FEDERAL AID FINAL RESEARCH PERFORMANCE REPORT

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF WILDLIFE CONSERVATION
PO Box 115526
Juneau, AK 99811-5526

PROJECT TITLE: Development of methods to assess effects of oil field infrastructure on caribou movements, growth, and survival

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FEDERAL AID GRANT PROGRAM: Wildlife Restoration

GRANT AND SEGMENT NO.: W-33-5 through W-33-12

PROJECT NO.: 3.49

WORK LOCATION: Units 24A, 25A, 26B, and 26C, eastern Brooks Range

STATE: Alaska

PERIOD: 1 July 2006–30 June 2014

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

This project was designed to complete collection and analysis of data concerning movements, growth rates, and survival of caribou from the Central Arctic herd (CAH) in relation to the oil field complex near Prudhoe Bay, Alaska. Data collection for this work began in 2001 as part of project 3.46. In addition, this project supported the work of 2 postdoctoral scientists in developing new methods of modeling movements of animals using data collected using GPS radio collars. These models will be used to assess potential effects of anthropogenic disturbance on movements and habitat use of caribou, and how changes in caribou behavior due to disturbance may affect growth and survival of caribou calves.

The CAH was estimated to consist of approximately 67,000 caribou in 2011, and is used extensively for sport and subsistence harvests, as well as wildlife viewing and other nonconsumptive uses. Although the herd increased during previous phases of development in the Prudhoe Bay and Kuparuk oil fields, most of the increase occurred outside of developed areas. Because previously-developed areas continue to be used for oil production, and are thus of low value as caribou calving habitat, further development is likely to reduce the habitat available for calving. One recent study (Wolfe 2000) has indicated that past development has displaced caribou to habitat of poorer quality than areas that were used before development occurred. Because the herd is currently at much higher density than during previous development phases, any negative effects on calf production or survival will have greater influence on growth of the herd. In addition, increased knowledge of the suitability of various habitats for caribou calving will

facilitate the development of effective mitigation measures that may reduce impacts of future development projects.

II. REVIEW OF PRIOR RESEARCH AND STUDIES IN PROGRESS ON THE PROBLEM OR NEED

Previous studies indicated that during the calving season (late May to late June) pregnant caribou cows and those with newborn calves avoid areas subject to disturbance caused by human activities associated with oil extraction (Dau and Cameron 1986, Cameron et al. 1992, Nellemann and Cameron 1996). For example, during the 1990s, the area of greatest concentration of calving by CAH shifted southward as development of oil-related infrastructure occurred in what was originally the core calving area (Lawhead and Johnson 2000). However, caribou males and nonpregnant females may habituate to some levels of oil field activity (Curatolo and Murphy 1986, Pollard et al. 1996) and it is unknown whether the shift in calving locations resulted in negative consequences for either calf production (birth rate) or calf survival. In fact, CAH increased from 19,000 to 67,000 caribou between 1991 and 2011 (Alaska Department of Fish and Game, unpublished data, Fairbanks). However, this increase occurred primarily in areas that were not affected by oil field infrastructure. Thus, possible effects of development on CAH may have been obscured by effects of unrelated events (primarily weather and cyclic changes in herd size).

III. APPROACHES USED AND FINDINGS RELATED TO THE OBJECTIVES AND TO PROBLEM OR NEED

OBJECTIVE 1: Estimate annual pregnancy and birth rates for caribou cows.

JOB/ACTIVITY 1A: Locate radiocollared caribou cows during June to determine parturition rates and initial calf survival.

Fifty-nine radiocollared caribou cows (≥3 years old) were located during 1–7 June 2007. Of these, 39 were pregnant and 16 were accompanied by calves. Parturition rate was 93%. Fifty-seven cows were located during 21–22 June, of which 46 (81%) were accompanied by calves. These rates were unchanged when only cows ≥4 years old were included (n = 55 and 53 cows for early and late June, respectively). No further work was planned or conducted under this project after June 2007 (monitoring continues under ADF&G's survey and inventory program).

OBJECTIVE 2: Estimate survival of female calves to yearling age class and determine causes of mortality.

JOB/ACTIVITY 2A: Monitor radiocollared calves to estimate survival rates.

Of 34 calves that had been radiocollared during early June 2006 (under project 3.46), 32 were alive in July 2006 and were monitored through early June 2007 to estimate survival rates. These included 15 from the eastern calving area and 17 from the western calving area (calving areas were either east or west of the Sagavanirktok River). Survival of the 2006 cohort through August was 1.00 for calves from the eastern area, whereas summer survival for western calves was 0.88 (2 deaths during July–August). Annual survival rates for the 2006 cohort were 0.70 and 0.43 for the eastern and western calving areas,

respectively. No further work was planned or conducted on this objective after June 2007. A complete description and summary of results of the survival analysis was presented by Arthur and Del Vecchio (2009).

OBJECTIVE 3: Estimate rates of weight gain by calves during summer (June–September) and winter (September–March).

JOB/ACTIVITY 3: Capture and weigh radiocollared calves in September and March.

Thirty radiocollared calves were captured by net-gunning in September 2006 and 18 were captured in March 2007. Weights and metatarsus lengths were recorded on each occasion. No further work was planned or conducted on this objective after March 2007. A summary of birth weights, metatarsus lengths, and growth rates was presented by Arthur and Del Vecchio (2009).

OBJECTIVE 4: Determine characteristics of physiography and vegetation at calving sites and assess changes in these that may occur over time.

JOB/ACTIVITY 4A: Determine habitat characteristics of calving sites.

Data collection concluded in June 2006 (project 3.46).

OBJECTIVE 5: Develop methods to model movements of caribou cow–calf pairs during summer to estimate exposure to human disturbance and use of habitats.

JOB/ACTIVITY 5A: Develop models of caribou movements.

Twenty-eight caribou cows equipped with GPS collars were monitored between June 2006–March 2007. Twenty-four of these were captured by net-gun during March 2007 and their collars removed. The remaining 4 collars were recovered on 3 July 2007 after the programmed release mechanisms caused the collars to fall off the caribou. Data were downloaded from the collars and will be analyzed to assess movement patterns. In October 2010, a cooperative agreement was signed between ADF&G and the University of Idaho (UI). This agreement provided funding to UI to cover partial salaries of a research professor (O. Garton), research scientist (J. Horne), and postdoctoral researcher (K. Nicholson), to develop models for analyzing animal movements using autocorrelated data from GPS collars. The term of the agreement was from 1 October 2010 through 30 June 2012. The final report from that project is attached as a separate pdf (see full citation in Section IX:Appendix).

OBJECTIVE 6: Monitor movements of caribou to determine areas used for wintering, and fidelity of cows to specific calving areas.

JOB/ACTIVITY 6A: Locate radiocollared cows during March to determine areas used for wintering and during early June to assess fidelity to calving areas.

Wintering distribution was assessed by radiotracking cows and calves during March 2007. Fifty-eight cows and 26 calves were located. The greatest concentrations of collared caribou were in Gates of the Arctic National Park, south of the crest of the Brooks Range, or along the northwestern boundary of the Arctic National Wildlife Refuge, in the northern foothills of the Brooks Range. Some additional caribou were in the Middle Fork Chandalar River and the Wind River. Further details were presented by

Arthur and Del Vecchio (2009). No further work was planned or conducted on this objective after March 2007 (monitoring continues under the ADF&G survey and inventory program).

OBJECTIVE 7: Estimate size of the herd using a complete aerial photocensus.

JOB/ACTIVITY 7A: Conduct a photographic census of CAH.

A photocensus was not conducted during 2006 or 2007 due to failure of the herd to aggregate. No further work was planned or conducted under this project after June 2007 (monitoring continues under the ADF&G survey and inventory program).

OBJECTIVE 8: Analyze and publish results.

JOB/ACTIVITY 8A: Prepare annual report, travel to meetings.

An interim progress report was prepared and distributed to cooperators and other interested individuals (Arthur and Del Vecchio 2009). In addition, presentations were made at the annual meeting of *The Wildlife Society* in September 2006 and at the North Slope Science Initiative caribou workshop in February 2007.

IV. MANAGEMENT IMPLICATIONS

Seasonal ranges of CAH were similar in size between summer and winter ($\bar{x}$ = 28,863 and 26,585 km^2, respectively, Section IX:Appendix; Nicholson et al., submitted). Overlap between consecutive summer and winter ranges varied from 3.3 to 18.2%. Percent overlap between summer ranges used during consecutive years ($\bar{x}$ = 62.4%) was higher than for winter ranges ($\bar{x}$ = 42.8%), suggesting that either habitat requirements of caribou were more specific during summer, or that conditions on winter ranges were more variable. Caribou used multiple migration routes each year, but some areas were used by large numbers of caribou during all years. In particular, large numbers of caribou migrated along the Ribdon River and crossed the Dalton Highway between the Kuparuk and Ribdon Rivers during both spring and fall, suggesting that this area should be managed to allow for continued access by caribou (Section IX:Appendix).

Initial work with modeling caribou movements during summer suggests that these models will be useful in quantifying effects of human disturbance on caribou during summer (Section IX:Appendix). Additional models are planned to further investigate these effects. Results of this work will be presented in future reports.

V. SUMMARY OF WORK COMPLETED ON JOBS IDENTIFIED IN ANNUAL PLAN FOR LAST SEGMENT PERIOD ONLY

JOB/ACTIVITY 5: Data analysis, report writing, and travel.

None.

VI. ADDITIONAL FEDERAL AID-FUNDED WORK NOT DESCRIBED ABOVE THAT WAS ACCOMPLISHED ON THIS PROJECT DURING THE LAST SEGMENT PERIOD, IF NOT REPORTED PREVIOUSLY

None.

VII. PUBLICATIONS

None.

Literature Cited:

ARTHUR, S. M., AND P. A. DEL VECCHIO. 2009. Effects of oil field development on calf production and survival in the Central Arctic herd. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration, Final Research Technical Report 1 July 2001–30 June 2006, Project 3.46, Juneau, Alaska.

CAMERON, R. D., D. J. REED, J. R. DAU, AND W. T. SMITH. 1992. Redistribution of calving caribou in response to oil field development on the Arctic Slope of Alaska. Arctic 45:338–342.

CURATOLO, J. A., AND S. M. MURPHY. 1986. The effects of pipelines, roads, and traffic on the movements of caribou, *Rangifer tarandus*. Canadian Field–Naturalist 100:218–224.

DAU, J. R., AND R. D. CAMERON. 1986. Effects of a road system on caribou distribution during calving. Rangifer Special Issue No. 1:95–101.

LAWHEAD, B. E., AND C. B. JOHNSON. 2000. Surveys of caribou and muskoxen in the Kuparuk–Colville Region, Alaska, 1999, with a summary of caribou calving distribution since 1993. Final Report prepared for Phillips Alaska, Inc. by ABR, Inc., Fairbanks, Alaska.

NELLEMANN, C., AND R. D. CAMERON. 1996. Effects of petroleum development on terrain preferences of calving caribou. Arctic 49:23–28.

POLLARD, R. H., W. B. BALLARD, L. E. NOEL, AND M. A. CRONIN. 1996. Summer distribution of caribou, *Rangifer tarandus granti*, in the area of the Prudhoe Bay oil field, Alaska, 1990–1994. Canadian Field–Naturalist 110:659–674.

WOLFE, S. A. 2000. Habitat selection by calving caribou of the Central Arctic herd, 1980–1995. Thesis, University of Alaska Fairbanks, Alaska.

VIII. RESEARCH EVALUATION AND RECOMMENDATIONS(optional)

None.

IX. APPENDIX

See separate PDF submitted with this report:

HORNE, J. S., E. O. GARTON, AND K. L. NICHOLSON. 2012. Modeling caribou movements in relation to oil field infrastructure: Developing tools for assessing the effects of human activities on wildlife. Final, unpublished report submitted to collaborators: Stephen Arthur and Scott Brainerd, Alaska Department of Fish and Game, Fairbanks, Alaska.

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