Wolf Survey in the Coast Mountains, 2009

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Summary

A survey done in Coast Mountains between February 5 and March 22, 2009 found that the wolf population had declined since 2004. The measures used to describe the decline are average number of wolves in each pack, the number of wolves in the population, and the number of packs in the area.

The survey technique used in the Coast Mountains was a modification of the standard snow tracking count method used in other areas of Yukon. Poor tracking conditions in the Coast Mountains required a more repetitive search pattern than in other areas.

Survey conditions for this survey were good and the search intensity was almost double the search intensity for 2004.

We found 9 packs resident in the area, for a density of 1.01 packs per 1000 km^2. The average pack size was 4.4 wolves per pack. The wolf population estimate was 44 wolves, resulting in a wolf density estimate of 4.9 wolves for every 1000 km^2.

In October 2009 we located a pack of 19 wolves in the area. The pack included 12 pups born after the March survey. We were able to determine that the 7 adults in this group included the pair grouping identified in the area during the survey. The subsequent addition of 5 adult wolves to the survey estimate did not change the results in any meaningful way.

The wolf density, average pack size and pack density determined for the Coast Mountains in 2009 was lower than previous surveys and indicated a continued decline in the wolf population since 2004.

- Nine packs were resident within the study area
- Average pack size was 4.9; down 17% since 2004.
- Wolf density was 45.5 wolves per 1000 km^2; down 22% since 2004.
- Pack density was 1.01 packs per 1000km^2; down 9% since 2004
- Total wolf population was 49, down from 69 in 2004.

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Introduction

Why we did the survey

The Coast Mountains wolf population was last surveyed in 2004. The 2004 survey showed that wolf density had fallen about 35% from the 1988 estimate.

The Southern Lakes Wildlife Coordinating Committee is developing a regional wildlife assessment of the Southern Lakes area and requested updated information about the wolf population in the Coast Mountains. A wolf population assessment will give us a better understanding of predator prey system changes that may have taken place over the last 2 decades. The increasing caribou and declining moose abundance since the late 1980s suggests that the dynamic interaction between predators and prey may have also undergone a change.

The purpose of this survey was to

- document wolf numbers;
- determine pack distribution; and
- evaluate wolf density over the study area.

The survey area

We surveyed about 9000 km^2 of the Coast Mountain block, an area bounded by Kusawa Lake in the west, the Alaska Highway to the north, Marsh and Little Atlin lakes on the east, and the Yukon/ BC Border on the south (Figure 1).

The 2009 survey area differed from previous surveys because the west side of Marsh and Little Atlin lakes were used as a boundary instead of the Alaska Highway and the Atlin Road. We also restricted our flights in 2009 to avoid the Whitehorse-area subdivisions along the Alaska Highway between its junctions with the North and South Klondike Highways (Appendix 1).

Methods

Survey timing

We flew 16 survey flights between February 5 and March 22, 2009 (Appendix 2). All flying was done out of Whitehorse. We did not fly because of bad weather on 16 days and were grounded for a 12-day period due to scheduled pilot unavailability.

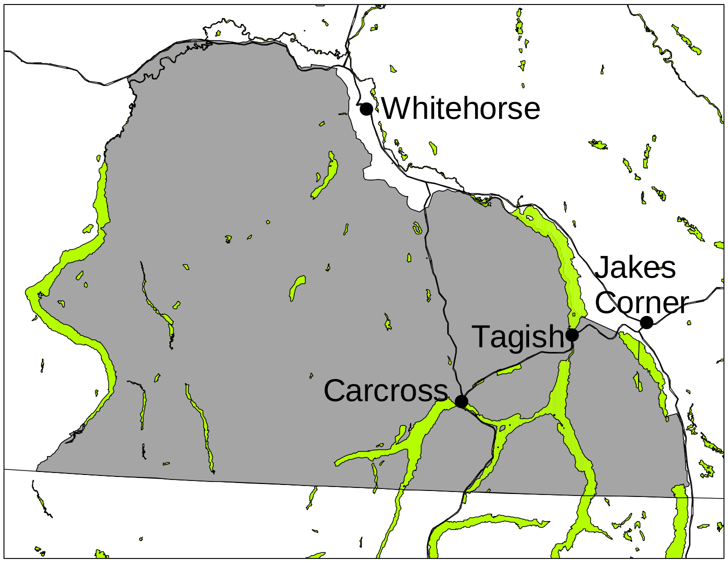


Figure 1. Coast Mountain Survey Area, 2009

Survey aircraft

All flights were made in a PA-18 Supercub airplane. This is a high-wing style aircraft with room for only a pilot and 1 observer. The observer sits behind the pilot and both crew members can look out either side of the airplane. The Supercub can fly and circle very slowly, and allows for very good visibility to either side and below the aircraft making it the ideal airplane for wolf tracking.

Estimating wolf numbers

Standard technique

The standard wolf survey method used in Yukon is a minimum count aerial snow-tracking method. This technique is designed to identify packs and estimate membership. A pack is any group of 2 or more wolves. Snow tracking of lone wolves is not done because they are not territory holders. Lone wolves are accounted for in the population count by adding 10% to the territorial pack population.

Wolf trails are located and followed from the air until wolves are seen or the trails are erased by drifting snow or lost in rocky, high-mountain terrain; caribou winter range; or extensive forest cover. Flight lines usually follow meadows, lake margins, watercourses, open forests, and ridges because it is easiest to intersect track sign in these terrain types.

The snow track count provides a minimum count of pack wolves based on track sign or actually seeing and counting the wolves. When pack wolves travel in winter they usually move single file until they come to a shallow snow area such as overflow on river ice, when they tend to spread out, each on its own trail. These splits in the trail form the basis of the minimum count. An estimate of the maximum number is based on “trail splits” where it is felt that the split is incomplete and thus 2 or perhaps 3 animals used one of the split trails (Figure 2).

Snow tracking in most areas of the Yukon, where weather fronts are stable and suitable flying conditions persist for many days, is attempted about 3 days after a 5–10 cm snowfall so packs can lay down enough track sign for us to find it while flying a single pass through an area. It is best to finish the survey before

Figure 2. When pack wolves travel in winter they usually move single file until they come to a shallow snow area such as overflow on river ice, when they tend to spread out, each on its own trail.

late February and the onset of breeding season. Social stress due to breeding can cause temporary pack splitting to occur. Some members, including the breeding pair, may separate from the main group and travel within the territory for several weeks before rejoining the main pack.

The survey is completed within the shortest time possible to ensure that pack duplication does not occur, as packs might make long distance moves and be counted twice if the survey period is extended. The usual survey technique is to fly uninterrupted daily flights until the survey is completed, usually within a week of starting the survey. The survey area is covered completely only once.

Technique modifications used in the Coast Mountains

In the Coast Mountains, the opportunity to track wolf sign on a sequence of days uninterrupted by weather conditions is very limited. There are many weather-caused flight cancellations. The mountainous terrain is open to the wind and frequent storms create dangerous flying conditions and wipe out trails, leaving large areas of drifted-in or hard-pack snow on which tracks are difficult to find. Here, visible wolf trails are generally short and restricted to valley bottoms or other sheltered areas.

We modified the standard technique to solve the problem of finding only short trail fragments by making repeated flights over the survey area, returning to the local areas of each prior trail contact and beginning a new search. Our assumption was that the wolves were "working" the area in which they were first located, and that repeat searches in the general area would eventually lead to finding fresh sign.

The method of multiple passes over the study area helped to define areas of individual pack activity, and made it unlikely we would count packs twice. Multiple passes also meant that it was very unlikely that we would miss a pack that may have been on a kill and not travelling for several days, or that had been outside the survey area boundary during our initial visit. If the pack was not seen we made a minimum and maximum estimate for the pack based on the trail splits. When new sign was encountered it was followed until lost again or a well defined trail split allowed a good count. If sign persisted across open slopes without any signs of drifting, we considered it to be less than 12 hours old and vigorously pursued it. After a good trail-split count was made and we felt that it was unlikely we would actually see the wolves due to the age or scarcity of the sign, we switched our efforts to the next priority area.

Total wolf population size was derived by adding 10% to the pack population totals to account for the number of lone wolves in the area. The actual proportion of "loners" in a population may vary considerably, and likely increases in lower density wolf populations, but cannot be precisely determined without more intensive methods. In our experience adding 10% to the pack population to account for lone wolves in the area is reasonable; it is standard procedure to add 10% to all surveys. The population estimate is presented as the midpoint of the minimum and maximum estimates.

In addition to the aerial tracking, 12 trappers with registered concessions within the survey area were mailed a questionnaire asking for their observations of wolf sign over the winter period.

Results and Discussion

Coast Mountain wolf population estimate

We located 9 packs with 36 to 43 members in the study area (Table 1). When we added 10% to the number of pack wolves to account for lone wolves, the total wolf population was 43.5 (range 39.6 to 47.3). Wolf density was 4.9/1000 km^2, (range 4.5–5.3) and pack density was 1.01 /1000 km^2; less than the Yukon average of 1.07 packs/1000 km^2 (Table 2).

Table 1. Wolf packs surveyed in 2009, Coast Mountain Survey Area.

Wolf pack	Minimum size	Maximum size	Source *
Little Atlin	6	9	T,V
Alligator Lake	4	4	V,T
Hendon River Pair	2	2	T
Rose Creek	4	4	V
Moose Hollow	4	4	V,T,P
Tagish Lake	4	6	T, P
West Arm	6	8	T
Sandpiper	4	4	T
McConnell Pair	2	2	T
Total Pack Wolves	**36**	**43**	

** V – Visual, T – track sign, P– Public or ground observation*

Table 2. Comparison of 4 Coast Mountain Surveys against Yukon averages.*****

Year	Area surveyed	mean pack size	Number of packs	wolves/ 1000	pack density	population estimate	% packs seen
1983	7,699	8.6	10	12.3	1.299	94.6	No data
1988	8,264	5.9	14	10.9	1.694	90.2	42
2004	9,029	5.9	10	7.1	1.108	64.4	30
2009	8,884	4.4	9	4.9	1.013	43.5	44
Yukon Average N=23	12,719	6.4		7.7	1.073		55.4

* Data for 1988 comes from Hayes *et al.* (1991); 1988 was the last year of recovery studies after a lethal reduction that ended in 1985.

The Coast Mountain wolf population declined since the 2004 survey in all important aspects, including pack density, average pack size, and overall population size (Table 2). When compared against the original 1983 population estimate the decline was even more pronounced (Table 3). The 2009 estimate was also lower in all important aspects than the Yukon averages.

Table 3. Wolf population changes in Coast Mountains since the first survey estimate in 1983 and between surveys from 1988, 2004, and 2009.

Year	Pack density change from 1983	Wolf density change from 1983	Average pack size change from 1983	Average pack size change from prior survey	Wolf density change from prior survey	Pack density change from prior survey
1983	0	0	0	0	0	0
1988	+ 30%	- 11%	- 31%	- 31%	- 11%	+ 30%
2004	- 15%	- 42%	- 31%	0%	-35%	- 35%
2009	- 22%	- 60%	- 49%	- 25%	- 31%	- 9%

How accurate was the survey?

The 2 most important requirements of the snow-tracking method are ensuring the complete area is searched and knowing that packs are not missed or counted twice.

The rate of coverage for the survey was more than double the Yukon average (each hour of flying time was dedicated to searching each 120 km^2 compared to the Yukon average where each hour of flight time had to cover 270 km^2). We are confident that the area was well covered. We flew only when weather conditions were favourable, with calm-to-light winds and sunny conditions. The decision on which ground to cover on any given day took into account the upper wind forecasts; when conditions were favourable we concentrated our search effort in the high mountain areas we did not often get into.

We took advantage of an unusually high number of fresh snowfalls during the survey period (Appendix 2). This fresh snow allowed us to record new sign without having to estimate its age and improved our understanding of timelines for wolf pack activity.

In areas where we found sign on the initial flights, we were often able to locate new activity close to the initial point of contact on our return flights. The repeated visits increased our chances of seeing the wolves and gave us a better understanding of each pack's operating area, reducing our chances of counting a pack twice. Despite repeated flights, we did not find any wolf sign in the central portion of the survey area (Figure 3).

The average pack territory size in Yukon is about 1000 km^2 so we assigned a 1000 km^2 area of probable territory to each pack we encountered (Figure 4) . This allowed us to roughly estimate any voids in track sign where undiscovered packs might be operating and we increased our search effort in these areas.

We saw 4 of the 9 wolf packs we tracked, but we could not always count all pack members; we saw some but not all wolves in the Atlin and Moose Hollow packs. Seeing wolves improved our understanding of other sign made in a given area at a given time and helped us sort out activity patterns and make pack territory separations (Figure 4).

Only 3 of the 9 packs were large enough to produce trail splits where we could not account for all wolves. We felt confident that no wolf packs were missed or double counted. First, the continued absence of wolf sign in specific portions of the area with new sign being located after each snowfall in areas already identified as having a wolf presence leaves us confident that no packs were operating in these voids. Second, intensive repeat searches over many days around Kusawa Lake, where we had to sort out the sign of 3 packs operating in close proximity to each other left us satisfied that no packs were double counted.

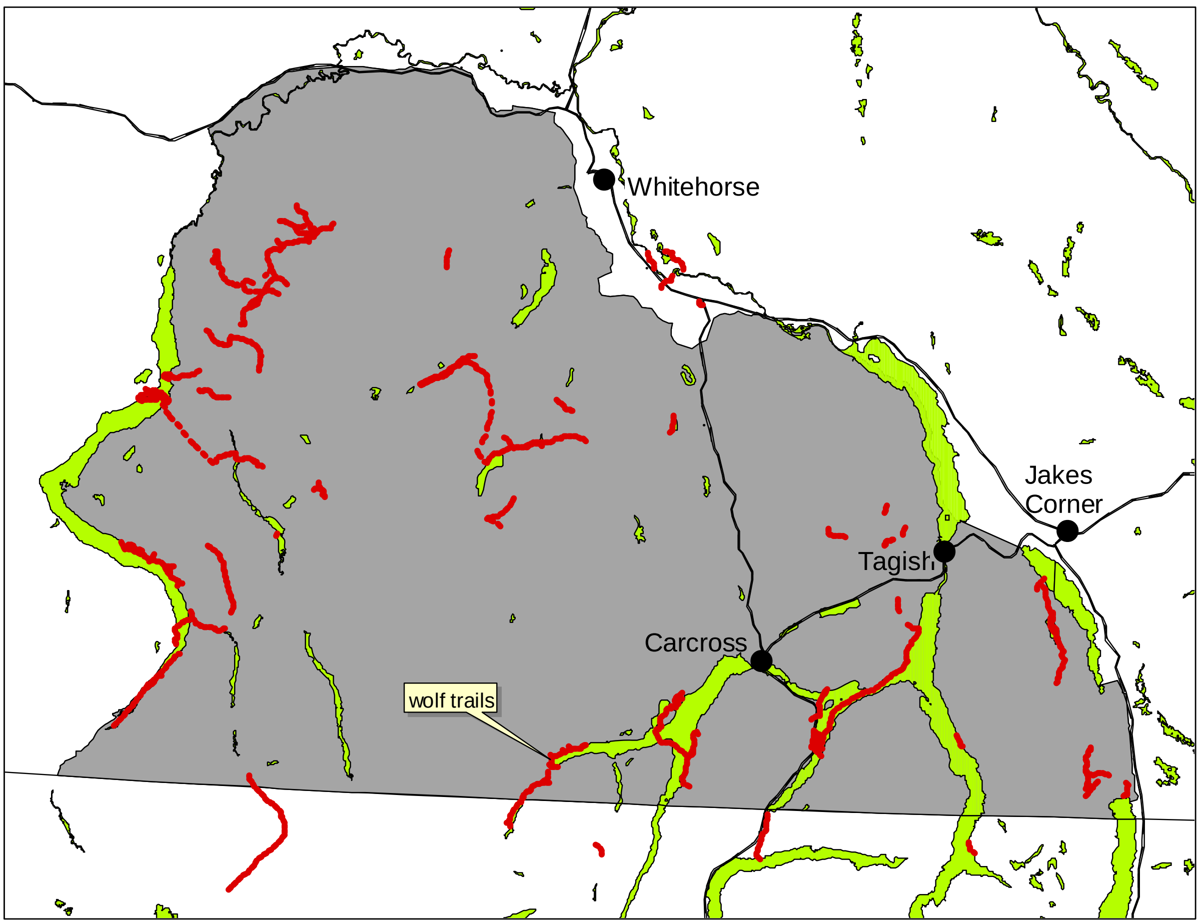


Figure 3. Wolf trails located during 2009 survey.

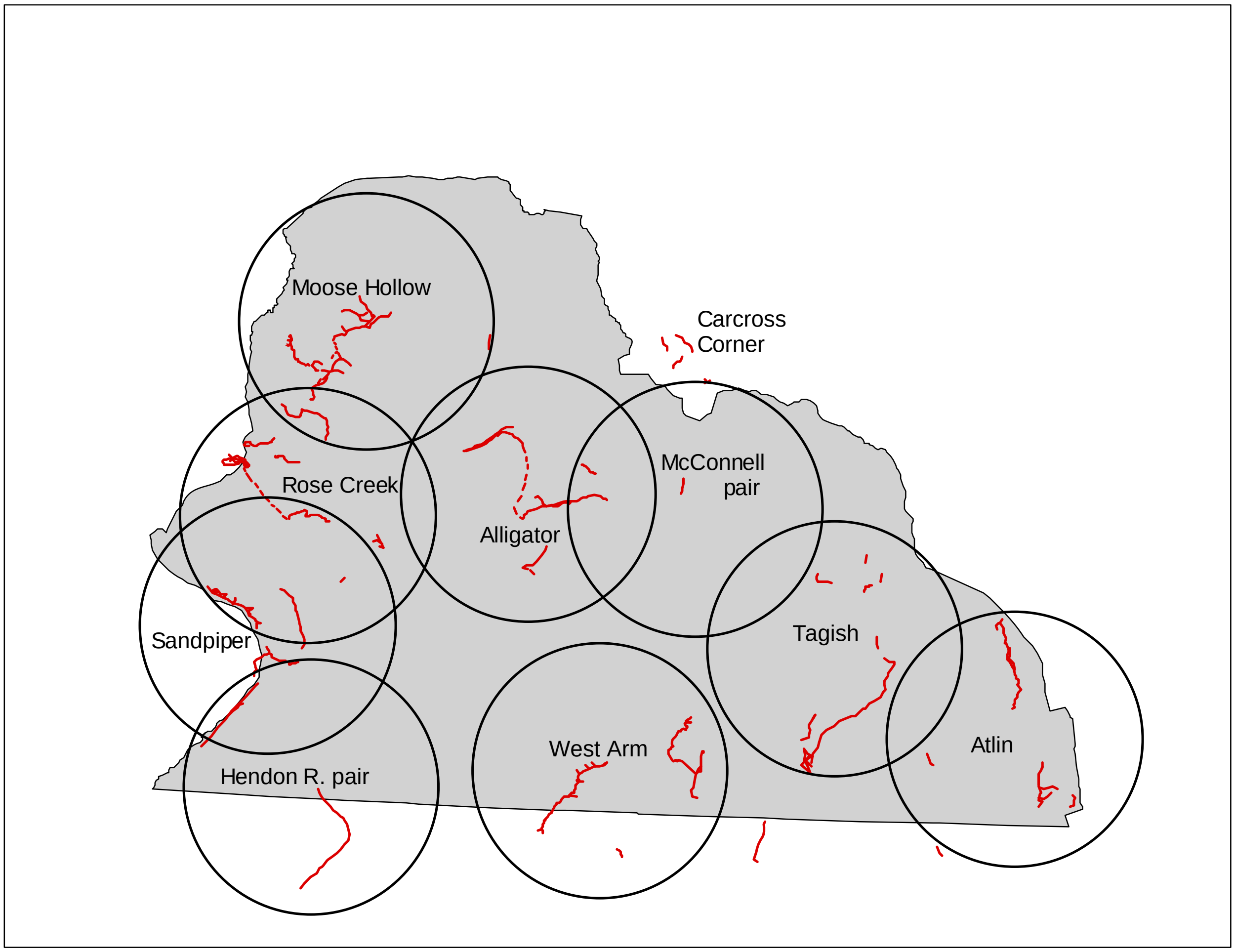


Figure 4. Packs identified as in being the study area, with generalized theoretical pack boundary circles to represent 1000 km^2 territories

We counted 2 packs of 2 animals each (pairs) that may have actually been members of identified packs but were temporarily separated from the larger groups due to breeding activity (see addendum below). If these 2 small packs are removed from our calculations and assigned membership in existing packs, then only 7 packs were in the survey area. The average pack size would then be 5.6 rather than 4.4 (about the same as in 2004), but pack density would be only 0.79 /1000 km^2 instead of 1.01 /1000 km^2, a 30% decline in pack density from the 2004 survey, rather than the 9% reported here (Table 3). The fact that the 2 pairs were separate means they must be assigned their own pack identity, but the possibility of them being temporarily separated pack members of existing packs is important to the outcomes and thus is noted here.

Of the 12 trappers we requested information of, only 1 returned a pre-paid mailing, but 3 responded in person. All 4 trappers confirmed our estimates of wolf numbers in relation to their trapline areas.

We are confident that all of the survey area was searched well enough not to have missed any packs and that we did not double count any packs.

The results of this survey indicate that lower productivity and pup survival combined with higher subdominant dispersal has likely been in effect over a multi year period. The continued decline since 2004 has brought the population to a level that is below Yukon averages. We are confident that our estimate of wolf numbers is within a range of values that support our assessment that the population has declined since 2004, and is certainly reacting to the decreased prey base in terms of wolf population trajectory.

Packs, pack sizes and populations

The impact of wolf predation is more directly related to the number of packs than the number of animals in the pack. A pack of 10 wolves does not kill 5 times as much prey as a pack of 2 wolves. Five packs of 2 wolves will kill more prey than 10 wolves in 1 pack. Knowing how many packs and what the average pack size is in an area helps us to understand the dynamics of the predator-prey system.

The ability of a wolf population to resist declining in number as its prey base declines is known as a *lag effect*. Wolf populations do not respond immediately to a declining prey base, but “lag” behind. When wolf populations finally do begin to respond, it is with a drop in the average pack size because of reduced pup production or survival and increased dispersal of subdominants. Wolves are territorial in areas with a year-round supply of ungulate prey and each pack maintains and protects an exclusive area for its own use. They usually respond aggressively to other wolves that are not pack members. The amount of area packs protect (which results in wolf pack density) is generally determined by social factors that are in effect over wide ranges of prey density and thus only loosely linked to the amount of prey available. Wolves may persist and defend territories as reproductive pairs over long periods of time even when the prey base has declined to very low levels. Chronic, long-term low pup production or survival and continued high dispersal of subdominants will eventually lead to a decline in the number of packs if the amount of prey in an area remains at low levels. When a pack disappears through the death of one or both alpha breeders and there are no surviving offspring, other packs in the area may absorb portions of the vacant territory and increase the amount of area they protect so they can incorporate more ungulate biomass under their protected “umbrella”. Thus, pack density declines.

Pack membership can change dramatically from year to year because year-to-year differences in prey availability affects pup survival and dispersal rates. Even if we knew exactly how many wolves were in an area that number would likely change within a few months due to births, deaths, or dispersal. Each pack may lose more than 20% of its members every year. Therefore, to understand the predator-prey dynamics in an area, knowing the number of packs and the trend with respect to pup production/survival and dispersal is more important than knowing the total number of wolves.

Counting moose

During the wolf survey we counted all moose seen and recorded their locations using a GPS unit. Moose were recorded as either adult or calf, although we could often identify yearlings. Care was taken to ensure that we counted each moose only once. The recorded waypoints allowed us to judge the probability of a new sighting being already counted on previous flights. If we saw a moose in an area with deep snow that we had flown over within the previous 3 days, and we had not seen a moose within 3 km we recorded it as a new sighting. We felt that snow depth restricted moose travel in many areas, because many moose were within a few hundred metres of their initial locations when we saw them again, even weeks later.

Where we had doubts due to shallow snow conditions, inconclusive track sign (moose tracks and trails were continuous along large tracts of habitat, rather than restricted to local sites) or if GPS locations were less than 3 km apart, we verified the new observation by checking the closest previous moose location to confirm that the new sighting was valid. If we did not find a moose at the previously noted location, we did not record the new observation. In some cases where the 2 locations were close together but the group composition was different we added only those individuals that we were certain we had not seen before.

Moose counted

The moose count was incidental to the wolf survey, and was not intended to be a population estimate. Of the 195 moose counted, 20% were calves. The percentage of calves in the population was much higher than the 7% noted in 2004 (Table 4).

Table 4. Moose count results from 2004 and 2009.

	2004	2009
Search intensity: minutes flown per 100 km	36	48
Survey time flown	53.5	70.7
Total adult moose	64	156
Calf moose	5	39
Percent calves	7.25	20
Adult moose seen per hour	1.2	2.21

Based on the 2004 moose survey information, and assuming a stable moose population, and with environmental and survey technique factors all being equal, we expected to see about 1.2 adult moose per hour, or 85 adult moose in the 70 hours flown. We saw, however, 156 adults or almost double the number expected. It is not possible, however, to make direct comparisons between the 2 surveys. Our search intensity (an expression of the amount of time spent looking in a certain unit of area) increased 33% in 2009. The longer survey period in 2009 also allowed more opportunities to see moose during repeated flights through each area.

In 2004, we did not dedicate as much conscious effort to count moose because we were operating a capture effort at the same time and we had 2 crews in the area. More time than we had available would have been needed to sort out the double counting that happens when 2 aircraft operate over the same areas each day. We thus elected to count moose on the first few days of survey in each valley or localised area to reduce double counting errors. Snowfall in 2009 was also notably higher than in 2004 and the deeper snow likely had an effect on moose distribution and increased our ability to see them. While direct comparisons cannot be made between the 2004 and 2009 moose counts, the information may prove to be a valuable reference.

The distribution of moose was relatively uniform across the survey area (Appendix 4).

Addendum

Post-survey Update

We encountered a pack of 19 wolves within the survey area on October 2, 2009, 8 months after the survey. The pack was found in the overlap area of the Alligator and McConnell pair territories theoretically identified in the March survey (Appendix 3). An examination of photos taken of the pack allowed us to distinguish pups and adults. We identified 7 adults and 12 pups in this group, indicating that more than 1 female had bred in February-March. The alpha male and female were identified in the photos; they were not the alphas of the Alligator pack photographed in March. With this observation of a large pack in the area that was not present during the survey, we concluded that the McConnell pair identified in March near Cowley Lake was a “breeding-season split off” of the group of 4 wolves identified as the Carcross Corner pack.

The Carcross Corner pack was not included in the original survey result because it was outside our study boundary. We also determined that the track sign found on the Yukon River east of Carcross Corner and the 2 wolves seen at Chadburn Lake were part of the Carcross Corner group. We therefore combined this pack with the McConnell pair and defined the group as the McConnell pack. The McConnell pack would have been a minimum of 6 members by March track sign, and adding 1 further adult seen in the October 2009 photos would mean that it was a 7-member pack in March (Table 5).

Table 5. Wolf packs surveyed in 2009, Coast Mountain Survey Area amended to reflect observations made in October 2009.

Wolf pack	**Minimum**	**Maximum**	**Source ***
Little Atlin	6	9	T,V
Alligator Lake	4	4	V,T
Hendon River Pair	2	2	T
Rose Creek	4	4	V
Moose Hollow	4	4	V,T,P
Tagish Lake	4	6	T, P
West Arm	6	8	T
Sandpiper	4	4	T
McConnell Pack	7	7	Survey Photos October 2009
Total Pack Wolves	**41**	**48**	

** V – Visual, T – track sign, P– Public or ground observation*

When more than 1 female within a pack breeds, it is often because of extended pack member separations, or the loss of the alpha female. This instance of disturbance to pack social structure is likely a result of the pack operating in the human populated valley bottom around Cowley Lake and Carcross Corner.

The addition of 5 adult wolves to the survey data only slightly changed the population estimate and the assessments of relative changes in the population (Table 6). The conclusions of the survey with respect to the Coast Mountain wolf population status were not changed. The Coast Mountain wolf population has declined since the 2004 survey in all important aspects, including pack density, average pack size, and overall population size.

Table 6. Wolf population changes in Coast Mountains since the first survey estimate in 1983 and between surveys from 1988, 2004, and 2009 amended to reflect observations made in October 2009.

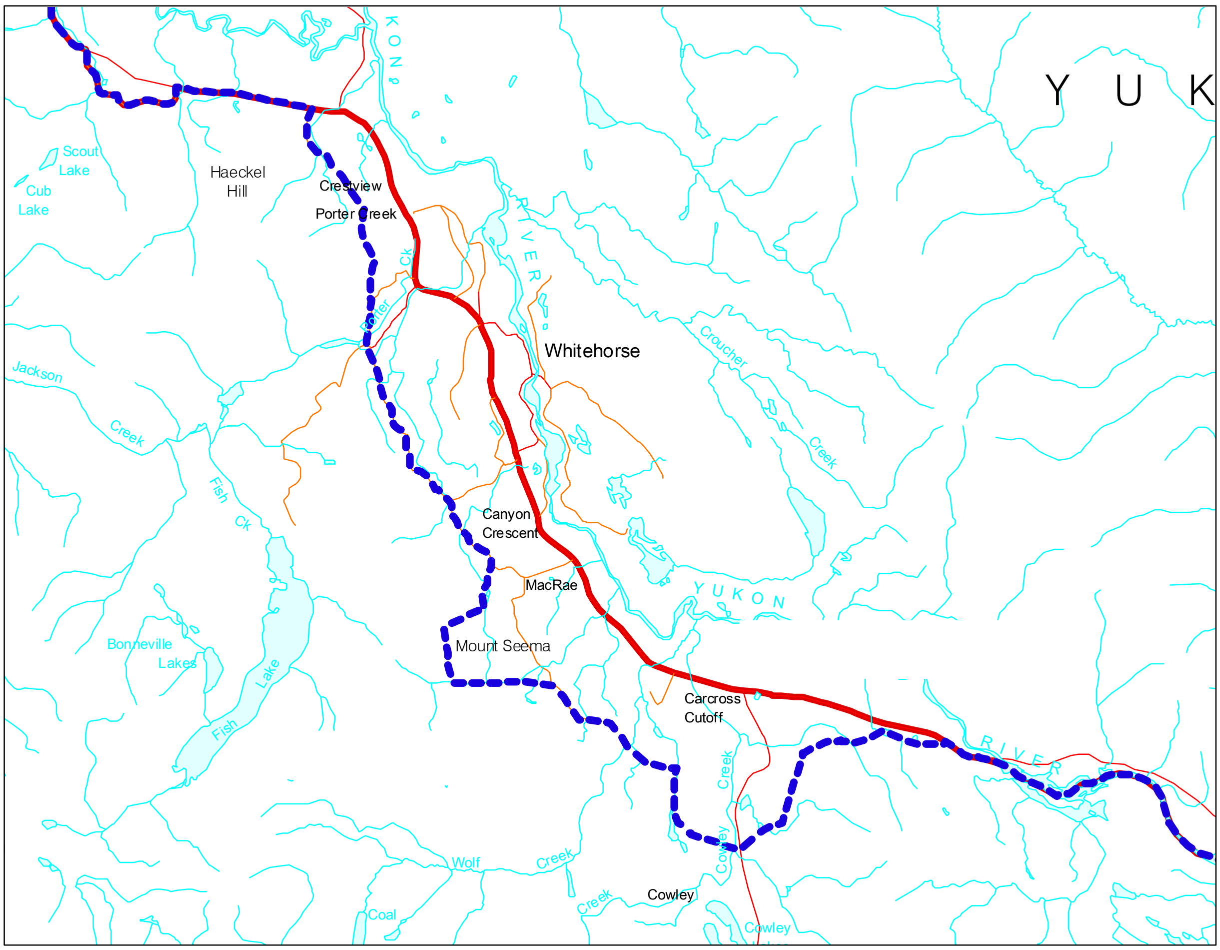
Year	Pack density change from 1983	Wolf density change from 1983	Average pack size change from 1983	Average pack size change from prior survey	Wolf density change from prior survey	Pack density change from prior survey
1983	0	0	0	0	0	0
1988	+ 30%	- 11%	- 31%	- 31%	- 11%	+ 30%
2004	- 15%	- 42%	- 31%	0%	-35%	- 35%
2009	- 22%	- 55%	- 43%	- 17%	- 22%	- 9%

Reference Cited

HAYES, R. D., A. M. BAER, AND D. G. LARSEN. 1991. Population dynamics and prey relationships of an exploited and recovering wolf population in the southern Yukon. Yukon Fish and Wildlife Branch Report TR-91-1, Whitehorse, Yukon, Canada.

Appendix I.

Boundary changes around Whitehorse. Dashed line is 2009 boundary; heavy solid line is 2004 boundary.



Appendix 2.

Flight times snowfall for Coast Mountain 2009 wolf survey.

February

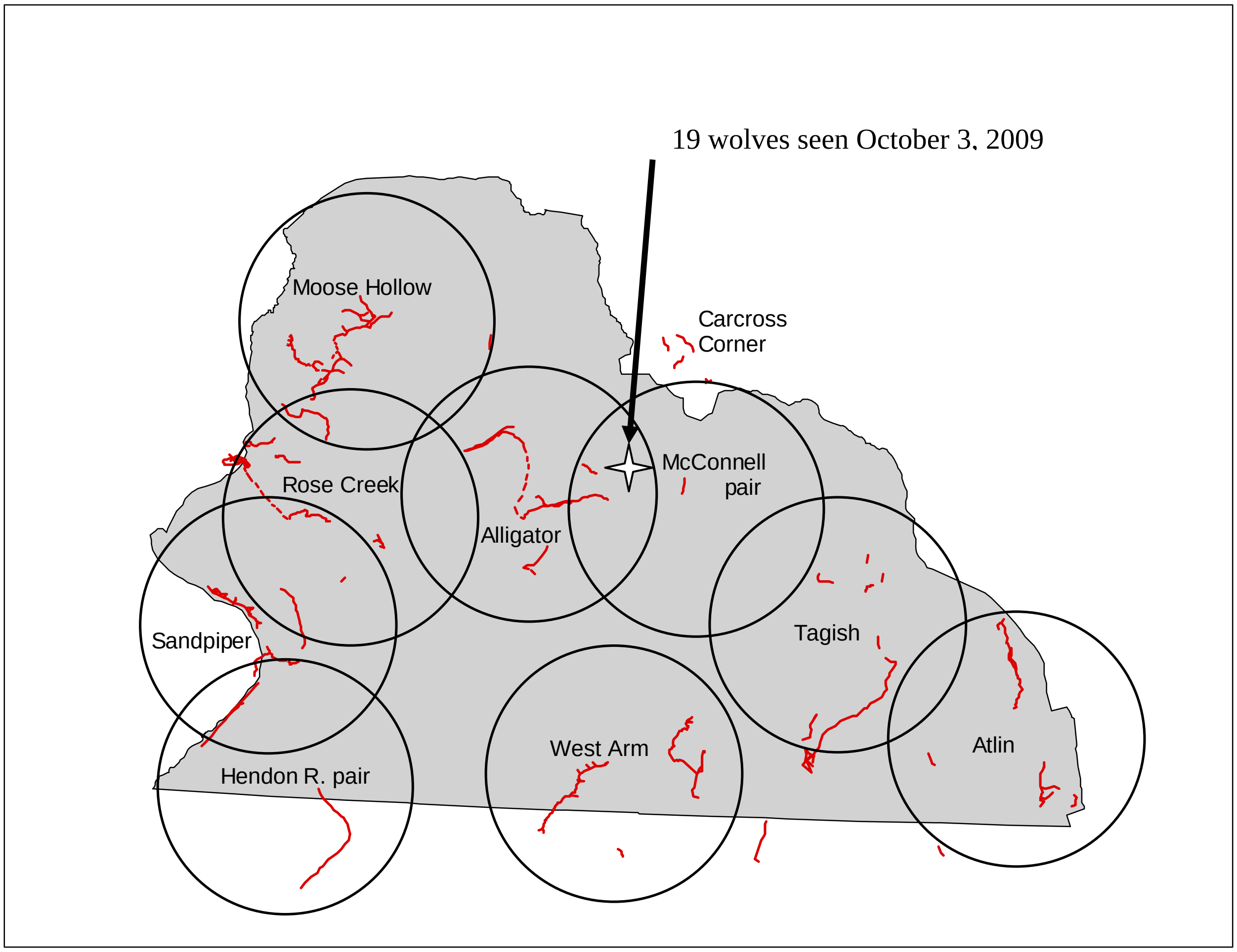
Date	3	5	6–8	9	10	11	12–23	24	25	26–28
Hours flown	-	4.2	0	5.1	0	4.1	Suspended (no pilot available)	5.2	3.4	0
Snowfall (cm)	5.6	-	16.6	-	2.8	-	4.0	-	-	3.8

March

Date	1	2	3	4	5–7	8	9	10	11–15	16	17	18	19	20–21	22
Hours flown	4.2	0	5.1	4.4	0	4.2	7.9	4.3	0	3.1	3.4	4.4	4.2	0	1.4
Snowfall (cm)	-	5.4	1.2	1.0	5.2	-	-	0.4	11.5	0.2	-	-	-	3.5	-

Appendix 3.

Location of wolves seen October 3, 2009 in relation to the generalized theoretical pack boundaries identified in the March 2009 survey.



Appendix 4.

Incidental Moose observation locations from the 2004 and 2009 wolf survey flights. Moose sightings registered on GPS between February 5th and March 22nd 2009 are circles, moose sightings from 2004 survey are square icons.