

Structures for caribou management and their status in the circumpolar north

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Abstract: Large herds of caribou (*Ranaifer tarandus*) in Canada, Alaska, and Russia that winter in northern coniferous forests and summer in tundra of the Arctic have provided a sustainable source of meat and other products for indigenous peoples for thousands of years. Several different administrative structures for management of large caribou herds have emerged throughout the circumpolar North. In Russia under the previous Soviet government, the herd of the Taimyr Region, numbering around 500 000 caribou, was managed under a harvest quota system for both subsistence use by indigenous people and commercial sale of meat and skins. In North America, as indigenous peoples have gained increasing political empowerment, systems for caribou management have been undergoing change. Establishment of the Beverly and Qamanirjuaq Caribou Management Board in Canada, with majority representation from users of the resource, provides a model and a test of the effectiveness of a comanagement system. The Western Arctic Herd in northwestern Alaska, numbering close to 500 000 caribou, has been managed under the traditional American system of game management, with user advisory groups, but with management decisions resting with a statewide Board of Game, whose major representation is from sport-hunting interests. The Porcupine Caribou Herd, which is shared by the United States and Canada, is the focus of an international agreement, in principle designed to assure its continued productivity and well-being. The diversity of systems for caribou management in the circumpolar North provides an opportunity for comparing their effectiveness.

Key words: reindeer, *Rangifer tarandus*, Russia, Scandinavia, Greenland, Canada, Alaska, subsistence, co-management

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Introduction

Caribou, or wild reindeer as they are known in northern Europe and Siberia (both are *Rangifer tarandus*), are an important subsistence resource for indigenous cultures throughout the circumpolar North. For many of these northern cultures, caribou have been the primary source of food and clothing, and the seasonal patterns of life of these indigenous peoples have followed the movements and availability of caribou. This dependency of many northern peoples on caribou remains as important today as it has been in the past. Although their cultures have evolved, incorporating or taking advantage of the technology, medical advances, educational opportunities, and other social services and material products of western society, the productivity of their northern homelands remains largely unchanged. Caribou and other fish and wildlife resources continue to be the primary support for the economy of northern peoples, whether it be directly for subsistence or through contribution to a cash economy.

Management of the fish and wildlife resources of these northern lands is the legal responsibility of the countries within which they lie. Strategies for management of caribou have varied considerably. It has only been in the last 15-20 years that these large northern herds of caribou have been the focus of substantial increases in attention by the responsible governments.

Russia

In the Soviet Union, prior to its dissolution, intensive management, designed to achieve maximum exploitation of their largest caribou population, was practiced (Klein & Kuzyakin, 1982). This occurred in the Taimyr region of north-central Siberia, where the caribou population had increased to occupy wintering areas formerly used by domestic reindeer. Under the communist government, indigenous reindeer herders abandoned their traditional lands for reindeer grazing where they had lived a subsistence life-style. They were encouraged by the government to move to centralized communities

where they were formed into reindeer herding cooperatives, and where medical and educational services could be provided.

When the Taimyr Caribou Herd had increased to several hundred thousand in the early 1970s, the Soviet government began a program of intensive management. Aerial censusing of the herd was begun, and organized hunts using indigenous hunters were conducted at river crossings during autumn migration (Klein & Kuzyakin, 1982). Facilities for dressing slaughtered animals were constructed, including cooling cellars dug into the permafrost. Carcasses were transported to the larger communities and cities of the region, where the meat was processed for distribution throughout the country or sold in local markets. Skins were prepared for processing as leather. Indigenous people, who had traditionally hunted caribou, were allowed to hunt for their subsistence needs. The Taimyr Herd in the past 2 decades has increased from about 350 000 in 1970 to over 600 000 by the early 1990s (B. Pavlov, L. Kolpaschikov & V. Zyryanov, pers. comm.). Aerial censusing with several aircraft and using photography has yielded population estimates and these, along with ground counts of sex and age composition, have provided the basis for setting harvest quotas.

Problems with management of this herd included overharvest of adult females; these females compose most of the early autumn migration when the harvest takes place. Recent attempts to increase the harvest of adult males, including conducting winter hunts, have restored herd sex ratios to prior levels and increased productivity; however, the dispersed nature of the caribou in winter when this effort is concentrated results in high transportation and processing costs. In the late 1960s and early 1970s, natural gas pipelines were constructed across a portion of the migration route of the Taimyr Herd, which obstructed their movements and deflected them away from traditional wintering areas (Klein & Kuzyakin, 1982). Year-round ship traffic on the lower Yenisei River, which maintains open ice-choked channels, has also obstructed movement of caribou to winter ranges on the west side of the river (L. Kolpaschikov, pers. comm.). Although traditional winter ranges were abandoned, the caribou were deflected into new wintering areas that had previously been used by domestic reindeer. Air pollution from the large metallurgical mining and smelting complex around Norilsk has destroyed or caused the reduction of lichens on extensive areas of caribou and reindeer winter range (Klein & Vlasova, 1992).

Although problems were confronted in the management of the Taimyr Herd, the relative success of intensive management brought about a

change in official Soviet policy toward caribou and reindeer management. In the early years following World War II, the Soviet policy was to expand reindeer husbandry through gradual replacement of the caribou (Andreev, 1975). Concurrent attempts to collectivize reindeer husbandry and force its expansion into the remote tundra areas occupied by caribou were not successful. By the 1980s the demonstrated success of intensive management of the Taimyr Caribou Herd convinced authorities that the remote areas supporting caribou populations were best left for production of caribou (Syroechkovski, 1986). Attempts to manage the only other large herd of migratory caribou in northern Siberia in a similar fashion through organized commercial harvest have met with limited success. This is a herd of about 200 000 caribou in northern Yakutia. The terrain that it occupies does not include major rivers that bisect its migration routes, as is the case with the Taimyr Herd; thus, appropriate harvest sites are not available.

Under the restructured government in Russia, caribou management is administered by regional governments (L. Kolpaschikov, pers. comm.). Management policy and practice have apparently not changed much, although the currently precarious economy has curtailed funding for aerial surveys and other management activities. Management of the caribou is now expected to be financially self-supporting.

Nordic countries

Northern Finland, Sweden, and Norway in prehistoric times supported large populations of caribou (wild reindeer) that were hunted by the earliest humans that arrived there at least 6 000 years ago (Skogland & Molmen, 1980). When the Sami (Lapp) people learned to capture and herd the caribou, the resulting herds of reindeer gradually displaced the wild caribou, which were deliberately killed in the reindeer herding areas. Today caribou are completely absent from areas occupied by domestic reindeer. The only wild reindeer or caribou occur in forest areas close to the Russian border of Finland and in alpine habitats in southern Norway.

The Norwegian caribou number about 35 000 in several herds. Management, whether on private or government lands, is based upon annual population estimates, composition counts to determine recruitment rates, and periodic assessment of range conditions. Large predators (wolves and bears) were extirpated from these range areas early in this century. Harvest quotas are set by regional governments. In Norway, caribou are the legal property of the landowner; therefore, caribou may be hunted by the landowner within the seasons and harvest quotas

established by the central or regional governments. Alternatively, hunting permits can be sold to individuals or groups of hunters by the landowners (private or government) authorizing killing of a designated portion of the total quota for each herd. Annually, about 6 500 wild reindeer are killed by hunters in Norway out of a management quota of over 12 000 (E. Reimers, pers. comm.).

Caribou exist on the arctic archipelago of Svalbard at 79–80°N, which is under the administrative jurisdiction of Norway. These caribou are a unique subspecies that existed there for thousands of years in the absence of predators and human hunters, and parasitic flies, and with few harassing insects. Their adaptations to these conditions and life at this high latitude include short legs and the capability of accumulating much greater fat reserves than other caribou (Reimers & Ringberg, 1983). Following discovery of these arctic islands, whalers, sealers, overwintering trappers, and miners hunted the Svalbard caribou to near extinction. They were given legal protection in 1925, and the population has now increased to about 11 000 (E. Reimers, pers. comm.) and in most areas appears to be near the carrying capacity of the habitat although lichens have been depleted locally.

Greenland

Caribou are restricted to western Greenland, primarily in the large ice-free areas of southwestern Greenland. Caribou formerly were present in northeastern Greenland, but they died out around the turn of the last century as a consequence of extreme climatic variation (Meldgaard, 1986). Caribou have been hunted traditionally in western Greenland by the indigenous Inuit for subsistence use, and sale and export of meat and skins. No large predators are present there, but harassment by insects in summer can be severe and parasitism by skin warble (*Oedemagena tarandi*) and nasal bot (*Cephenemyia trompe*) flies, which were brought there in the 1950s with domestic reindeer (Clausen *et al.*, 1980), has apparently had a serious effect on productivity of the population. Historically, the population fluctuated widely, with a peak in the early 1970s reaching 100 000 (Thing, 1984) and a low of 9 000 in 1993 (H. Thing, pers. comm.). Overgrazing of lichens has reduced the carrying capacity of the range. Harvest quotas have been reduced by the Greenland Home Rule Government, but poor range conditions and annual harvests in excess of the designated quota are believed responsible for failure of the herd to increase. Currently, little effort is expended by the Home Rule Government to monitor herd numbers and condition or to control illegal harvest. A higher priority is placed on increasing the extent

and numbers of introduced muskoxen. Their expanding populations are viewed as a substitute for the current low density of caribou as a source of meat for subsistence and possible commercial use.

Comparative management of caribou in Canada and Alaska

The large migratory herds of caribou of northern Canada and Alaska are of importance for subsistence use by indigenous people. Hunting of the caribou in these herds occurs during autumn migration when they can be intercepted at water crossings and, more commonly, in winter when transportation by snow scooter or dog sled is possible. Some hunting occurs in summer when caribou may be close to coastal settlements. The herds involved are (1) the George River Herd in the Ungava Peninsula of Labrador and Quebec, estimated at about 700 000 in 1993, and the largest caribou herd existing at that time; (2) the Leaf River Herd in the northwestern Ungava Peninsula of Quebec, numbering about 150 000; (3) the Qamanirjuaq, and (4) Beverly Herds occupying the barren lands of Northwest Territories (NWT) to west of Hudson Bay and extending in winter into northern Manitoba and Saskatchewan, and estimated at 260 000 and 285 000, respectively; (5) the Bathurst Herd, farther to the west, north of Great Slave Lake and east of Great Bear Lake in the NWT with over 500 000 animals; (6) the Bluenose Herd still farther west in NWT, north and west of Great Bear Lake and east of the Mackenzie River with about 65 000 caribou; (7) the Porcupine Herd, estimated at 160 000, that calves and occurs in summer in tundra regions of northern Yukon and northeastern Alaska and in winter is distributed between Alaska, Yukon Territory, and the northern edge of NWT; and (8) the Western Arctic Herd of northwestern Alaska of about 560 000 animals (sources pers. comm.: 1 and 2 S. Courturier; 3–6 M. Williams; 7 D. Russell; 8 P. Valkenburg). Several smaller herds are also resident in the Canadian arctic islands, in the northwestern mainland of the Northwest Territories and the Alaskan central Arctic. There are also smaller and more southern herds that do not migrate into the Arctic and that are associated with alpine and woodland habitats. These generally number in the tens of thousands or less, and their importance for subsistence use by indigenous people is also correspondingly lower than is the case for the larger northern herds.

A variety of management systems exists for the large migratory herds of Canada and Alaska. Because the George River Herd is shared by Quebec and Labrador, responsibility for its management rests with the Quebec Ministry for Outdoor

Recreation, Hunting, and Fishing, and the Division of Wildlife of the Government of Newfoundland and Labrador. No official policy for sharing of responsibility for monitoring the herd's numbers and population status or for establishing harvest quotas exists. Nevertheless, in recent years biologists of both provincial governments have cooperated in the collection and sharing of data on herd population dynamics and general ecology. There is currently growing pressure from indigenous users and others interested in the herd's welfare and its importance to subsistence and monetary economies of northern Quebec and Labrador for the formal establishment of a cooperative management system - a system that would include the governments of the 2 provinces as well as representatives of user groups.

The large size of the George River Herd stimulated interest in commercial harvest of the caribou, and in the mid-1980s the Quebec government proposed herding caribou into large corrals where they would be held while slaughtering took place. To test the feasibility of this procedure, some caribou were captured in 1987 and held in a portable corral, where they were offered supplemental feed (Crête *et al.*, 1993). Although results of this trial were promising, commercial harvest from the herd was not initiated in Quebec, apparently because of indications of deteriorating body condition and lowering recruitment rates, as well as opposition from various interest groups. In Labrador a small commercial harvest from the herd was initiated by an Inuit cooperative using processing facilities at Nain. The total annual human harvest from this herd has remained low in view of the large size of the herd.

The extreme remoteness of the Leaf River Herd has generated little attention in the past toward its management by the Quebec government. Recent surveys, however, by government biologists provide population data that, when compared with those from the George River Herd, indicate that the Leaf River Herd is a vigorous population, with favorable range conditions and a high recruitment rate (Crête *et al.*, 1990). Only a few relatively small communities of indigenous people on the periphery of its range have access to the herd, and the annual hunter harvest is low.

The Canadian Wildlife Service assumed major responsibility for collection of biological data and associated management of caribou in NWT in the years following World War II until the early 1970's. At that time the territorial Game Management Division took over these responsibilities later to become the Department of Renewable Resources of NWT. Caribou populations throughout the mainland of NWT increased during the last three decades, alleviating earlier concerns of potential

overharvest by subsistence hunters. Under provisions of the NWT Act indigenous people were granted the right to hunt caribou (and other wildlife) for subsistence use without restriction unless the caribou populations were threatened with extinction.

The Bathurst and Bluenose Herds are under the management jurisdiction of the Government of the Northwest Territories (Hall, 1989). The recent Nunavut settlement granting limited self-government to the eastern portion of NWT did not, however, include jurisdiction over wildlife. Nevertheless, user participation in management decisions affecting both the Bathurst and Bluenose Herds will likely increase with the trend toward regional autonomy in northern Canada and in view of the management model provided by the Beverly and Qamanirjuaq Caribou Management Board.

The Beverly and Qamanirjuaq Caribou Management Board was established in 1982. It is a co-management system that establishes management policy and provides guidelines and priorities for research and monitoring of population dynamics and ecology of the 2 herds, approves methods and means of hunting, and can set and allocate harvest quotas if needed (Thomas & Schaefer, 1991). The Board is composed of 8 representatives of the diverse indigenous groups that hunt these caribou, one representative from each of the 2 provinces, and one representative each from the Northwest Territories and the Government of Canada. This 12-member board oversees a comprehensive program to communicate information about the herds and the Board's activities to the users and other interested parties, including hunter-training programs in user communities, school-educational programs, summer youth camps, and a widely distributed periodical. Financial support that enables the Board to meet annually and to conduct its activities is provided by contributions from the 4 government entities represented as well as occasional foundation grants.

Management of the Beverly and Qamanirjuaq herds under the Board's guidance during its 12 years of existence has been considered highly successful by the government entities that are involved. Opinion among the users, however, is more variable. The success that the board has experienced is associated with marked improvement in communication and mutual understanding between users and government administrators, managers, and biologists, and in the building of trust among the diverse representation on the Board. Since the Board was established, there has been no need to recommend hunting quotas for the indigenous users of the herds because the herds have remained productive and at high population levels. Questions have been raised

as to whether this co-management system will be able to deal effectively with the difficult process of establishing harvest quotas should the herds decline markedly in the future. Board members and most observers are, however, optimistic that the shared responsibility for caribou management as well as the building of trust among Board members and with user groups and government will enable the Board to deal effectively with crises that may develop.

The Porcupine Caribou Herd that occupies range lands in the United States and Canada in its annual migratory movements is an international resource. Recognition of the need for international oversight in the management of this herd led to the signing of an international agreement on the conservation of the Porcupine Caribou Herd by the United States and Canada in 1987. This agreement provided for the establishment of an International Porcupine Caribou Board with representation from both countries to cooperate in defining and recommending fundamental requirements to conserve the herd. Although development of this agreement has focused attention on this international resource and its importance to both countries, actions of the board may be considered nonbinding by either of the two countries. For example, disapproval by the board of a proposal for development of petroleum or other activities considered detrimental to the caribou and their habitat could be unilaterally overridden.

In Canada, a Canadian Porcupine Caribou Management Board was established in 1985, modeled after the Beverly and Qamanirjuaq Caribou Management Board, including representation by the governments of Canada, the Yukon, and Northwest Territories, and the 3 indigenous groups in Canada who have subsistence dependency on the Porcupine Herd (Peter & Urquhart, 1991). This board, although with jurisdiction only in Canada, has a positive record of building trust and approval among Canadian users of the herd and the involved government administrators, managers, and biologists. Indigenous users of the caribou in Alaska, supported by environmental organizations, are lobbying the state and federal governments for establishment of a companion Alaska Porcupine Caribou Management Board.

In Alaska, management of Porcupine Herd caribou is under the jurisdiction of the State of Alaska. A Board of Game, with appointments made by the Governor, has responsibility for establishing wildlife management policy and hunting regulations and for setting harvest quotas for resident wildlife throughout the state, including caribou. Local wildlife advisory committees include indigenous hunters that make recommendations to the Board. A state law

intended to grant priority for hunting of wildlife for subsistence use by rural residents has been held unconstitutional by the State Supreme Court. As a consequence, an overriding federal subsistence hunting law requires that the federal government assume responsibility for management of wildlife on all federal lands in Alaska where hunting may occur, until the state legislature passes a new subsistence law that complies with the federal subsistence law, as well as the state constitution. Alternatively, the state constitution could be amended, or a much less likely option is amendment of the federal law by the U.S. Congress.

During this period of legal challenge to state jurisdiction over wildlife, the state, through the Alaska Department of Fish and Game, and the federal government, through the U.S. Fish and Wildlife Service, have cooperated in the collection of biological data on the Porcupine Herd and its habitat. Monitoring of population dynamics of the herd and research on its ecology were fostered by legislation of the U.S. Congress related to proposals for oil and gas exploration and development in the coastal plain of the Arctic National Wildlife Refuge in northeastern Alaska. The coastal plain includes calving grounds and summering habitat of the Porcupine Herd. The legislation mandated a 5-year period of research on the ecology of caribou and other wildlife using the area and appropriated money for the study during 1981-85, with some supplemental funding in subsequent years. The funds were shared by the Fish and Wildlife Service with the Alaska Department of Fish and Game, the Canadian Wildlife Service, the University of Alaska Fairbanks, and biologists from these organizations often worked together in the field on both sides of the international border. In a similar way, Canadian financial support for research on the ecology of this herd, funneled through the Canadian Wildlife Service, was used to support studies on both sides of the international border. A comprehensive record of the population biology of this herd now exists (Russell *et al.*, 1993) and provides an excellent background to assist future management of the herd. On the basis of this information, a comprehensive computer model of the population ecology of the Porcupine Herd also was developed.

The Porcupine Herd, as is the case with all the other large migratory herds in North America, has increased in the past decade. Its large size and relatively low annual hunter harvest of <5 000 animals have not made it necessary to impose harvest quotas.

The Western Arctic Herd is under similar management jurisdiction as the Porcupine Herd within Alaska. There has been less focus of attention on the collection of biological data on this herd by

the state of Alaska and the federal government because of lesser threats of development activities within its range, its remoteness, and its non international status.

The Western Arctic Herd's precipitous decline from an estimated minimum of 242 000 in the early 1970s (Hemming, 1972), to 75 000 in 1976 (Davis *et al.*, 1980) was accompanied by blame for the decline being placed on the state's record of low-management emphasis on this herd. There was also strong resistance by indigenous hunters to the establishment of harvest quotas by the state when the drastic decline of the herd became known. A higher priority for monitoring the population dynamics of the herd was a consequence of the state's experience following the decline, and more comprehensive efforts to assess recruitment and mortality have been made annually since then. Aerial photo-censuses have been conducted approximately every 2-3 years. The current large size of the herd has generated concern that it may have exceeded, or may soon exceed, the carrying capacity of its range.

In recent years, with increasing herd size, caribou from the Western Arctic Herd have moved into areas rarely or not previously used, at least in this century. This has resulted in the annual encroachment of tens of thousands of caribou each winter into traditional grazing areas of domestic reindeer on the eastern Seward Peninsula. Reindeer herders have been forced to herd their animals more closely and to move them to avoid mixing with caribou. Nevertheless, many reindeer have been lost through mixing with caribou or through predation from wolves that have accompanied caribou into the reindeer-grazing areas. Indigenous people in villages in the eastern Seward Peninsula not directly involved in reindeer husbandry, however, have benefited greatly from the availability of caribou for their subsistence use.

The Western Arctic Herd is an important subsistence resource for over 30 communities, including more than 5 000 households. At its present large size there is little need to curtail human harvest. Residents of the area are allowed unlimited annual harvest, although hunting of adult females is prohibited during May 16 - June 30 and a daily bag limit of 5 caribou has been imposed to limit wastage. For nonresidents of the area the annual bag limit is five caribou of either sex.

Although authority for establishment of hunting seasons and bag limits has rested with the Alaska Board of Game, users of the caribou have made recommendations regarding management of the herd through their local game advisory committees. Indigenous hunters, through these advisory committees, have taken a more active role in management of

caribou than was the case during the previous peak and decline of the herd in the 1970s. Effectiveness of this system and continued support by users of the caribou remain to be tested should the caribou population undergo a major decline in the future, necessitating imposition of harvest quotas.

Management of wildlife on federal lands in Alaska had been under authority of the state until 1992, when the state law granting priority for hunting to subsistence users was challenged in court and judged unconstitutional. As a consequence, until the state passes new subsistence hunting legislation to meet requirements of federal legislation, the federal government must assume responsibility for management of wildlife on federal lands. An Office of Subsistence Management has been established within the U.S. Fish and Wildlife Service with participation from representatives of the National Park Service and other federal land-managing agencies. Local advisory committees composed of subsistence users have been developed as part of the federal management system with membership often overlapping with the state game advisory committees. Transition to federal control of wildlife management on federal lands is continuing to evolve with a strong dependence on the Alaska Department of Fish and Game as a source of data on population dynamics of wildlife. This is particularly true in the case of the Western Arctic Herd, and the future of management responsibility for this herd remains uncertain pending legal clarification at both the state and federal levels.

All of the large migratory herds of caribou in northern North America appear to have reached peak population levels or may be at peak levels soon. During the past 2 decades, management regimes for these herds have dealt with population surpluses with no need to constrain hunter harvest. Under these most favorable conditions, users have little cause to be critical of management systems. With the likelihood of declines in caribou population occurring again in the future, as they have in the past, management systems will be put to the test. The need for harvest quotas will become a reality, and the difficult task of allocating these quotas among users will confront the managers. Only then can the relative effectiveness of systems for caribou management across North America be evaluated.

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