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INTERIOR SHEEP STUDIES

by
Wayne E. Heimer

Final Report
Federal Aid in Wildlife Restoration
Project W-17-7, Job 6.8R
and
Volume I
Project Progress Report
Federal Aid in Wildlife Restoration
Project W-17-7, Jobs 6.9R, 6.10R and 6.11R

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FINAL REPORT (RESEARCH)

State: Alaska

Cooperator: Wayne E. Heimer

Project No.: W-17-7 Project Title: Big Game Investigations

Job. No.: 6.8 R Job Title: Study Area Selection in the Tok Management Area

Period Covered: July 1, 1974 to June 30, 1975

SUMMARY

An aerial survey of a section of the eastern Alaska Range was performed in order to select an intensive study site in an area supporting Dall sheep of high quality. Sheep numbers, composition, mineral licks and suitable winter range were noted. Data were then evaluated, the various areas ranked according to sheep population quality indicators such as density and production and the optimum area selected.

BACKGROUND

Previous studies by the Alaska Department of Fish and Game (Heimer and Smith 1975) have shown that striking differences in Dall ram horn growth exist in the sheep (*Ovis dalli*) populations along the Alaska Range east of Mt. McKinley National Park. These studies were considered by the authors to be supportive of the "Quality Hypothesis" of Geist (1971). In part, this hypothesis states that differences in population quality exist between mountain sheep populations and that populations of higher quality are characterized by more rapid horn growth and larger horns at any given age than are low quality populations. The studies of Heimer and Smith (1975) indicate in addition that Dall sheep population quality (as interpreted from ram horn growth and size) is inversely related to population density.

Heimer and Smith (1975) divided the Alaska Range east of Mt. McKinley National Park into three areas for purposes of investigating sheep quality based on ram horn growth characteristics. These areas, from McKinley Park to the east, are: ARE I, from the Nenana River eastward to the Delta River; ARE II, from the Delta River eastward to the Johnson River and ARE III, from the Johnson River eastward to the Tok-Slana Road. In the quality ranking of Heimer and Smith (1975) ARE I was of very low quality, ARE II was of average quality, and ARE III was of very high quality. For these reasons it was decided to pursue a comparative study of Dall sheep ecology in ARE I and ARE III in an effort to determine the causative factors of the apparent differences in quality.

The Dry Creek study area (Heimer 1974) has provided information which is considered typical of ARE I since 1963 (Jones et al. 1963, Jones 1964 and 1965, Rausch and Jones 1966, Nichols 1968, Erickson in Nichols and Erickson 1969, Erickson 1970, Smith in Nichols and Smith 1971, Heimer in Nichols and Heimer 1972 and Heimer 1974). The first step towards gathering comparable information from ARE III was establishment of a study site representative of the area.

OBJECTIVE

To locate and describe a suitable study area containing a high quality population (or populations) of Dall sheep.

PROCEDURES

An intensive aerial survey of ARE III was carried out in July and August of 1974. The objectives of this survey were to determine the summer distribution and abundance of Dall sheep, to determine the production of lambs and to locate mineral licks which serve as foci of sheep activity. Foot surveys of potential study sites were made whenever possible. Also, winter survey flights were made to determine wintering areas used by sheep.

Surveys were flown in Helio Courier (250hp) and Piper PA18 (150hp) aircraft. Whenever possible two observers were used in the Helio Courier. Surveys were flown only when conditions were optimal and all sheep seen were classified to the extent possible from the aircraft. This allowed

segregation of the observed sheep into groups of "ewes" (Nichols in Nichols and Erickson 1969), lambs and rams of varying degrees of horn development. On some flights rams were classified into groups less than and greater than or equal to 3/4 curl (the dominant statewide legal designation) and some flights were made which classified rams into groups less than and greater than or equal to full curl (the legal definition in the ARE III, Tok Management Area). During winter flights the presence of sheep in areas was noted, but no attempts were made to classify these animals. The use of several different pilot-aircraft-observer teams in this survey was unfortunate, but unavoidable. It is understood that the efficiency of each team in sighting and classifying sheep is different. Only observed figures will be used, and these are minimum estimates of the sheep populations on the areas surveyed.

For analysis of survey data the area, ARE III, was divided into separate blocks of mountains (Fig. 1).

FINDINGS

The data gathered during the aerial survey are presented by area in Table 1. Additional information gathered from each area is listed below:

Area 1 had a lamb:"ewe" ratio of 39:100. The area was found to contain two active mineral licks. A lick which appeared to be of minor importance was found on Elting Creek, and a lick which had been reported by Slim Moore (personal communication) was located on Township 19N Range 15E. This appeared to be a major lick (Fig. 1).

Area 2 had an observed lamb:"ewe" ratio of 40:100.

Area 3 had an observed lamb:"ewe" ratio of 39:100.

Area 4 had an observed lamb:"ewe" ratio of 28:100. This area also contained a large mineral lick. This lick is located on the west fork of Sheep Creek near its confluence with Sheep Creek proper. This lick is at about 4,700 feet elevation and is approached from below with difficulty because of the steep, unstable terrain. Observations of sheep in the vicinity of this mineral lick were made from the ground with a 15-60 power spotting scope on June 24 and 25. The total number of sheep classified at that time was 116; the composition was 62 ewes, 35 lambs, 13 yearlings, 2 one-half curl rams, 4 three-quarter curl rams and 1 full curl ram. The calculated lamb:ewe ratio was 56:100. The differences in lamb:ewe and lamb:"ewe" ratios (56:100 obtained from the ground and 28:100 from aircraft) are partially explainable by the following:

1. From aircraft it is impossible to separate yearlings and young rams from mature ewes.
2. When frightened by aircraft lambs often hide under their ewes.
3. Observer motivation often determines the lamb:"ewe" ratio because only highly motivated observers will circle enough times to make certain all lambs are counted.

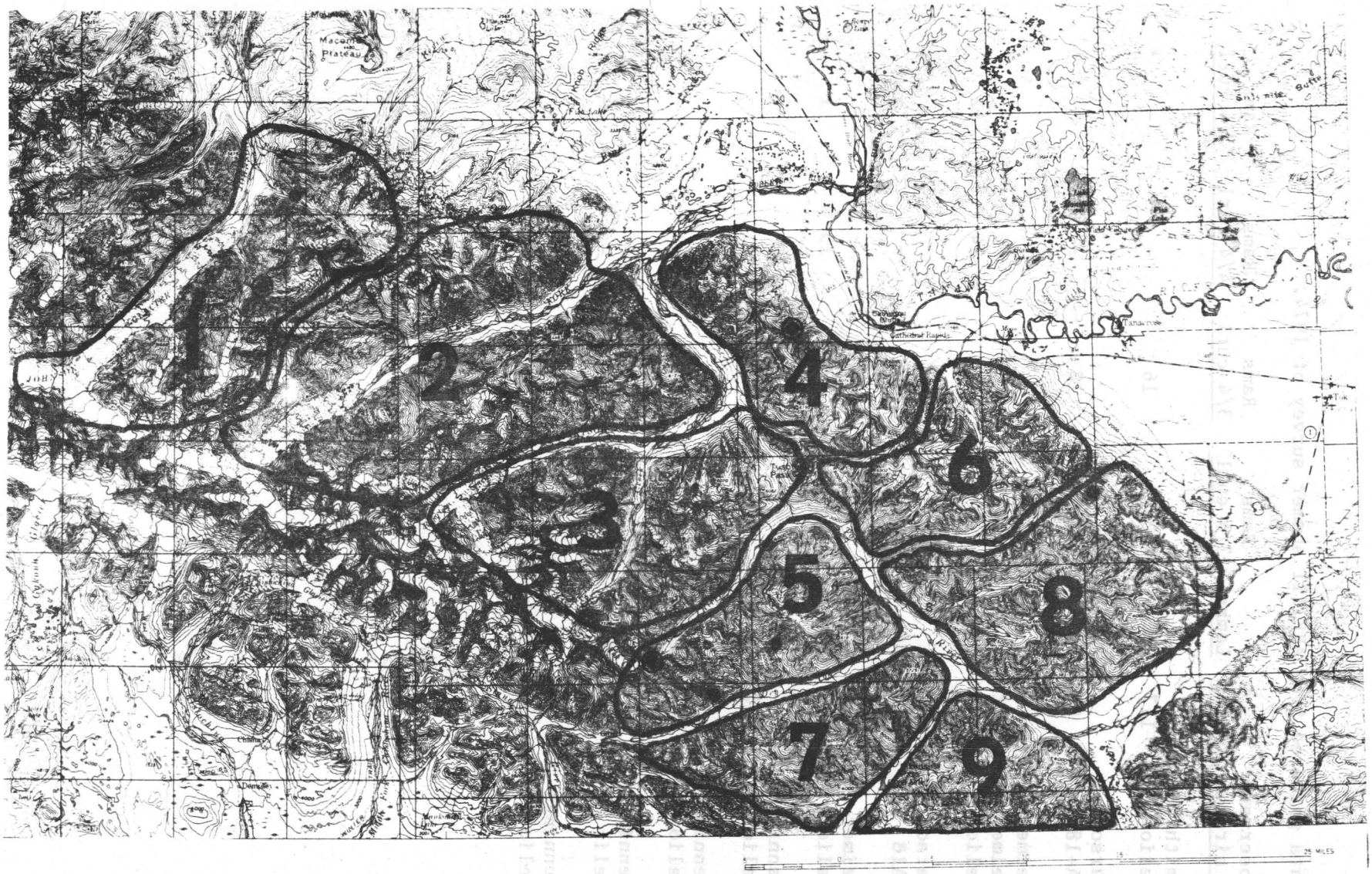

Figure 1. Division of Alaska Range East III used for survey data analysis.

Legend: ● = mineral lick
◉ = major mineral lick

Table 1. Data gathered from ARE III summer survey of 1974.

Area	Date	Observers & aircraft	"Ewes"	Lambs	Rams 3/4 curl	Rams 3/4 curl	Rams 4/4 curl	Rams 4/4 curl
1	7/4	Smith, Heimer Helio	117	46	37	16	-	-
2	8/1,2	Larson PA-18	88	35	19	18	-	-
3	7/5,12	Heimer, Smith Heimer, McKnight Helio	99	38	-	-	24	12
4	8/2	Larson PA18	163	46	4	4	-	-
5	7/12	Heimer Helio	83	33	-	-	15	1
6	7/31	Jennings Helio	112	29	5	11	-	-
7	7/31	Jennings Helio	40	11	0	4	-	-
8	7/27	Jennings Helio	109	23	35	56	-	-
9	7/31	Jennings Helio	36	14	7	13	-	-

4. Classification is much more difficult with large groups of sheep than small groups. The Sheep Creek lick was always seen to have large numbers of sheep present.

These factors probably acted in concert to produce the low observed lamb:"ewe" ratio observed from aircraft. Comparing the aircraft data with those gathered from ground observations suggests that when correction for the numbers of yearlings and young rams is made the actual lamb:ewe ratio observed from aircraft should be increased by 20 percent for these data only (yearling and young ram numbers vary from year to year and area to area). This would provide a lamb:ewe ratio of about 35:100 seen from the air. This is much less than the 56:100 figure obtained on the ground.

Area 5 had an observed lamb:"ewe" ratio of 40:100. One portion of this area was surveyed twice, on July 12 and July 31. It is unlikely that a large range shift occurred during this period. The July 12 survey indicated 33 "ewes," 13 lambs and 12 rams for a total of 57 sheep. The July 31 survey indicated 48 "ewes," 11 lambs and 1 ram for a total of 61 sheep. This comparison is not a rigorous test of survey efficiency, but does demonstrate the variability between pilot-aircraft-observer teams. Both surveys were flown in Helio Courier aircraft, but the pilot for the survey of July 12 had much more experience both in the aircraft type and in sheep survey work. The observer of the July 31 flight had much more experience in Dall sheep survey flights.

Area 5 was found to contain one major mineral lick and two licks of apparently lesser importance. The major lick lies at the terminus of the Tok Glacier. The smaller licks are off the main drainages of the Dry Tok River, one in T16N, R8E and one in T15N, R7E.

Area 6 had an observed lamb:"ewe" ratio of 26:100 and Area 7 a lamb:"ewe" ratio of 28:100.

Area 8 had an observed lamb:"ewe" ratio of 21:100. This area also contained a moderate sized mineral lick at the headwaters of Clearwater Creek on the fork of the creek which runs directly south from the summit of Mt. Neuberger.

Area 9 had an observed lamb:"ewe" ratio of 39:100.

Because most of the survey areas are small and encompass a single unit of mountains it was decided to pool data from those areas which appeared to fall into more or less definable physiographic units (Table 2). Data from Areas 1 and 2 were pooled because they have similar terrain; very rugged with large glaciers at the heads of all major drainages. Data from Areas 4, 6 and 8 were pooled because they have no glaciers present and represent a block of sheep habitat which is essentially separate from the remainder of ARE III. Because glaciers are absent it may be inferred these areas received less snow than other portions of

Table 2. Pooled data for areas of ARE III.

Areas Pooled	Total sheep	Total area	Lambs per 100 "ewes"	Density per square mile "ewes"	lambs	total sheep	Percent "ewes"
1,2	376	440mi^2	40	0.47	0.18	0.85	55
3,5	302	230mi^2	39	0.79	0.31	1.32	60
4,6,8	597	294mi^2	26	1.31	0.33	2.40	64
7,9	125	145mi^2	33	0.52	0.17	0.86	61

ARE III. Area 3 and Area 5 were considered together because the major mineral lick on the Tok Glacier, in all probability, influences sheep from both sides of the Tok River. Data from Areas 7 and 9 were pooled because these areas are small, have few sheep and are of similar physiography.

The quality hypothesis of Geist (1971) suggests that high quality sheep populations should show higher production than populations of lower quality. The studies of Heimer and Smith (1975) indicate that high quality populations have generally lower population densities than those of low quality, and that there is some suggestion of higher quality being associated with glacial presence. Based on these criteria the highest quality populations are probably those of Areas 1 and 2. This would seemingly indicate that these areas are the best potential study site for a quality comparison with ARE I. However, the terrain of these areas is rugged enough to prohibit easy travel on foot. Also, access is difficult to the area of the lick, T19N, R15E on the Johnson River, where much summer work would be carried out.

Fig. 2 represents the current status of knowledge regarding the potential good winter ranges in ARE III. It can be seen that the winter range which is most likely to support the bulk of sheep activity in Areas 1 and 2 lies along the west bank of the west fork of the Robertson River. This terrain has been observed to be blown free of snow during late winter and to support sheep at that time. However, it seems likely that sheep wintering there are probably influenced by the mineral licks on the Johnson River. The terrain separating these suspected wintering and summering areas, although easily negotiated by sheep, is rugged enough to preclude convenient foot travel. For these reasons Areas 1 and 2 were not selected for intensive study.

Other areas which were found to be potentially suitable are Areas 4, 6 and 8 (pooled) and 3 and 5 (pooled). These areas have major mineral licks within their boundaries and probable winter ranges which appear to be fairly accessible. Of these, Areas 4, 6 and 8 are the areas of high animal density, lower (according to aerial observations) lamb production and highest percentage of "ewes." These factors seem to indicate it is of the lowest quality of any area in ARE III according to the quality hypothesis of Geist (1971). In addition to these factors, there are no existing glaciers present in this area. Because of Geist's (1971) emphasis on glacial influence as a determinant of quality, and the suggestion of glacial influence shown by Heimer and Smith (1975), Areas 4, 6 and 8 are not deemed suitable for intensive study. Future plans, however, call for a continued survey and inventory effort based at the Sheep Creek lick because of its ready access from the Alaska Highway.

The areas selected for intensive study were 3 and 5. These areas extend from the Robertson River to Dry Tok Creek and from Tushtena Pass and the Tok River to the crest of the Alaska Range. In this area the observed population exceeds 300 sheep, the density of animals is moderate and the production is high. Glaciers are present and the percent "ewes"

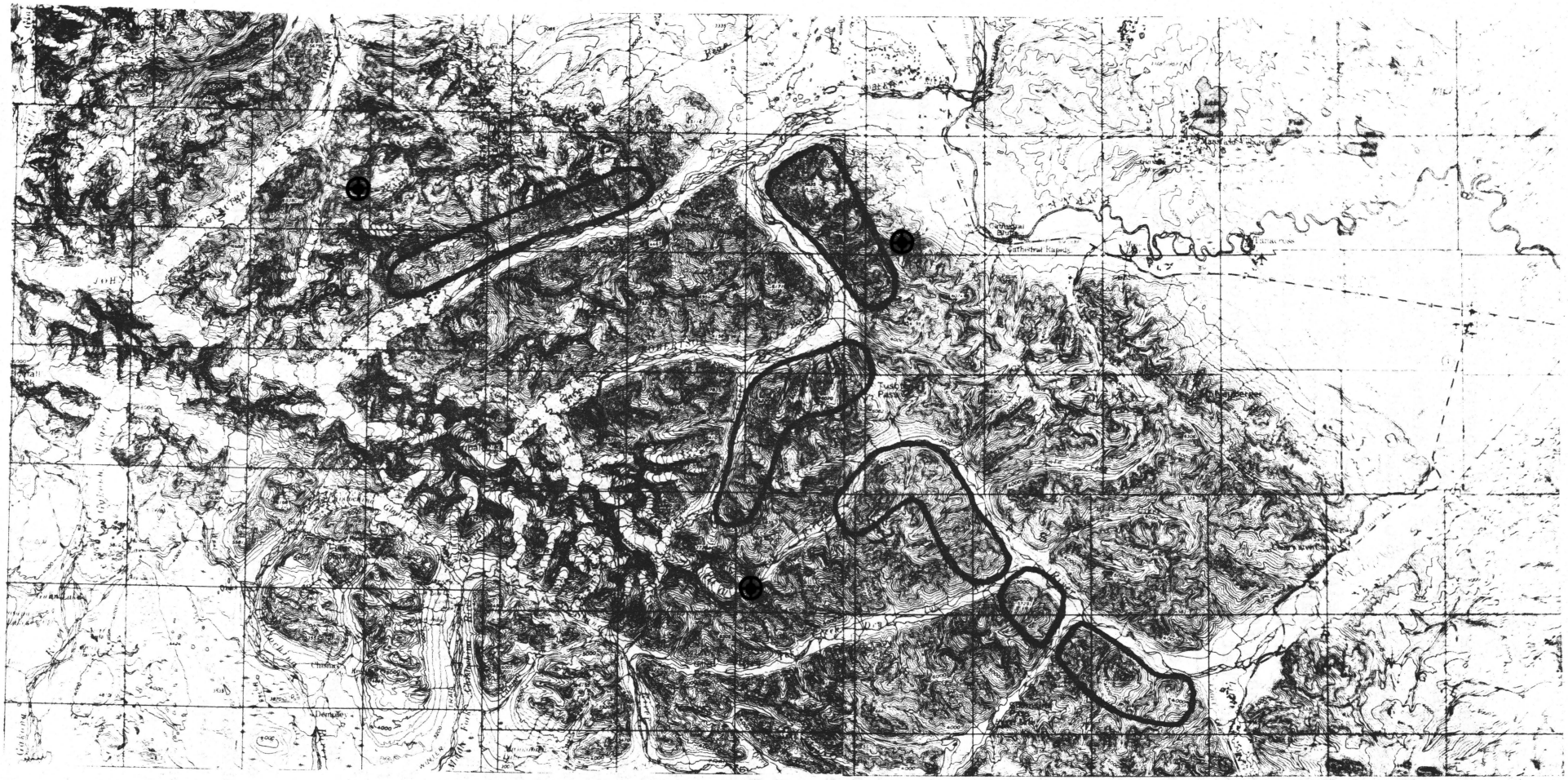

Figure 2. Areas within Alaska Range East III which have high potential as Dall sheep winter ranges.

Legend: ◉ = major mineral lick

indicates that hunting pressure has been as limited in this area as anywhere in ARE III excluding Areas 1 and 2. Also, reference to Fig. 2 shows that potentially good winter range is distributed in fairly close proximity to the main lick at the base of the Tok Glacier. It appears that prevailing winds clear snow from the west side of Rumble Creek and the Robertson River below Rumble Creek, as well as from the west side of the Tok River (where it runs south to north) and the south side of the Tok River where it runs west to east. The mineral lick and summer ranges will be accessible by the trail running up the Tok River in summer and ski-equipped aircraft should be able to land near the area in winter. The possibility of snow machine access in winter is also attractive. One further advantage is the presence of several cabins on the Tok River which may be available for use as winter facilities if the owners are agreeable.

CONCLUSIONS

Apparent Dall sheep population quality, suitable terrain, the presence of a major mineral lick in close proximity to probable winter ranges, as well as suitable access to both summer and winter ranges make the area east of the Robertson River (specifically Rumble Creek) and west of Dry Tok Creek from Tushtena Pass and the Tok River to the crest of the Alaska Range the most desirable intensive study site in ARE III. The major mineral lick closely accessible from the Alaska Highway and apparent differences in population numbers and physiography of the area suggest the "outer range" of the ARE III as an alternate or comparative area.

MANAGEMENT RECOMMENDATIONS

On the basis of these aerial surveys it is recommended that care be taken in interpretation of composition data obtained by aerial surveys. Also it is recommended that, whenever possible, experienced observers using suitable aircraft flown by experienced pilots undertake Dall sheep surveys.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperator: Wayne E. Heimer

Project No.: W-17-7

Job. No.: VIB-6.9 R Job Title: Dynamics of Selected Sheep Populations

Job No.: VIB-6.10 R Job Title: Assessment of sheep populations occupying designated wintering areas

Job No.: VIB-6.11 R Job Title: Seasonal availability of Dall sheep range

Period covered: July 1, 1974 through June 30, 1975

SUMMARY

Data were gathered on production, survival and total estimated sheep population at the Dry Creek mineral lick. Aerial surveys were flown in the Tok Management Area. Production figures were compared. One survey flight of winter ranges is reported.

BACKGROUND

Previous studies by the Alaska Department of Fish and Game (Heimer and Smith 1975) have shown that striking differences in Dall sheep ram horn growth exist in the sheep (*Ovis dalli*) populations along the Alaska Range east of Mount McKinley National Park. These studies were considered by the authors to be supportive of the "Quality Hypothesis" of Geist (1971). In part, this hypothesis states that differences in population quality exist among sheep populations and that populations of higher quality are characterized by more rapid horn growth and larger horns at any given age than are low quality populations. The studies of Heimer and Smith (1975) indicate additionally that Dall sheep population quality (as interpreted from ram horn growth and size) is inversely related to population density.

Heimer and Smith (1975) divided the Alaska Range east of Mt. McKinley National Park into three areas for purposes of investigating "quality" based on ram horn growth characteristics. These areas, from McKinley Park to the east, are: ARE I, from the Nenana River eastward to the Delta River; ARE II, from the Delta River eastward to the Johnson River and ARE III, from the Johnson River eastward to the Tok-Slana Road. In the quality ranking of Heimer and Smith (1975) ARE I was of very low quality, ARE II was of average quality, and ARE III was of very high quality. For these reasons it was decided to pursue a comparative study of Dall sheep ecology in ARE I and ARE III in an effort to determine the causative factors of the apparent differences in quality.

The quality hypothesis of Geist (1971) predicts that the dynamics of high and low quality populations will be different. His hypothesis states specifically that high quality populations will be characterized by extravagant individuals which will exhibit high reproduction and high survival to yearling age, more rapid growth and generally shorter life expectancy than individuals in low quality populations.

In order to test this hypothesis for Dall sheep the population dynamics for the high quality population (ARE III) will be investigated and compared with those of the low quality (ARE I) population.

The suggestion of Heimer and Smith (1975) that population quality is inversely related to population density in Dall sheep raises the possibilities that range quality and/or food availability may be major determinants of quality. In order to investigate these possibilities the relationship of Dall sheep to their seasonal ranges will be investigated. It appears that animal density on winter range may be the most important correlate. This is, of course, determined by the number of animals and the area and quality of range available. Nichols (1974) has suggested that Dall sheep winter range is limited by snow depth and hardness. This may result in different winter range carrying capacities from year to year. The number of animals on winter ranges for Dall sheep in the Alaska Range is thought to be fairly consistent from year to year. The population densities of Dall sheep on specific winter ranges in the high quality (ARE III) and low quality (ARE I) populations will be determined. Also, available winter range will be determined and densities of sheep calculated. These measurements will then be correlated with range quality and sheep condition, production and survival.

OBJECTIVES

To ascertain the current composition and productivity of sample populations in ARE I and ARE III.

To accurately determine the numbers of sheep wintering on specific areas in ARE I and ARE III.

To determine the availability of winter range to Dall sheep wintering in the ARE I and ARE III.

PROCEDURES

Dynamics of selected sheep populations: Mineral lick observations, in which all sheep using the main mineral lick on Dry Creek were classified, have been carried out since 1970. These data have been summarized by Heimer (1974). Similar observations were made in 1974, observations were made for 12 hours per day from May 31 through June 30. All sheep entering the lick during those hours were classified with respect to age (lamb, yearling, adult) and sex and the number of sheep influenced by the lick during the period of observation was estimated.

Heimer (1974) reported that during the periods of continuous observation marked sheep visited the lick an average of four times per licking season. The lick season generally lasts for about the month of June. Consequently, the total number of sheep (excluding lambs) entering the mineral lick was divided by four to estimate the number of sheep influenced by the main mineral lick on Dry Creek. Composition data allowed calculation of the number of ewe sheep, the production rate (lambs per 100 ewes) and the total population size.

It has not been practical to make continuous observations each year so the data gathered in that period were used to develop a means of extrapolating to the number of sheep influenced by the mineral lick from data gathered during 12-hour observation days from 0400 hours to 1600 hours. This method involved determining the number of sheep entering the lick between the hours of 0400 and 1600 during the period of 24-hour observations from June 1 to June 30. This total was then divided by the total estimated population for the year of 24-hour observations (1972) and a correction factor determined. This factor, found to be 2.14, was used to estimate the total population influenced by the main mineral lick on Dry Creek for the years subsequent to 1972. The calculation was made by dividing the total incoming sheep for the observation period by 2.14.

Because the events of the mineral lick use cycle are variable, as shown by Heimer (1974), it was decided that production and survival information would be selected from the data for incoming sheep from June 19 through June 30.

Although mineral lick observations were made at the Sheep Creek lick no mineral lick observations were made in the intensive study area

within ARE III because the area had not been selected by the termination of the lick use season. Composition data were gathered during aircraft surveys of 1969, 1973 and 1974.

Assessment of sheep populations occupying designated wintering areas: Plans were made to mark sheep on the intensive study area in ARE I and make repeated surveys in an effort to determine population numbers on winter range. Logistic problems precluded the marking of animals so no data were gathered by this means. A preliminary survey flight was made during November and this comprises the only data on the number of sheep in the intensive study area of ARE I. Preliminary flights will be made in ARE III after completion of this report.

Seasonal availability of Dall sheep range: Aerial surveys were to be used in determination of the extent of winter range in a general manner, and specific data were to be gathered by measurement of snow conditions (on foot).

FINDINGS

Dynamics of selected sheep populations: Data gathered on productivity, survival and total number of sheep using the Dry Creek mineral lick are presented in Table 1.

An intensive aerial survey of the study site in ARE III has been reported elsewhere (Heimer 1975). Table 2 presents data from ARE III.

It is difficult to compare production in the study areas. ARE I data were derived from mineral lick observations, and ARE III data were derived from aerial surveys. From composition data gathered at the Sheep Creek mineral lick Heimer (1975) suggested that in ARE III during 1974 ground surveys might reflect 20 percent more lambs per 100 ewes than aircraft surveys because of the number of yearlings present. If this figure were used to adjust the lamb:"ewe" ratio gathered from aircraft in ARE III the figures for 1973 and 1974 become 32 and 47 lambs per 100 ewes, respectively. If these data are compared with data from ARE I for those years it can be seen that ARE III has a higher average production than ARE I, but a statistical comparison is impractical because of the limited sample size.

Assessment of sheep populations occupying designated wintering areas: The only data available for the numbers of sheep on winter ranges at this time were gathered during an aerial survey flown in mid-November of 1974. Data from this flight are presented in Table 3.

These data are not indicative of any population figure or composition. They represent only the sheep observed during one mid-November flight.

Seasonal availability of Dall sheep range: Data gathering was not completed during this reporting period.

Table 1. Productivity, survival, and estimated number of Dall sheep influenced by the Dry Creek mineral lick from 1968 through 1974.

Year	Lambs per 100 ewes	Yearlings per 100 ewes	Estimated population
1968*	63	13	about 1600 (Smith aerial survey)
1969*	64	31	-----
1970*	55	31	-----
1971*	50	51	-----
1972	15	16	1473
1973	38	11	1315
1974	28	25	1270

*data gathered at mineral lick using observation schedules not described in procedures (see Heimer 1974).

Table 2. Productivity and numbers of sheep observed in ARE III study area during summer aerial surveys.

Year	Lambs per 100 "ewes"	Total Sheep Observed
1969	41	159
1973	27	326
1974	39	302

Table 3. Composition and enumeration of sheep seen on the ARE I study area during aerial survey in mid-November 1974 (Helio Courier 250hp; Heimer).

Total sheep	"Ewes"	Lambs	Rams (≤3/4 curl)	Rams (≥3/4 curl)
83	63	3	10	8

MANAGEMENT RECOMMENDATIONS

No specific management recommendations may be made from preliminary results of this study.

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