

# Revisiting Extinction in National Parks: Mountain Caribou in Banff

M. HEBBLEWHITE,\* C. WHITE,† AND M. MUSIANI†

\*Wildlife Biology Program, College of Forestry and Conservation, University of Montana, Missoula, MT 59802, U.S.A., email mark.hebblewhite@umontana.edu

†Environmental Sciences Program, Faculty of Environmental Design, University of Calgary, 2500 University Drive NW, Calgary, AB T2N 1N4, Canada

## Introduction

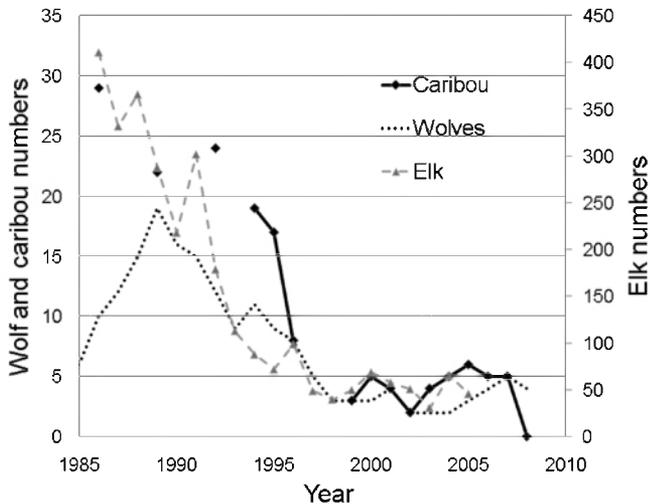
On April 30, 2009 environmental groups released a national media story that said that the Banff Spring's snail (*Physella johnsonii*), found solely in Banff National Park (BNP), Canada, was the only species out of 449 listed under the Canadian Species at Risk Act (Government of Canada 2002) to benefit from the full legally mandated conservation process. Ironically, on the same day in BNP's backcountry, Parks Canada staff dug a dead caribou (*Rangifer tarandus*) out of a snow avalanche. This individual was likely the last southern mountain woodland caribou, also a SARA-listed species, in the park. With its demise, caribou in Banff became the first large mammal species to disappear from a Canadian National Park in over a century (Gurd & Nuuds 1999). Yet trends for the park's caribou should have raised concerns because this population numbered just over 25 individuals as early as 20 years ago and research had provided information on causes of risks to the species and a blueprint for recovery.

Faced with caribou extirpation in BNP, we revisited the controversial question Berger (2003) raised about whether it is acceptable to let a species go extinct in a national park. Is it fair to both the public at large and to the species itself to sit idly and let extirpation occur when parks are funded by tax dollars? We reviewed the policy and scientific processes that have driven this species to extinction in Canada's oldest and flagship national park in an effort to provide proactive solutions to potential extinctions in protected areas. Clearly, caribou in Banff or pronghorn (*Antilocapra americana*) in Berger's (2003)

case are not the only species living in national parks that face risks in North America or globally.

## History of Mountain Caribou Extirpation in Banff

Both Boreal and Southern Mountain woodland caribou populations were first listed as threatened in 2000 by the Committee on the Status for Endangered Species in Canada (Thomas & Gray 2002). The major cause for decline has been recognized ultimately as the departure from long-term ecosystem states through habitat loss and fragmentation. Habitat loss and fragmentation lead to declines induced by wolves (*Canis lupus*) through a complex mechanism of apparent competition with moose (*Alces alces*) or elk (*Cervus elaphus*) (Hebblewhite et al. 2007). Caribou in BNP were the southeastern most mountain caribou population, which, historically (but not currently), was connected to adjacent larger populations in Jasper National Park (JNP) and British Columbia. Recent mtDNA and microsatellite analyses show these Banff caribou are genetically identical to Jasper herds and that these populations originated from a pleistocene swarm of Barrenground and Woodland caribou that created a hybrid with migratory behavior unique among caribou classified as "woodland" (McDevitt et al. 2009). This hybrid likely retained the ability to migrate seasonally to alpine tundra environments from its Barrenground ancestors of the tundra (i.e., a fundamental adaptive trait). In the 1970s caribou numbers in BNP peaked at close to 35, and as recently as the mid 1980s the park had at least 25 caribou (Fig. 1). Where then, did the caribou go?



*Figure 1. Time series of population counts for wolves, caribou, and elk in the Bow Valley watershed of Banff National Park from the time of wolf recovery in the mid 1980s to the extirpation of the Banff caribou herd in 2009. Counts were obtained from telemetry studies in the case of wolves and from aerial surveys and annual maximum counts and telemetry studies for caribou and elk.*

Wolves recolonized the Canadian Rockies through dispersal in the mid 1980s, whereupon they benefitted from high elk densities (Hebblewhite et al. 2002). Consistent with the literature supporting apparent competition as the main driver of caribou declines across Canada (Holt 1977), the Banff caribou started declining through the mid to late 1990s (Fig. 1). Empirically based modeling with Banff data (Hebblewhite et al. 2007) confirmed that elk and wolf densities in 2007 were close to thresholds for viability, however. Yet, waiting for this caribou herd to recover itself through the remaining five animals was risky, and “active and aggressive recovery efforts” were needed (e.g., Kinley 2009). Observations that this herd has failed to successfully recruit a calf to adult status in the last 5 years and that in the last decade most known caribou mortalities were of old females, raised the specter of extinction due to demographic stochasticity. So the avalanche that hit the small group of five caribou in April 2009 finished off the Banff caribou herd.

#### What Led to Caribou’s Fate?

What could have been done to avoid this untimely fate for the Banff caribou? A quick review of the steps taken under SARA (Government of Canada 2002) offers clues and helps answer Berger’s question. Following listing under SARA, the responsible federal government (Environment Canada in this case, not Parks Canada) must first

develop a recovery plan and then designate critical habitat; 18 months are allotted for each of these first two stages. Next, an implementation plan and the habitat protection follow; ideally, the final steps are recovery and delisting.

Although Southern Mountain woodland caribou have been listed in Canada since 2000 (first by COSEWIC and then by SARA in 2002), no federally designated recovery plan has been started by Environment Canada and identification of critical habitat or recovery planning has not occurred. On the other hand, the British Columbia provincial government, under the banner of their own provincial legislation, has developed a recovery plan and strategy. Despite some misgivings, across Canada, the British Columbia recovery plan is by far the most aggressive, with restrictions to hundreds of thousands of hectares of commercial forestry lands and short-term manipulation of predators and prey to restore conditions for caribou persistence (Government of British Columbia 2002). And the mountain caribou outside of national parks in Alberta are covered under the Alberta recovery plan (AWCRT 2004).

Unfortunately, the mandated SARA actions for caribou proceeded much slower on national park lands. From our perspective, this occurred for three related reasons. First, it is only in the last few years that scientists have begun to develop a consensus on the pervasiveness of top-down predator-prey interactions and the large areas over which these may occur (Ray et al. 2005). Thus, only recently could the disappearance of caribou in a Banff wilderness area be reasonably attributed to human influences on top-down predation by wolves. Second, most stakeholders and some wildlife managers were either unaware of or not ready to accept these recent findings as reliable scientific knowledge. Thus, the diversity of human interests in national parks followed their own agendas and attributed caribou demise to the other guy. Finally, senior wildlife managers perceived no political consensus for caribou conservation within national parks, and combined with scientific uncertainty this delayed implementation of the SARA process.

Thus, it was not until there were only five caribou in 2002 that park management began monitoring them in any systematic fashion and starting common-sense recovery actions. Actions included reducing human impacts (White & Fisher 2007), shelving prescribed fire plans (caribou use old-growth forests in winter), and reducing elk (and hence wolf) numbers in caribou summer range, conducting demographic and genetic studies of caribou, and commissioning reviews of the prospects of successfully translocating caribou to augment the Banff population (Kinley 2009). Nevertheless, the management actions, uncoordinated and underfunded within an Environment Canada caribou recovery plan as mandated by SARA, came a penny short and a second too late for Banff’s caribou.

## The Challenge of Incorporating Science in Decision Making

To answer Berger's question, then, after reviewing the likely doom of the Banff caribou herd, we think the critical issue is developing public and institutional support for a process conducive to timely decisions that also take science into account. We offer suggestions for three specific courses of action:

1. Conduct ecosystem-level research. Past human-caused species extinctions can often be linked to simple overharvest, but today a host of causal factors may be implicated at the scale of whole ecosystems. Concurrent multitrophic-level studies are essential in understanding extinction dynamics in endangered species (Sinclair & Byrom 2006).
2. Report results, even at an interim stage, to managers and stakeholders so that they can move toward scientific consensus. Conducting research and publishing peer-reviewed papers in scientific journals can take years. The Banff caribou would have benefitted from acceptance of the scientific results of earlier studies on moose declines in Banff following wolf recolonization (e.g., Hurd 1999). Because the methods used in real-world conservation biology depend on consensus of a majority of interest groups, these groups should be informed of preliminary results to prompt dialogue and expedite the recovery process. Interim results should also be incorporated into formal recovery planning in real time to avoid the tragedy of uncertainty (Grantham et al. 2009).
3. Facilitate regular meetings and other interactions among scientists, managers, various interest groups, and politicians to ensure information sharing on all issues for effective adaptive decision making. A fundamental principle is that ecosystem management is most successful when public officials implement actions supported by an informed citizens. In Banff's case, Parks Canada maintains a stakeholder advisory committee that hosts annual scientific workshops open to all interested parties and synthesizes recommendations to park management (White & Fisher 2007). Unfortunately, although this committee was open to discussing all environmental issues of concern, caribou never made the agenda.

Finally, an obvious cause of this "lost decade" for caribou is the failure in recovery planning under SARA. Alternately, one could ask why the Banff springs snail (for which Parks Canada was the designated federal agency under SARA), and not caribou, received sufficient recovery dollars. The discrepancy highlights the need for increased investment by Environment Canada in recovering endangered species. Systematic implementation of SARA by Environment Canada would have side-stepped the delays in initiating mountain caribou recovery in Banff because a formal recovery plan would have forced the

issue. Indeed, extirpation of the Banff caribou may be the canary in the coal mine for systemic problems with endangered-species recovery in Canada. Given the declines of caribou across Canada (Vors & Boyce 2009), increased recovery planning seems urgently needed. Similar failure by Environment Canada to implement recovery planning for boreal woodland caribou across the country will most likely contribute to caribou population declines as at least 25 other populations are at risk of decline across Canada (Environment Canada 2009). Rigorous reviews of SARA's effectiveness, or lack thereof, similar to reviews sponsored by the Society for Conservation Biology for the Endangered Species Act (Clark et al. 2002) appear to us as the next logical step for scientists, policy makers, and stakeholders to work together to make sure other protected areas in Canada need not answer the same question in the future.

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## Literature Cited

- AWCRT (Alberta Woodland Caribou Recovery Team). 2005. Alberta woodland caribou recovery plan, 2004/05—2013/14. Alberta species at risk recovery plan number 4. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Canada.
- Berger, J. 2003. Is it acceptable to let a species go extinct in a national park? *Conservation Biology* **17**:1451–1454.
- Clark, J. A., J. M. Hoekstra, P. D. Boersma, and P. Karieva. 2002. Improving U.S. Endangered Species Act recovery plans: key findings and recommendations of the SCB Recovery Plan Project. *Conservation Biology* **16**:1510–1519.
- Environment Canada. 2009. Scientific review for the identification of critical habitat for Woodland caribou (*Rangifer tarandus caribou*), Boreal Population, in Canada. Pages 1–254 in Ottawa, Ontario.
- Government of Canada. 2002. Species at Risk Act: an act respecting the protection of wildlife species at risk in Canada. § Bill C-5, 1st Session 37th parliament, 49-50-51 Elizabeth II.
- Government of British Columbia. 2002. A strategy for the recovery of mountain caribou in British Columbia. Ministry of Water, Land and Air Protection, Victoria, British Columbia, Canada.
- Grantham H. S., K. A. Wilson, A. Moilanen, T. Rebelo, and H. P. Possingham. 2009. Delaying conservation actions for improved knowledge: how long should we wait? *Ecology Letters* **12**:293–301.
- Gurd D. B., and T. D. Nudds. 1999. Insular biogeography of mammals in Canadian parks: a re-analysis. *Journal of Biogeography* **26**:973–82.
- Hebblewhite M., D. H. Pletscher, and P. C. Paquet. 2002. Elk population dynamics in areas with and without predation by recolonizing wolves in Banff National Park, Alberta. *Canadian Journal of Zoology* **80**:789–99.
- Hebblewhite M., J. Whittington, M. Bradley, G. Skinner, A. Dibb, and C. A. White. 2007. Conditions for caribou persistence in the wolf-elk-caribou systems of the Canadian Rockies. *Rangifer* **17**:79–91.

- Holt, R. D. 1977. Predation, apparent competition, and the structure of prey communities. *Theoretical Population Biology* **12**:197-229.
- Hurd, T. E. 1999. Factors limiting moose numbers and their interactions with elk and wolves in the Central Rocky Mountains, Canada. MS thesis. University of British Columbia, Vancouver, British Columbia.
- Kinley T. 2009. Caribou population augmentation feasibility assessment for Banff National Park. Sylvan Consulting, Invermere, British Columbia, Canada.
- McDevitt A. D., S. Mariani, M. Hebblewhite, N. J. Decesare, L. E. Morgantini, D. Seip, B. V. Weckworth, and M. Musiani. 2009. Survival in the rockies of an endangered hybrid swarm from diverged caribou (*Rangifer tarandus*) lineages. *Molecular Ecology* **18**:665-679.
- Ray, J. C., K. H. Redford, R. S. Steneck, and J. Berger. 2005. Large carnivores and the conservation of biodiversity. Island Press, Washington, D.C.
- Sinclair, A. R. E., and A. E. Byrom. 2006. Understanding ecosystem dynamics for conservation of biota. *Journal of Animal Ecology* **75**: 64-79.
- Thomas D. C., and D. R. Gray. 2002. COSEWIC assessment and update status report on the Woodland Caribou, *Rangifer tarandus caribou*, in Canada. Committee on the Status of Endangered Wildlife in Canada, Environment Canada, Ottawa, Canada.
- Vors L. S., and M. S. Boyce. 2009. Global declines of caribou and reindeer. *Global Change Biology* DOI: 10.1111/j.1365-2486.2009.01974.x.
- White, C. A., and W. Fisher. 2007. Ecological restoration in the Canadian Rocky Mountains: developing and implementing the 1997 Banff National Park Management Plan. Pages 217-244 in M. F. Price, editor. Mountain area research & management: integrated approaches. Earthscan, London.

