WINTER HABITAT PREFERENCES OF BIGHORN SHEEP IN THE MUMMY RANGE, COLORADO[1]

TIMOTHY G. BAUMANN, Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins Colorado 80521

DAVID R. STEVENS, United States National Park Service, Estes Park, Colorado 80517

ABSTRACT

Winter distribution and habitat preferences of bighorn sheep (Ovis canadensis canadensis) were studied in the Mummy Range, Rocky Mountain National Park, Colorado by ground and aerial observations of 257 bighorn bands during 1968-1976. Intensive field study conducted during 1974-1976 indicated that mature rams remain spatially segregated from ewes and subadults during January through May. Ewe-subadult bands drifted among tundra winter ranges and low elevation ranges in the upper montane forest during winter. Bands of mature rams remained on discrete tundra ram winter ranges throughout winter. Both ram and ewe-subadult bands exhibited a preference for southfacing regions of tundra where topographic and vegetational diversity are maximum. Regional topography and weather minimize snowfall and snow accumulation in the Mummy Range making a variety of vegetational types accessable to bighorn sheep during winters of normal precipitation.

INTRODUCTION

The objective of this paper is to describe winter habitat preferences, group composition and range use patterns exhibited by a remnant herd of

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[1]The United States National Park Service financed field research conducted during this study. Data gathered during the 1974-1976 period are the subject of the Senior author's Master of Science thesis.

Rocky Mountain bighorn sheep in the Mummy Range of north central Colorado. The size of range of this herd have been greatly reduced since 1900 when the resort community of Estes Park was settled. Early sightings recorded by National Park Service personnel indicate that ewe-subadult bands occupied low elevation winter ranges which are characterized by bunch grass meadows and granitic cliffs. Loss of low elevation ranges near what is now Estes Park resulted in lungworm-induced die offs and precipitated the decline of this herd. Recent aerial surveys have indicated that a remnant herd has occupied the southern Mummy Range since the late 1960's.

STUDY AREA

The Mummy Range study area is located within the north-east quadrant of Rocky Mountain National Park roughly 72 km south of the Colorado-Wyoming border. The area lies immediately east of the Continental Divide near the northern terminus of Front Range. Average total monthly precipitation recorded at Estes Park is about 1.8 cm per month for January and February and 3.5 cm per month during March and April. Mountains in the vicinity are composed of Precambrian schist, gneiss and granite. Topographic features characteristic of valley glaciation are prominent throughout the study area. Elevations range from 2400 m at valley floors to 4100 m near mountain summits. Treeline occurs near 3400 m; roughly one-half of the study area lies above this elevation and is covered by rock outcrops, talus and tundra vegetation. Dense stands of subalpine spruce-fir forest cover approximately three-eights of the area. Stands of ponderosa pine (Pinus ponderosa), Douglas fir (Pseudotsuga menziesii), and aspen (Populus tremuloides) are interspersed with xeric bunch grass stands and mesic-hydric meadowlands in the upper montane zone below 2800 m. Vegetational associations characteristic

of the area have been described by Marr (1961), Willard (1963), and Stevens (1970).

Neighboring bighorn herds occur to the north, west, and south, of the Mummy Range. These herds are separated by straight line distances of 5-25 km. Movement data necessary to evaluate the genetic status of these herds and the potential for gene flow among them is essentially non-existent at present.

METHODS

Winter distribution patterns of bighorn sheep were determined by ground and aerial observations of 257 bands recorded beween 1968 and 1976. Date, time, location, aspect, slope, vegetational cover and age-sex composition were recorded for each band observed. Bighorn sheep were classified according to Geist (1971).

Winter observations of sheep were recorded during yearly helicopter surveys conducted between 1968-1974, Intensive ground surveys were carried out during the November to May periods of 1974-1975 and 1975-1976. Supplementary observations were obtained during helicopter surveys conducted during the winters of 1975 and 1976. Population size and composition estimates were constructed on the basis of maximum non-duplicate class counts recorded during 1974-1976.

Climatological data were recorded at the Estes Park U.S. Weather Bureau station (2300 m) which is located on the south-eastern edge of the Mummy Range. Snow depth data were recorded at monthly intervals by U.S. National Park Service personnel along three U.S. Soil Conservation Service snow courses adjacent to the study area.

RESULTS AND DISCUSSION

Herd Size and Composition

A herd of 50-60 bighorn sheep occupied approximately 80 km^2 (32 square miles) of the southern Mummy Range during this study. Ram to ewe ratios were estimated at 185/100 during 1975 and 167/100 during 1976. Yearling and class I rams formed 58 percent of the ram segment of the herd during 1975 and 48 percent during 1976. Class II, III, and IV rams, in aggregate, accounted for less than 50 percent of rams wintering in the Mummy Range during 1974-1976. Estimates of lamb to ewe ratios (including yearling and adult females in the ewe class) were 54/100 during 1975 and 67/100 during 1976.

Group Composition and Range Use Patterns

Limited observations recorded during 1974 and 1975 rutting seasons indicated that mixed sex groups were widely distributed on south-facing slopes of the upper montane forest and alpine tundra between 2550 and 3950 m. Average band size was 7 sheep during the rut.

Mature rams disassociated from ewe-subadult bands during January and remained on discrete alpine tundra ram ranges during winter and spring. These ram winter ranges are located on the periphery of ewe-subadult winter ranges, in the most remote regions of the study area, and observations of ram bands have been limited. Average band size for 14 ram bands observed during 1968-1976 was 5 rams. Class I and II rams were commonly associated with class III and IV rams and accounted for 61 percent of all rams observed in such bands during 1974-1976.

Average ewe-subadult band size was 6 sheep during winter. Composition

of 111 ewe-subadult bands observed during winter was 46 percent ewes and yearling females, 29 percent yearlings, class I and class II rams, and 26 percent lambs. Successive relocations of ewes identified by broken horns indicated that ewe-subadult bands drifted among tundra and upper montane forest winter ranges by traveling along ridgetops and through open stands of subalpine conifers, where snow accumulation was limited by wind.

Habitat Preferences

Both ram and ewe-subadult bands exhibited a preference for south-facing regions of tundra during winter. Ninety-seven percent of all bands located on alpine tundra were sighted on south aspects (Fig. 1). Tundra winter ranges inhabited by rams and those used by ewe-subadult bands are characterized by similar topography. Unglaciated 30-45° slopes are juxtaposed to 50-60° cliffs which have been formed by valley glaciation and subsequent weathering. Kobresia-dominated sedge-grass turf stands are interspersed among rock and forbs on open unglaciated slopes. Kobresia stands are wind-swept and remain snow-free throughout winter. Vegetation is patchy and sparsely distributed among rock outcrops on cliff sites which extend down to treeline near 3400 m. Hairgrass (Deschampsia) is associated with sedges, rushes, clover (Trifolium) and Potentilla in drainage depressions on cliff faces. Cushion plant associations occur on relatively steep, coarse and unstable soil sites interpersed among rock outcrops. Small stands of Kobresia-dominated turf occur on stable, well-developed soil sites among the cliffs.

Fifty-one percent of all bands observed on tundra winter ranges during 1974-1976 were located on 40-45° slopes and 37 percent were seen in 50-60° cliff terain (Fig. 2). Winter activity of bighorn sheep was centered about

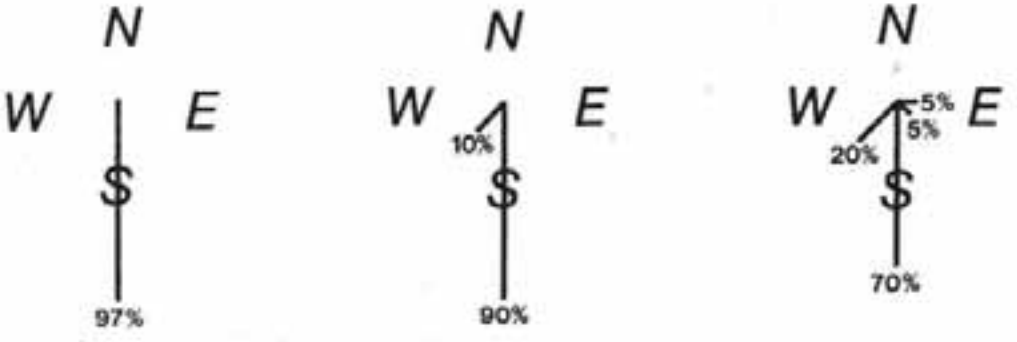
WINTER

(JANUARY-MARCH)

UPPER MONTANE FOREST	SUBALPINE FOREST	ALPINE TUNDRA
(N = 36 bands)	(N = 16 bands)	(N = 43 bands)

SPRING

(APRIL-MAY)



UPPER MONTANE FOREST	SUBALPINE FOREST	ALPINE TUNDRA
(N = 89 bands)	(N = 30 bands)	(N = 20 bands)

Fig. 1. Seasonal distribution of bighorn sheep observed in the Mummy Range, Colorado, 1975-1976, by aspect and vegetational regions. Percentage totals less than 100 indicate that remainder of observations occurred on level ground.

the rimrocks which separate 40-45° slopes from 50-60° cliff terrain. Sheep utilized a variety of vegetational associations on these two topographic types (Fig. 3). Preferences in cover type use related to seasonal variations in snow depth and quality can not be demonstrated by data collected during this study. Thermal eddies and strong northwesterly winds rapidly removed light accumulations of dry powder snow from cliff sites following winter storms during December-February.

Deeper accumulations (0.3-1 m) of wet snowfall were generated by upslope storms during the transition from winter to spring. Snowfall during March and April was generally not accompanied by the strong persistent winds of early winter. In the absence of wind, avalanche and melt removed accumulations of wet snow from tundra winter ranges at a slower rate.

Intermittent use of upper montane winter ranges by ewe-subadult bands was restricted to a 45° south-facing slope between 2550 and 2750 m; located above a mineral lick. This one remaining low elevation range represents approximately one-fifth of the total area of low elevation ranges used by this herd during the early 1900's. Open stands of aspen and ponderosa pine are interspersed with shrubs, bunch grasses, and granitic benches and boulders on this south slope. Common shrubs include choke cherry (Prunus virginiana), juniper (Juniperus communis), bitterbrush (Purshia tridentata), hollygrape (Mohonia repens), squaw current (Ribes cereum), and wild rose (Rosa sp.). Grasses of common occurrence include wheatgrasses (Agropyron spp.), bluegrasses (Poa spp.), bromes (Bromus spp.), and mountain muhly (Muhlenbergia montana).

Early winter snow accumulations on this low elevation range rarely exceeded 20 cm during the January-February periods of 1975 and 1976.

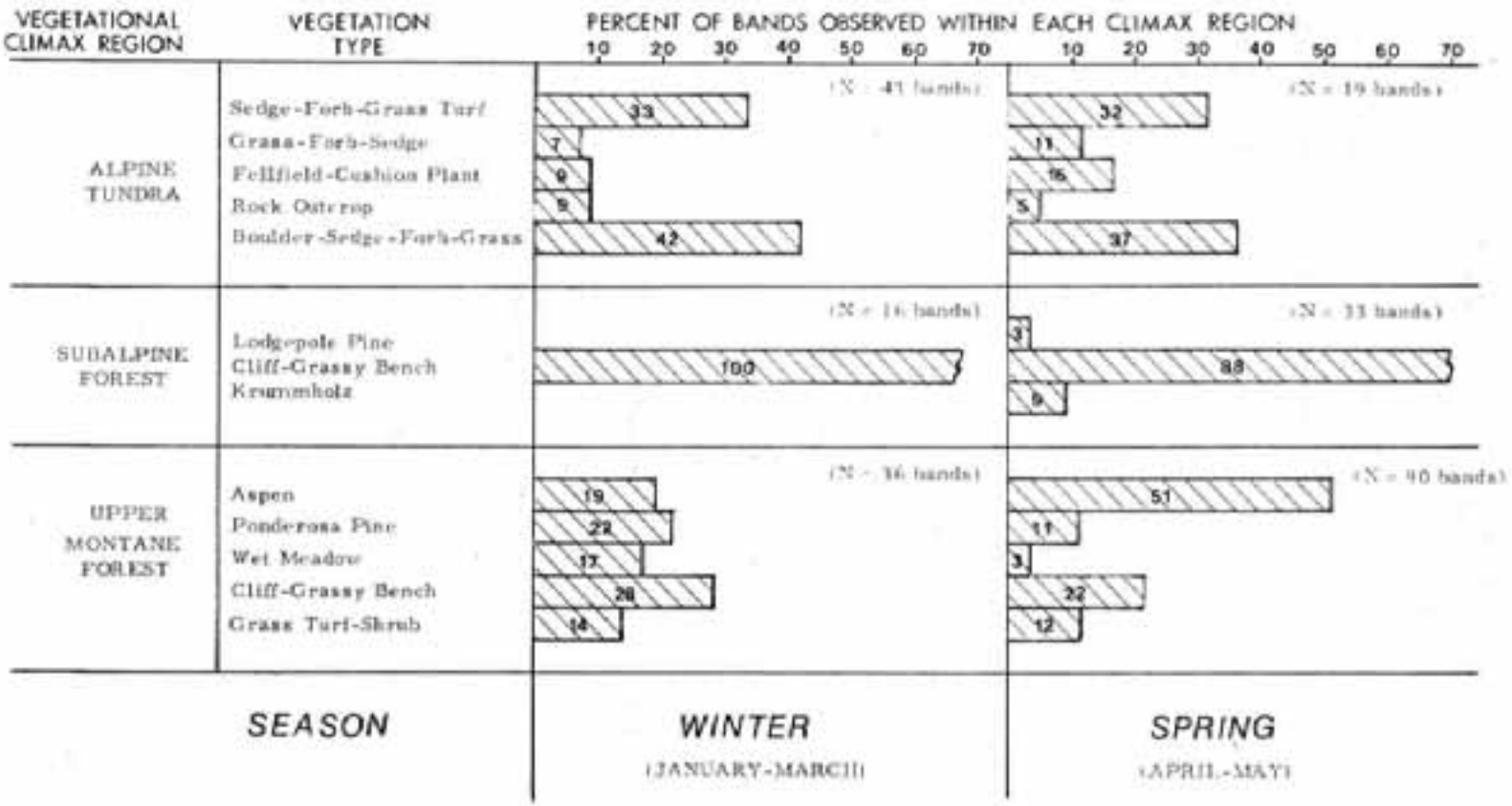


Fig. 3. Seasonal distribution of bighorn sheep observations recorded in the Mummy Range, Colorado, 1975-1976, by vegetational types.

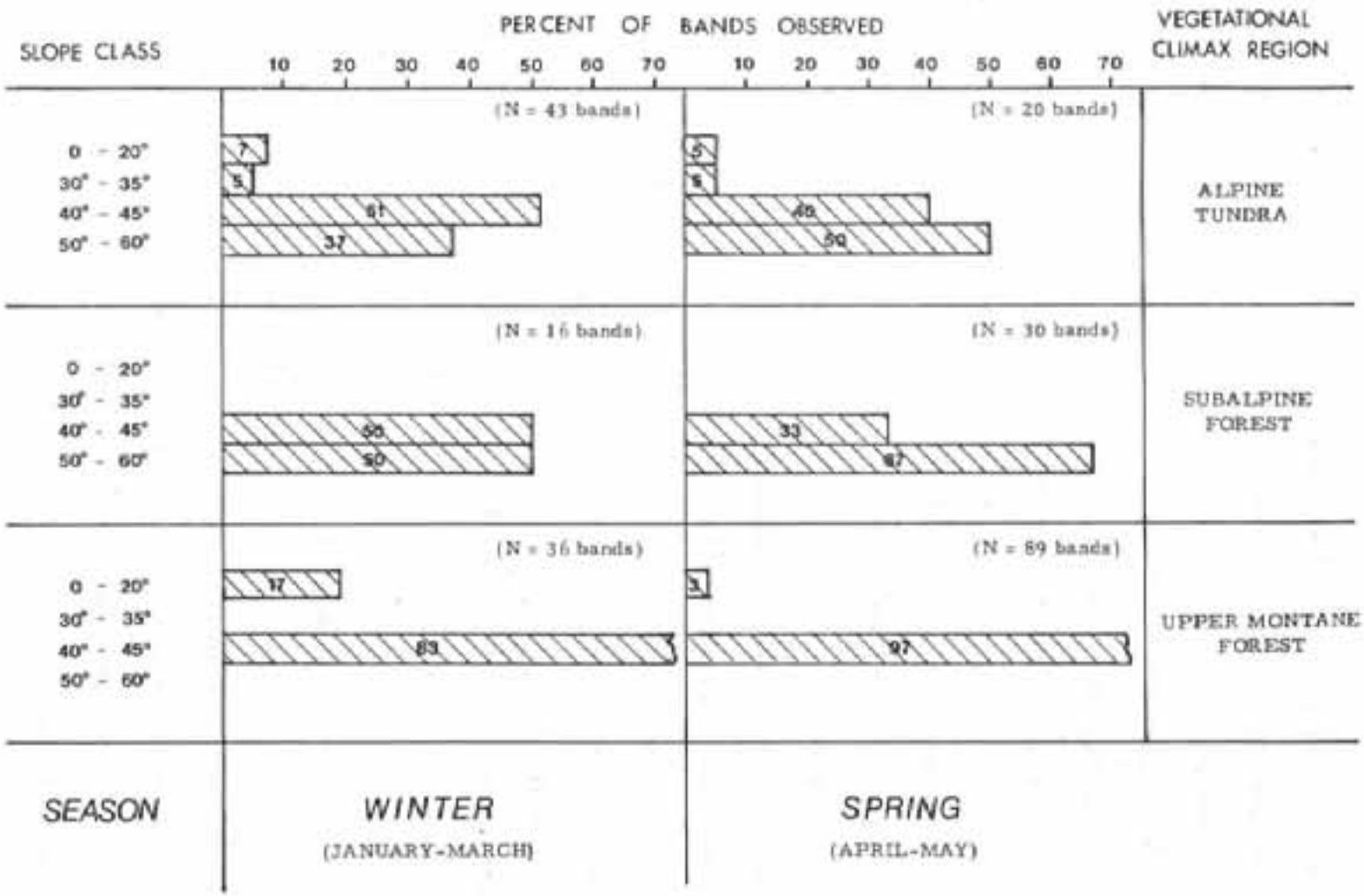


Fig. 2 . Seasonal distribution of bighorn sheep observations recorded in the Mummy Range, Colorado, 1975-1976, on four discrete classes of slope.

Wind swept snow out of bunch grass stands and into the trees, rapidly opening up the areas preferred by sheep. Late winter storms produces 30-50 cm snow accumulations which gradually melted on south-facing sheep range. Crusted and persistent snow cover was not observed on low elevation range during the 1974-1976 study period.

Total monthly precipitation recorded at Estes Park was 50 percent of normal between January and February and 74 percent of normal between March and April during winters of 1975 and 1976. Monthly snow depths for corresponding time periods along three snow courses in the subalpine forest (between 2800-3100 m) adjacent to the study area, were 95-102 percent of normal. These data illustrate the effect of wind on snow accumulation in the subalpine forest where snowfall is supplemented by wind-deposited snow. Similarly, they emphasize the effect of wind on bighorn sheep winter ranges in this region. Clearly, winter wind is a significant "welfare factor" for these sheep and the severity of winter is dependent upon its intensity.

Recent studies of winter habitat ecology of Rocky Mountain bighorn sheep by Petocz (1973), and Geist and Petocz (1977) indicate that winter snowfall and deep frozen snow accumulations influence bighorn behavior and habitat selection in the Canadian Rockies. While similar reations to occasional heavy snowfall may occur in the Mummy Range, it appears that local interactions of regional weather with topography limit snowfall and accumulation below levels common on sheep range in the northern Rocky Mountains. Winter habitat preferences exhibited by bighorn sheep in the Mummy Range indicate that this remnant herd is able to utilize a variety of vegetational communities by concentrating on tundra winter ranges where topographic diversity is maximum that is, where open slopes are juxtaposed to cliffs.

Game managers frequently allude to cliff terain as an element of bighorn habitat necessary for escape cover; perhaps we should begin to investigate the importance of cliffs as an essential source of winter food for bighorn sheep as well.

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