

**Alaska Department of Fish and Game
Wildlife Restoration Grant**

GRANT NUMBER: W-33-8

PROJECT NUMBER: 6.14

PROJECT TITLE: Effects of snowshoe hare population cycles on demography of Dall sheep and their predators

PROJECT DURATION: 1 July 2003–30 June 2012

REPORT PERIOD: 1 July 2009–30 June 2010

REPORT DUE TO HQ: 1 September 2010

PRINCIPAL INVESTIGATOR: Stephen M. Arthur

WORK LOCATION: Central Alaska Range, Unit 20A

COOPERATORS: Alaska Chapter, Foundation for North American Wild Sheep;
University of British Columbia

I. PROBLEM OR NEED THAT PROMPTED THIS RESEARCH

Dall sheep (*Ovis dalli*) populations in the central Alaska Range (CAR) declined by an estimated 60% from 1984 to 1994, a period when the snowshoe hare (*Lepus americanus*) population reached a peak and then declined. Lamb production from 1991 to 1993 averaged only 12 lambs per 100 ewes. Causes of the decline in sheep numbers are unknown, but severe winters, dry summers, and predation may have been involved. Recent studies indicated that coyotes (*Canis latrans*) and golden eagles (*Aquila chrysaetos*) were the major predators of Dall sheep lambs in the CAR. However, little is known about population levels of coyotes and eagles in the area or how these may change in response to changes in abundance of the snowshoe hare, which is their major prey species. Thus, increased understanding of factors that influence populations of Dall sheep and their predators will benefit a variety of management programs.

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

At northern latitudes, snowshoe hares are an important prey of coyotes, at least when hare populations are abundant. In the CAR, hares made up 58% of the diet of coyotes during a peak in the hare population. However, coyotes also eat a variety of other mammals and birds, and fluctuations in hare populations may affect populations of these alternate prey by altering the amount of predation that occurs. A decline in hare abundance may have either positive or negative effects on alternate prey, depending on the degree to which predators respond functionally (by switching among prey species) or numerically (through reduced fecundity and increased dispersal and mortality). In addition to hares,

coyotes in the CAR also commonly prey on Dall sheep lambs, and predation accounted for approximately 92% of all lamb mortality during a period of increasing hare abundance. Annual survival of lambs was 48–65% early in the increasing phase of the hare cycle, and declined to 17–27% when the hare population reached its maximum. Thus, any changes in predation rates that occur as a result of changes in populations of hares may have pronounced effects on Dall sheep recruitment and survival. However, the nature and magnitude of these effects during periods of hare scarcity have not been documented.

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

This study will complete the data analysis and publication of results of fieldwork conducted during 1999–2005, primarily under federal aid project 6.13.

IV. MANAGEMENT IMPLICATIONS

In northern areas where snowshoe hares undergo dramatic population cycles, predator-caused mortality of Dall sheep lambs may periodically exceed sustainable levels. Therefore, long-term persistence of sheep in these areas may depend on the ability of the sheep population to grow sufficiently during low and intermediate phases of the hare cycle so as to accommodate periodic declines when hares and their predators are abundant. Managers should be aware that lamb mortality rates may differ greatly among years. Some of these changes can be predicted based on changes in snowshoe hare populations, especially in areas where coyotes and golden eagles are present. This knowledge should help managers interpret results of periodic sheep population surveys and identify potential causes of population fluctuations.

V. SUMMARY OF WORK COMPLETED ON JOBS FOR LAST SEGMENT PERIOD ONLY

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

Accomplishments: Analysis of lamb survival rates in relation to hare abundance was completed and a manuscript was prepared and submitted to *The Journal of Wildlife Management*. This manuscript was reviewed, revised, and accepted for publication. These results were presented at the March 2010 annual meeting of the Alaska chapter of *The Wildlife Society* and the June 2010 symposium of the *Northern Wild Sheep and Goat Council*.

VI. PUBLICATIONS

ARTHUR, S. M., AND L. R. PRUGH. 2010. Predator-mediated indirect effects of snowshoe hares on Dall's sheep in Alaska. *Journal of Wildlife Management* 74:In press.

VII. RECOMMENDATIONS FOR THIS PROJECT

Data analysis is continuing for future publications.

PREPARED BY: Stephen M. Arthur

DATE: 20 August 2010