A tribute to Arthur T. Bergerud, 1930–2019

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Dr. Arthur T. (Tom) Bergerud (Figure 1), aged 89, passed away on 27 November 2019. He left us to mourn the loss of the “Caribou biologist” who was also a provocative thinker on animal behaviour and population dynamics in wildlife, an activist for the specific causes he knew needed to be heard, and a respected professional to those who were blessed with time to get to know him as naturalist, scholar, peer, friend, and mentor. Tom was born on 11 November 1930 in Minneapolis, Minnesota, to Alf and Marjorie Bergerud. Alf was a lawyer and popular state politician for 30 years, and General Counsel and President of the midwestern grocery store chain, Red Owl. At its peak, the Red Owl chain had over 400 stores. Alf served a week shy of 11 000 days in public office.

Tom found little of interest in his father’s pursuits, instead spending much of his youth in outdoor adventures. Always enamoured of nature, Tom recounted to many the story of his first visit to the Bell Museum of Natural History on the St. Paul campus of the University of Minnesota. There, he saw a diorama depicting a cranberry bog on the Red Lake Peatland, about 100 km south of the Manitoba–Ontario border; the diorama featured taxidermy mounts of among the last Caribou (Rangifer tarandus) seen alive from this location in the state of Minnesota (Figure 2). It was on seeing this magnificent display that Tom convinced himself to be that “Caribou biologist” who could fight for the conservation of the species so emblematic of the boreal forest and much of the tundra of Canada and Alaska.

Tom’s academic and professional career started in 1953 with a B.Sc. in Wildlife Management from Oregon State University, after which he began work as a Fish and Wildlife Specialist at the Delta Waterfowl Research Station in Minnedosa, Manitoba. His friendship there with Hans Albert (Al) Hochbaum almost led to M.Sc. research on ducks, but Tom knew that his two years of U.S. Army service was imminent, so this plan was put aside. After his army service, Tom was hired in 1956 as a District Wildlife Biologist in St. John’s, Newfoundland and Labrador, and by 1960 became Director of the Province’s Game Division.

While in Newfoundland and Labrador, Tom became familiar with parts of Canada that always remained dear to him. He published well into the...
1970s on some of the basics in monitoring Caribou and on the unique Caribou dynamics on the island of Newfoundland. Tom also used this time to embark on an M.Sc. degree in Wildlife Management from the University of Wisconsin in Madison (Bergerud 1961a) and a Ph.D. degree from the University of British Columbia (Bergerud 1969a). By 1971 he had published a summary on what he knew about Caribou in Newfoundland in No. 25 of the widely read Wildlife Monograph series (Bergerud 1971a). During this first part of his career, Tom also found time to help raise his first young children who all experienced rural life on the Avalon Peninsula.

Tom’s publishing career spanned seven decades and over 100 published papers, and in the weeks before his passing, he did not arrest his passion for science. He could be found working on improvements to an earlier draft of his last manuscript, which documents the demise of the Caribou population on the Slate Islands, Ontario. It was published in the previous issue of The Canadian Field-Naturalist (Bergerud et al. 2020) and completes a part of Tom’s career that started in the early 1970s, testing his hypothesis that Caribou in North America are limited by Gray Wolf (Canis lupus) predation (Bergerud 1974a). Regrettably, illustration of this hypothesis along the north shore of Lake Superior includes the near extirpation of Caribou from this part of their range, even in protected areas like Pukaskwa National Park (Bergerud et al. 2014). Tom made early alarm calls for this region (Bergerud et al. 2007), and pleas for wolf management in many other areas where Caribou were threatened (Bergerud 2007).

Tom assisted wildlife conservation and management in Newfoundland and Labrador’s pioneering years far beyond the work on Caribou in Newfoundland, by conducting research on Caribou in Labrador (Bergerud 1967a), and on Willow Ptarmigan (Lagopus lagopus; Bergerud and Mercer 1966, 1972; Bergerud and Huxter 1969a,b; Bergerud 1970a,b, 1971c, 1972a), Arctic Hare (Lepus arcticus; Bergerud 1967b), Moose (Alces americanus; Bergerud et al. 1962, 1968; Bergerud and Manuel 1969), American Marten (Martes americana; Bergerud 1969b), and American Beaver (Castor canadensis; Bergerud and Miller 1977) in Newfoundland. His last paper specific to Newfoundland (Bergerud 1983a) popularized in Scientific American the story of a unique predator, Canada Lynx (Lynx canadensis), which contributed to Caribou calf mortality at levels that could account for population decline in a ‘simple ecosystem’ driven by declines in Snowshoe Hare (Lepus americanus). The beauty of that paper was in demonstrating the role of prey switching.

Perhaps it was his use of the word “simple” in the title of the Scientific American paper that set Tom up for later criticism. It was almost two decades later that Coyotes (Canis latrans) became established in Newfoundland and played the role of the Gray Wolf in increasing calf mortality, as well as raising the vulnerability of Caribou in this part of the world. Tom’s hypothesis of the predator’s role for Caribou decline

Figure 2. Woodland Caribou (Rangifer tarandus) diorama in the original Bell Museum of Natural History, St. Paul, Minnesota, with famed painted backdrops by Francis Lee Jaques, ca. 1940. The diorama was viewed by visitors until renovation of the museum in 2016. Photo: P. Carroll, Wikimedia Commons.
was illustrated once again, this time by a new set of researchers who confirmed not just the likelihood of Tom’s hypothesis involving canids, but also the importance of the bear and lynx as sources of calf mortality in Caribou (Mahoney et al. 2016; Lewis et al. 2017). Tom’s tradition for good wildlife research in Newfoundland and Labrador continues.

Tom knew of the two main controversial elements to his career, and stick-handled them well. The first came with his publication of a paper with a title that named Caribou “buffalo of the North” (Bergerud et al. 1984b), a reference to their vulnerability to overharvest or poaching that can push a species to extinction, like what happened earlier to Bison (Bison bison). The 1984 paper was motivated by the need for responsible construction of pipelines and highways in the north of Canada, in part to reduce access by hunters, but also by concerns about logging and other developments in the south of Canada. It was in this paper that the idea first surfaced that higher alternate prey abundance and subsequent high wolf densities in the southern and more disturbed portion of British Columbia (BC) were the proximate cause for Caribou declines. Tom recognized that logging per se was not detrimental but that it led to a cascade of changes in interactions with Caribou and their predators. Logging increased access by wolves and humans, increased density of predators with increases in alternate prey, and reduced the area of large predator-free habitat refuges for Caribou calving.

The “buffalo of the North” paper, published in Arctic, came at a controversial time in Canadian history, when the repercussions of Justice Thomas Berger’s report on the potential effects of developing the Mackenzie Valley pipeline were resounding in the media. Bergerud et al. (1984b) twice cautioned about interpreting correlations of events in the population dynamics of Caribou as causes for effects. In addition, the authors attest agreement with the warning by C.C. Shank (1979, of the Arctic Institute of North America, University of Calgary, who wrote one of the industry-led reviews of effects of pipelines on northern mammals, as cited in Bergerud et al. 1984b: 8) that:

there is a potentially infinite universe of manners in which human activity can influence animal populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors.

Nevertheless, the sweeping review that encompassed Tom’s experience with Caribou and their conservation at this time led some critics to believe that he and his co-authors (1) surrendered themselves to industry, (2) disregarded the potential that individual effects of disturbance on Caribou may translate to cause-and-effect relationships at the population level, (3) filled their paper with inaccuracies in citation and omission of examples of documented effects of disturbance on Rangifer tarandus—for some reason, largely on Reindeer in Eurasia—and (4) referenced the literature selectively to make their points. These charges, in the form of letters to the Editor of Arctic, were humbly corrected by Bergerud et al. (1984c) and not so humbly confronted by Bergerud and Jakimchuk (1985). In the second response, Tom and consulting biologist Ronald Jakimchuk dryly extolled the virtues of Tom’s having established 18 new Caribou populations, and of his helping to illustrate, largely in Newfoundland, that curtailing of regulated and unregulated hunting can restore Caribou populations. We suggest that a call for curtailing overharvest from all sources was the ultimate purpose of the Bergerud et al. (1984b) paper.

The second controversy arose a year later, when Tom and BC Ministry of Environment biologist John Elliott co-wrote the most memorable paper in Tom’s bibliography (Bergerud and Elliott 1986). In it, they reviewed Caribou populations in northwestern BC, using reports of provincial biologists over approximately six decades on the harvest of Gray Wolves, Moose, and Caribou, including a period during 1949–1962 when wolves were controlled not only by bounty, but also by poisoned bait. They reviewed Gray Wolf and Caribou census data collected during their own experimental wolf control measures in 1977–1982 on one of the populations and compared to other areas without wolf control. The outcome matched Bergerud’s (1974a) hypothesis on wolves limiting Caribou, although the work was criticized for rather coarse measures of demographics that spanned so many decades. What was undeniable was that during the experimental wolf control, populations increased predictably by 6% per year when no such increases occurred for the adjacent reference populations.

Figure 10 in Bergerud and Elliott (1986) increased the scope of the five Caribou populations it described to an additional 17 populations where Caribou calf counts were previously published, plus an additional 13 populations where Caribou mortality was estimated, in eight cases by some of the first radio-collared Caribou studies. Drawing on work from 1968 to 1985 in Caribou populations spanning Alaska and Canada, where Gray Wolf densities were also estimated, Bergerud and Elliott (1986) showed—Tom’s graphics were always comprehensive—that mortality balanced recruitment at a point corresponding to 12% calves in a survey. This point matched a threshold density of 6.5 wolves per 1000 km². The figure was reproduced at the beginning of Tom’s “open letter” written 20 years later and calling for management of
wolves as an urgent conservation measure (Bergerud et al. 2007); it is still frequently referenced by those urging for or implementing wolf control.

Part of what made Bergerud and Elliott’s (1986) paper so elegant was how they showed that the expansion of Moose southward and westward in BC was correlated with increases in the threshold density of wolves that then corresponded to periods of Caribou decline. Moose were bigger prey at higher densities and could support more wolves than Caribou alone. The argument, while not a ‘smoking gun’, was a hypothesis on an indirect interaction between Moose and Caribou, mediated by their common predator, and based in Robert Holt’s (1977) idea that ‘apparent competition’ could structure ecological communities. Indeed, there was cause for less controversy: calls for management of wolves could include reducing populations of Moose or other ungulates more abundant than Caribou, an argument that could be inferred from Bergerud and Elliott’s (1998) second paper reviewing a similar geography in BC. Apparent competition was later identified by Tom, and accepted by most biologists, as a driver in the evolution of Boreal populations of Caribou; Tom adopted “rareness as an antipredator strategy to reduce predation risk” as a defining phrase for this ecotype in the title of his chapter in the *Wildlife 2001* series (Bergerud 1992).

What was controversial in Bergerud and Elliott’s (1986) paper was that it supported wolf control. Tom later described wolf predation as the driver in Caribou evolution (Bergerud 1996), and the suggestion that predation by Gray Wolves could be the deciding factor in the decline of Caribou populations was not well received. Some readers found it alarming that ‘top-down’ effects could be so easily described in wildlife research. Tom caused disbelief in some other readers by further describing Caribou, where limited by food supply, as on the Slate Islands, Ontario, to be conforming to a “maintenance phenotype”, a term coined by Valerius Geist (1998, in his book on deer evolution, as cited by Bergerud et al. 2007). It took time for biologists who previously had almost universally thought that food limitation was the driver of Caribou population dynamics to accept the norm of top-down control by wolves in most of Caribou range. Wolf control can immediately ‘buy time’, before other Caribou conservation measures, such as habitat restoration, take effect (Hervieux et al. 2015). But as Mech (2012) has pointed out, too many biologists wish to paint the wolf as a ‘saint’.

Despite later support from Seip (1992) and Wittmer et al. (2005) from radio-tracking data on Caribou in southern BC, and despite continued tests of the hypothesis that declines in Caribou in northern BC were due to top-down control by wolves and appar-
interested in ungulate ecology or northern ecosystems”. Ironies aside, there is much sadness in the very large number of Caribou declines themselves.

Part of the success in Tom’s career as a naturalist and biologist is owing to the alliances he made with steadfast colleagues and field personnel, in particular people who excelled in their own right. The collaboration with John Elliott co-occurred with an important study on Caribou calf mortality by R.P., at the time another BC biologist. Earlier, Newfoundland and Labrador biologist W.E. (Gene) Mercer collaborated with Tom on Caribou (Bergerud and Mercer 1968, 1989) and Willow Ptarmigan (Bergerud and Mercer 1966, 1972); later, biologist Stu (S.N.) Luttich, of the same provincial Wildlife Division, co-wrote The Return of the Caribou to Ungava (Bergerud et al. 2007) with Lo Camps, another long-time collaborator. A special kind of alliance in Newfoundland and Labrador was with two of this province’s Conservation Officers, Mike (M.I.) Nolan (Bergerud et al. 1968; Bergerud and Nolan 1970) and Lloyd (L.R.) Russell (Bergerud et al. 1964; Bergerud and Russell 1964, 1966). These officers are among the most celebrated people throughout the province’s Wildlife Division, and a credit to Newfoundland and Labrador’s continued and unique recognition of Conservation Officers not just as enforcers of the law, but also as active participants in supporting research, should they choose this route. In the case of Mike Nolan, his recognition that poaching was a foremost barrier to recovery of the Avalon Caribou population, an idea that Tom helped reinforce, earned him an Honorary Doctor of Philosophy from Memorial University. The recognition was specific to his on-the-ground recovery efforts of the Avalon Caribou, efforts that Tom so kindly extolled (Figure 3), efforts that took this herd from a few hundred remaining individuals to a few thousand in three decades.

Throughout all the studies since 1974, Tom was accompanied and assisted by his wife, Heather Butler, who is also a biologist studying Caribou behaviour. Dave Mossop of Yukon College in Yellowknife and the late Michael Grason assisted Tom in many studies on grouse. In Ontario, Tom’s work on the Slate Islands and in Pukaskwa was assisted by many biologists, including Lo Camps from Salt Spring Island, but also Thunder Bay based H.R. (Tim) Timmermann, Terrace Bay District Biologist Barry Snider, Roger Ferguson also from Terrace Bay, Wawa based Gord Eason, and Sault Ste. Marie based W. (Bill) Dalton. Bill would be ready for any task on the Slate Islands, even though the trip was several hours away. He helped collect countless bones and antlers from deceased Caribou for Tom and Heather to return to Salt Spring Island, where Tom resided through most

![Figure 3. Woodland Caribou (Rangifer tarandus) calf held by Tom Bergerud in Newfoundland. Photo: source and date unknown.](https://example.com/image-url)

of his career. Gord’s favourite story was Tom calling from a pay phone on the highway after he had just seen a Caribou and thought a local biologist should know about it because it was one that had been translocated to Lake Superior Provincial Park and had now moved south. Tom was not much for long phone calls, so Gord managed to say, “Yes, Tom, you just saw the southernmost mainland Caribou in the world”. Tom replied “Okay, bye”.

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