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SHEEP AND GOAT INVESTIGATIONS

by

Franklin F. Jones, Leader
Ronald F. Batchelor
Harry R. Merriam
Leslie A. Viereck

Volume III
Annual Project Segment Report
Federal Aid in Wildlife Restoration Act
Project W-6-R-3, Work Plan E

The subject matter contained within these reports is often fragmentary in nature and the findings may not be conclusive; consequently, permission to publish the contents is withheld pending permission of the Department of Fish and Game.

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3

Name: Alaska Wildlife Investigations

Work Plan: E

Title: Sheep and Goat Investigations

Job No: 1

Title: Statewide Sheep Distribution

PERIOD COVERED: July 1, 1961 to June 30, 1962

ABSTRACT

Twelve hundred twenty-two sheep were counted in 10.8 hours of flying time in 7 different areas. The summer months are the best months of the year for these surveys due to the daylight hours and snow conditions (months of little snow coverage and long hours of daylight). Composition data secured from the air are not as accurate as those taken from the ground with the exception of adult rams, but aerial surveys permit the coverage of large areas with the expenditure of little time and effort.

RECOMMENDATIONS

Extensive aerial surveys should be conducted in the future to secure more information on the distribution, estimation of numbers, and the composition of those groups located.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 1 Title: Statewide Sheep Distribution

PERIOD COVERED: July 1, 1961 to June 30, 1962

OBJECTIVES

To determine the distribution and relative abundance of sheep on a Statewide basis, and to map their distribution.

TECHNIQUES

Aerial surveys were flown in a Piper PA-18 with the writer acting as pilot and an observer plotting on a chart the locations and numbers of sheep observed. Composition data were secured where terrain and air conditions permitted. The aircraft was flown at a speed as near 70 miles per hour as possible and as close to groups of sheep as was feasible for accurate counting. Weather with unlimited visibility and very high clouds is necessary if satisfactory results are to be obtained and flights must be conducted early in the morning and the evening in order to avoid turbulent air conditions.

Composition data were secured on foot, by the use of binoculars and a 20 power spotting scope, in 3 of the areas flown in an attempt to compare data collected.

No concentrated effort was made on this job during this period and the counts were flown for the most part in connection with other investigations.

FINDINGS

During this reporting period eight aerial surveys were conducted in seven different localities in conjunction with other work. These surveys required 10.8 hours actual counting time

not including travel to and from the areas, and resulted in tabulation of 1,222 animals or approximately 113 animals per hour of flying.

Surveys 1 and 2

These surveys were made on the Tonzona River and the headwaters of the East Fork of the Yentna on July 15, 1961. No animals were found on the Yentna, but the Tonzana and its small tributaries yielded 101 animals. This same area was again counted on November 20, 1961, when snow coverage was complete, to compare counts made during the summer when little or no snow was present. Only 56 sheep were found on the second count as compared to 101 for the first. It is extremely difficult to locate white animals when the terrain is snow covered. In addition, the poor light conditions found during the short winter days hinder finding the animals.

Survey 3

The headwaters of the Swift Fork of the Kuskokwim and its small tributaries were flown on August 2, 1961. No sheep or signs (trails, pawed areas or bedding grounds) were found.

Survey 4

On February 16, 1962, while on a caribou reconnaissance flight, 89 sheep were located above timberline northeast of the Black Rapids Road House.

Survey 5

On May 2, 1962, a survey flight for sheep was conducted on the south slopes of the Talkeetna Mountains. This survey covered Sheep Creek, the Chickaloon River, Boulder Creek, Caribou Creek, and the north side of Sheep Mountain. Three hundred forty-four sheep were found on these drainages.

Survey 6

The Dry Creek (near Fairbanks) and its tributaries were flown on May 11, 1962, and 277 animals counted. This drainage required but one hour to fly and gave the largest number of animals per hour of flying time thus far.

Survey 7

While on a reconnaissance flight for caribou on June 8, 1962, a band of 76 sheep was found near the Hot Springs on Big Windy Creek, a tributary of Birch Creek.

Survey 8

The Wood River, a heavily hunted area near Fairbanks, was flown on June 29, 1962. This river and its tributaries gave a count of 279 sheep.

Composition on the different groups of sheep was obtained when and where possible. However, flying mountainous terrain is at all time hazardous. Turbulance, visibility and area inaccessability often prevent securing complete composition data. In addition, no attempt was made in the early counts to separate the rams into different catagories, but in those counts secured after May 1, 1962, the rams were divided into two classes: legal size (3/4 curl or better) and less than legal size (under 3/4 curl). Young rams (two years or younger) cannot be distinguished from adult ewes from the air.

Table 1 presents the count for each area, the date flown, composition secured and the flying time involved. The flying time is not a true picture as some of these counts were made while about other work which resulted in finding some sheep and counting them; whereas on other flights, the time was recorded even though some minutes might pass between finding groups of sheep. This is true particularly of the groups at Black Rapids and Big Windy.

In order to compare data secured by aerial counts with data from ground counts, the Tonzona River, Dry Creek and the Wood River were checked on foot within a few days of the time they were flown. The Tonzona River was covered in two days by one man and both Dry Creek and the Wood River in one day by two men. These were 8-hour days or a total of 48 hours as compared to 4.2 hours for the same areas by air. Aside from the saving in time, coverage was much more complete. Table 2 gives the data collected by both methods.

No good correlation is evident from these data; however, it would seem that we did find a higher lamb to ewe ratio on foot as compared to the aerial counts and we find a greater

Table 1. Composition of sheep counted from the air, 1961 - 1962.

<u>Date</u>	<u>Flying Hours</u>	<u>Location</u>	<u>Legal Rams</u>	<u>Young Rams</u>	<u>Ewes</u>	<u>Lambs</u>	<u>Yrlngs.</u>	<u>Unid.</u>	<u>Totals</u>
7/15/61	1.4	Tonzona River		32*	35	15	10	9	101
8/ 2/61	.5	Swift Fork							00
8/20/61	1.1	Tonzona River		12*	21	8	0	15	56
2/16/62	.2	Black Rapids		25*	46		18		89
5/ 2/62	4.5	Talkneetna Mts.	35	50	148		51	60	344
5/11/62	1.0	Dry Creek	42	61	91		355	48	277
6/ 8/62	.3	Big Windy	19	14	28	10	5	0	76
6/29/62	<u>1.8</u>	Wood River	<u>38</u>	<u>74</u>	<u>68</u>	<u>21</u>	<u>28</u>	<u>50</u>	<u>279</u>
Totals	10.8		134	268	437	54	147	182	1222

ram:ewe ratio 100:109

Total rams:total ewes 402:437

*Rams not divided into legal and smaller than legal.

Table 2. Comparison of composition data collected by air and by foot.

<u>Date</u>	<u>Method</u>	<u>Time (Hours)</u>	<u>Location</u>	<u>Legal Rams</u>	<u>Young Rams</u>	<u>Ewes</u>	<u>Lambs</u>	<u>Yrlngs.</u>	<u>Unid.</u>	<u>Totals</u>
7/15/61	Aerial	1.4	Tonzona River		32	35	15	10	9	101
7/19-20/61	Foot	16.0	Tonzona River		27	19	10	8	7	71
5/11/62	Aerial	1.0	Dry Creek	42	61	91		35	48	277
5/16/62	Foot	16.0	Dry Creek	6	9	36		16	62	129
6/29/62	Aerial	1.8	Wood River	38	74	68	21	28	50	279
6/26/62	Foot	16.0	Wood River	7	5	43	16	12	9	92

percentage of rams from the air. This may be valid, as from the ground it is possible to keep the groups under observation for a greater length of time, thereby locating lambs that may be hidden by the larger sheep. The rams are more apt to be overlooked from the ground since during the summer months they occupy more precipitous terrain and are much harder to locate from the ground, yet are in plain view from above. Identification of animals from the air is probably not quite so accurate as from the ground, as the longer period of observation from the ground increases the chance for positive identification.

In conclusion, it is apparent that the distribution of sheep is somewhat irregular. No sheep, or evidence of their presence, were observed on the Yentna or the Swift Fork even though these areas seem to be suitable habitat, while on the Tonzona River, adjacent to these other two areas, a fair population of sheep was present. In those drainages that have sheep, we find an uneven distribution with some tributaries having very few animals and others having rather large groups containing as many as 46 sheep. Aerial surveys should be conducted during those months of the year when the least amount of snow cover is present (June, July, August and early September). Aerial surveys yield more information for the time and effort expended, but composition data secured in this manner are probably not as accurate as data recorded from ground surveys, except for adult rams.

SUBMITTED BY:

Franklin F. Jones
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-a Title: Range Survey

PERIOD COVERED: July 1, 1961 to December 1, 1961 and
April 1, 1962 to April 30, 1962

ABSTRACT

Dall sheep ranges in the Tonzona River and Mt. Hayes areas of the Alaska Range were examined and the main vegetation types of sheep range adjacent to the Tonzona River are described.

Sheep in the Tonzona River area have a summer range along the divide of the Alaska Range and a winter range near the mouth of the Tonzona Canyon. In feeding during the summer, sheep are selective as to vegetation type but in most cases do not select for particular plant species. During summer, forbs, grasses, and shrubs are all utilized. In fall there is a shift of feeding to grasses and leaves of Dryas octopetala and a more selective type of feeding continues throughout winter.

The ranges observed do not appear to be over-utilized. In the Mt. Hayes area adequate grazing areas remain after a winter of use.

RECOMMENDATIONS

With only six months of study, it is as yet impossible to draw any conclusions regarding carrying capacity of sheep range in Alaska. The study should be continued with emphasis on the following:

Quantitative descriptions of plant communities in sheep ranges.

Quantitative observations on utilization of plant species and vegetation types throughout the year.

Distribution and per cent of cover of various vegetation types within the ranges.

More observations in the critical winter and spring months.

Construction of exclosures for determination of effects of utilization of range over long periods of time.

Areas of over population of sheep should be sought in order to determine some index of utilization.

More observations should be made on the interrelationship of other animals to sheep and the vegetation.

Comparisons of all sheep ranges throughout Alaska should be made.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-a Title: Range Survey

PERIOD COVERED: July 1, 1961 to December 1, 1961 and
April 1, 1962 to April 30, 1962

OBJECTIVES

To conduct a primary survey of sheep range in certain parts of Alaska. To determine the important plant communities and to describe the characteristics of these associations and the environmental factors affecting them.

TECHNIQUES

Description of Vegetation Types

The first year's study of Dall sheep range in Alaska was of necessity rather general. It was essential to determine the areas of sheep range and vegetation types utilized by the sheep during the entire year before intensive quantitative analysis of the range was initiated.

During the summer of 1961 the principle alpine vegetation types in the Tonzona River area were identified and described generally. Plant species were listed for the entire stand and their cover estimated using the following scale:

1. less than 1/16 cover
2. 1/16 to 1/8 cover
3. 1/8 to 1/4 cover
4. 1/4 to 1/2 cover
5. 1/2 to 3/4 cover
6. 3/4 to 1/1 cover

No fixed size quadrats were used in this preliminary survey.

Collection of the Flora

I attempted to make a complete collection of all species in the alpine flora of the Tonzona River area for use as a reference collection for the vegetation analysis and food habits studies.

Food Habits Study

Direct observations of vegetation types utilized by sheep and of individual plants browsed and grazed by sheep were made during the field season. During the winter period I marked the grazed areas so that they could be analyzed the following summer. Rumen samples were obtained from three sheep shot in the valley during the fall hunting season.

Snow Depth in Relation to Vegetation Types and Sheep Utilization

Snow poles were established in stands of most of the main vegetation types in the upper Tonzona River area. Snow depth was read during the field trip in November, but they have not been read since that time due to our inability to return to the area.

FINDINGS

Description of the Study Areas

Tonzona River Area: The area utilized for the preliminary study of Dall sheep range is the drainage of the Tonzona River (recently listed as the Swift Fork of the East Fork of the Kuskokwim River on new Geological Survey maps) which originates in the glaciers along the divide of the Alaska Range about 60 miles southwest of Mt. McKinley and flows northward into the Kuskokwim River. The drainage consists of several glaciers, the largest of these, Surprise Glacier, being approximately ten miles long and a mile in width. The surrounding area is extremely rugged with many 6,000-8,000 foot peaks. Adequate maps of the area are not available.

The Tonzona River flows in a narrow valley that forms a 2,700 foot pass across the Alaska Range. The river, originating from several glaciers, forms a typical glacial braided stream with broad areas of gravel outwash. Several tributaries, also originating from glaciers, join the river as it flows northward through

the Alaska Range. About 15 miles north of the pass the river leaves the mountains and enters the broad flat area of the Kuskokwim River basin.

The mountains on both sides of the river rise to steep talus slopes and jagged ridges and peaks. The geological formations are poorly known, the area having been visited only briefly by Capps (1927) in his general geological survey. Capps described three main types of rocks from the area: the Tonzona group of phyllites and schists forming the mountains to the west of the river along the northern edge of the Alaska Range, the post Tonzona paleozoic rocks along the east side of the river in its middle section, and the Cantwell formation, consisting of coarse conglomerates and sandstones and shales which make up many of the peaks and resistant ridges in the area. All of these formations have been eroded and transported by glaciers and the swift flowing glacial streams which have in turn formed glacial moraines and valley outwash.

Sheep range in the Tonzona River valley is entirely above the regional timber line. However, well developed stands of white spruce (Picea glauca) occur on the river alluvium to elevations of 2,200 to 2,300 feet along the northern edge of the Alaska Range. Scattered individuals of both white and black spruce (Picea marianna) occur to within 3 miles of the pass and to an elevation of 2,500 feet.

Above the spruce zone is a well developed zone of alder and willow thicket that occupies a band several hundred feet thick on slopes just above the river. This zone becomes progressively narrower toward the divide of the Alaska Range and disappears entirely about 2 miles below the 2,700 foot pass. Occasional clumps of poplar trees (Populus balsamifera) occur on well drained gravels within this zone.

Above this zone, or from approximately 2,500 feet upward, the vegetation consists of low alpine tundra, which comprises the sheep range. This zone is rather narrow, its upper limit on south facing slopes being determined by active talus at 3,500 to 4,000 feet and its distribution on north facing slopes being limited by glaciers and perpetual snow fields. In protected locations on ridges alpine tundra reaches an altitude of about 6,000 feet.

Stands of vegetation in the alpine zone adjacent to Tonzona River are distributed in a mosaic of patterns that is determined by slope, elevation, exposure, parent material, relation to snow cover and wind exposure, and other environmental factors. Most of the stands are only an acre or two in extent and thus the vegetation defies mapping on an extensive scale. However, several vegetation units occur repeatedly under similar conditions and it is thus possible to recognize a few common vegetation types.

The following is a brief preliminary description of these principle vegetation types. Because the plant species identifications are incomplete and analysis of quantitative data unfinished, I have made no attempt to include a complete description of these vegetation types in this report. Only the most important species are listed:

1. Spruce Zone: The vegetation of the spruce stands was not examined.

2. Shrub Zone: Both alder and willow form almost impenetrable thickets along the sides of the river valley. Willows are confined largely to gulleys and areas of drainage or seepage. Alders form a nearly continuous cover on steeper valley slopes, but in the less steep areas alder clumps are interspersed with small meadow-like stands, especially in areas near the mouth of the Tonzona River canyon. These meadows are usually on sites of deep snow accumulation during the winter.

(a) Alder Thickets: Alder (Alnus crispa) forms a dense canopy varying in height with altitude and exposure to winds and snow accumulation but averaging from three to ten feet. Growth under the dense canopy is sparse and consists largely of Calamagrostis canadensis (bluejoint), Equisetum arvense (field horsetail), and the low shrub Ribes triste (red currant). Several forbs including Heracleum lanatum (cow parsnip), Angelica lucida (sea coast angelica), and Aconitum delphinifolium (monkshood) occur scattered throughout the stands.

(b) Willow Thickets: Stands of several species of willow including most commonly Salix glauca, S. richardsonii, and S. pulchra occur commonly along drainages and in wet protected sites in the alder zone. As with the alder stands, the canopy is dense

and the growth under the willows sparse. Festuca altaica (blue-joint), Arctagrostis latifolia (a grass), Sanguisorba sitchensis, (burnet), Mertensia paniculata (lungwort) and Virburnum edule (highbush cranberry) are the most common plants growing under the willow.

(c) Meadows: Several types of sedge and grass meadows occur as small patches in the alder zone. Many are located where snow accumulates in gulleys while others are found in depressions on nearly level terrain. Most of the meadows in the alder zone are similar to the bunchgrass meadow of the alpine zone and will be described under that type.

3. Alpine Zone:

(a) The Low Shrub-Bunchgrass Type: The low shrub-bunchgrass type occurs on steep south-facing slopes at the upper edge of the alder zone and in the alpine zone above. Ground cover consists of mats of Dryas integrifolia (mountain avens) interspersed with clumps of Festuca altaica. Low shrubs total about 50 per cent of the cover and consist of Vaccinium uliginosum (mountain blueberry), Salix reticulata, Salix arctica, Betula glandulosa (shrub birch) and Potentilla fruticosa (shrubby cinquefoil). Lichens, including Cetraria cucullata, Cladonia rangiferian, C. sylvatica, and Stereocaulon sp. make up a conspicuous part of the cover.

(b) Bunchgrass Meadow Type: The bunchgrass meadow occurs commonly just above the alder zone near the mouth of the Tonzona Canyon and occasionally on the slopes in the upper part of the valley to elevations of 4,000 feet on steep slopes and outwash fans where underlying drainage is good. In November large areas of this vegetation type were completely free of snow.

The meadow consists of a rich growth of grasses and forbs with scattered low shrubs. Festuca altaica is always dominant but there is usually a scattering of low shrubs between the grass clumps. A large number of forbs are scattered throughout the stands.

Table 1 summarizes the cover for the important species in four stands of this type in the upper and lower sections of the Tonzona River valley.

Table 1. Cover values for important species in four stands in the bunchgrass meadow type in the Tonzona River area.

<u>Stand</u>	<u>Exposure</u>	<u>Elevation</u>	<u>Location</u>
I	East-facing slope	2400 feet	lower camp
II	North-facing slope	2600 feet	upper valley
III	South-facing outwash fan	3500 feet	upper valley
IV	Southwest-facing slope	3500 feet	upper valley

<u>Species</u>	<u>Stand</u>			
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
<u>Grasses and Sedges</u>				
Carex podocarpa	1	-	1	2
Festuca altaica	5	5	4	3
Hierochloe alpina	1	2	-	-
Kobresia simpliciuscula	3	-	-	-
<u>Low and High Shrubs</u>				
Dryas octopetala	2	-	3	1
Potentilla fruticosa	1	-	-	1
Salix reticulata	1	2	3	2
Salix rotundifolia	-	2	4	-
<u>Forbs</u>				
Aconitum delphinifolium	1	-	-	1
Anemone parviflora	1	-	-	1
Artemisia arctica	1	2	2	2
Astragalus umbellatus	1	-	-	1
Epilobium latifolium	1	2	1	2
Mertensia paniculata	2	2	2	3
Sedum roseum	-	3	1	2
Solidago multiradiata	1	1	1	2
Therofon richardsonii	-	1	-	1
<u>Mosses</u>				
Hylocomium splendens	2	-	2	-
Pleurozium schreberi	1	-	1	-
Rhytidium rugosum	1	-	1	-
<u>Lichens</u>				
Lobaria linita	-	-	1	-
Peltigera aphthosa	-	-	1	-

(c) Dryas Mat Type: Low mats of Dryas octopetala occur on windswept ridges in the Tonzona River area from elevations of 2,500 feet to 5,000 feet. There is some variation in the vegetation in this type depending primarily on the degree of exposure to wind and on winter snow depth. The type is characterized by a nearly continuous 1-3 inch-high mat of Dryas octopetala through which are scattered other low shrubs, a few grasses, forbs, and usually considerable quantities of fruticose lichens, of which Cetraria cucullata is the most common.

The Dryas mats often have an eroded appearance due primarily to frost action and soil creep which tends to break the Dryas mats apart. This phenomena is commonly observed in this vegetation type in alpine and arctic areas where there are no sheep; however, it is very likely that erosion of the Dryas mats on steep slopes is increased by actions of sheep in grazing and trampling on the Dryas mats.

I sampled 9 stands in this vegetation type at elevations of 3,000 to 5,000 feet in the vicinity of our upper camp and at the mouth of the canyon (lower camp). Altitude and general location of these stands and cover values for important species are listed in Table 2.

(d) Dryas-Cassiope - low willow type: In north-facing slopes of 5 to 30 degrees in the upper section of the Tonzona valley this vegetation type covers large areas, especially in locations that are protected from prevailing winds. The vegetation consists primarily of a low mat of Dryas octopetala, Cassiope tetragona, and Salix reticulata beneath which there is a nearly continuous moss layer. Occasional grasses, forbs, and two-foot shrubs are scattered through the stands.

In winter the snow cover of this type is continuous but variable as to depth. In November snow depth varied from 8 to 24 inches at a time when many of the adjacent vegetation types were snow free.

Four stands of this type adjacent to the upper camp were sampled and the results are included in Table 3.

Table 2. Cover values for the most important species in the Dryas mat type in the Tonzona River area.

<u>Stand</u>	<u>Elevation</u>	<u>Location</u>
I	3000 ft.	Upper camp
II	3200 ft.	Upper camp
III	3200 ft.	Upper camp
IV	3300 ft.	Upper camp
V	3350 ft.	Lower camp
VI	3500 ft.	Upper camp
VII	4000 ft.	Middle strip
VIII	5000 ft.	Upper camp
IX	5000 ft.	Lower camp

<u>Species</u>	<u>Cover Values</u>								
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>V</u>	<u>VI</u>	<u>VII</u>	<u>VIII</u>	<u>IX</u>
<u>Grasses and Sedges</u>									
Carex michrochaeta	1	1	1	1	1	-	1	1	-
Festuca altaica	-	2	-	-	-	1	-	1	-
Festuca brachyphylla	1	-	-	-	-	-	-	1	-
Hierochloe alpina	1	1	1	1	1	-	1	1	-
Kobresia myosuroides	-	-	1	-	2	-	-	-	-
Trisetum spicatum	-	-	-	-	1	-	1	1	-
<u>Low Shrubs</u>									
Diapensia lapponica	3	-	1	1	-	-	-	-	-
Dryas octopetala	4	6	4	5	6	5	6	5	5
Ledum decumbens	1	-	-	1	-	-	-	-	-
Salix arctica	-	-	2	1	1	-	-	-	-
Salix brachyphylla	2	-	-	1	-	-	-	-	-
Salix reticulata	-	2	-	-	2	-	-	2	2
Vaccinium vitis-idaea	1	-	1	-	-	-	-	-	-
<u>Forbs</u>									
Androsace chamaejasme	-	-	-	-	1	-	-	1	-
Anemone narcissiflora	-	1	-	-	1	-	-	-	1
Arenaria macrocarpa	-	-	-	-	-	-	1	1	-
Epilobium latifolium	-	2	1	1	-	1	-	-	-
Oxytropis nigrescens	-	-	-	-	1	-	1	-	2
Saussaurea viscida	-	-	-	-	-	1	-	1	-

Table 2. (Continued)

Species	Cover Values								
	I	II	III	IV	V	VI	VII	VIII	IX
<u>Forbs (Continued)</u>									
<i>Saxifraga bronchialis</i>	-	-	1	-	-	-	-	1	-
<i>Silene acaulis</i>	-	-	2	-	-	-	1	-	1
<i>Syntheris borealis</i>	-	-	-	-	-	-	1	-	1
<u>Mosses</u>									
<i>Dicranum</i> sp.	1	-	-	1	-	-	-	-	-
<i>Hylocomium splendens</i>	-	1	-	1	-	-	-	-	-
<i>Polytrichum strictum</i>	1	-	1	-	-	-	-	-	-
<i>Racomitrium lanuginosum</i>	1	-	1	1	-	-	-	-	-
<i>Rhytidium rugosum</i>	1	-	-	-	4	-	-	-	1
<i>Tomenthypnum nitens</i>	1	2	-	1	-	1	-	-	-
<u>Lichens</u>									
<i>Alectoria ochroleuca</i>	-	-	1	1	-	-	-	-	-
<i>Cetraria cucullata</i>	1	2	1	2	-	2	-	-	-
<i>Cetraria islandica</i>	1	1	-	-	-	1	-	-	-
<i>Cetraria nivalis</i>	1	-	1	-	-	-	-	-	-
<i>Cetraria tilesei</i>	-	-	-	1	-	-	-	1	-
<i>Cladonia rangiferina</i>	1	-	1	-	-	-	-	-	-
<i>Lobaria linita</i>	1	1	-	1	-	-	-	-	-
<i>Ochrolechia frigida</i>	1	-	1	-	-	-	-	-	-
<i>Sphaerophorus globosus</i>	1	-	1	-	-	-	-	-	-
<i>Stereocaulon</i> sp.	-	-	-	1	-	1	-	-	-
<i>Thamnolia vermicularis</i>	1	-	-	1	-	-	-	-	-

(e) Snow-bed Communities: Where snow accumulation is deep in the winter and melts late in spring or summer, a group of plants occurs that has been termed the snow-bed community. Vegetation that occupies these sites varies with the time that the snow melts in the summer, with slope, exposure, altitude, and parent material. There is, therefore, no one characteristic plant community that can be considered as a typical snow-bed community. Even within one snow bank area the vegetation usually forms conspicuous bands related to

Table 3. Cover values for important species in the Dryas-Cassiope - low willow type in the Tonzona River area.

<u>Stand</u>	<u>Exposure</u>	<u>Degree Slope</u>	<u>Elevation</u>
I	north-facing	20° slope	3500 feet
II	north-facing	10° slope	2800 feet
III	north-facing	20° slope	3000 feet
IV	northeast-facing	25-30° slope	3500 feet

<u>Species</u>	<u>Cover Values</u>			
	<u>Stand</u>			
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
<u>Grasses and Sedges</u>				
Carex podocarpa	2	-	-	1
Carex scirpoidea	1	1	-	1
Festuca altiaca	1	1	-	-
Hierochloe alpina	1	1	-	1
<u>Low Shrubs</u>				
Arctostaphylos alpina	1	2	1	-
Cassiope tetragona	6	5	3	2
Dryas octopetala	3	2	5	4
Salix glauca	-	1	1	-
Salix reticulata	1	2	2	3
<u>Forbs</u>				
Anemone narcissiflora	1	-	-	1
Anemone parviflora	1	-	1	1
Epilobium latifolium	-	1	-	2
Therofon richardsonii	2	-	-	3
<u>Mosses</u>				
Hylocomium splendens	5	5	4	4
Ptilidium ciliare	1	1	-	-
Rhytidium rugosum	2	-	3	1
<u>Lichens</u>				
Cetraria cucullata	1	1	2	1
Cladonia rangiferina	-	1	-	1
Dactylina arctica	1	1	-	-
Lobaria linita	-	-	-	2
Stereocaulon sp.	1	-	-	1

the time that the area first becomes free of snow. Often in the center of such an area there is a region completely devoid of vegetation because snow melt is too late for there to be time for plants to complete sufficient growth to maintain themselves.

Fourteen snow-bed communities were examined in the Tonzona River area. Because of their great diversity, I have only listed some of the more important species rather than listing cover values for species in each of the stands that I examined.

List of important plants in the snow-bed communities
in the Tonzona River area.

Vascular Plants

<u>Anemone parviflora</u>	<u>Cassiope tetragona</u>	<u>Leutkia pectinata</u>
<u>Angelica lucida</u>	<u>Dodecatheon frigidum</u>	<u>Lupinus arcticus</u>
<u>Bartsia alpina</u>	<u>Equisetum arvense</u>	<u>Lycopodium selago</u>
<u>Carex podocarpa</u>	<u>Geum rossii</u>	<u>Mertensia paniculata</u>
<u>Cassiope stellariana</u>	<u>Juncus biglumis</u>	<u>Oxyria digyna</u>
<u>Ranunculus nivalis</u>	<u>Sedum rosea</u>	<u>Salix polaris</u>
<u>Senecio triangularis</u>	<u>Salix reticulata</u>	<u>Sibbaldia procumbens</u>
<u>Salix rotundifolia</u>	<u>Therofon richardsonii</u>	<u>Sanquisorba officinale</u>
<u>Valeriana capitata</u>		

Mosses

Many species

Lichens

<u>Cetraria islandica</u>	<u>Cetraria richardsonii</u>	<u>Solorina crocea</u>
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(f) Talus Slopes: In the Tonzona River valley steep slopes, especially those above 3,500 feet, are comprised largely of loose talus. From a distance these slopes appear to be completely un-vegetated but close examination shows that there are a number of plants widely scattered between the rocks.

As with the snow-bed communities, it is difficult to recognize any plant community as typical of the talus slopes. A few of the more important plants that are adapted to these unstable sites are listed below:

<u>Arenaria macrocarpa</u>	<u>Epilobium latifolium</u>	<u>Arnica alpina</u>
<u>Papaver spp.</u>	<u>Claytonia sarmentosa</u>	<u>Polemonium boreale</u>
<u>Crepis nana</u>	<u>Salix arctica</u>	<u>Dryopteris fragrans</u>
<u>Saxifraga oppositifolia</u>		

Mt. Hayes Area: Because of the inaccessibility of the Tonzona River area and the relatively small number of sheep in the valley, I decided in the spring of 1962 to shift my emphasis from the Tonzona River area to that of the Mt. Hayes area 75 miles south-east of Fairbanks. I made a brief ten day reconnaissance in the area in late April in order to determine the winter range of the sheep.

The Mt. Hayes area is less precipitous than the Tonzona area--the ridges being more rounded and the slopes, being at a less steep angle, are more completely vegetated. Treeline is about 1,000 feet higher, and termini of the glaciers are in general at a higher elevation (2,300-3,500 feet in the Tonzona River area--4,000-5,000 feet in the Mt. Hayes area).

Palmer (1941) has described the vegetation of the area in some detail. A complete description of the area and its vegetation will be presented after I have completed a summer of field work in the area.

Sheep Distribution

Tonzona River Area: Sheep in the Tonzona range are widely distributed during winter. During the summer, bands of rams were found in all of the meadows surrounding glaciers along the divide of the range and a few were observed to be several miles across the divide on the south side of the range. Ewes and lambs were occasionally observed on steep slopes above glaciers along the divide of the Alaska Range but they tended to remain in greater numbers on the slopes closer to the northern limit of the range.

The few observations that were made during the winter months showed that summer ranges along the divide were completely abandoned during the winter months and that sheep had congregated in the hills to the west of the mouth of the Tonzona River canyon. In this area snow accumulation was less than in higher slopes along the divide and the effects of the strong winds in removing snow cover from the vegetation seemed to be greater.

Mt. Hayes Area: In the Mt. Hayes area in April, sheep were feeding on south-facing slopes from the shrub zone at about 3,000 feet elevation to exposed ridges at elevations of 5,200 feet. Nearly every south-facing wind exposed ridge at an elevation of 3,000 to 5,000 feet had a few sheep on it. These south-facing slopes were the only ones bare of snow at this time of year. Most of the winter's sheep droppings were concentrated on these south-facing ridges between elevations of 3,500 and 4,500 feet.

Sheep Feeding Habits

In summer there is adequate food for many more sheep than exists in the Tonzona River area--only a small percentage of the vegetation is utilized by sheep, even in areas where sheep tend to congregate. From July 15 to September 10 sheep were observed to feed in most of the vegetation types from that of the willow clumps just above the river to high exposed Dryas ridges. One general tendency was observed during summer, especially during the latter part of August and early September: that was for the sheep to concentrate their feeding in the areas that had recently come out from under the snow and were thus green and rapidly growing. A brief discussion of utilization of the various vegetation types in the Tonzona area is given below:

Utilization of the Vegetation Types by the Sheep

1. Spruce Zone: Sheep were never observed in spruce stands in the Tonzona River area and it is very unlikely that vegetation in these stands is utilized as food by sheep.

2. Alder Zone:

(a) Alder Thickets: Sheep were never observed to feed directly on alder but they were seen grazing in the meadow between the alder patches during late summer and fall.

(b) Willow Thickets: Sheep were observed to browse on several species of willow during summer. It is difficult to determine whether winter browse of the willows is by sheep, moose, or rabbits as all three animals were observed in the general vicinity of willow clumps and droppings of all three were found at edges of willow stands. Some of the willows adjacent to wintering range of sheep were heavily browsed.

(c) Meadows: Sheep were observed to be feeding in these meadows during late summer and in the fall.

3. Alpine Zone:

(a) The Low Shrub-Bunchgrass Type: Although this type does not cover large areas, it forms an important part of the winter range of sheep. Festuca altaica clumps are commonly grazed and shrubs in some stands are browsed.

(b) Bunchgrass Meadow Type: Festuca altaica provides good grazing for sheep during most of the winter. In winter range at the mouth of the Tonzona Canyon this type occurs extensively and remains snow-free during much of the winter. It is, therefore, grazed extensively by sheep and with the Dryas mat type provides the bulk of the winter grazing.

(c) Dryas Mat Type: This type is widespread in alpine areas of the Tonzona River and constitutes an important part of sheep range in winter and early summer. During winter months dried Dryas leaves remain on the plant and provide large quantities of plant material for sheep. In spring and summer green leaves and shoots of Dryas are eaten.

(d) Dryas-Cassiope - Low Shrub Type: This vegetation is utilized by sheep during summer months but because of accumulation of snow during winter it is not available after the first heavy snows. Also, the type occurs primarily in summer range of the sheep.

(e) Snow-bed Communities: Snow-bed vegetation is important to sheep for a short period during late summer. In winter and early summer the vegetation is under snow, but in late summer, plants in the snow-bed communities are often just developing and

thus they offer a source for young tender shoots for sheep even after much of the other vegetation has turned brown. As soon as heavy frosts occur in the area most of the plants in snow-beds become unpalatable because they tend to be more adversely affected by freezing than do the plants that have reached maturity and become somewhat dried.

(f) Talus Slopes: Sheep spend considerable time feeding on these talus slopes during summer months and in many cases they paw and dig in the talus in order to remove the thick tap roots of some of the talus slope species.

Utilization of Individual Species

During the summer sheep are selective as to the vegetation type in which they feed but in most cases do not select particular plants within the area in which they are feeding. One exception to this was noted--during July and August sheep utilized young flowering shoots and leaves of Therofon richardsonii (Richardson's saxifrage) and selected extensively for this species in spite of the fact that there was other vegetation locally available.

In winter sheep seemed to select Festuca altaica clumps over other locally available vegetation. When feeding in the Dryas mat type they eat any of the plants growing in the Dryas mat including lichens and grasses.

My observations in the Mt. Hayes area in April showed that sheep were still utilizing grasses heavily, especially Festuca altaica clumps, but that there was also considerable grazing of leaves of Dryas octopetala on exposed ridges. In the Mt. Hayes area, at least, there appeared to be plenty of grazing material available to sheep even in early spring before any new growth had developed.

Plants in Table 4 were observed to be grazed or browsed by sheep during the months indicated. Sheep undoubtedly feed on many more species but it is often difficult to determine if a plant has been utilized by sheep.

Table 4. Plant species on which sheep have been observed to graze or browse. July to November in the Tonzona River area, April in the Mt. Hayes area.

Frequency of Grazing

o - occasionally

c - commonly

a - abundantly

Species (in order of observation)	Frequency by Month				
	July	Aug.	Sept.	Nov.	Apr.
<i>Therofon richardsonii</i>	a	a	a	-	-
<i>Epilobium latifolium</i>	a	a	a	-	-
<i>Carex podocarpa</i>	c	c	c	-	a
<i>Claytonia sarmentosa</i>	c	-	-	-	-
<i>Artemisia arctica</i>	c	a	a	-	-
<i>Arnica alpina</i>	c	c	-	-	-
<i>Lloydia serotina</i>	o	-	-	-	-
<i>Papaver</i> sp.	o	o	-	-	-
<i>Oxytropis nigrescens</i>	c	-	-	-	-
<i>Dryas octopetala</i>	c	c	-	a	a
<i>Salix arctica</i>	c	-	-	-	-
<i>Salix richardsonii</i>	o	-	-	-	-
<i>Salix niphoclada</i>	o	-	-	-	-
<i>Anemone parviflora</i>	o	c	-	-	-
<i>Senecio residifolia</i>	o	-	-	-	-
<i>Poa alpina</i>	o	c	c	-	-
<i>Erigeron humilis</i>	o	-	-	-	-
<i>Aster sibiricus</i>	c	-	-	-	-
<i>Arenaria macrocarpa</i>	o	-	c	-	-
<i>Arctagrostis latifolia</i>	-	c	c	-	-
<i>Mertensia paniculata</i>	-	o	o	-	-
<i>Oxyria digyna</i>	-	a	-	-	-
<i>Sanguisorba officinalis</i>	-	o	-	-	-
<i>Sedum rosea</i>	-	c	-	-	-
<i>Carex bigelowii</i>	-	o	-	-	-
<i>Lychnis</i> sp.	-	o	-	-	-
<i>Saxifraga lyalli</i>	-	o	-	-	-
<i>Salix rotundifolia</i>	-	o	c	-	-
<i>Saxifraga punctata</i>	-	o	o	-	-
<i>Dodecatheon frigidum</i>	-	o	o	-	-
<i>Achillea borealis</i>	-	-	c	-	-
<i>Arnica latifolia</i>	-	-	o	-	-
<i>Anemone narcissiflora</i>	-	-	o	-	-
<i>Silene acaulis</i>	-	-	o	-	-
<i>Solidago multiradiata</i>	-	-	o	-	-
<i>Lupinus arcticus</i>	-	-	o	-	-
<i>Trisetum spicatum</i>	-	-	o	a	c
<i>Salix reticulata</i>	-	-	o	-	-
<i>Senecio lugens</i>	-	-	o	-	-
<i>Equisetum arvense</i>	-	-	o	-	-
<i>Festuca altaica</i>	-	-	c	-	-
<i>Phleum alpinum</i>	-	-	-	a	a
<i>Kobresia myosuroides</i>	-	-	-	a	o
<i>Betula glandulosa</i>	-	-	-	-	c
<i>Salix</i> spp.	-	-	-	-	c
<i>Hierochloa alpina</i>	-	-	-	-	c
<i>Potentilla fruticosa</i>	-	-	-	-	o

Competition with Other Animals

In the Rocky Mountains, distribution of big horn sheep has been greatly reduced in historical times partly as the result of competition with domestic sheep and cattle for available range (Beuchner, 1960). In Alaska such a problem has not arisen but competition for available range plants with native species may be of some importance. The following animals may at times compete with sheep for available vegetation and might contribute to over-utilization of some of the winter ranges. Much more work on the interrelationship of all of these alpine animals and their predators is needed before any definite conclusions can be drawn.

Ground Squirrel: The ground squirrel is abundant on many of the Dryas ridges that make up the winter range of Dall sheep. Although the squirrel is inactive during winter, its feeding on vegetation during summer might possibly produce a shortage in these critical areas. The burrowing and tunnelling activity of the ground squirrel is definitely a contributing factor to the eroded condition of some of the Dryas covered ridges.

Small Rodents: Many of the Dryas mats utilized by sheep were observed to be riddled with tunnels of small rodents. Traps were placed in one of these areas at approximately 4,500 feet elevation in the Tonzona Valley. The species causing destruction of vegetation in this particular case was Microtus miurus. In a few areas their numbers were great enough to cause some damage to the Dryas mat, but in most of the Tonzona area they created no conspicuous change in vegetation.

Caribou: Caribou are usually found in less steep areas in the Tonzona River area and are apparently not in competition with sheep. In the Mt. Hayes area, however, caribou antlers and droppings were found in several areas utilized as winter range by sheep.

Moose: During April several moose were observed to be intermingling with small bands of sheep on south-facing slopes. Heavily browsed willows occurred in areas being utilized by sheep for grazing. The extent to which sheep utilize willows and birch during winter has not been determined, but Scott and Klein (1953) reported heavy browsing of willows in the Indian Creek area and Palmer (1941) lists both birch and willow as important winter browse species. Murie (1944) found that willow made up about 10

per cent by volume of 75 winter stomach samples in McKinley Park. High population of moose, therefore, could have some influence on availability of browse to sheep during the critical late spring period.

Snowshoe Hare: Many rabbit droppings were observed in the immediate vicinity of browsed areas in the winter range of sheep in the Mt. Hayes area. High populations of rabbits could have a deliterious effect on willows and birch in these areas.

Other herbivores in alpine areas that might have some influence on sheep range are ptarmigan, pikas, and marmots, all of which occur abundantly in some sheep range areas.

The actual interrelations of these species with each other and with the range is a complex process that cannot easily be determined. During times of overpopulation of sheep, these other animals might be of importance in limiting availability of browse and grazing plants. At present, their influence on sheep range does not seem to be of any great significance.

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SUBMITTED BY:

Leslie A. Viereck
Game Biologist

APPROVED BY:

Don H. Strobe
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-b Title: Ecology and Behavior

PERIOD COVERED: July 1, 1961 to April 30, 1962

ABSTRACT

Some parts of the life history and behavior of Dall sheep were studied, in the upper part of the Tonzona River, and are described.

The general activities of Dall sheep are those connected with feeding, resting, avoiding enemies, and reproducing their kind. The daily activities are feeding and resting in about equal periods during the summer months. In cold months feeding periods are much longer than are resting periods during daylight hours.

Daily movements are from a few feet to several miles. These movements are dependent on range conditions and the location of mineral licks in relation to the feeding pastures. Seasonal movements are made at a leisurely pace, in the nature of a general drift, and may be as much as 30 miles.

Sheep are gregarious, but the size of the bands probably depends upon range conditions. Two distinct groups are found: the ewe bands containing ewes, lambs, and young stock; and rams or "bachelor bands." In both groups a "peck order" is evident.

Their protection from enemies depends upon their extreme wariness, excellent eyesight, the ability to traverse precipitous terrain with ease, and the nature of the country in which they live.

RECOMMENDATIONS

No recommendations relating to management can be made at this time.

JOB COMPLETION REPORT
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Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-b Title: Ecology and Behavior

PERIOD COVERED: July 1, 1961 to April 30, 1962

OBJECTIVES

To obtain information about the life history of sheep, with special attention to daily and seasonal behavior and movements.

TECHNIQUES

This project was accomplished by living within the sheep habitat and keeping them under direct daily observation. The animals were observed during July, August, September, November, December, and March on 71 different days, and for a total of 256 observation hours.

FINDINGS

Description of the Study Area

This work was done in the upper part of the Tonzona River. This river originates in the glaciers along the divide of the Alaska Range about 60 miles southwest of Mt. McKinley, and flows northward into the Kuskokwim River. For a complete description of the area note report E-2a.

Behavior

Daily Routine

The Dall sheeps' general activities are: getting food, resting, avoiding enemies, and reproducing their kind. No particular pattern is evident. The daily routine consists of alternate periods of feeding and resting. These feeding periods are from a few minutes to three or four hours, and the resting periods are about the same length. Little difference in routine is evident in summer as it

is light most of the day. In winter, when daylight hours number but four to six, most of the light hours are spent feeding with few and short periods of rest, or none at all. The dark hours are spent bedded down; however, I have found evidence of night feeding during the winter months.

When bands of sheep are kept under observation, usually there are several animals bedded down in the midst of the feeding groups, and the opposite will occur with most animals bedded but with a few feeding. There seems to be no selection of day beds, but night beds are chosen along ridge tops or with rock outcroppings at the back.

Communication

Very little communication is evident among Dall sheep. Ewes, with lambs, bleat occasionally to call their lambs, and lambs bleat frequently; but I have never heard a ram make any vocal sound. During the rutting season, rams sometime assume the stance of a range bull, with head thrown back, lips curled back, give (I assume) a challenging call. Welles (1961, p. 63) has this to say, "Probably the most dramatic use of the voice by the Death Valley bighorn is the challenge of the rams in the mating season."

Young rams and yearlings often stamp the ground with the forefeet when surprised and this appears to be a signal of alarm.

Movement serves as an involuntary method of communication. In many cases an alert posture or attitude is responded to by the rest of the band; they usually assume the same posture of alertness. In the same manner, if the leader relaxes and dismisses the danger, the others usually follow suit. If one animal is alarmed and bolts, the other animals follow suit even though they are unaware of the cause.

I have no evidence or knowledge of the use of "signposts" by sheep as do many other animals.

Wariness

The degree of wariness exhibited by Dall sheep seems to be an individual behavior. Some animals can be approached much more closely than can others; however, all have their "flash or scare point" and cannot be approached more closely. This "scare point" probably depends on the individual's past experience. On several occasions I have been able to approach ewes and lambs to within 150 feet, even though I was in plain view at all times, before they moved off. Sudden movement

while under observation by the animals will certainly result in their bolting much sooner than would otherwise have been the case.

Adult rams are more wary than are other age classes with the exception of ewes with lambs.

All sheep are a great deal more alert during periods of low visibility, fog, rain, or snow conditions that restrict visibility and are much more difficult to approach during these periods.

Curiosity

It is difficult to differentiate between curiosity and fear. It is true that while one is in the presence, and this may be at some distance, of sheep they keep one under almost constant surveillance and will move in order to do so. I have had animals climb outcroppings or move to better viewpoints in order to keep me in sight but I have never been able to induce their approach by waving a flag, hat, or other object, or make unusual movements in order to attract them as are sometimes successful methods with caribou. If the animals are unable to keep you in sight they are sure to be frightened and retreat.

How far sheep will retreat when frightened is unpredictable. I have seen them run a mile or more and on other occasions climb extremely precipitous terrain; but in any case the movement will be to a location where they regain their feeling of safety. In most cases this retreat will be ascending, an attempt to get higher on the mountain.

Response to Noises

Sheep exhibit little fear of strange noises. They pay no heed to high flying aircraft and a tractor moving up a valley below them receives but a casual glance. The sound of the human voice receives nothing more than a casual glance. As an illustration of the last two statements the following is from my field notes 23 July 1961 -- "16:30, Have been in full view of these rams for 55 minutes now and they check me from time to time but otherwise I'm ignored. Wonder what they would do if I yelled--nothing, didn't even look my way." During this time I was about 250 yards from 5 rams.

The noise of a falling rock will draw their attention but no exhibition of fear is seen except when the rock is moving in their vicinity and appears to be coming in their direction. They nimbly

leap aside to let it pass. On several occasions I have observed sheep feeding on rocky slopes when one of the uppermost in the group dislodged a stone. All eyes were on the bounding stone and those animals in the stone's course moved aside to let it pass. The other sheep watched it until they were sure they were out of danger.

Sheep break and run hard from a low flying aircraft but I believe this is because of an unknown moving object rather than a response to the noise.

Climbing Ability

Much has been written and said about the seemingly phenomenal climbing ability of sheep, all wild sheep in general, and these statements hold true for Dall sheep as well as the others.

The usual climbing is at a leisurely pace and along the lines of least resistance, but when disturbed they can and do ascend and descend almost vertical rock faces; however, they sometimes find themselves in places beyond their capabilities and must retreat. At other times they make mistakes that result in injury and even death.

Caution is shown when traversing danger points. Testing of footing has been observed on rock slides, talus slopes, and particularly snow slides in the winter. They carefully scrutinize the line of march, sometimes start then back up and finally cross at great speed. Once past the danger point they proceed at a leisurely pace.

Their feet are adapted to their environment as stated by Russo (1956, pg. 35) for bighorn but applies to Dall sheep as well. "The front hoofs are larger than the rear. The hoof tips are more blunt than those of deer, and the imprint is somewhat oval and presents a "dished-in" appearance. The bottoms of the hoofs are soft, the outside edge hard, yet pliable. The toes are capable of being widely cleft, giving the necessary brake for running downhill."

Daily Movements

The daily movement is quite variable but in general is not of great magnitude and in fact amounts to wandering for food. This wandering is normally to more than a mile or two in any given 24-hour period and on occasion is much less.

From August 10, 1961, at 8:50 a.m. until August 12, 1961, at 6:00 p.m. (57 hours and 10 minutes) 3 small rams remained in one little dryas patch that measured approximately 400 feet by 100 feet in size.

As opposed to this, on July 21, 1961, I observed a group of eight sheep traveling along a trail to a mineral lick. At 1:02 p.m. when first observed they were approximately four miles from the lick; they arrived at the lick at 1:43 p.m. This represents a traveling pace of six miles per hour. This same group had been observed earlier in the day grazing in a pasture some three miles further down the canyon. After ingesting material from the lick for 1 hour and 48 minutes, six of the eight moved on about one fourth mile and bedded down. The other two remained at the lick for another nine minutes then joined the others and bedded down among them. This represents between seven and eight miles of travel in just about a 12-hour period.

I seldom observed sheep below the upper edge of the willow growth but they do cross valley floors through timber when going from one slope to another. The animals are extremely wary on these crossings and move at a rapid pace, not slowing until above timberline on the opposite side when the usual leisurely movement is resumed.

No specific movement is necessary for water as many small pools and pockets of water are available in the area and movement of but a few yards furnishes this requirement.

On the other hand quite some distances are traveled in order to secure minerals, depending upon the proximity of mineral licks to the animals when they have the urge for the material. Deep and much traveled trails lead to these deposits from all parts of the range. When a group of sheep feel the need of this material, there is little loitering on the way and in many cases the last few hundred yards are covered at a fast trot.

A group of sheep arriving at a lick usually spend an hour or so ingesting the material. They then bed down in the immediate vicinity or move on a little way to bed down (Table 1). They feed from time to time but spend from several hours to two or three days around the lick returning at intervals to ingest more of the minerals. After satisfying their desire for the material, they return to pastures farther afield. How often any particular group returns to the lick throughout the summer months is not known. These licks are not visited much during the cold months and in any case the material would not be available after freeze-up.

The following is an analysis of material collected from one lick as reported to me by a letter from Paul F. Martin and I quote, "All samples reacted vigorously with dilute HCl. The supply of calcium is high. Free carbonates released readily. A low amount of nitrogen (NO_3) was detected. This is probably from seepage and animal droppings.

Table 1. Time spent in mineral lick (continually feeding) during July and August, 1961.

Observation	1	1.2	Tenths of Hours
	2	.5	
	3	1.0	
	4	.9	
	5	.5	
	6	.7	
	7 (Same sheep as 6)	2.0	
	8	2.0	
	9	.8	
	10 (Same sheep as 9)	.3	
	11 (Same sheep as 10)	.7	
	12	.6	
	13	1.5	
	14	.3	
	15	.2	
	16 (Same sheep as 15)	.7	
	17	1.5	
	18	.5	
	19	3.0	
	20	.3	
	21	1.8	
	22	<u>1.0</u>	
		22.0	Total hours
Average Time		1.0	Hours

A medium level of K_2O was found. Only a trace of phosphate as P_2O_5 was detected. The animals at this lick are after calcium as carbonate and probably sulphate."

But three times during the months we worked in this area did we see adult rams at this lick and on these occasions they spent little time there. The bands using the material were ewes, lambs, and young stock.

Seasonal Movements

The summer range occupied by sheep was the meadows adjacent to the glaciers along the divide and is in general between 3,000 feet and 5,000 feet above mean sea level.

By the middle of September it was apparent that the sheep in the Tonzona River area were moving down to the lower foothills near the mouth of the valley. This movement was a slow leisurely movement with the animals feeding along the way; sometimes backtracking to some extent, but in general moving toward the lower hills.

The movement was obvious before any snowfall occurred. The time of completion of the movement is not known as it was necessary to move out of the area in late September because of freeze-up.

The area occupied during the winter months was larger than that occupied in the summer and included the hills to the west of the mouth of the Tonzona River canyon. In this area the depth of snow was less than the area along the divide occupied during the summer, and strong winds removed the snow to a greater extent than in the more precipitous summer range. The pastures of the winter range are from approximately 2,300 feet to 3,600 feet above mean sea level.

The distance covered by this fall drift was from 18 to 30 miles.

Rest

A great deal of variation exists among sheep in relation to rest but age and sex seem to have a decided influence.

Old rams spend longer periods of rest than do the other animals except during the rut when the periods of rest are brief and far between.

When moving to the position of rest the front quarters normally

are lowered first and then the hind quarters, and they come to a standing position hind quarters first. The position of rest is usually with all four feet tucked under the body and with the head up; however, occasionally one is observed lying on its side with feet stretched out. Several times rams have been observed with the feet tucked under the body but with the head resting on the ground.

Mostly no bed is prepared, the animal goes down wherever it might be. On occasion, however, a few pawing strokes are made with the forefeet before reclining and the shifting of the body helps to prepare the bed. In addition no effort is made, so far as I can determine, to select a spot for the bed except for its night bed (during fall, winter, and spring) and those times of high wind when the bed is usually selected on the lee side of some obstruction. The night bed is selected, with some element of security in mind such as high promontory or with outcroppings at the back.

During the summer months there is little difference in the resting routine since we have no true period of darkness, but during the fall, winter, and spring, night beds are selected for the dark hours. (I have found evidence of night feeding during the winter months when we have from 16 to 20 hours of darkness.

Sanitation

Sanitation is not a problem since the animals are continually moving about and seldom spend any length of time in one location, normally never bedding in the same place for two days running. I suspect there may be some problem in and around mineral licks as many sheep visit these areas during the warm months, spend quite some time there, and undoubtedly contaminate the material ingested with their excreta. (Some data will be forthcoming on this problem from the disease and parasite study to be conducted soon.)

Herd Behavior

As a general rule the adult rams stay by themselves or as "bachelor bands" while the other groups are formed of ewes, lambs, and yearlings; however, it is not uncommon to see young rams with the ewe bands (young rams, two, three, and four year olds) or by themselves. During the rut in November and December all sexes and age classes are intermingled. There are exceptions and from time to time an old ram or two may be found with the ewe bands; young rams with the "bachelor bands," and one or two old rams may be found alone.

In the ram bands I have no evidence or data to indicate any

leadership; it would seem there is none, but in the ewe bands the leader is in most cases an old ewe. She will be the one leading when the band is traveling and usually seems to be a great deal more alert than are the rest of the band. Let me state here, I have not as yet seen anything in sheep behavior that to me would indicate the posting of sentinels as has been described to me on several occasions. As previously stated, seldom is a band observed when all animals are feeding. Normally one or more sheep are resting and in many cases are a little apart from the main group. Resting sheep are more alert than are those busy feeding. They are more apt to see possible danger, and on bounding up, spook the rest of the band.

The ewe bands of sheep consist in number from 2 or 3 to as many as 40 or 50. The ram bands are smaller groups usually from 2 or 3 to as many as 15 or 16. I have reports of much larger groups in both sexes and I suspect the gregariousness of sheep depends on range conditions and the relative abundance of food.

There is a "peck order" among sheep. It is not uncommon for younger, less robust animals to move aside to allow a larger animal the right-of-way. I have observed large mature rams run a smaller, younger animal from its bed and then bed in the same spot, or on occasion run them from a particularly lush clump of feed. In the same way, a three or four year old ram found in a ewe band is never challenged and will bully the ewes and young stock as the old ram bullies the smaller ones, taking the choice feed, beds, etc. Even so, an old ewe is the leader of the ewe band, although she will move aside for a young bully to feed.

The ram bands occupy the higher more precipitous terrain while the ewe and lamb bands are found on the lower pastures.

Play is a small part of the sheeps' daily activity and is indulged in by the young animals: lambs and yearlings. Lambs and yearlings often engage in little butting contests, scampering around, chasing each other, and clambering around rock formations. The older animals seldom engage in these antics but on occasion ewes will be seen in play with the lambs for short periods of time.

The older animals engage in butting contests from time to time other than during the rut and this activity appears to be playful in nature rather than fighting. This activity is sometimes seen between two ewes or for that matter several ewes. The butting between rams just prior to the breeding season is more play or an exhibition or exuberance than it is competition for the ewes. (This will be covered in report E-2c.) These contests are between animals of nearly

the same size and for the older animals, the same sex. I have never seen a mature animal scrimmage with a small one.

Feeding Behavior

As stated previously, feeding is mainly of a wandering nature with the band moving along short distances between bedding periods although some animals in the group are down resting while the others feed. As they feed they move considerably, going around obstructions and perhaps moving ahead several paces to a favorable patch of feed where the animal may spend several minutes cropping away, then be attracted by a plant several feet away and move to it.

This wandering feeding results in daily movements from a few hundred feet to a couple of miles or more depending upon the condition of the range. (Note instance mentioned before of three sheep feeding and resting in one small pasture for 57 hours and 10 minutes.)

As stated previously under Rest, these periods of feeding alternate with periods of rest in summer months for the entire day (24 hours). A comparison of the length of summer feeding periods to rest periods are presented in Table 2. During the seasons when there are dark hours the periods of feeding are greater length than the rest periods. In winter when daylight hours are extremely few, almost all daylight is spent feeding. Table 3 presents some observations made during the winter as a comparison. (For a discussion of the plants ingested see report E-2a.)

Watering Behavior

Little travel is necessary to secure water. During the summer months ample water is available in small pockets and pools of melt water. These water supplies are dispersed throughout the range.

Dall sheep stop to drink at times when crossing streams enroute from one pasture to another, but many in the band will cross without drinking.

During the months when most water supplies are frozen they get their water requirements from the snow ingested. I have never seen them travel to open water even though some exists at times during the coldest months.

Table 2. Summer feeding period as compared to summer resting period taken during July and August, 1961.

<u>Observation*</u>	<u>Feeding Period (Tenths of Hours)</u>	<u>Resting Period (Tenths of Hours)</u>
1	.3	.7
2	3.5	1.3
3	1.7	.7
4	.2	2.0
5	.8	1.6
6	2.0	1.7
7	1.1	2.2
8	.4	.2
9	.7	.3
10	.9	2.7
11	1.0	.5
12	1.2	1.2
13	.9	.8
14	2.1	1.7
15	1.1	.8
16	.3	.5
17	1.5	1.9
18	1.0	1.3
19	1.1	.9
20	<u>.2</u>	<u>.2</u>
Total	22.0	Total 23.2
Average Time	1.1	Average Time 1.16

* Each observation, feeding and resting, are of the same sheep.

Table 3. Winter feeding period as compared to winter resting period (taken during short daylight hours), November 1961.

<u>Observation*</u>	<u>Feeding Period</u>	<u>Resting Period</u>
1	3.1	?
2	1.2	?
3	2.6	.3
4	1.9	.5
5	3.4	.2
6	2.9	?
7	1.7	.4
8	2.5	.3
9	2.3	?
10	1.8	.6
11	<u>2.4</u>	<u>.2</u>
	Total 25.8	Total 2.5

* These observations are of ewes and young stock; the rams stop to feed but briefly as at this time of year they are constantly on the move.

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SUBMITTED BY:

Franklin F. Jones
Game Biologist

APPROVED BY:

Don H. Strobe
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-c Title: Productivity

PERIOD COVERED: July 1, 1961 to April 30, 1962

ABSTRACT

Dall sheep were observed during November and December 1961, to describe breeding behavior and timing of the rut. The work was done in the upper Tonzona River drainage, Alaska Range. Rams were first observed fighting on November 6 and continued such activities until November 27. Rams were with ewes from November 12 until December 11 and the ewes were in heat from November 17 through December 8.

Rams appear to fight primarily to release energy, not to prevent other rams from breeding or to collect harems. During the rut, rams feed from time to time but most of their time is spent traveling from one group of ewes to another.

In the ewe groups only one or two ewes were in oestrus at one time and the period of heat appeared to be about three days. Other than during oestrus the ewes' activities were not much different from pre-rut or post-rut periods.

Courting behavior and copulation are described.

Natality rates are not available for this year but just over 50 per cent of lambs observed in late July lived until the following April.

RECOMMENDATIONS

No recommendations relating to management can be made at this time.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 2-c Title: Productivity

PERIOD COVERED: July 1, 1961 to April 30, 1962

OBJECTIVES

To obtain information regarding breeding behavior and sexual cycles, fertility and natality rates, growth of fetus and lamb, magnitude of lamb crop, and survival of lambs to the yearling age.

TECHNIQUES

Project activities during this period consisted of direct daily observations. Lamb counts were made on July 21, 1961, and again on April 25, 1962, to ascertain ewe-lamb ratios as an estimate of the lamb crop and survival to yearling age. Forty-one days were spent in sheep country during November and December to determine the timing and duration of the rutting season. On 29 of these days sheep were observed for a total of 84 hours, in an attempt to discover and describe the breeding behavior.

FINDINGS

Description of the Study Area

The work was done in the upper part of the Tonzona River valley. The Tonzona River originates in glaciers along the Alaska Range about 60 miles southwest of Mt. McKinley, and flows northward into the Kuskokwim River. The part of the drainage occupied by sheep during winter consisted of rolling foothills adjacent to and west of the mouth of the Tonzona River canyon. This area is bigger than that containing sheep during the summer months, and the sheep are more widely scattered in winter. The depth of snow is less than that found in the summer months, and strong winds remove the snow to a greater extent. The areas used during the winter are at an elevation of 2,300-3,600 feet above mean sea level.

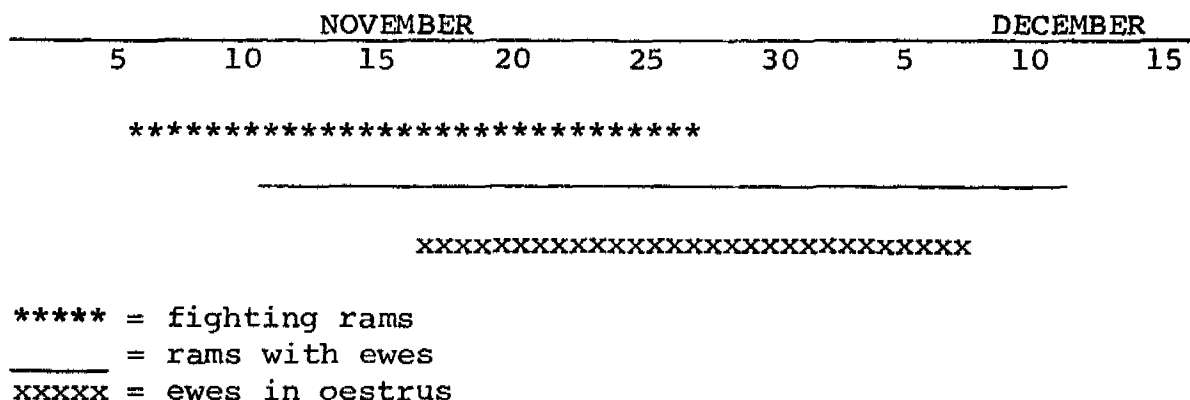
In the areas where my observations of the rut were made there were three groups of ewes, lambs, and young stock numbering 38 animals, 17 of which were mature ewes, In addition there were 16 rams present occasionally.

Mating Behavior

Rutting Period

The rut (determined by the commencement of butting contests) started on November 6, 1961. No rams were observed in such activity after November 27. Rams started joining the ewes on November 12; rams were not seen with the ewes after December 11. Ewes were first observed in oestrus November 17, and none seemed to be after December 8. This indicates a rutting period of 36 days for 1961. The rut reached its peak the last few days of November, after a rather slow start, and tapered off during the second week of December. Figure 1 shows the timing and duration of the rut.

Figure 1. Diagram of the rutting period, 1961.



Behavior of Males

The first indications of the rutting activity were butting contests between individuals of the "bachelor bands" of rams. Occasionally butting has been observed at other times of the year but other than during the rut it is infrequent and without vigor. In addition to the "head cracking," an occasional attempt by one ram to mount another was seen. This attempt to mount was not observed at other times of the year.

These butting contests did not seem to indicate aggression, nor did they eliminate contestants for mates except when a serious

accidental injury was received by one ram. These contests appeared to be an exhibition of exuberance and of skill, a release of excess energy during this preliminary phase of the rut. During these early contests ewes were not present. The rams remained by themselves. Two rams engaged in a duel invariably were of almost identical size. I never saw a mature ram engaged with a smaller, inferior opponent, nor have I seen a small ram challenge or pester a larger one.

I have never been able to ascertain precisely what constitutes a challenge. The stimulus may be different at different times. On most occasions it seems to be an "on guard" position (body low, head outstretched in low position straight in front of body) followed by a blow to the flank or shoulder delivered by the forefoot, or a butt or gouge with one horn followed by a few pawing strokes at the ground with one front hoof. This usually is followed by some pushing and shoving between contestants and blows delivered with the forefeet and horns, then suddenly, they back off 10 to 12 feet, rear up on their hind feet, take a few steps toward each other, and lunge forward, dropping to all four feet and bashing heads at the same time. This results in a loud crash that can be heard at considerable distance. After a solid crash of heads both rams appear to be badly shaken. I never saw this head bashing repeated sooner than several minutes afterwards; in fact, the contest usually was over after the first lunge. If the blow was not solid, the contestants moved back and charged again usually with a solid hit on the second attempt. After the match was completed the animals returned to feeding or occasionally to rest. Most jousts did not progress through the entire routine but terminated with the pushing and shoving phase. These clashes usually aroused no interest in other rams present but at times they appeared to be watching. I have never seen another ram attempt to interrupt the proceedings.

Contests were a substantial part of the ram's daily activity for six days prior to the first time rams were seen in the ewe bands. Clashes between rams continued after they had joined the ewes for two more weeks, but during the last few days of this period only occasional contests were observed.

After joining the ewes the larger rams were quite interested in the ewes, as well as in other animals. On one occasion I saw a mature ram attempt to mount a lamb. The younger rams are not so aggressive. However, when the opportunity occurred they attempted to court the ewes. When there were no large rams present the next in size became quite aggressive. During this early courtship, before any ewes were in oestrus, the aggressive rams seem to have difficulty in determining ewes from young rams, as they will attempt to mount the young rams.

Courtship seemed to consist of the "on guard" position or presentation followed by a short charge, then a nudge or butt in an attempt to get the object of the courtship to run. If the ewe or young ram did not run, the large ram sometimes tried to mount or changed his attention to another animal.

As soon as the ewes came in heat the rams paid no attention to any other animal except for occasional contests with other rams. The pattern of successful courtship is as follows: 1) The ram presents to a ewe, which urinates. 2) The ram thrusts his muzzle into the urine, raises his head, curls his lips back, and - I assume - issues a bawl or challenge as does a range bull. I have never been close enough to hear any sound. 3) The ram then nudges the ewe with his nose, or forefoot. 4) The ewe runs away, the ram following. The chase may be from a few yards to as much as a quarter of a mile but usually when she stops running he mounts her. 5) Copulation is extremely brief. The ewe stops with hind legs slightly spread, the ram mounts, and after one thrust forward he slides back and off. 6) The chase occurs again. The chases get progressively shorter and the ewe may be pursued by more than one ram at the same time. On one occasion I witnessed four rams chasing the same ewe and on three successive stops she was mounted by different rams.

After chasing and breeding a ewe from time to time during approximately two days the ram leaves her and heads across country looking for another ewe band and another "girl-friend." The rams during this month-long period do a great deal of travelling from one band of ewes to the next.

During this rutting period I saw no attempts by rams to collect or hold groups of ewes as a harem. In fact there seems to be no opposition among rams for the females except the difference paid large rams by the younger, smaller animals. As mentioned before, young rams are not aggressive when in the presence of mature animals, but on one occasion I witnessed a young ram, probably in his third year, judging from horn size, breed a ewe in the presence of three mature rams without opposition.

I do not know how far rams travel during the rutting period, but the groups of ewes I kept under observation were spread over four miles of the hills adjacent to our camp. The rams traveled between these groups and in addition I feel sure they also traveled to other groups of ewes that were outside my radius of action.

Behavior of Females

The ewes' activities during the rut were little changed from

their normal pattern except during the oestrus period. Normally only one or two ewes were in oestrus at the same time, and it would seem that the period of oestrus is about three days in length. When a ewe is coming in heat she may and often does court other ewes. Those ewes not in oestrus pay little attention to the activities going on about them.

The ewe and lamb bands traveled very little, and from day to day I could depend on finding them within a short distance of the place they occupied the previous day. On one occasion when my observations were interrupted for three days by snow and low visibility a group I felt were the same animals were still within one-quarter mile of their location before the storm. The composition of the group remained the same except that two rams had joined the group.

Feeding

The rams, during the rut, feed occasionally for short intervals. The ewe and lamb groups are busy feeding almost all the daylight hours, and I have found evidence of feeding during the dark hours. Daylight hours during the rutting period are from four to six hours in length at the latitude of the study area.

Lamb Survival

Natality rates are not available since this study was not initiated until July 1961, but composition counts were obtained soon after I arrived in the field. From this count and from the one obtained the following April, some insight was gained as to lamb survival during the year. On July 21, 1961, 132 animals were counted with the following composition: 42 rams, 49 ewes, 27 lambs, and 14 yearlings; therefore, at this time lambs and ewes were in the proportion 55:100. Counts were taken again on April 25, 1962. At that time there were 37 rams, 54 ewes, and 16 short yearlings in the area. The proportion of short yearlings to ewes was 29:100, or a loss since July of 26 lambs per 100 ewes. In short, just over one-half of the lambs present in July lived to the last of April. This, of course, overlooks the possible loss of some ewes during this period.

SUBMITTED BY:

Franklin F. Jones
Game Biologist

APPROVED BY:

Don H. Strodé
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 3-a Title: Goat Distribution and Population Status, Southeast Alaska

PERIOD COVERED: July 1, 1961 to June 30, 1962

ABSTRACT

Mountain goat composition counts were made in Southeast Alaska on Baranof and Chichagof Islands and in the vicinities of Juneau, Farragut Bay, Bradfield Canal and Wilson Lake on the mainland. The combined counts for all areas was 1,101 animals and the kid:adult ratio was 31:100. The greatest concentrations were near Juneau and Farragut Bay. No goats were found on Chichagof Island.

RECOMMENDATIONS

Counts should be continued until all goat ranges in Southeast Alaska have been covered. Very low hunting pressure and static populations make additional annual counts unnecessary with the exception of populations which are close to towns or are accessible from "fly-in" lakes.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work plan: E Title: Sheep and Goat Investigations

Job No: 3-a Title: Goat Distribution and Population
Status, Southeast Alaska

PERIOD COVERED: July 1, 1961 to June 30, 1962

TECHNIQUES

Aerial counts were flown in August and September to determine kid:adult composition and distribution. Flights were made during early morning and evening when goats were feeding on open slopes. Counts are expanded each year to include new areas. Biologists Loren Croxton and Alan Courtright and Coordinator David Klein assisted with counts near Ketchikan and Juneau.

OBJECTIVES

To determine the distribution, abundance and sex and age compositions of mountain goat populations.

FINDINGS

Mountain goat surveys were flown in the vicinities of Wilson Lake, Bradfield Canal, Farragut Bay to Endicott Arm and from the Taku River to Berners Bay. Table 1 shows the composition data for each area counted. The count for all areas in 1961 was 1,101 and the kid:adult ratio 31:100. The largest goat population was in the coast range between Port Houghton and Endicott Arm. Large numbers of goats were also seen near Berners Bay, north of Juneau. The count on Baranof Island was 118 in 1961 as compared to 116 in 1960.

One hour was spent flying the southeastern portion of Chichagof Island, searching for evidence of the 17 goats which

Table 1. Mountain goat composition counts flown in Southeast Alaska, 1961.

Location	No. Kids	No. Adults	Kid:Adult Ratio	Total Count
Baranof Island	20	98	20:100	118
Chichagof Island	0	0		0
Taku River to Salmon Creek	23	107	21:100	130
Salmon Creek to Berners Bay	61	216	28:100	277
Farragut Bay to Endicott Arm	129	302	43:100	431
Bradfield Canal	13	46	28:100	59
Smeaton Bay to Rudyerd Bay	18	68	26:100	86
All Counts	264	837	31:100	1,101

were transplanted near Basket Bay between 1953 and 1956. No goats were sighted.

The harvest of mountain goats in Southeast Alaska is presently insignificant with the exception of the immediate vicinity of some "fly-in" lakes. Some of the largest populations are found in the proximity of the larger towns.

Approximately two-thirds of the possible goat habitat in Southeast Alaska has been flown from 1959 to 1961.

SUBMITTED BY:

APPROVED BY:

Harry R. Merriam
Game Biologist

Don H. Strobe
P-R Coordinator

James W. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: E Title: Sheep and Goat Investigations

Job No: 3-b Title: Goat Distribution and Population
Status, Kodiak Island and Prince
William Sound

PERIOD COVERED: July 1, 1961 to June 30, 1962

ABSTRACT

Twenty goats representing eight adults, two yearlings and ten kids were observed in the Crown Mountain area of northeastern Kodiak Island during a one hour aerial survey conducted by the Department of Fish and Game and Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service.

No goat surveys were conducted in the Prince William Sound region during the period covered by this report.

RECOMMENDATIONS

None.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3

Name: Alaska Wildlife Investigations

Work Plan: E

Title: Sheep and Goat Investigations

Job No: 3-b

Title: Goat Distribution and Population
Status, Kodiak Island and Prince
William Sound

PERIOD COVERED: July 1, 1961 to June 30, 1962

OBJECTIVES

To determine distribution, abundance and sex and age composition of mountain goat populations in the Kodiak Island and Prince William Sound regions.

TECHNIQUES

Aerial surveys were conducted with a Piper Super Cub manned by a Bureau of Sport Fisheries and Wildlife pilot and Department of Fish and Game observer.

FINDINGS

The annual mountain goat survey of Kodiak Island was conducted on September 14 in cooperation with the Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service, who furnished the aircraft. During approximately one hour of flying time, 20 goats were observed in the Crown Mountain area of north-eastern Kodiak Island. Of the 20 animals, 8 were classed as adults, 2 as yearlings and 10 as kids of the year. This count represents the greatest number of goats observed since the initial introduction in the early 1950's and equals almost twice the number (11) of animals previously counted in this area. The low number of yearling animals observed may suggest that a rather high kid mortality occurs in the population during the first winter which perhaps accounts in part for the slow increase over the past ten years. The animals observed during this survey represent the minimum population of goats in the Kodiak Island area at this time. A few additional

goats may occupy the range but were not detected during this survey.

No work was accomplished in the Prince William Sound region during the period covered by this report.

SUBMITTED BY:

Ronald F. Batchelor
Game Biologist

APPROVED BY:

Don H. Strobe
P-R Coordinator

James H. Brooks
Director, Division of Game