

Aishihik Caribou and Moose Recovery Program

1992 – 1997

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Yukon Fish and Wildlife Branch

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In 1992 the Yukon Department of Renewable Resources began a project to study the effects of wolf reduction on the Aishihik caribou herd. The study was comprehensive and far-reaching: it lasted 5 years and stretched across the territory. The results of the program were reported to the scientific community through the Wildlife Society as Wildlife Monograph 152.¹ This report is a summary of that publication. You may use this report for education or information purposes. Anyone wishing to cite information in a scientific publication should refer to the monograph.

Acknowledgements

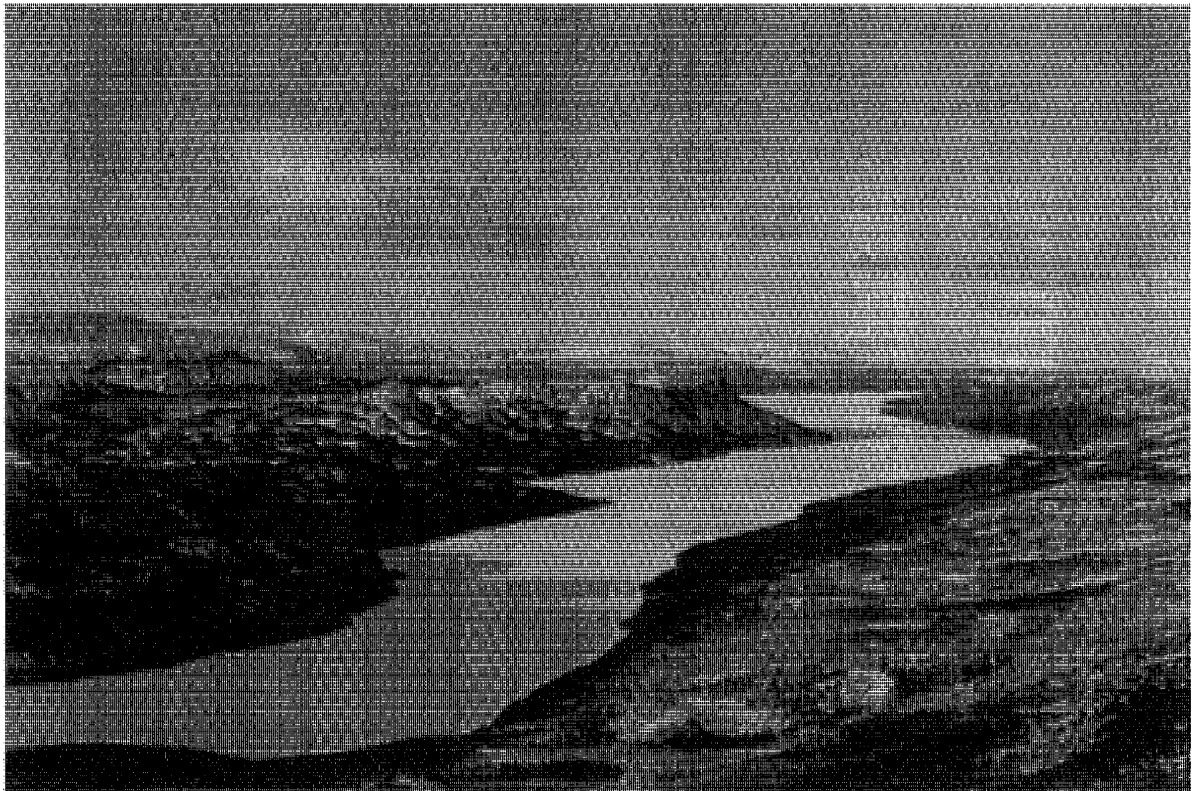
From the monograph:

We thank the Champagne–Aishihik and Kluane First Nations and the many people who served on the local Steering Group for supporting the study. We especially thank B. Brewster, Yukon Minister of Renewable Resources, for his dedicated political and financial support in the difficult early years of the study. D. Toews, L. Joe, and D. Larsen provided administrative support for the project. L. LaRocque and L. Workman ably assisted in all aspects of fieldwork. D. Drummond, P. Maltais, C. Spence, and J. Allen assisted with wolf studies, and Drs. J. Kenyon and D. Smith performed wolf surgical sterilizations. R. Florkiewicz, K. Egli, D. Graangard, and C. Domes assisted with caribou field studies. S. Westover, D. Cooley, and M. Kienzler assisted with moose studies. We thank pilots D. Denison, C. Drinnan, D. Drinnan, D. Makonnen, and D. Washington, who all flew safely in often windy and difficult conditions. Their personal interests in our project made it possible. We thank A. R. E. Sinclair, F. Messier, and S. Boutin for their academic advice throughout the study. Earlier drafts were improved by suggestions by A. R. E. Sinclair, S. Boutin, B. McLellan and 2 anonymous reviewers. J. Ver Hoef advised us on the use of bootstrap statistical techniques. We thank D. Milne for organizing and formatting the many drafts.

Teresa Earle helped to condense the monograph.

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¹ Experimental reduction of wolves in the Yukon: ungulate responses and management implications by Robert D. Hayes, Richard Farnell, Richard M. P. Ward, Jean Carey, Michael Dehn, Gerald W. Kuzyk, Alan M. Baer, Craig L. Gardner, and Mark O'Donoghue. Wildlife Monograph 152, July 2003.



Aishihik Lake

In the Aishihik area, local people first became concerned about declining caribou, moose, and Dall sheep in the 1980s when harvest success began to fall sharply. By 1990, biologists reported that the Aishihik and Kluane caribou herds had declined by half compared to earlier studies. Moose declined by almost two-thirds between 1980 and 1992 and Dall sheep numbers in the area also dropped.

Wolves were first counted in the Aishihik area in 1992, and the number of ungulates (hoofed animals such as caribou, moose, sheep, elk, or bison) per wolf was lower than had been seen elsewhere. Local people believed

that both predation and overhunting caused the declines in caribou and moose numbers.

Solid evidence shows that predation by wolves is a primary force limiting moose and caribou in Alaska and the Yukon. One way to study predation is to reduce its effect on a prey population and monitor other comparison populations where predation is not altered, and look for different responses. This is how we set up the Aishihik program.

In earlier wolf reduction studies in Yukon and elsewhere, most researchers did not adequately monitor treated populations after wolf reduction ended. Controls were not properly monitored, and

evidence was often based on before-after effects in reduction areas. Most of these studies could not show the relative effects of wolf predation compared to other factors, like reduced harvest and mild winters. In our study, we tried to examine all factors that could possibly affect what we saw.

In 1992 the Yukon Government pulled together a team of citizens to develop a plan for the conservation and management of wolves. The Yukon Wolf Conservation and Management Plan provided ethical and scientific guidelines for managing wolves, including conditions for wolf reductions. The plan shaped our study in two important ways:

- by limiting wolf reduction to one area in the Yukon at any one time, and
- by requiring that there be no hunting of moose and caribou in a wolf reduction area.

Study Design

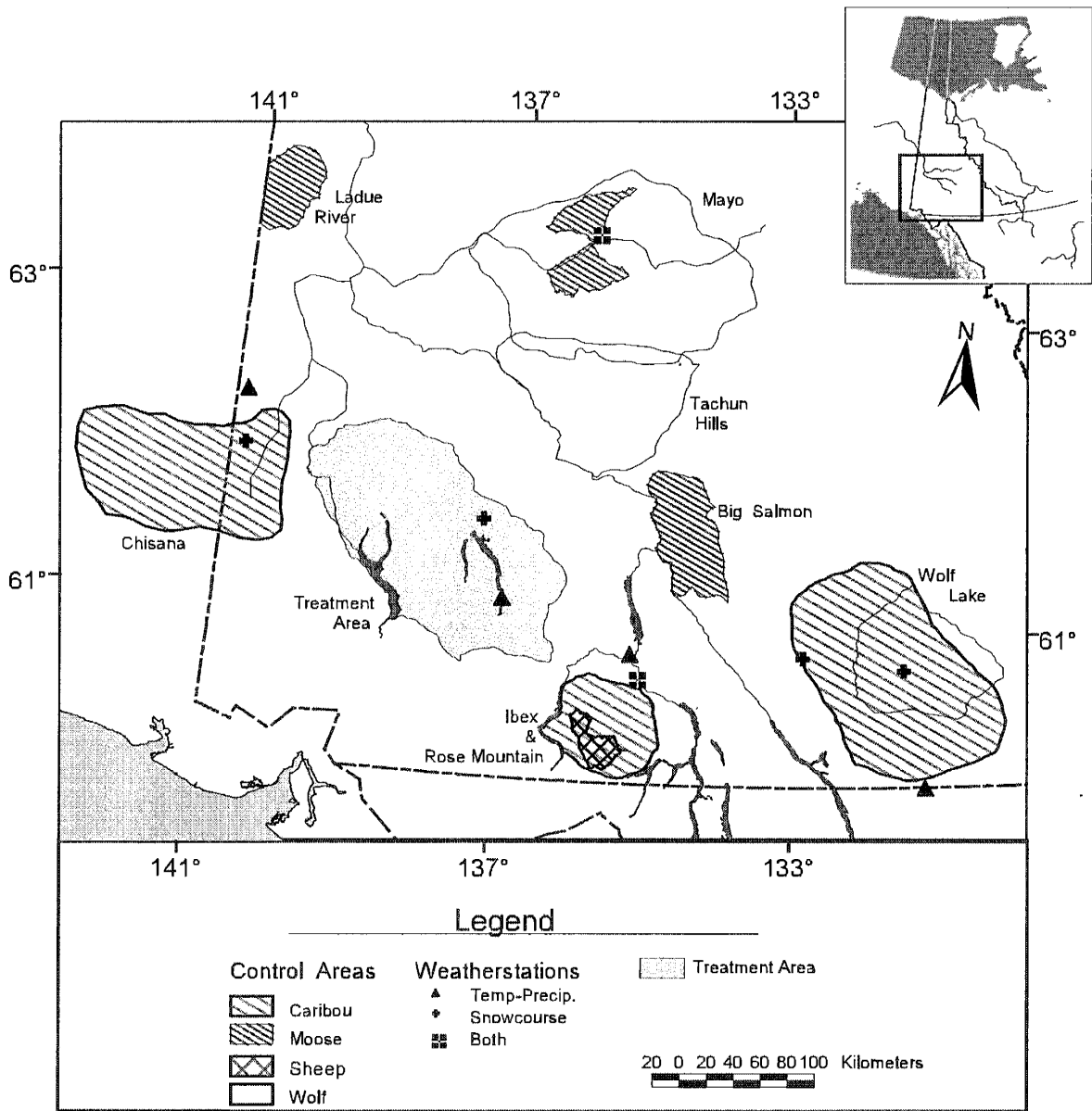
Our study design was based on a workshop involving researchers, university professors, and members of the public. It included predictions about how ungulate populations would respond to reduced wolf numbers in one area compared to several comparison areas where wolf numbers were not reduced. We predicted that if all other factors were the same, a strong reduction in wolf numbers would increase recruitment (the number of young surviving), adult

survival rates, and the numbers of caribou, moose, and sheep. We used differences in the rates of increase among treated and comparison groups to provide the evidence that reduced wolf predation caused a response in ungulate populations. Because the comparison areas were scattered throughout the territory, we expected that each area might be under different ecological influences, so we looked for other possible explanations for what we saw.

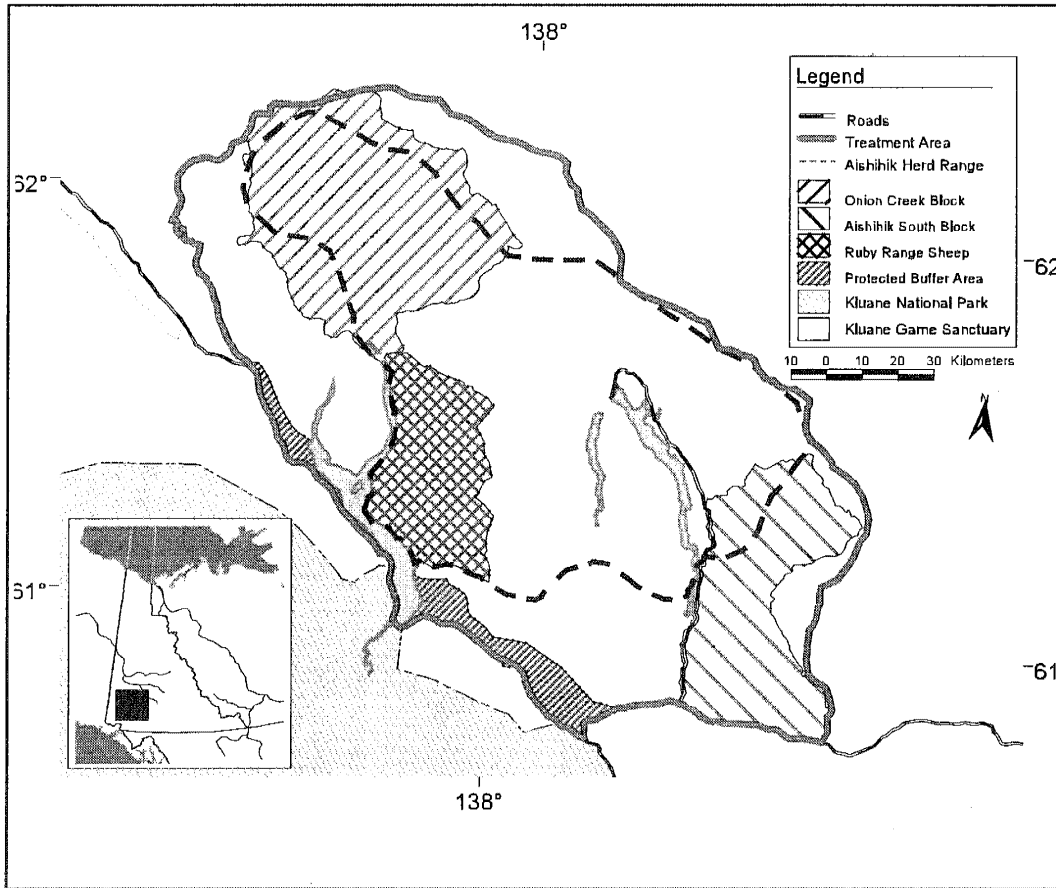
Study Areas

Our study areas included the Aishihik wolf reduction area and 10 comparison areas. Each winter, we studied caribou numbers and composition (the number of bulls, cows, and calves), wolf numbers, and moose recruitment (the number of calves living through winter) throughout the entire Aishihik wolf reduction area. Each year we counted Dall sheep in the Ruby Range mountains, a part of the Aishihik area.

The comparison study areas were spread through the southern and central Yukon. We monitored the Wolf Lake, Ibex, and Chisana caribou herds, and counted wolves near Mayo, the Tatchun Hills, and Wolf Lake. Three comparison populations of moose were monitored near Big Salmon, Mayo and the Ladue River. Dall sheep in the Rose Lake comparison area were also counted.



Locations of the Aishihik study area and the comparison areas.



Locations of the wolf reduction area and the moose, caribou and Dall sheep study areas.

The study

Starting in 1990, hunting of the Aishihik caribou herd was closed. This allowed us to estimate the effects of reduced harvest before wolf numbers were reduced. Even though hunting was stopped, herd size continued to fall.

Our main idea was that reducing wolves by 80% should cause higher recruitment and adult survival rates and that this would result in increased numbers of caribou, moose, and sheep. In

fact we saw sharp reversals in Aishihik caribou and moose populations from declining to rapidly increasing during wolf reduction.

Wolves

Between January and March 1992 to 1998, we estimated the number of wolves in the Aishihik area each year by counting them from the air. We used some radiocollars to help us regularly find some wolf packs, but whenever we saw tracks in the



Wolf trails were followed until the wolves were seen or individual tracks could be counted.

snow we followed them until we either saw the wolves or could count individual tracks. We counted each of the three comparison wolf survey areas once during our study using the snow-tracking methods, but we did not have radiocollars to help us find the wolves.

We began wolf reduction in February 1993 and ended March 1997. Each year, we tried to reduce wolf numbers to about one fifth of what we saw in February 1992. Most wolves were shot from helicopters, but some were trapped and others were surgically sterilized.

Caribou

Of the three ungulates studied, we did the most research on caribou. We used total counts and other sampling methods to determine the size of each caribou herd at the beginning and end of the study.

From 1993 to 1997, while we kept March wolf density well below what we saw in 1992, the Aishihik caribou herd stopped declining, then rapidly increased. Of the caribou herds we looked at only the Aishihik herd showed a sustained increase in the number of calves during the reduction period.

We captured and radio-collared a total of 229 caribou in all of the study herds. We recorded over 2,600 radio-collar locations from aircraft. Radio-collar data collected each year helped us to estimate caribou range use, herd size, sex and age composition, and adult survival rate.

Each July and October we sampled 28–100% of the caribou in each herd to determine calf recruitment (the number of calves for every 100 cows) and the number of bulls for every 100 cows. We used radio collars to locate caribou groups and then classified them as bulls, cows, or calves from a helicopter. The Aishihik adult sex ratio increased from 29 bulls for every 100 cows in the three years before wolf reduction to an average of 52 bulls in the last three years of reduction. Sex ratios in comparison herds did not change. Survival of adult caribou was the same in all the herds, whether wolves were reduced or not.

In all wolf reduction years, we compared the Aishihik and Wolf Lake caribou herds for the net loss of calves from July to October. The Aishihik caribou herd lost fewer calves between July and October during wolf reduction compared to the two years before wolves were reduced. Calf losses from July to October were lower for the Aishihik caribou herd than for the Wolf Lake caribou herd during all study years.

We captured 216 cow caribou

during the winters of our study to determine pregnancy rates in each herd. There were no differences in pregnancy rates. We collected 20 groups of 20 fecal pellets in February or March from each herd range to see if poor range might be causing the decline in the number of caribou in the Aishihik herd. Only the Chisana herd seemed to be using poor range, so this was not a good explanation for the declines we saw in the Aishihik herd before wolf reduction began. We investigated two aspects of weather that could affect caribou. Deep snow could bury their forage or limit their mobility in winter, reducing physical condition and survival. Second, late snow on the alpine calving areas could increase predation of calves. We didn't find any evidence that weather was affecting caribou numbers in any way.

Moose

We counted moose in two blocks of the Aishihik area in November 1992 and in two comparison areas (Mayo and Big Salmon) in November 1993. We repeated counts in the four areas in 1998, one year after wolf reduction ended. We estimated annual moose recruitment based on the proportion of 9-month-old calves counted in late winter in the Aishihik and comparison moose areas. We compared moose recruitment in the Aishihik area before and during reduction and among Aishihik and three comparison areas.



Adult moose survival increased when wolf numbers were reduced.

During wolf reduction moose recruitment in the Aishihik area increased from 10% in 1993 to average 19%. Adult moose survival also increased from 80% before wolf numbers were reduced to more than 96% during the wolf reduction period. At the same time moose numbers stopped declining then rapidly increased.

Winter snow depth and quality of summer forage can both affect moose populations. We examined each year's maximum snow depth and looked for trends in moose recruitment. We also explored whether changes in growing season length could influence moose population dynamics in our study areas. We found no significant relationship between recruitment

rates and the other factors we looked at (season length, spring weather, or maximum snow depth).

We used computer models to estimate how many more adult moose we could have expected to have if we had only reduced harvest, or only increased recruitment, or only increased adult survival. We then added all of these results and compared them to what we actually saw. The factor having the most effect on the results was the increase in adult survival. We also found that the combination of wolf and harvest reductions gave us a larger increase than we would have predicted by adding the effects of each factor.

Sheep

We used helicopters to count Dall sheep in June or July, after the lambs were born and when the white sheep were easiest to see. The Rose Lake comparison

population showed similar annual responses as the Ruby Range area where wolves were reduced. Neither study population changed during the study.

Questions	Actions	Outcomes*
If we reduce wolf numbers...	Reduce wolf density to 69-83% of 1992 population	<ul style="list-style-type: none"> Decline from 28 wolf packs in 1992 to 7-20 packs during the reduction period Mean pack size drops from 6 to less than 4 wolves
...will more caribou calves survive?	Count cow caribou with calves in July and October	<ul style="list-style-type: none"> Mean ratio increases from 15 calves for every 100 cows before reduction to 42 calves for every 100 cows in Aishihik herd More calves survive to October whether wolf numbers are reduced or not
...will adult caribou survive better?	Monitor 229 radio-collared caribou in four herds to look at lifespan	<ul style="list-style-type: none"> Adult caribou survive at the same rates where wolf numbers are reduced
...will caribou numbers go up?	Count caribou in the years before and after wolf numbers were reduced	<ul style="list-style-type: none"> Aishihik herd decline ends and the herd begins to increase Herds decline or stay the same where wolves are not reduced
...will more moose calves survive?	Count the number of moose cows with calves in late winter	<ul style="list-style-type: none"> Moose recruitment in Aishihik improves from 10% to 19% during wolf reduction Moose recruitment does not change in comparison areas
...will adult moose survive better?	Compare the rate of change in population size in reduction and comparison areas	<ul style="list-style-type: none"> Adult survival in Aishihik improves during reduction, but it also improves in Mayo
...will moose numbers go up?	Count moose in reduction and comparison areas, before and after wolf reduction	<ul style="list-style-type: none"> Moose numbers stop declining, then rapidly increase in Aishihik Moose also increases in Mayo
...will more sheep lambs survive?	Count the number of ewes with lambs in June	<ul style="list-style-type: none"> The proportion of ewes with lambs is similar in both areas

*Detailed caribou, moose, and wolf data is included at the back of this report.

What else could be happening?	Actions	Outcomes
How does hunting affect the Aishihik herd?	Stop licensed hunting	<ul style="list-style-type: none"> Caribou numbers continue to decline 1990–1993
How does hunting affect moose numbers?	Use a computer model to determine effects	<ul style="list-style-type: none"> If only hunting was reduced, moose numbers would have continued to decline
Could poor range explain the change in numbers?	Collect fecal pellets to see what the caribou were eating	<ul style="list-style-type: none"> Caribou diets are good in all herds except Chisana
Are enough caribou cows pregnant?	Capture cow caribou in winter	<ul style="list-style-type: none"> Most cows are pregnant in all herds except Chisana
Could late springs be having an effect on caribou?	Look at weather data from calving periods	<ul style="list-style-type: none"> None of the study herds experience late snowmelt in any spring during the reduction
Could deep snow be a problem for caribou?	Measure snow depth in each herd's winter range	<ul style="list-style-type: none"> Snow depth on the Aishihik caribou range never exceeds the threshold of 80–90 cm. There is no relation between snow depth and trends in any caribou herd
Could deep snow be a problem for moose?	Measure snow depth in each moose study area	<ul style="list-style-type: none"> Snow depth does not limit moose survival in any year
Could growing season length affect moose numbers?	Look at weather data for longer or shorter seasons	<ul style="list-style-type: none"> No significant relationship between recruitment rates and season length

Interpreting the results

We did not precisely predict exactly what would happen to the ungulate populations once we reduced wolf numbers. This shows that our knowledge of wolf-prey systems is still incomplete and reminds us how complex natural systems are. However, by making predictions to test for, we were able to better understand what

happened in our study by using the principles of experimentation. The large scale of our study also meant we compared comparison groups being affected by other conditions not related to wolf reduction.

Interpreting our results was made more difficult because both wolves and harvest by people were reduced at the same time. When all

things are considered, differences in the trends of Aishihik and comparison populations of moose and caribou are best explained by reduced wolf numbers. Decreasing populations rapidly increased only when both wolf predation and harvest were reduced.

Our study compared to others

Our study supports the conclusion of the U.S. National Research Council that northern prey populations will increase when wolves are greatly reduced over a large area for at least four years. In other studies, similar rates of increase were reported for moose and caribou after four or more years of wolf reduction. Caribou and moose recruitment in our study increased at the same time, similar to increases in other studies.

In previous wolf reduction studies, researchers made no attempt to account for the effects of reduced harvest or mild winters. We know that mild winters during the Aishihik wolf reduction helped boost moose and caribou responses. To learn how weather affects wolf predation rates, a study would have to be done during years of poor weather conditions.

Adapting to circumstances

Large-scale studies like ours are expensive and not always practical. Despite efforts to make the best design possible, our study was not scientifically ideal. We were limited to reducing wolves in one area

only, and that area was chosen by public concern. Also, hunting of moose and caribou was stopped in the Aishihik area but not in most comparison areas. As well, we did not monitor predation by bears, which are important predators of moose and caribou calves in Alaska and the Yukon.

These sorts of problems are shared with other wolf-prey experiments. When sites are not selected randomly and when the reductions are not done elsewhere at the same time, researchers cannot easily apply their findings to other areas. The task of selecting effective controls for large-scale ecological studies is also challenging. The cost of monitoring many comparison populations is high, and other Yukon Fish and Wildlife Branch programs were reduced or eliminated to fund this study. However, we adapted the study to take into account the limitations we faced. We made the best use of resources to meet as many objectives as possible and to learn as much as we could.

Ecological differences among our reduction and comparison caribou populations complicated our results. For example, snow depths are typically lighter in some herds' ranges than others. Some herds are affected by road access, while others are less affected by people. In the end, we saw moose and caribou herds showing wide variations in population trends.

This was important because it reinforces the idea of managing woodland caribou as individual herds and managing moose on a population basis, rather than by territory-wide formulas.

Wolf–Moose–Caribou Systems

Declines of moose and caribou in the same area at the same time are well documented in the north. We think that Yukon woodland caribou declines are linked to declines in moose numbers. After moose fall below a certain level (probably less than 200 moose for every 1,000 km²) wolves increase their predation rate on caribou. The initial moose decline could be due to a combination of high wolf predation and excessive harvest, as appeared to happen in our study area. Or, severe winters could cause the declines. High harvest rates could depress moose and caribou populations even further.

When moose numbers drop, one of three things could happen:

- Moose could be held at low numbers for a long time while wolves continue to prey on caribou. Local extinction of the caribou could eventually result, especially if caribou harvest continues.
- A small remnant caribou herd could persist, avoiding wolf predation by reducing its range and minimizing the number of wolf packs it is exposed to year-round. Moose and caribou could then increase to higher

numbers after wolves naturally decline.

- A combination of bad weather and wolf predation could cause spikes and declines in caribou numbers over long periods

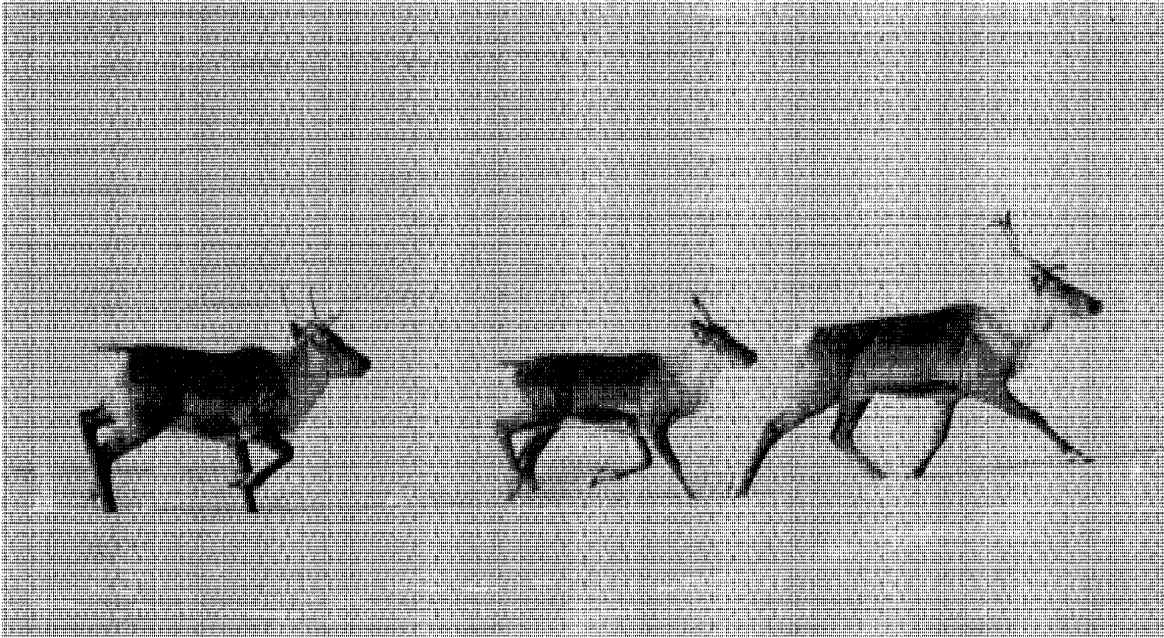
In no case does it seem likely that moose would disappear.

Predation by grizzly bears is also an important factor affecting moose and caribou calf survival in the north. There is no single explanation of how wolf–bear–moose–caribou systems work that we can apply everywhere, and we should not be surprised when circumstances change over time. As a result, we must use caution when deciding which explanation best fits the current conditions in areas of the Yukon.

Harvest management

In other studies, sharp declines in caribou were caused by high harvest rates by people. Annual harvest of 5–8% was an important factor causing the decline in moose and caribou before we began our study. Harvest rates greater than 5–6% for moose and 3% for caribou are probably not sustainable in the Yukon and Alaska where bears and wolves are common.

We recommend that maximum harvest rates in the Yukon be set at 2% for caribou and up to 5% for moose, unless there is strong evidence that populations are increasing. Harvest rates should be set well below recruitment rates, and when bad weather slows



The Aishihik caribou herd stopped declining and began to increase when wolf numbers were reduced.

recruitment a sustainable harvest may not be possible.

Both wolf and harvest reductions were necessary to cause the high rate of recovery of the Aishihik caribou herd, and to a lesser extent moose. We recommend that reduction of wolves be accompanied by a substantial harvest reduction to provide the greatest benefit from wolf management actions.

Proactive Wolf Management

Subsistence use of wildlife is an important part of the culture and economy of northern communities. The Yukon Wolf Conservation and Management Plan recommended that instead of using broad-scale wolf reduction to recover already low ungulate populations, wildlife managers should avoid such situations. The challenge is to find publicly acceptable methods that

boost ungulate populations without harming predator populations. Other proactive methods such as public wolf trapping, live relocation, and surgical sterilization of breeding wolves are being studied elsewhere. Habitat enhancement can also be used to support higher moose and caribou numbers.

Surgical sterilization of wolves

In the future, broad-scale lethal wolf reduction programs will probably be rare in the Yukon, as they are in other parts of Canada. Our study was the first to show that wolf predation could be reduced by using a combination of lethal and non-lethal techniques. Surgical sterilization procedures are safe, do not change the social behaviour of wolves, and are more publicly acceptable than killing wolves.

Our study showed that fertility control effectively reduces the rate of increase of wolves over a large area. In 1990, a wide range of stakeholders endorsed the use of fertility control and wolf trapping in the Aishihik area as part of long-term management to reduce predation losses. We recommend that fertility control be considered whenever there is a management plan to hold wolf densities below natural levels for long periods.

Public Involvement in Management Decisions

Public sentiments about the roles of natural predators and the ethics of predator control are diverse. Our experiment was the first wolf reduction program developed using ethical and scientific guidelines set by a team of citizens. Our study followed the intent of the Yukon Wolf Conservation and Management Plan. We used reduced harvest and wolf reduction to increase moose and caribou numbers without losing broad public and political support.

Although wolf reduction was unacceptable to some, the Yukon government stayed committed to the study mainly due to strong support from people in communities, First Nation governments, and wildlife management advisory groups. We recommend that management plans that include predator

reductions be guided by careful planning that integrates biological information with the diverse values of stakeholders and local communities. In this way, socially directed management actions can be sustained by broader public support.

Balancing Public Interest

Even with conservative harvest rates and ideal habitat, low densities of moose and caribou will likely be the norm in areas of the Yukon and Alaska where predation is unmanaged. In most accessible areas, the combination of natural predation and the demands of local people for wild food often exceeds the sustainable supply of ungulates, and moose and caribou numbers decline. This has happened around most communities in the north.

Most Yukon residents agree that the consumptive interests of people should be balanced with the needs of predators. In the Yukon there are ways to balance these conflicting values. Options can include reserving areas where large-mammal systems are managed for natural change and predators are not manipulated to benefit people's use of ungulates. In other areas, some reduction of wolf predation can be considered to allow people a share of wildlife without compromising the long-term health of predators.

Population data for caribou herds in Aishihik and 3 control areas in the Yukon, 1981–1998.

Area	Estimated herd size (90% CI)	Caribou density (per 1,000 km ²)	Calves per 100 cows	Bulls per 100 cows
Aishihik (16,100 km ²) ^a				
Oct 1981	1,500 ^b	9.3		
Oct 1990			29	28
Mar/Oct 1991	785	4.8	9	24
Oct 1992			7	35
Mar 1993	732	4.5		
Oct 1993			39	43
Oct 1994			38	40
Oct 1995			42	50
Oct 1996			47	47
Mar 1997	1,148±6.5%	7.1		
Oct 1997			45	59
Oct 1998	1561 ^c		33	50
Wolf Lake (20,000 km ²)				
Mar 1987	664±20% ^b	3.3	27	29
Mar 1993	1,249±12%	6.2		
Oct 1993			22	53
Oct 1994			31	53
Oct 1995			16	42
Oct 1996			30	47
Oct 1997			34	51
Mar 1998	1,491±30%	7.4		
lbex (2,000 km ²) ^b				
Oct 1990	155	7.8	60	54
Oct 1991			56	47
Oct 1992			53	76
Oct 1993			57	29
Oct 1994			44	65
Oct 1995			50	67
Oct 1996			35	47
Oct 1997			36	76
Mar 1998	450±24%	22.7		
Chisana (13,200 km ²) ^d				
Oct 1987	1800	13.6	33	39
Oct 1990			11	36
Oct 1991			1.3	40
Oct 1992	1270	9.6	<1	31
Oct 1993	869		2	24
Oct 1994			11	27
Oct 1995			4	21
Oct 1996			4.8	16
Oct 1997			14	24
Oct 1998	493	3.7	4	19

^a Range size determined from minimum convex polygons from radio telemetry studies (R. Farnell, Yukon Fish and Wildlife Branch, unpublished data).

^b R. Farnell (Yukon Fish and Wildlife Branch, unpublished data).

^c Population estimate derived from computer modelling simulation.

^d Data for Chisana herd from C. Gardner (Alaska Department of Fish and Game, unpublished data).

Characteristics of moose populations in Aishihik and 2 control areas in the Yukon.

Areas	Estimated number ± (90% CI)	Moose density (per 1,000 km ²)	Calves Per 100 Cows (Oct)	Yearlings per 100 cows	Bulls per 100 cows
Moose areas in Aishihik treatment blocks					
Aishihik South					
1981 ^a	332±10%	168	24	37	69
1990	247±32%	125	58	40	43
1992	126±29%	64	11	15	61
1998	349±18%	173	51	30	85
Onion Creek					
1992	416±18%	122	21	12	49
1998	999±21%	294	18	22	67
Untreated moose areas					
Big Salmon					
1993	527±17%	195	50	17	71
1998	526±18%	195	49	41	68
Mayo					
1988 ^a	315±22%	104	72	54	65
1993	372±17%	122	51	18	82
1998	615±19%	200	58	37	70

^a no sightability correction factor incorporated

Characteristics of wolf populations in the Aishihik area and 3 control study areas in the Yukon, 1992–1998.

Wolf treatment began February 1993 and ended April 1997.

	Aishihik treatment area (20,000 km ²)													Control study areas		
														Mayo (22,130 km ²)	Wolf Lake (6,970 km ²)	Tatchun (10,050 km ²)
	1992 Feb	1993 Jan	1993 Mar	1994 Jan	1994 Mar	1995 Jan	1995 Mar	1996 Jan	1996 Mar	1997 Jan	1997 Mar	1998 Jan	1998 Mar	1995 Mar	1994 Mar	1996 Mar
Wolves (no.)	178 ^a	120	55	81	44	75	38	52	30	55	33	58	52	96–107	45–52	45–52
Packs (no.)	28	26	11	20	12(1) ^b	18	11	12	7(3) ^b	13	9(6) ^b	14	14	15	8	9
Pack density (packs/1,000 km ²)	1.4	1.3	0.6	1.1	0.6	0.9	0.6	0.6	0.4	0.7	0.5	0.7	0.7	0.7	1.2	0.9
Mean pack size	5.6	4.2	3.8	3.7	3.1	3.8	2.7	3.9	3.4	3.4	2.8	3.8	3.4	6.1	5.5	4.9
(±SE)	±0.6	±0.4	±0.5	±0.4	±0.3	±0.6	±0.2	±0.6	±0.7	±0.7	±0.7	±0.5	±0.4	±0.8	±0.8	±0.4
Density (wolves/1,000 km ²)	8.9	6.0	2.8	4.1	2.2	3.8	1.9	2.6	1.5	2.8	1.7	2.9	2.6	4.3–4.8	6.5–7.4	4.5–5.1
Survey coverage rate (km ² /hr)	205		72		100		95		102		100		222	316	162	223