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environmental research & services

26 January 2007

Ms. Caryn Rea, Senior Staff Biologist
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P.O. Box 100360
Anchorage, AK 99503

Subject: **Data report for Alpine Pipeline caribou surveys, 2006**

Dear Ms. Rea:

This letter report constitutes our deliverable for the 2006 project titled "Caribou Along The Alpine Pipeline." It summarizes data on caribou distribution and movements in 2006 in the area surrounding the Alpine Pipeline, extending from the Alpine project facilities on the central Colville River Delta east to the processing facilities at Kuparuk CPF-2.

Please contact either one of us with any questions or requests for further information.

Thank you,

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Senior Scientists
ABR, Inc.

Introduction

The State of Alaska's Right-of-Way Lease/Grant Stipulation 2.6.1 states that the pipeline systems carrying liquids between the Alpine Development Project and the Kuparuk Oilfield "…shall be maintained to avoid significant alteration of caribou and other ungulate movement patterns. The Commissioner may require additional measures to mitigate impacts to ungulate movements."

This letter report addresses the stipulation by summarizing data from 2006 on caribou distribution and movements in the area crossed by the Alpine Pipeline between the Colville River delta and Kuparuk Central Processing Facility 2 (CPF-2). The data were derived from surveys conducted for two larger projects carried out under contract to ConocoPhillips Alaska, Inc. (CPAI): the Greater Kuparuk Area (GKA) mammal study (Lawhead and Prichard 2007) and the Alpine Satellite Development Program (ASDP) caribou monitoring study (Lawhead et al. 2006b; 2007).

Study Area

The Alpine Pipeline extends ~55 km (34 mi) from the processing facilities at the Alpine CD-1 pad to those at Kuparuk CPF-2. The Colville East aerial survey area encompasses most of the length of this pipeline between the Colville River delta and the Kuparuk CPF-2 area and extends from the Beaufort Sea coast inland 48–56 km (30–35 mi) (Lawhead and Prichard 2006a).

The Alpine pipeline was constructed in the winter of 1998–1999. ABR conducted aerial surveys of caribou in the area of the pipeline corridor both before (1992–1998) and after construction (1999–2006) (Lawhead and Prichard 2007).

Methods

Two methods were used to examine caribou distribution and movements. Aerial surveys provided information on caribou distribution and radio-telemetry provided information on movements by individual caribou.

A fixed-wing airplane (Cessna 185 or 206) was used to survey systematically spaced strip transects (50% sampling coverage) twice during the calving season in 2006 (3–5 June and 11–12 June) and once during postcalving (20 June). The early calving survey was timed to coincide with the approximate peak of calving (estimated as 2 June; S. Arthur, ADFG, pers. comm.) and the later calving survey was near the end of calving. Detailed methods used for transect surveys were described by Lawhead and Prichard (2007).

Radio-telemetry data from caribou collared with satellite and Global Positioning System (GPS) transmitters in the Central Arctic Herd (CAH) and Teshekpuk Herd (TH) by the Alaska Department of Fish and Game (ADFG) and North Slope Borough (NSB) Department of Wildlife Management were provided by those agencies under data-sharing agreements for the ASDP caribou monitoring study (Lawhead et al. 2007). The GPS collar data from ADFG that were used in this analysis were for the period January–October 2006 and only included caribou locations within a 48-km (30-mi) radius of the Alpine CD-4 pad (hereafter referred to as the study area). Telemetry data allowed examination of movements by specific collared individuals in relation to the Alpine Pipeline. GPS collars provide the finest scale of resolution of caribou movements with the highest degree of accuracy and precision and the most frequent position fixes (5-h interval for CAH, 2-h interval for TH) (Lawhead et al. 2007).

All caribou outfitted with GPS collars were adult females. GPS collars were deployed on CAH caribou in March 2005 and March 2006 while they were on winter range in and near the Brooks Range (Arthur and Del Vecchio 2005; S. Arthur, ADFG, pers. comm.); some collars may have been deployed in September 2004 as well, but the specific history of each collar was not available. GPS and satellite collars were deployed on TH caribou by ADFG in July 2006 around Teshekpuk Lake (Lawhead et al. 2007). Satellite collars provided locations accurate to within 1 km and 1–2 location fixes daily (Lawhead et al. 2006b, 2007). Both female and male caribou of the TH were outfitted with satellite collars, but the majority of collars were put on females.

Results

Transect Surveys

Systematic surveys of strip transects provided a good picture of caribou distribution during the calving season. In 2006, the highest densities of calving caribou occurred southeast of the Alpine Pipeline in the Kuparuk South calving survey area, which typically has contained the highest densities of calving caribou in most years since 1993 (Lawhead and Prichard 2007). In some years, such as 2004 and 2005, the highest densities during calving occur in the Colville East survey area (Lawhead and Prichard 2005, 2006b). In the Colville East survey area, the greatest density of calving activity tends to occur inland away from the coast, south of the Alpine Pipeline (Lawhead and Prichard 2006b, 2007). This inland/coastal gradient is reflected by the data on estimated density (Table 1), which showed greater numbers and densities south of the Alpine Pipeline on both calving surveys in June 2006, as in 2005 (Lawhead and Prichard 2006a). About 35% of the calving survey area was located north of the Alpine Pipeline and 16% and 13% of the numbers of groups and total caribou, respectively, were found there on the first calving survey; the comparable proportions on the second calving survey were 21% and 13% respectively. The numbers in the southern part of the survey area increased during mid-June as more caribou continued to move into the area from the south, in advance of mosquito harassment.

Table 1. Number of groups and caribou observed and estimated density of all caribou and calf caribou in the Colville East survey area during early calving (3–5 June), late calving (11–12 June), and postcalving (20 June) surveys in 2006.

Survey	Location [a]	Area Sampled (km²)	No. of Groups	Total No. of Caribou	No. of Calves	Total Density	Calf Density
Early [b]	North	248	9	14	3	0.051	0.011
	South	470	48	91	11	0.181	0.022
Late	North	248	66	261	75	0.508	0.146
	South	470	253	1,767	436	1.868	0.461
Postcalving	North	254	23	163	35	0.642	0.138
	South	594	78	1,043	173	1.756	0.291

[a] North or South of Alpine pipeline.
[b] Sightability Correction Factor was applied to density estimates due to patchy snow cover (Lawhead and Prichard 2007).

On 20 June 2006, shortly before mosquito harassment began for the season, 2,412 caribou were estimated in the Colville East survey area (Lawhead and Prichard 2007). The area sampled on that date (848 km²) was larger than during calving (718 km²); 30% of the survey area was south of the pipeline and contained 23% of the groups and 14% of the individuals, proportions that were slightly greater than on the second calving survey. The situation changed dramatically within the next week, however. By 26 June, four days after mosquito emergence was first noted and a day after severe mosquito harassment began, all caribou had vacated the survey area, presumably having moved northeast toward mosquito-relief habitat at and near the sea coast (Lawhead and Prichard 2007).

Movements of GPS-collared Caribou

CAH collars, 2006 — Of the GPS-collared sample of 29 female CAH caribou, 20 different individuals entered the study area at least once in 2006 and 14 of those animals crossed the Alpine Pipeline at various times (Figure 1). The other 9 collars were distributed elsewhere in the CAH range (S. Arthur, ADFG, pers. comm.). The 14 collared caribou that crossed the Alpine Pipeline did so at least 91 times during spring and summer 2006, an average of 6.5 crossings each: 6 crossings in May, 7 in June, and 78 in July. All of the July crossings occurred between 6 and 15 July. A large number of collared caribou were in the area in mid-July and crossed the pipeline repeatedly, presumably in response to changes in weather conditions that caused fluctuations in mosquito harassment, which caused caribou to seek relief along the coast.

May — Eleven different GPS-collared caribou entered the study area in the second half of May 2006. Two of those caribou crossed the Alpine Pipeline and were north of the Spine Road at the end of May. The rest remained south of the Alpine Pipeline, mostly east of the Tarn and Meltwater Roads.

June — Eleven different GPS-collared caribou entered the study area during June 2006. The two collared caribou that were north of the Alpine Pipeline at the end of May both crossed back to the southern side of the pipeline in June. One additional caribou crossed the Alpine Pipeline and proceeded to cross the Oliktok Point Road. All 11 animals moved out of the study area to the east after mosquito harassment began in late June.

July — Sixteen different GPS-collared caribou entered the study area in July 2006, crossing the Alpine Pipeline repeatedly as they moved back and forth between inland foraging areas south of the pipeline and coastal mosquito-relief areas north of the pipeline. Most of the collared caribou moved into the study area from the southeast on 4–5 July. Eleven caribou crossed the pipeline while moving north on 8 July and then moved inland again on 9–10 July, with many crossing back to the south side of the Alpine Pipeline. They moved back toward the coast on 11 July, with 11 caribou crossing the Alpine Pipeline going north. Caribou moved farther inland to the east on 12–13 July and then moved west on 14 July. On 15 July, high temperatures and low winds presumably resulted in high insect harassment and 10 caribou in the area moved rapidly east along the coast while 3 others moved inland past CPF-2. No GPS-collared caribou remained in the study area after 19 July. Of the 16 caribou in the study area at least once in July, 14 (87.5%) crossed the Alpine Pipeline at least once.

August — No GPS-collared caribou were in the study area in August 2006.

September — Ten GPS-collared caribou entered the study area in September 2006, but none came near the Alpine Pipeline. Most remained east of the DS-2P (Meltwater) access road.

October — Four GPS-collared caribou entered the study area in October 2006, but none came near the Alpine Pipeline. Most remained near or east of the Meltwater road.

TH collars, 2006 — Of the 12 GPS collars that were deployed in the TH in July 2006, none came anywhere near the Alpine Pipeline in 2006. Eight of those collared caribou traversed the southern edge of the study area and crossed the Colville River to the east during fall migration in October 2006, well south of the Alpine Pipeline. They continued east toward the Dalton Highway and the Trans-Alaska Pipeline. Hence, they did not provide any additional information on the influence of the Alpine Pipeline.

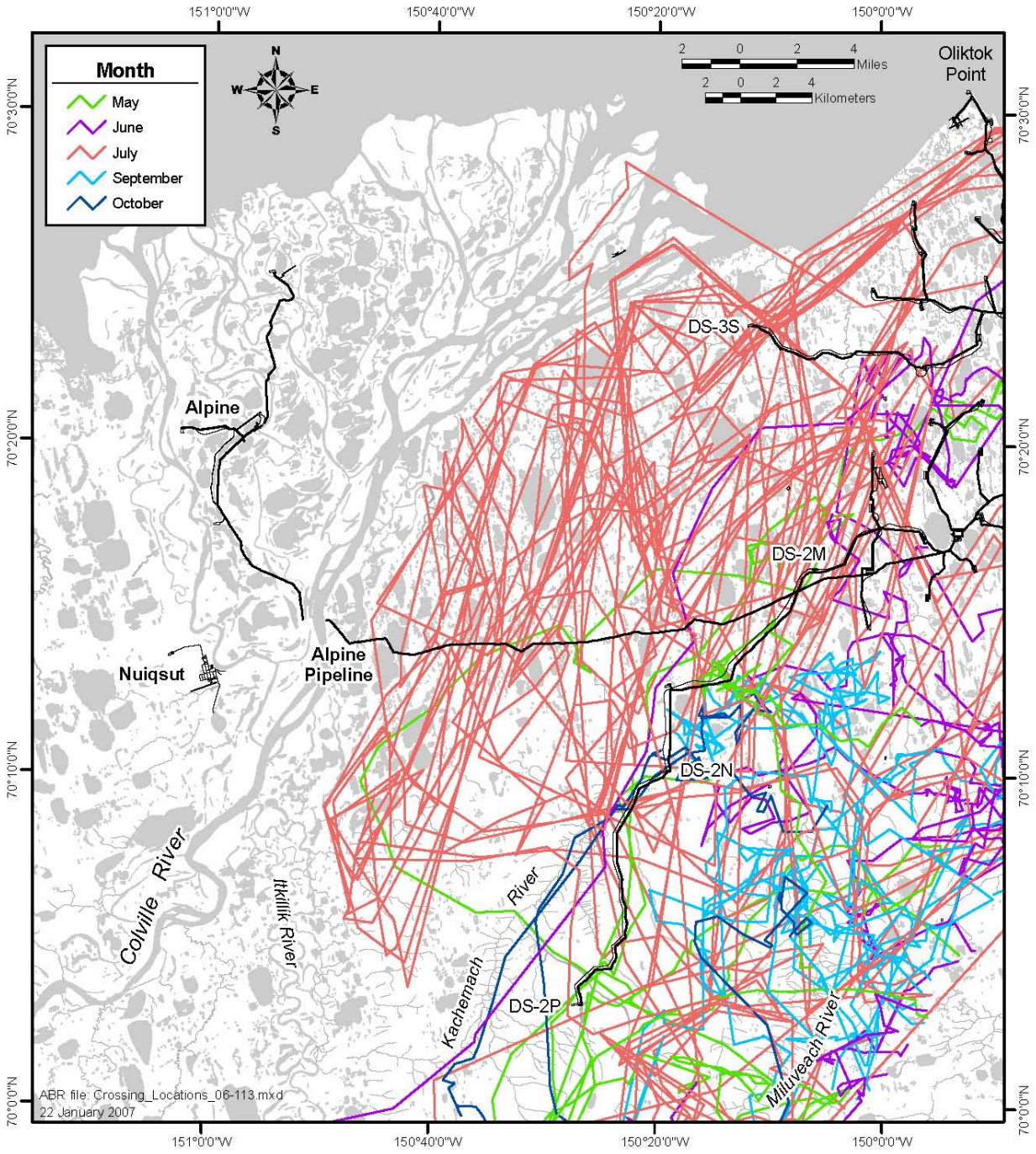

Figure 1. Movements of 20 GPS-collared CAH caribou in the vicinity of the Alpine Pipeline corridor, May–October 2006.

Movements of Satellite-collared Caribou

No CAH caribou were outfitted with satellite transmitters in 2006, but two satellite-collared caribou from the TH crossed the Alpine Pipeline in June 2006.

Caribou 0512 was a male, collared in July 2005, that spent much of the winter of 2005–2006 in the Brooks Range foothills along the Dalton Highway near Toolik Lake. It moved northwest in spring 2006 and crossed the Alpine Pipeline about 21 June, then crossed the Colville River delta to the west and moved northeast of Teshekpuk Lake by late June.

Caribou 0406 (collar 59096) was a female that was outfitted with a GPS collar during 2004–2005 and then was refitted with a satellite collar in July 2005. After crossing the Colville and Itkillik rivers eastbound in mid-September 2005, she crossed to the north side of the Alpine Pipeline on 22–24 September and then recrossed to the south on 24–25 September. This animal overwintered in the upper Sagavanirktok River drainage east of the Dalton Highway. She began the northward migration in May 2006 and remained west of the Meltwater road during calving before crossing to the north side of the Alpine Pipeline on 13–14 June 2006. She subsequently crossed the Colville River delta westbound in mid-June and moved northeast of Teshekpuk Lake by late June.

Discussion and Conclusions

The combined results of systematic aerial-transect surveys and telemetry data from GPS- and satellite-collared caribou provided indirect and direct evidence, respectively, of crossings of the Alpine Pipeline in 2006. The densities of caribou north of the pipeline during the calving season were lower than they were south of it, but that result was consistent with the expected gradient of higher density inland during calving observed in previous years. Caribou densities north and south of the pipeline during the postcalving survey on 20 June 2006 were similar to the proportions seen during the calving surveys.

As the movements of GPS-collared caribou demonstrated, CAH caribou crossed the Alpine Pipeline frequently during 2006. Northward crossings of the pipeline occurred during May and June as caribou moved toward the coast during the calving and postcalving periods, especially after mosquito harassment began. Most crossings occurred during the insect season, a highly dynamic period between late June and early August when caribou movements are affected primarily by changing weather conditions and the resulting levels of insect activity (Curatolo and Murphy 1986, Murphy and Lawhead 2000). The movements of caribou during the insect season are predictable in terms of general responses to the ebb and flow of insect harassment, but movements through specific areas are determined by complex interactions involving previous locations of the caribou; current air temperature, wind speed, and wind direction; solar radiation; and the seasonal chronology of insect emergence and life spans. CAH caribou typically move to the coast and Colville River delta when mosquito harassment occurs in late June and July, then move inland again to preferred foraging areas when mosquito harassment abates due to cooler temperatures or higher winds. A prominent issue in oil and gas development has been whether these north–south movements in response to changing weather and insect activity will be limited by the presence of development infrastructure or activity (Murphy and Lawhead 2000). The CAH GPS-collar data set demonstrated that caribou frequently crossed the Alpine Pipeline during the insect season in 2006, often crossing and recrossing on the same day or successive days, indicating that the Alpine Pipeline was not impeding caribou movements.

Most movements by collared CAH caribou, which have experience negotiating oilfield infrastructure and thus are more likely to be habituated, did not suggest delays in crossing. The limited data from TH caribou, which have less exposure and experience negotiating oilfield infrastructure, suggest that they also were able to cross the Alpine Pipeline successfully. It must be borne in mind that telemetry data are suggestive rather than conclusive in interpreting pipeline crossing behavior, because no one witnessed the encounters and other factors potentially affecting pipeline crossings (such as snow cover, weather conditions, insect activity, intraspecific behavioral interactions) were undocumented. It is possible that telemetry locations spaced 5 hours to a day apart could obscure delays or aborted crossings, but the multiple documented crossings and analysis of movement rates (ABR, Inc., unpublished data) indicate that caribou that approached the Alpine Pipeline were able to cross with little or no delay. On the basis of the available data, therefore, we conclude that the Alpine Pipeline was not significantly altering caribou movement patterns during periods for which movement data were available (spring, summer, and fall) and that no additional mitigation is necessary beyond the elevated design of the pipeline (minimum height 1.5 m [5 ft] above ground level). This conclusion is consistent with previous research and reviews (Curatolo and Murphy 1986, Cronin et al. 1994, Lawhead et al. 2006a) regarding the ability of caribou to cross under pipelines elevated to a minimum height of 1.5 m (5 ft) during snow-free periods.

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