

THE EPIZOOTIOLOGY OF PROTOSTRONGYLOSIS IN A POUDRE RIVER BIGHORN SHEEP HERD

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INTRODUCTION

An epizootiology study of protostrongylosis in Rocky Mountain bighorn sheep was conducted on the Cache La Poudre drainage in north central Colorado from July 1974 through November 1975. The study area is located approximately 45 miles west of Fort Collins, Colorado. The sheep inhabit a deep rugged canyon, using the steep south facing slopes on the north side of the river almost exclusively. Altitudes in the study area vary from approximately 7,000 feet to 9,900 feet. This region is composed of both upper and lower montane regions as described by Marr (1961). The steep slopes are vegetated primarily with browse plants, big sagebrush (*Artemisia tridentata*) and bitterbrush (*Purshia tridentata*), as well as assorted grasses. Douglas fir (*Psuedotsuga* sp.) and lodgepole pine (*Pinus contorta*) occupy ridge tops with groves of aspen (*Populus tremuloides*) dominating more moist regions. The climate is composed predominantly of hot, dry summers and cool winters, with most moisture occurring in late winter and early spring in the form of wet snow and rain.

Bighorn sheep were present when the first white men came to the area, probably in the early 1700's. Market hunting did take place in the Poudre River area in the 1860's, but later, laws were passed to control the hunting of deer, elk, antelope, and bighorn sheep. However, by the early 1940's personnel of the Colorado Game and Fish Department were quite positive that bighorn sheep had been extirpated from the area. As a result, 16 bighorn sheep were trapped at Sugarloaf Mountain in the Tarryall Mountains of central Colorado and transported to the Cache La Poudre River area and released approximately 3 miles west of the Zimmerman Ranch on 6 December 1946. The three rams, six ewes, three yearlings, and four lambs provided the nucleus for the herd presently using the area.

Colorado Division of Wildlife personnel estimated the bighorn sheep herd consisted of approximately 75 individuals in 1970 (Bear and Jones 1973). However, current observations indicate the herd is considerably larger.

OBJECTIVES

1. Determine the larval output of lungworm (*Protostrongylus* spp.) in fecal pellets of the sheep.

2. Identify snail intermediate hosts, determine densities of snails, and determine the extent to which these snails are infected.
3. Determine lamb survival of the study herd.

METHODS AND MATERIALS

Lungworm larvae in bighorn sheep fecal pellets were monitored by collecting and analyzing 220 fecal samples. The samples were air dried and Baermanized. Larvae were counted utilizing a gridded petri dish and a dissecting microscope, resulting in numbers of larvae per gram of air dry fecal material.

Snails were collected, identified, and examined for infection by lungworm larvae. A snail sampling method was devised, utilizing randomly selected plots on systematically located transects. Two transects located on north-south and east-west coordinates were selected and a total of 40 randomly selected 10 centimeter square plots located along the transects were searched for terrestrial snails. Six sets of the above described transects were established, searched, and evaluated. Snails collected yielded data on densities of snails and rate of infection by larvae of Protostrongylus spp.

Lamb survival was monitored by conducting periodic lamb:ewe ratio counts and comparing ratios as the summer progressed.

A concurrent project by the Colorado Division of Wildlife on extending bighorn sheep ranges resulted in the trapping and marking of 37 bighorn sheep, 26 of which were transplanted approximately 18 airline miles down river, to the east of the current bighorn sheep range. The observation of marked animals provided valuable information on movements as well as group interactions.

RESULTS

Of the fecal samples collected and analyzed, 91 percent (200) contained Protostrongylus spp. larvae. Monthly means of lungworm larvae from fecal samples showed seasonal fluctuations as noted by other investigators (Pillmore 1955, Forrester and Senger 1964). The peak month of larval output was April, with a mean of 654.2 larvae per gram of feces. Lungworm larvae were found in lamb fecal material collected in early July 1975, indicating the probability of transplacental transmission of lungworms occurring in this herd of sheep.

The survey of intermediate host snails yielded 648 snails, of which 197 were alive. Of the 197 snails, 145 were known intermediate hosts for Protostrongylus spp., and 3.44 percent (5) of these live snails were infected with the larval Protostrongylus spp.

Lamb survival was monitored throughout the study, with lamb:ewe ratios of 55 lambs per 100 ewes occurring in December of 1974, and 32 lambs per 100 ewes occurring in November 1975.

DISCUSSION

The monthly means of lungworm larvae in fecal material is considered low or moderate when compared to results obtained by Uhazy et al. (1973). However, a trend seems to have been established showing increased larval output in the months of August and September of 1975 when compared to means of larval output of the same months in the previous year. This trend is evidently continuing, as fecal samples collected by Wild Animal Disease Center personnel at Colorado State University during January 1976 show a significant increase in larvae when compared to the means of samples collected in January 1975. This increase could be indicative of a decline in overall condition of the herd. The probability of transplacental transmission of lungworm larvae could be a mechanism causing lamb mortalities in this herd, as has been shown to occur in other herds of bighorn sheep in Colorado (Hibler et al. 1972).

Rates of infection of intermediate host snails by lungworm larvae are low at 3.44 percent, however, collection of snails in late spring and early summer may have yielded a far greater number of snails and possibly a considerably higher infection rate in snails.

Lamb survival at 32 lambs per 100 ewes is fairly low, and is a 42 percent decrease from the previous year's ratio of 55 lambs per 100 ewes. The survival rate decline is in correlation with increasing larval production in fecal samples, disregarding all other variables. The 1975 lambing season in the Poudre River area was hit by inclement weather. Unseasonable snow and low temperatures occurred in May and continued into the second week of June. This unusual weather may have increased neonatal deaths on the different lambing grounds in the Poudre River area. However, the Pikes Peak area received severe weather in the form of deep snows on 31 May 1975 (24 inches) and 7 June 1975 (20 inches). These snows persisted for at least 2 weeks. Lamb survival in the Pikes Peak herd was 93 lambs per 100 ewes as of July 1975 and 82 lambs per 100 ewes as of 31 December 1975 (Schmidt 1976). The Pikes Peak herd had been treated with Cambendazole to kill third stage larvae in the ewe and prevent transplacental transmission of Protostrongylus spp.

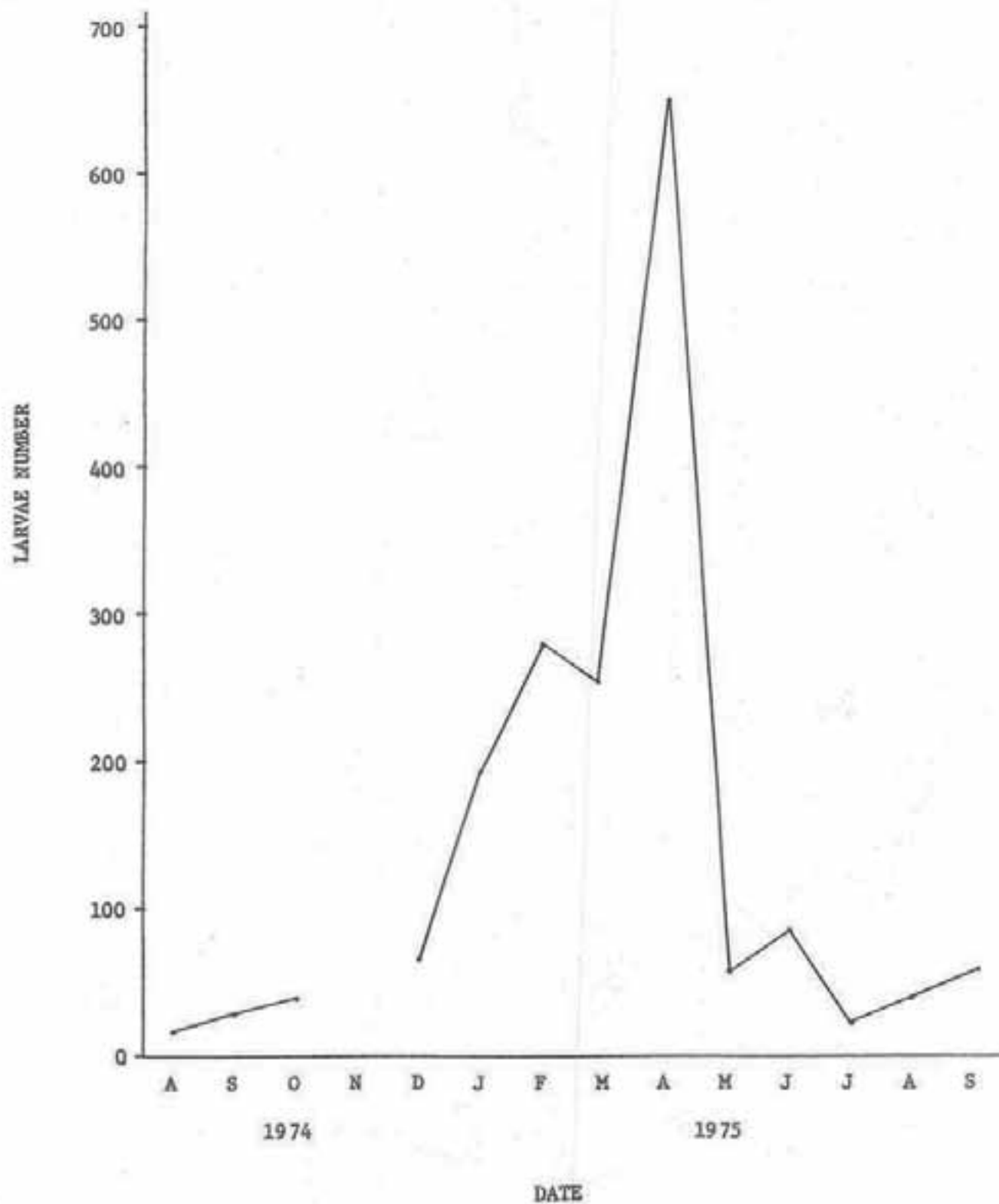
The probability remains that moderate levels of lungworm infection are causing lamb mortalities through the mechanism of transplacental transmission of the third stage larvae to the fetus. To what extent this alternate method of infection of lambs is occurring, is impossible to determine at this time in the Poudre River bighorn sheep herd.

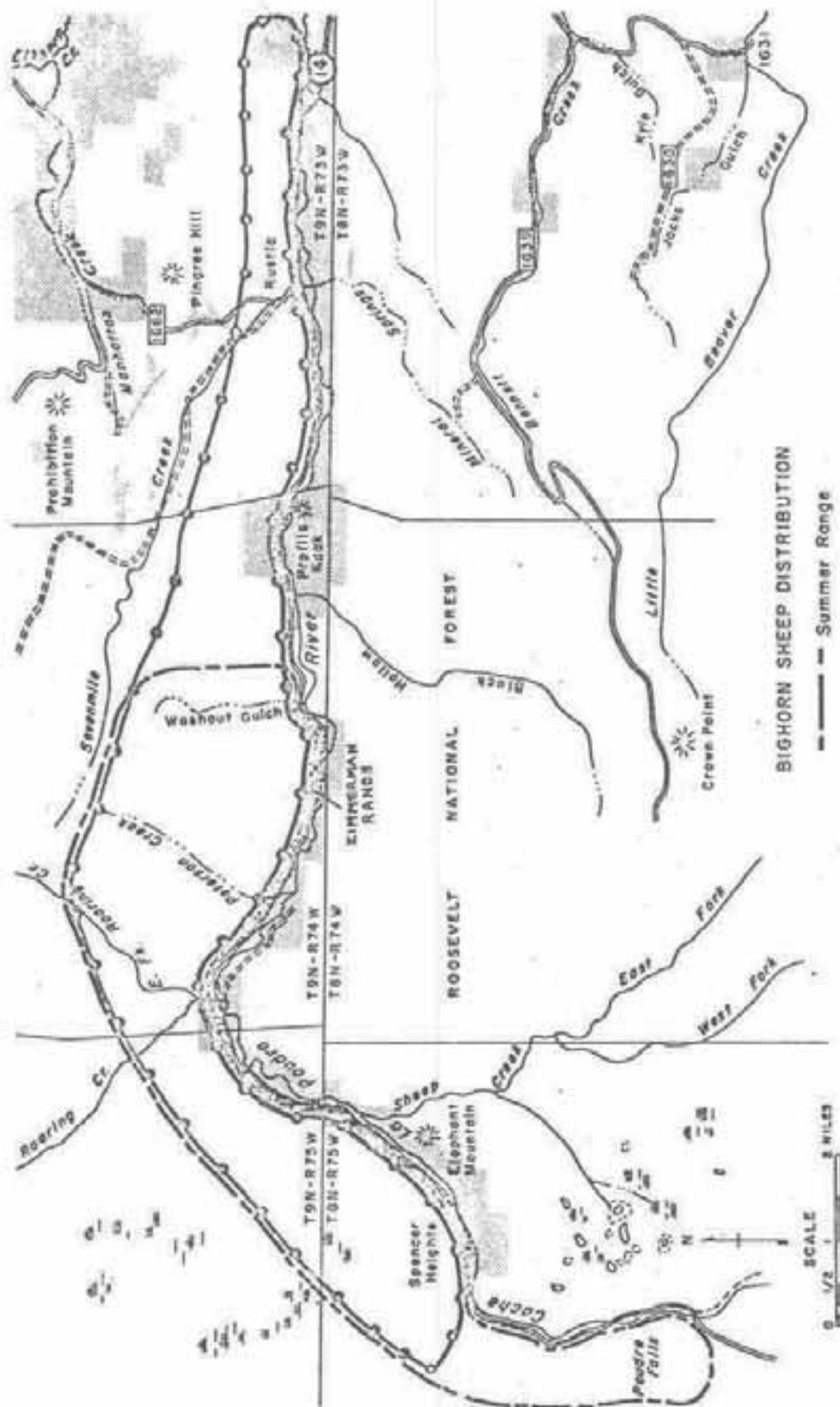
Literature Cited

- Bear, G. D., and G. W. Jones. 1973. History and distribution of bighorn sheep in Colorado. Fed. Aid Rept., Project No. W-41-R-22. Colo. Div. of Wildl., Denver. Jan:1-231.
- Forrester, D. J., and C. M. Senger. 1964. A survey of lungworm infection in bighorn sheep of Montana. J. Wildl. Manage. 28(3):481-491.

- Hibler, C. P., R. E. Lange, and C. J. Metzger. 1972. Transplacental transmission of Protostrongylus spp. in bighorn sheep. *J. Wildl. Dis.* 8(4):389.
- Marr, J. W. 1961. Ecosystems of the east slope of the Front Range in Colorado. *Univ. Colo. Studies. Series in Biol.* 8:1-134.
- Pillmore, R. 1955. Investigation of the life history and ecology of the lungworm Protostrongylus stilesi. Fed. Aid Rept., Project No. W-41-R-7. Colo. Game and Fish Dept., Denver. Jan:61-74.
- Schmidt, R. 1976. Personal communications. Senior Conservation Aid. Colo. Div. of Wildl., Fort Collins, Colo.
- Uhazy, L., J. Holmes, and J. Stelfox. 1973. Lungworms in the Rocky Mountain bighorn sheep of western Canada. *Can. J. Zoo.* 51:817-829.

Monthly Means of Lungworm Larvae
(*Protostrongylus* spp.) in Bighorn Sheep Fecal Pellets





BIGHORN SHEEP DISTRIBUTION

- Summer Range
- Winter Range

Bighorn sheep distribution, Cache la Poudre River.
 Map used by permission of Bear and Jones (1973).