MANAGEMENT AND RESEARCH ON BIGHORN SHEEP SUN RIVER AREA, MONTANA

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Abstract - Data for harvest by hunters and transplanting are discussed. Condition of ranges are compared to those in Idaho. Harvesting males has not caused the decline in ram populations reported for Idaho and Nevada. Classification data from 1955-1971 also show better lamb and yearling survival ratios than those reported by the above states. Weights for 213 animals are compared by sex and age class. Horn measurements for 145 females and 206 males are discussed for various age classes. Success of transplanting as a management technique is discussed.

Introduction

The Sun River area of Montana supports the largest bighorn sheep herd in the state. Minimum big game populations wintering in the area include 700 bighorn sheep, 2,400 elk and thousands of mule and white-tailed deer. The mule deer are the most numerous species. Domestic livestock including horses and cattle graze portions of the area.

The bighorn sheep hunting season was closed in 1912 and remained closed until 1953 when 15 3/4 curl ram permits were issued. Bighorn sheep populations reached very high levels in the 1920's and die-offs were recorded in 1924-25, 1927, 1929, 1932 and 1936. Elk populations were greater in that period than at present and large die-offs of elk were recorded in 1929. Deer populations reached their highest peak in recorded history during the late 1950's.

In 1929 a large irrigation dam was completed in Sun River Canyon and the filling of the reservoir covered some big game winter range and blocked migration routes. Another result of the dam building was that as many as 5,000 cattle which had formerly grazed the National Forest for six months of the year were banished from the area by 1934.

Major forest fires occurred in 1889, 1910 and 1919. Much of the present bighorn range is found in old burns. Some of the old burns have been restocked with timber, and conifers are also encroaching on other areas and reducing big game range.

Bighorn sheep trapping and transplanting was initiated in 1941 and 125 animals were removed by this method prior to 1967.

The first studies of the Sun River bighorn sheep were accomplished in 1941. (Couey, 1950). I worked on a food habits and range relationships study in the area in 1964 and 1965, and since have been associated with the area as a Game Management Biologist.

Methods

Composition of low growing vegetation was measured by the method of Daubenmire, 1959. Grass utilization was measured by the methods of Cole, 1958.

Bighorns were trapped in corral traps using hay and salt for bait. Both portable net traps and permanent wire and log structures were used. Snowmobiles and a helicopter were used to transport bighorn sheep from roadless areas.

Bighorn sheep were aged in the field with binoculars and a spotting scope. Yearling ratios were determined by classifying yearling males and assuming a like number of females were present. When the animals were handled, they were aged by the methods of Deming, 1952 and Geist, 1966.

Horns were measured around the outside of the curl, around the lowest portion of the horn base and from tip to tip.

Description of the Area

Bighorn sheep habitat in the Sun River area is located on the east face of the Rocky Mountains approximately 80 miles west of Great Falls, (Fig.1) Montana. According to Deiss (1943) the mountains were formed by the Lewis overthrust which moved Proterzoic and Palezoic shales and limestones over younger Mezozoic sediments. Glacial action and water erosion have modified the range to a characteristic series of closely spaced, parallel reefs running in a north to south direction. The reefs have steep east facing sides with vertical limestone cliffs several hundred feet high. West facing sides slope more gradually and are covered by scattered patches of conifer timber. Elevations vary from 4,590 feet at Gibson Lake to 9,392 on Rocky Mountain, the highest peak in the area. Tops of most of the reefs utilized for bighorn sheep winter range are from 6,000 to 7,000 feet in elevation. (Fig.2)

Climatological data recorded at Gibson Dam indicate mean temperature is 41.4 degrees with extremes of 100 and -42. Mean annual precipitation is 17.5 inches (U.S. Dept. Commerce Weather Bureau, 1929-65). Strong southwesterly winds, "chinooks", remove snow cover from southern and western exposures within a few days after snowstorms. Reef tops are also often blown bare.

Major grass species are bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis) and rough fescue (Festuca scabrella). Tree species common in bighorn sheep winter habitat include Douglas-fir (Pseudotsuga menziesii), limber pine (Pinus flexilis) and lodgepole pine (Pinus contorta).

Research and Management

Classification surveys have been made since 1955 (Table 1). Ratios of rams per 100 ewes indicate harvesting rams by hunting and transplanting has not caused the decline in ram populations reported by Hanson, 1967 and Morgan, 1970. Survival of lambs to six months of age averaged 47 per 100 ewes for the 1955-1972 period and the range was 34 to 59. This is considerably higher than that reported by the above authors also.

Grass utilization for 1967-71 is presented in Table 2. Use appears excessive in most cases if bunchgrass ranges are to be improved in condition. Because the bighorn sheep population seems to be increasing in size and some of the ranges are in a deteriorated condition, a program of trapping and transplanting has been attempted.

From 1967 through 1971 a total of 333 bighorns was trapped. A total of 235 was transplanted to other areas within Montana and the remaining 98 animals were individually marked and released in the vicinity of the traps. Since 1969, females released have been neckbanded and

males have been marked with large numbered eartags for an intensive movements study carried out by a graduate student. Rams were not marked with neckbands because of fear from some quarters that the capes would be damaged. No evidence of damage has been seen on ewe necks. The final report for the summer-winter ecology of the bighorns is due in June of 1972. Another researcher, utilizing marked animals also, will study the spring-fall ecology of the animals with a report due in 1973.

Winter weights for 157 females and 56 males trapped are listed in Table 3. A monthly breakdown of the data showed lambs gained weight and the other age classes lost weight during winters. Extreme weight losses were not noted.

Horn measurements for 145 females are given in Table 4. The measurements indicate difficulty would be encountered in segregating anything except lambs through field observations during the winter period.

Horn measurements for 50 males trapped are listed in Table 5. The data indicate serious overlap in horn measurements for the two and three year old age classes. Two animals from the two year class fell within the range of yearling males. Unless these animals were incorrectly aged, the overlap could bias field observations.

Overall, over 877 bighorns have been removed from the area since 1955 (Table 6). Since 1967, 186+ males have been removed by hunters and 52 by trapping and transplanting. Percentages by age classes for the 52 males transplanted since 1967 are as follows: 50 lambs, 33 yearlings, 11 two year olds and 6 three year olds.

Horn measurements for hunter kills are shown in Table 7. Measurements declined under the pressure from 60 3/4 curl permits combined with transplanting. Hunter success fell from the remarkably high 52 rams for 60 hunters in 1967 to 40 rams in 1969. A reduction to 40 3/4 curl permits in 1970 and 1971 allowed an increase in the ram horn size in 1971. The horns were nearly as large as the 1967 level in 1971.

Comparisons of the horn data for 1971 in the Sun River area and for Idaho bighorn sheep in 1966-67 is shown in Table 8. Horn size for the Sun River bighorns is nearly the same as those in Idaho with average ages of 4.5 and 7.7 years, respectively.

Apparently better range conditions are found in the Sun River area in comparison to the areas studied by Morgan, 1970 in Idaho. In Idaho, nine Daubenmire transect clusters showed a grass coverage of 12.4 per cent and a coverage of soil and erosion pavement of 42.3 per cent. Desirable components - grass, forbs, litter, and moss made up 34 per cent on the area sampled in Idaho. In the Sun River area data were gathered from bighorn sheep winter ranges by 33 Daubenmire transects (Schallenberger, 1965). Observations showed 92 per cent of the bighorn sheep were found on three habitat types. Grasses made up an average of 19.6 per cent of the coverage on these habitat types and ranged as high as 29.3 per cent in the bunchgrass habitat type on which bighorns often grazed. Soil and rock made up 39.6 per cent of the coverage. Low growing vegetation, measured by the Daubenmire system in the Sun River area, made up 41.5 per cent of the canopy coverage. Taller browse species were not measured by the method so the actual vegetative cover was even greater.

Effects of removal of bighorns from two apparently separate winter populations in Sun River Canyon were quite apparent in classification data (Table 9). The herd in upper Sun River Canyon lives under conditions of more deteriorated winter range, competition from elk, and greater snow depths than does the herd wintering in lower Sun River Canyon. In 1969, removal of 52 bighorns was accomplished on the ranges at the upper end of the canyon. Males removed included three lambs, two yearlings and two, two year olds. Females included 10 lambs, 5 yearlings, 7 two year olds, 4 three year olds and 19 which were 4 plus. In the winter following the removal, ram, lamb and yearling ratios were higher than for the two succeeding years in the head of the canyon. As population numbers built up again the ratios declined. In 1971, removal of 74 bighorns from the better range at the lower end of the canyon resulted in an increase in the ram and yearling ratios per 100 ewes. Males removed included 11 lambs, 7 yearlings, 1 two year old and 1 three year old. Females removed included 11 lambs, 6 yearlings, 4 two year olds, 5 three year olds and 25 four plus animals. Perhaps the lamb ratio per 100 ewes didn't increase because of the relatively high previous level and the fact that many one and two year old ewes remained in the population. These age classes may not have produced lambs.

Summary and Discussion

Data for the Sun River area shows that ram ratios per 100 ewes have not been greatly reduced by several years of limited permit hunting for 3/4 curl rams and additional harvest by transplanting. This is in contrast to results reported for Nevada and Idaho. Perhaps the stability in the Sun River area results from the better range conditions and better survival of lambs and yearlings.

Trapping and transplanting is not the final answer to keeping the Sun River bighorn population in balance with the range. As better bighorn habitats have been populated the success of the technique has declined.

Minimum costs of at least $40.00 per animal trapped cannot be justified for many years if transplanting success declines. Other environmental problems demand personnel and money.

The final solution may be to maintain the range in the highest possible condition through reduction of competing animal species, preservation of the wilderness habitat, creation of new range through forest fires and control of excessive bighorn populations through harvest of large rams with limited 3/4 curl or either-sex permits and harvest of ewes with limited ewe permits.

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Table 1. Bighorn sheep classifications 1955-72

Year	Lambs	Ewes	Lambs/100 Ewes	Rams	Rams/100 Ewes	Unk.	Total
1955-56	62	113	55	62	55	38	275
1956-57	54	125	43	61	49	88	328
1957-58	50	89	56	43	48	153	325
1958-59	67	117	57	55	47	25	274
1959-60	52	131	40	77	59	109	369
1960-61	69	117	59	48	41	64	298
1961-62	86	209	41	67	32	55	417
1962-63	0	0	0	0	0	0	0
1963-64	61	117	52	37	32	34	249
1964-65	527	1,306	40	632	48	0	2,465[1/]
1965-66	75	138	54	78	56	0	291
1966-67	98	289	34	108	38	0	495
1967-68	78	172	45	66	38	0	316
1968-69	111	281	40	78	28	20	490
1969-70	130	274	47	114	42	69	587
1970-71	150	326	46	111	34	2	588
1971-72	142	311	46	138	44	8	599

1/ Repeated observations of about 400 bighorn

Table 2. Grass utilization on bighorn sheep winter range in Sun River Area 1967-71

Year	Grass Species								
	Feid			Fesc			Agsp		
1967	8	77	60	3	93	74	7	96	77
1968	7	89	71	4	95	76	7	81	64
1969	7	64	49	3	77	60	7	70	54
1970	8	73	57	4	84	66	7	83	66
1971	9[1/]	85[2/]	67[3/]	4	93	74	9	87	69

1/ No. transects examined with 100 plants per transect
2/ No. plants grazed per 100
3/ Per cent weight utilization of plants

Table 3. Winter weights bighorn sheep 1967-71

Sex	1/2 No.	1/2 Ave.	1/2 Range	1 No.	1 Ave.	1 Range	2 No.	2 Ave.	2 Range	3 No.	3 Ave.	3 Range	4+ No.	4+ Ave.	4+ Range
Female	32	61	38-70	19	99	75-115	24	119	91-145	14	120	110-150	68	131	80-155
Male	26	66	48-97	12	111	85-140	10	154	135-175	7	150	125-186	1	190	

Table 4. Horn measurements for female bighorns trapped

Age	No.	Curl Circ. $\bar{X}$	Curl Circ. Range	Basal Circ. $\bar{X}$	Basal Circ. Range	Tip-Tip $\bar{X}$	Tip-Tip Range
1/2	21	3.0 [1/]	1.3-5.0	2.5	.7-43	4.8	2.6-6.5
1	16	6.6	3.2-8.2	4.5	3.4-4.9	7.8	5.6-12.5
2	23	8.2	5.3-10.3	4.8	3.6-6.4	8.6	6.0-12.0
3	14	9.0	7.3-10.4	5.2	4.8-5.5	9.9	7.5-13.0
4+	71	9.7	5.6-13.5	5.1	4.0-6.1	11.1	6.5-14.5

1/ Inches

Table 5. Horn measurements for male bighorns trapped

Age	No.	Curl Circ. $\bar{X}$	Curl Circ. Range	Basal Circ. $\bar{X}$	Basal Circ. Range	Tip-Tip $\bar{X}$	Tip-Tip Range
1/2	18	4.3[1/]	1.6-6.5	3.7	1.6-5.5	6.8	4.5-9.1
1	12	12.6	7.2-17.5	7.8	5.4-9.3	12.2	11.3-13.3
2	11	19.8	12.4-24.8	11.7	7.8-13.4	18.6	16.3-20.5
3	9	21.1	18.0-27.0	12.4	10.7-14.0	17.0	12.3-22.0

1/ Inches

Table 6. Bighorn sheep harvested 1955-71

Year	No. 3/4 Curl Permits	Rams Shot	Total Sheep Transplanted	Total
1955	20	12	0	12
1956	20	15	13	28
1957	40	32	7	39
1958	40	30	8	38
1959	40	35	13	48
1960	40	30	10	40
1961	40	32	9	41
1962	40	28	18	46
1963	40	31	0	31
1964	40	27	25	52
1965	40	37	0	37
1966	40	34	0	34
1967	60	52	49	101
1968	60	45	53	98
1969	60	40	57	97
1970	40	29	2	31
1971	40	20+ [1/]	84	104+

1/ Hunter questionnaire information not available for 1971.

Table 7. Hunter harvested ram horn measurements from Sun River

Year	Sample No.	$\bar{X}$ Curl Circ. Right	Left	$\bar{X}$ Basal Circ. Right	Left	$\bar{X}$ Tip-Tip	Score $\bar{X}$	Range
1966	25	31.9	31.7	14.9	15.1	19.5	114.5	89.5 122.5
1967	40	31.5	31.3	14.9	14.9	19.5	111.9	83.0 [illegible]
1968	25	31.2	31.2	15.1	15.1	20.0	[illegible]	92.0 145.1
1969	24	29.0	29.3	14.8	14.9	19.3	107.2	86.3 124.5
1970	22	27.3	28.0	14.6	14.6	19.1	104.1	91.8 120.0
1971	20	30.2[1/]	30.5	14.7	14.6	19.3	109.4[2/]	95.1 [illegible]

1/ Inches
2/ Sum of measurements

Table 8. Hunter harvested bighorn ram measurements

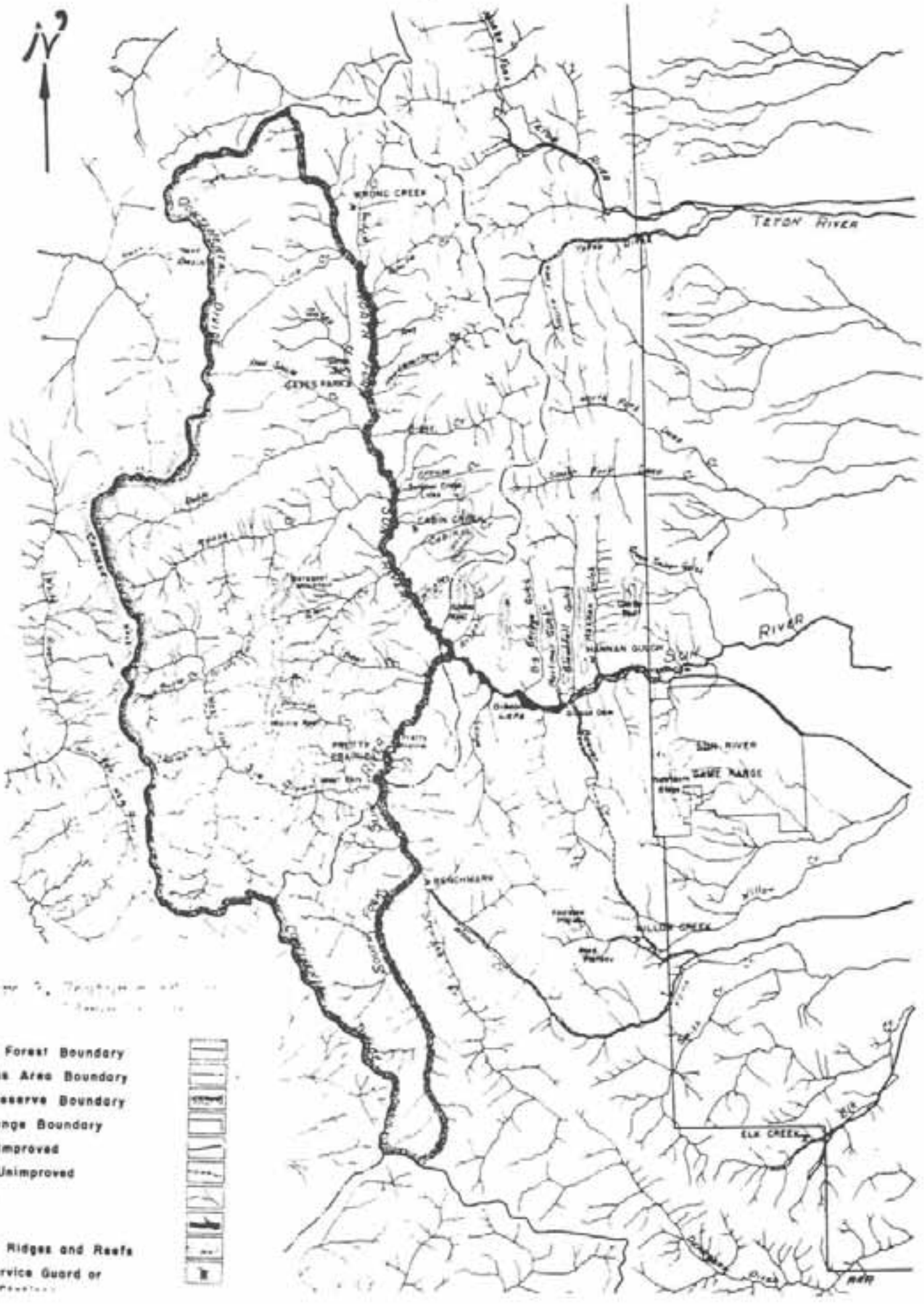
Date and Location	Sample No.	$\bar{X}$ Age	$\bar{X}$ Curl Circ. Right	Left	$\bar{X}$ Basal Circ. Right	Left	$\bar{X}$ Tip-Tip	$\bar{X}$ Score
1966-67 Idaho	29	7.7	31.5[1/]	30.9	14.2	14.0	19.8	110.4[2/]
1971 Montana Sun River Area	20	4.5	30.2	30.5	14.7	14.6	19.3	109.4

1/ Inches
2/ Sum of measurements

Table 9. Ram, lamb, and yearling numbers per 100 ewes

Location	Year	Rams	Lambs	Yearlings	Sample Size
Upper Sun Canyon	1969-70	52	48	39	122
	1970-71	31	34	30	216
	1971-72	39	39	29	233
Lower Sun Canyon	1969-70	36	53	56	191
	1970-71	36	54	49	201
	1971-72	55	51	79	161
Ford-Fairview	1969-70	47	37	46	128
	1970-71	43	55	35	109
	1971-72	58	53	58	84
Deep Creek	1969-70	45	47	41	102
	1970-71	29	51	26	63
	1971-72	34	49	43	126

Figure 1. Sun River Area


N
WRONG CREEK
TETON RIVER
GEMS RANGE
CABIN CREEK
SUN RIVER
SUN RIVER GAME RANGE
WILLOW CREEK
ELK CREEK
National Forest Boundary
Wilderness Area Boundary
Game Preserve Boundary
Game Range Boundary
Roads - Improved
Unimproved
Streams
Lakes
Mountain Ridges and Reefs
Forest Service Guard or

A. Schallenberger - Question Period

Q. You mentioned about 100 bighorns in a transplant. In how big an area did this take place?

A. This was down on a wildlife refuge on the Missouri River, a former Audobon Sheep Habitat. They built up a pasture of about 2,000 acres and put sheep in there in late 1950. The pasture was protected from cattle grazing but the whole area was overrun with sheep. Last year, three-quarters of the winter range was removed before the bighorn sheep started wintering there. They took hay off the area, cattle grazed part of the area, and we had a lot of snow, 2 to 3 feet deep. Even last fall, after a dry summer, sheep were hacking and coughing, the typical symptoms of lungworm. With the range in bad shape and the sheep down with lungworm, they will suffer with starvation this winter.

Q. When did the ram seasons occur?

A. Generally ran from about the 15th of September to about the 30th of November. A few years ago when we had sixty permits, the season ran to the end of December.

Q. What is the age structure of kill? Toward the tail end of the season are you taking more older rams or younger rams than in the beginning? In order to maintain your 4 1/2 year average, you must be taking 2 1/2 and 3 1/2 year old rams too?

A. No. Most of them were 4 1/2 or so. We had one 2 1/2 year old ram with 27" curl that got shot - an inch less than 3/4 curl standard - from the front horn, through the back of the eye to the horn again. Most of the sheep are taken late in the season - the latter part of November when they move down into accessible areas.

Q. You had a mean age of 4 1/2 years in last year's season?

A. Right.

Q. Where are the big rams?

A. We wiped most of the big rams out with 60 permits. They are just building back up again.

Q. Al, the figures on rams per 100 ewes - you included yearling ewes as well?

A. Right, we included all ewes.

Q. You took all your big rams then; you are averaging 32" 4 1/2 yr. of age - there are no big rams left? All you have left are 4 1/2 year old rams? Don't you think you are over-harvesting?

A. There are big rams left. As I told you, the sheep population is increasing. We have seen a number of real large rams this winter. We are recommending that for this coming year there be 40 either sex permits. We have seen 55 rams which we feel will be legal size next year.

Q. Then do you have a goal - a mean age goal type of thing - in the harvest? In other words, do you have a goal which you would like to reach, e.g. a mean age in the harvest of 4 1/2, 6 1/2 or 8 1/2?

A. No particular age goal. One of our goals is not to go the full curl ram hunting, or something like that. It is getting to be a monetary thing in Montana. We have some outfitters charging as much as $5,000 for a ram.

DIFFERENCE BETWEEN YEARS AND NUTRIENT CYCLES

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Sheep, (Ovis canadensis canadensis) along with most other ungulates of the mountainous areas of Canada, undertake seasonal migrations to and from high alpine ranges. The downward migration appears to be weather induced while the motivation for the upward movement appears to be food oriented. The known facts of phenology and the associated changes in the chemical composition of plants suggests that one of the probable advantages to be gained is improved nutrition.

A group of adult ewes (1967-68) were maintained on a variety of forages (ration 36-57, alpine, winter) which changed in quality with season. During 1968-69, two groups of yearling sheep were maintained, one on winter range forage year-round while the other was changed from winter to alpine range to simulate the normal migratory pattern.

The winters of 1967-68 and 1969-70 could be considered mild with a light snowfall and relatively mild temperatures. This resulted in a short critical winter period (January and February) of both years and an early spring green-up. Precipitation was lowered, presumably resulting in lowered productivity and reduced succulence of the forage. The light snowpack of the two years did not knock down over-wintering forage and therefore did not allow ungulates to graze much of the spring growth until it reached 4 to 6 inches in height and in some cases emerged from the previous years growth. Observations showed that considerably less spring growth had been grazed in 1968 than in 1969. This is believed to have reduced the average nutrient intake of sheep grazing on the winter ranges during the early spring. The proportion of old growth to new, available to sheep is shown in Table 1.

The winter of 1968-69, although harsh resulted in many beneficial side effects. The abnormal snow depths produced abundant soil moisture and resulted in greater subsequent forage productivity as compared to the summer of 1968. In June a record rainfall of 6.02 inches caused forage to remain green and succulent later into the summer and greatly aided productivity. The extreme weight and compaction of the winter snow flattened all of the past years growth and allowed spring growth to emerge from old growth when only one to two inches in height (Table 1). This resulted in deer, sheep and elk utilizing the earliest spring growth in late March and early April.

Observations on the grazing habits of a tame bighorn lamb indicated the difficulty of a grazing animal to select high quality feed when old growth protected new growing forage. Bighorns tend to pull