildlife and Aboriginal Policies on the Barren Grounds of Canada 1947-60. – In: D. Anderson & M. Nuttall (eds.). *Cultivating Arctic Landscape.* New York: Berghahn Books, pp. 172-199.