ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

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SHEEP REPORT

by

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FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO: W-15-R-3 and W-17-1 TITLE: Big Game Investigations

WORK PLAN: N TITLE: Dall Sheep

JOB NO: 3, 4, 5, 6, and 7

PERIOD COVERED: January 1, 1968 to December 31, 1968

ABSTRACT

Life History and Ecology

Multiple aerial surveys were conducted on several study areas to classify sheep before and after lambing and during the winter. A method is suggested for using the results of these surveys to construct population models which more accurately represent the actual herd composition than do observed compositions obtained during any one survey.

Seasonal distribution of sheep on two of these study areas has been plotted and is discussed in relation to climate, behavior and other influencing factors. The rutting season commenced between November 18 and 25, 1968 in the Peters Creek study area; the preceding lambing season began between May 17 and 20, 1968. Breeding and lambing behavior are briefly discussed. Little evidence of serious predation has been found, although two probable instances of sheep having been killed by wolves were noted. Possible predation and other mortality factors are discussed.

Distribution and Abundance

Aerial inventory surveys were conducted on four areas suring the summer of 1968. Six hundred seventy nine sheep were counted in the Chugach Mountains between Knik and Nelchina Glaciers; 2,195 were counted in the Kenai Mountains; 820 in the southeastern Nutzotin Mountains; and 924 in the southeastern Wrangell Mountains. General sheep distribution was observed in the Brooks Range during a reconnaissance flight in August, 1968.

Harvest of Dall Sheep

The reported harvest of Dall sheep rams for 1968 was 1,122, the largest since 1962 when the present reporting system began. Thirty eight percent of harvest ticket holders hunted, and 33 percent of these hunters were successful. The mean reported horn length of rams killed was 33.3 inches. Successful hunters hunted an average of 3.9 days, and unsuccessful hunters hunted 4.6 days. A further breakdown of hunting results is presented.

Dall Sheep Habitat

Attempts to delineate sheep winter range by means of aerial photography were unsuccessful. Assistance was given the U.S. Forest Service and the U.S. Bureau of Sport Fisheries and Wildlife in the establishment of a permanent range transect and exclosure on Cooper Mountain, Kenai Mountains.

Movements of Dall Sheep

Seven sheep were experimentally captured and immobilized by means of a 60x60-foot nylon net which was dropped on them when triggered electrically from a blind. These animals were marked for future identification. Many of the problems encountered were overcome, and with technique modifications greater success is anticipated in May and June, 1969.

RECOMMENDATIONS

It is recommended that this study be continued with emphasis placed on determining methods for describing and comparing sheep populations; actually comparing sample populations under conditions of varying hunting pressure; determining sheep movements, and particularly ram movements during the rut; and describing and comparing harvested horn sizes by area.

It is further recommended that distribution and abundance inventories and the monitoring of hunter-harvest be continued; if necessary under another project.

The range and habitat investigations should not be carried as an active job again until time and qualified personnel are available.

Because of the experimental nature of this study to date, no management recommendations can be made at this time.

WORK PLAN SEGMENT REPORT

FEDERAL AID IN WILDLIFE RESTORATION

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OBJECTIVES

To determine the basic life history and ecology of the Dall sheep in Alaska including their reproduction, productivity, population dynamics, mortality factors, movements, general habits and behavior, food habits and range relationships, and physical characteristics.

To assess the general distribution and abundance of Dall sheep in Alaska and note major changes thereto, and also to select suitable populations and areas for further intensive study.

To determine and quantitatively and qualitatively evaluate the hunter harvest of Dall sheep.

To determine and evaluate the characteristics of Dall sheep habitat.

To determine methods of capturing and marking sheep for future identification.

TECHNIQUES

Life History and Ecology

The major effort of this phase of the study was directed at developing a method for determining the composition of sheep herds, and hence, production and changes in the herds' status. Aerial surveys were conducted on several study areas in the spring to study lamb survival through the previous winter by enumerating the number of yearlings present in the population, in the summer to determine the current year's production by counting lambs, and in the winter to delineate the ram segment of the population when rams are easiest to classify. Additional aerial surveys were conducted as time permitted to note seasonal distribution, snow conditions, and general behavior

of the sheep. The counting routes were pre-selected on each of the study areas involved and a map was carried during the flight on which was marked the actual route of travel and the location of all sheep observed. Low, slow passes were made by each sheep or group of sheep seen until the desired classification was obtained. The group was then listed by sex and age class on mimeographed count forms with each such listing paired with the map location for future reference. During some of the the surveys every effort was made to accurately classify all sheep seen. On other surveys only the segment of the population of interest was classified. For example, during some of the summer counts every effort was made to classify all lambs present, while the remainder of the population was not broken down by sex or age. Following each count the observations were summed on a count summary form for easy reference. These summary forms for all counts made during the year are on file.

During the flights other observations of interest were also noted on the counting forms. These included location and use of natural mineral licks, incidences of lambing or breeding behavior, carcasses of dead sheep, predation notes, etc. During some of the counts we attempted to cover the study area completely in order to come up with a total population estimate. This was most efficiently done during the mid-summer counts when sheep were easiest to see against the snow-free, green background of the alpine tundra. On other surveys we attempted only to obtain a large representative sample for classification purposes.

Trips were conducted on foot into the Dry Creek study area in March and June, 1968. Winter conditions were noted during March. Although the June trip was for the primary purpose of trapping sheep for movement studies, classification counts were conducted on foot with spotting scope and binoculars being used to identify sheep. General notes on sheep behavior were made on printed observation forms which are on file, but which have not been completely analyzed as yet due to insufficient numbers for meaningful conclusions.

A short foot trip was conducted into Peters Creek in late May, 1968 to observe early spring behavior, and another in early November, 1968 to note early winter conditions. A week-long trip was made into sheep habitat on Peters Creek in late November to further note winter conditions and to observe sheep behavior just prior to the rut. During the latter trip field observations were recorded on a portable tape recorder because it was too cold to write notes in the open. These recorded observations were later transcribed onto the appropriate observation forms.

Plans were drawn up for the construction of a small cabin to be placed in sheep winter habitat on an alpine ridge in the Peters Creek study area. Such a cabin would provide a safer and more comfortable base of operations for winter study work than the tent which was used this year. Some materials for this cabin were purchased, but construction will not begin until the spring of 1969. Several short trips into the Peters Creek study area were made for the purpose of checking proposed sites for the cabin.

One young ram was collected on November 25, 1968 in the Chugach Mountains just outside of the Peters Creek study area. The animal was collected with the aid of a helicopter and the carcass was brought down to the Anchorage laboratory for complete necropsy. The purpose of the collection was to obtain a young ram during the rut to determine its breeding condition as well as to obtain a winter rumen sample and to examine the animal for indication of disease or parasites. Attempts to collect other animals at this time were unsuccessful due to weather and lack of time.

A continuing review of available literature was conducted throughout the year in order to obtain a working knowledge of applicable research and techniques.

Distribution and Abundance

An aerial survey utilizing a Piper Supercub was conducted on portions of the Wrangell and Nutzotin Mountains in order to note and map general distribution and abundance of sheep in the area as well as to pick a tentative study area for future intensive work. The flight was made so as to obtain as complete coverage as possible of sheep habitat in the area involved. Routes of the flights were marked on maps to enable future repetition if desired. Observations of sheep were recorded on the aerial count forms as well as being marked on the map. Following the survey, results were summed on aerial survey summary forms for quick reference. These are on file.

An additional survey was conducted in the Chugach Mountains to determine sheep distribution and abundance between the Knik River and the Nelchina Glacier. This survey continued the general inventory of sheep in the Chugach Mountains which was commenced during the previous segment.

A similar survey was conducted on the Kenai Peninsula, resulting in a complete aerial inventory of all sheep habitat on the Peninsula. Detailed classification of sheep seen was generally not attempted since the primary purpose of the counts was to obtain information on general distribution and abundance.

A reconnaissance flight was made during late August in the Brooks Range for familiarization purposes and to note general distribution of sheep there. No attempt was made to make accurate counts or to classify sheep because of the great area involved and lack of time for such detailed surveys. A Cessna 185 on floats was used for this trip in order to cover as much ground as possible in a limited time.

Although the surveys were primarily conducted by Lyman Nichols, Study Leader; James A. Erickson, Study Assistant; and Arthur C. Smith, temporary Wildlife Aide; assistance was generously given by the following staff biologists: Paul LeRoux, Lee Miller, Royce Perkins, Larry Jennings, and Joe Blum.

Harvest of Dall Sheep

Sheep Hunter Information Survey

Sheep hunters are required to obtain a harvest ticket and report card (Figure 5-1) before hunting and they must fill in the report card after killing a sheep or after the season ends. Data obtained from the 1968 report cards were coded and entered on IBM cards. Desired analyses were programmed and the data were processed at the University of Alaska with an IBM 360 computer.

Horn Growth Study

Sheep horns (265 sets) from the 1968 harvest were measured at taxidermy shops in Anchorage and Fairbanks by A.C. Smith, J.A. Erickson, L. Jennings and S. Grundy. Assisting in taking these measurements were W. Cunningham, F. Howe, R. Lofgren, R. Smith, N. McArthur, P. LeRoux, J. Sexton and D. Bader.

We attempted to measure all sheep horns that hunters brought to taxidermy shops in the Anchorage and Fairbanks areas. Measurements taken included total length of each horn, horn spread; and on the longest horn, lengths of horn segments, diameters of horn segments, curl of horn in degrees of a circle, and diameter of horn curl on the 90° -270° diameter. The harvest ticket number was recorded from each set of horns so that the mountain range from which the sheep was taken could be obtained from the sheep hunting report card.

A C-clamp was clamped on the skull between the horns, and then was clamped in a vice mounted on a ball and socket base which permitted the vice to swivel. The horns were measured while held securely in the vice. A flexible steel measuring tape was fastened to the horn with masking tape and the lengths of the growth segments were measured along the outside curve, between horn annuli. By fastening the measuring tape to the horn, the tape could not slip during the measuring process. This assured that the sum of the segment lengths equalled the total length. The greatest diameter at the proximal end of each segment was measured in the groove of the annulus.

After linear measurements were made, the horns were tilted and swiveled until an observer about 4m away could sight along the axis around which the longer horn was coiling. When one sights on the axis the outer surface of the horn is very nearly described by a circle. About 50cm the other side of the horns from the observer was located a series of concentric circles from 20 cm to 36cm in diameter engraved on a plexiglass plate. The outermost circle was divided into degree graduations. This plate was attached to the measuring device in a vertical plane as a background to the horns and was free to move up and down in a slot. The 0° -360° radius was extended to a length of about 28 cm and a movable arm with an engraved radius extending to 28 cm and a movable arm with an engraved radius extending to 28 cm was added to the apparatus. An observer, sighting along the axis of coiling, could have an assistant move the horns and the plexiglass "target" plate until the axis of coiling passed through the center of the circles on the plexiglass plate. The circle described by the horn could then be matched with one of

the concentric circles on the plate. Maintaining his sighting along the axis of coiling to the circle centers, the observer would have an assistant move the $0-360^{\circ}$ reference radius until it intersected the base of the horn on the front edge. Then the reference would be moved until it intersected the distal end of the horn, and the degrees of curl could be read directly from the scale on the outer circle. Next the diameter of the coil (or curl) was measured on the $90^{\circ}-270^{\circ}$ diameter at right angles to the axis of coiling with forestry-type or other calipers.

No attempt has been made as yet to analyze horn measurement data other than for gross comparisons with hunter-measured horns. Complete analysis will be done under a future job description and will necessitate use of a computer.

Dall Sheep Habitat

A series of 35mm color photographs was taken of Dry Creek, Alaska Range, from a Piper PA18 aircraft with a Pentax Spotmatic (50mm lens) using Kodochrome film on March 14, 1968. The photographs were taken from altitudes of about 8,600 and 12,400 feet. Another series of photographs was taken of Peters Creek, Chugach Range, from a Cessna 206 flying at 16,300 feet.

Jerry McCoy (U.S. Forest Service), Robert Semall (U.S. Bureau of Sport Fisheries and Wildlife) and James Erickson were flown in a Forest Service chartered helicopter from Cooper Lake to Cooper Mountain on the Kenai Peninsula on July 23, 1968 where McCoy and Semall were assisted in establishing a 50-foot transect using the cover method of Daubenmire (1959). A 6x12-foot hog-wire exclosure was built near the transect and permanent plots were established within and without the exclosure.

During a one-week trip in March, 1968, on the ground in Dry Creek, several areas of noticable winter use by sheep were marked with flagging and photographed. However, the intended study of these areas in summer was not made.

Movements of Dall Sheep

Sheep were captured and immobilized with a 60x60-foot net which dropped on them when the blasting caps in the supporting ropes were triggered electrically from a blind about 10m away. The net was constructed of No. 72 knotless nylon in 3 1/2-inch square mesh and was dyed black (Nichols Net and Twine, East St. Louis, Ill.). Four corner posts of 2-inch steel pipe 10 feet long plus a 12-foot center post supported the net off the ground. The methods and materials used were similar to those used by Glazener et. al. (1964) and Ramsey (1968) in trapping turkeys (Meleagris gallopavo) and deer (Odocoileus) respectively.

An area along a major trail leading to the main mineral lick in Dry Creek, 70 miles south of Fairbanks, was baited on June 7, 1968, with several 5-lb. salt blocks (98% NaCl with trace amounts of $FeCO_3$, oxides of Mn, Fe, Cu, Co and Zn, and 3-5 di-iodosalicylic acid). On June 10, 1968, sheep

were first observed using the salt and by June 14, 1968, when we received the net, sheep were using the salt extensively. The net was hung over the baited area June 15, 1968. During the next 4 days, the baited site was watched from a blind for 6 to 8 hours per day but we saw no sheep go under the net. On June 20, 1968, the net, along with the remaining salt, was moved to a corner of the natural lick and was watched from June 21 to June 28, 1968. The first sheep were captured June 23.

Yellow, 3/4-inch thick, polypropylene rope collars with red pendants engraved with white 4 cm tall numerals ("Giantag", Western Ranch Supply, Billings Mont.) were placed on the animals, and metal ear tags with "RETURN ADF&G ANCHORAGE" were attached. Collars were fastened with hog rings.

FINDINGS

Life History and Ecology

Population dynamics

In this segment of the study much of the emphasis was directed toward determining a suitable method for describing annual production and population changes. Analyses of the aerial count results on selected study areas provided the main tools to accomplish this objective. Most of the work was conducted on the Peters Creek study area because of its proximity to Anchorage (see Figure 3-1). Some aerial and most of the ground work was conducted on the Dry Creek study area south of Fairbanks (see Figure 3-2). Additional aerial counts were conducted on the Kenai study area, including Crescent Lake Mountains, Cooper Mountain, and Surprise Mountain (Figure 3-3) and in McKinley Park, Watana Creek Mountains and Boulder Creek in the southern Talkeetnas.

Much effort has been directed in the past toward counting sheep herds in various areas and in attempting to determine production, survival, and population changes from the results of these counts. Such counts were usually made during the summer when sheep are easiest to see and, theoretically, easiest to classify. Conclusions drawn from the results of these counts - generally in the form of ratios of ewes to lambs, ewes to yearlings, and ewes to rams - were thought to be valid.

We have found, however, that it is extremely difficult to obtain an accurate classification of all segments of the sheep herd during any one count in one season. Without an accurate classification of all segments of the population, true ratios cannot be determined nor can valid conclusions be drawn regarding production, survival, etc. For example, during a mid-summer count - which is probably the best time of year to obtain a maximum enumeration of the population as a whole - it is almost impossible to differentiate yearlings, that is the previous year's lambs, from adult ewes and even from current lambs. Additionally, many of the older rams isolate themselves at this season in rugged, broken country where they are hard to find. Consequently, classification of a given herd almost always results in a higher number of ewes being recorded than are actually present, and in lower numbers of yearlings and rams. Careful counting at this season can result in the accurate tallying of lambs of the year. Counts conducted in the spring, after winter losses

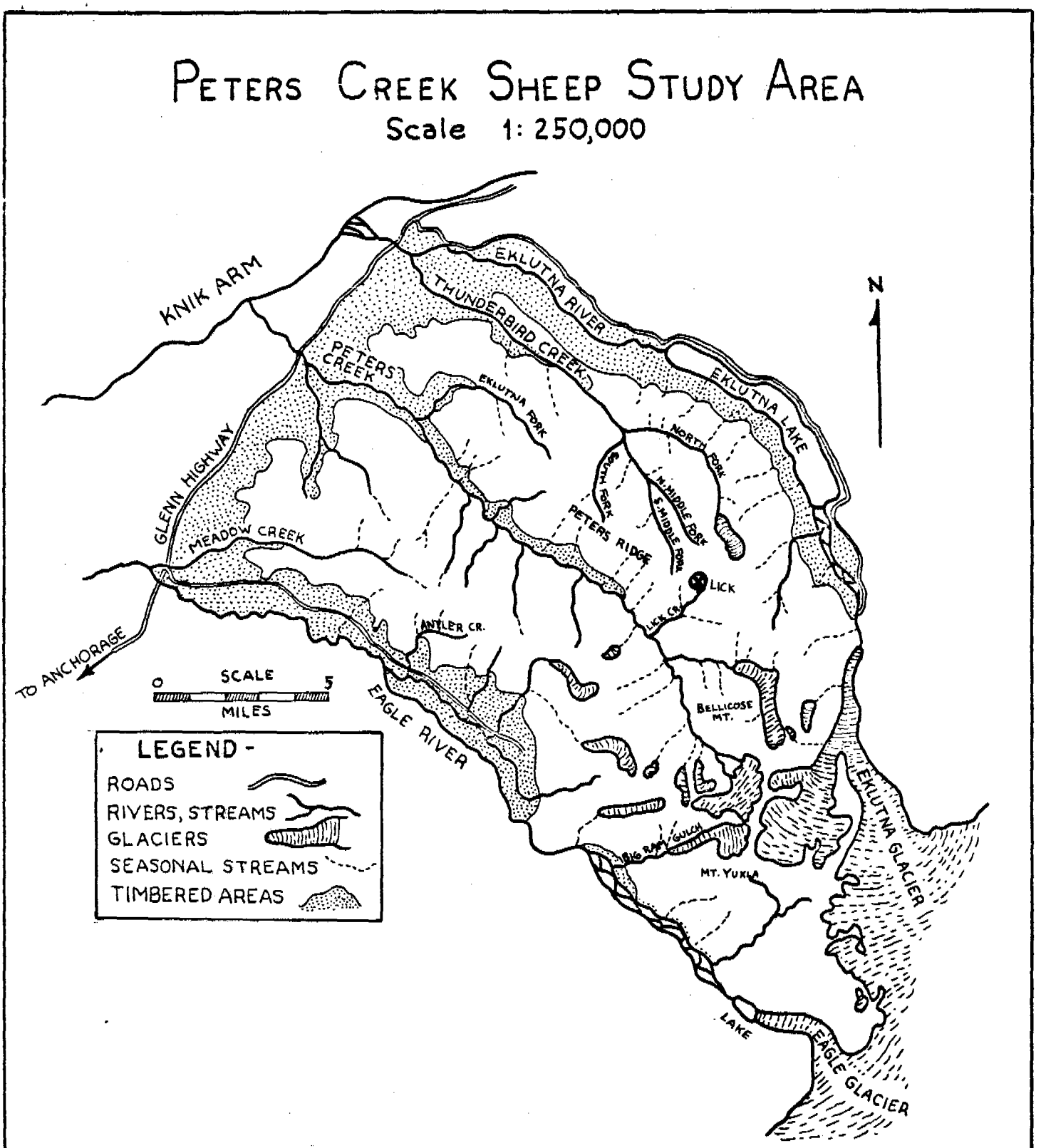


FIGURE 3-1
FEATURES OF PETERS CREEK STUDY AREA

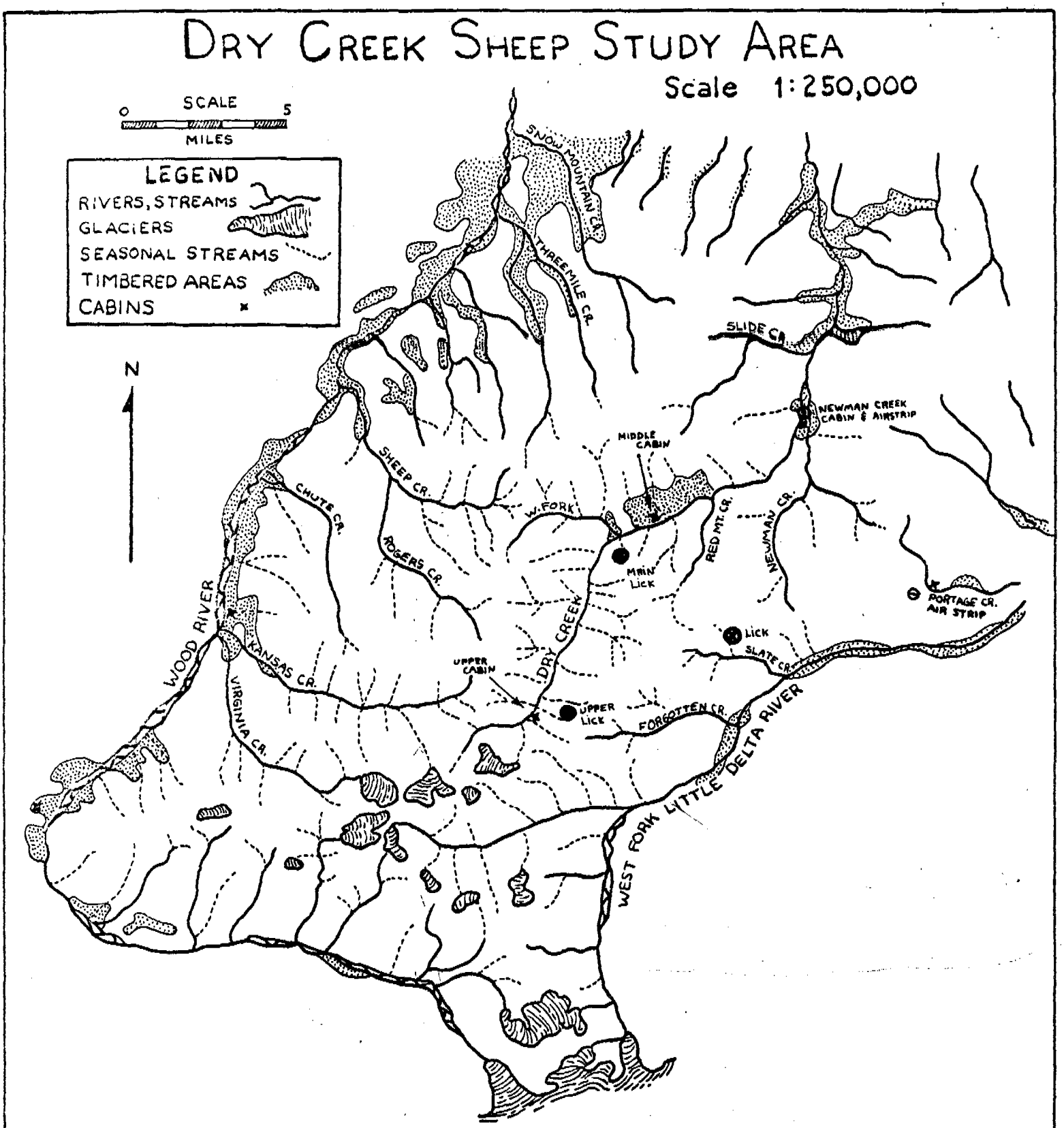


FIGURE 3-2
FEATURES OF DRY CREEK STUDY AREA

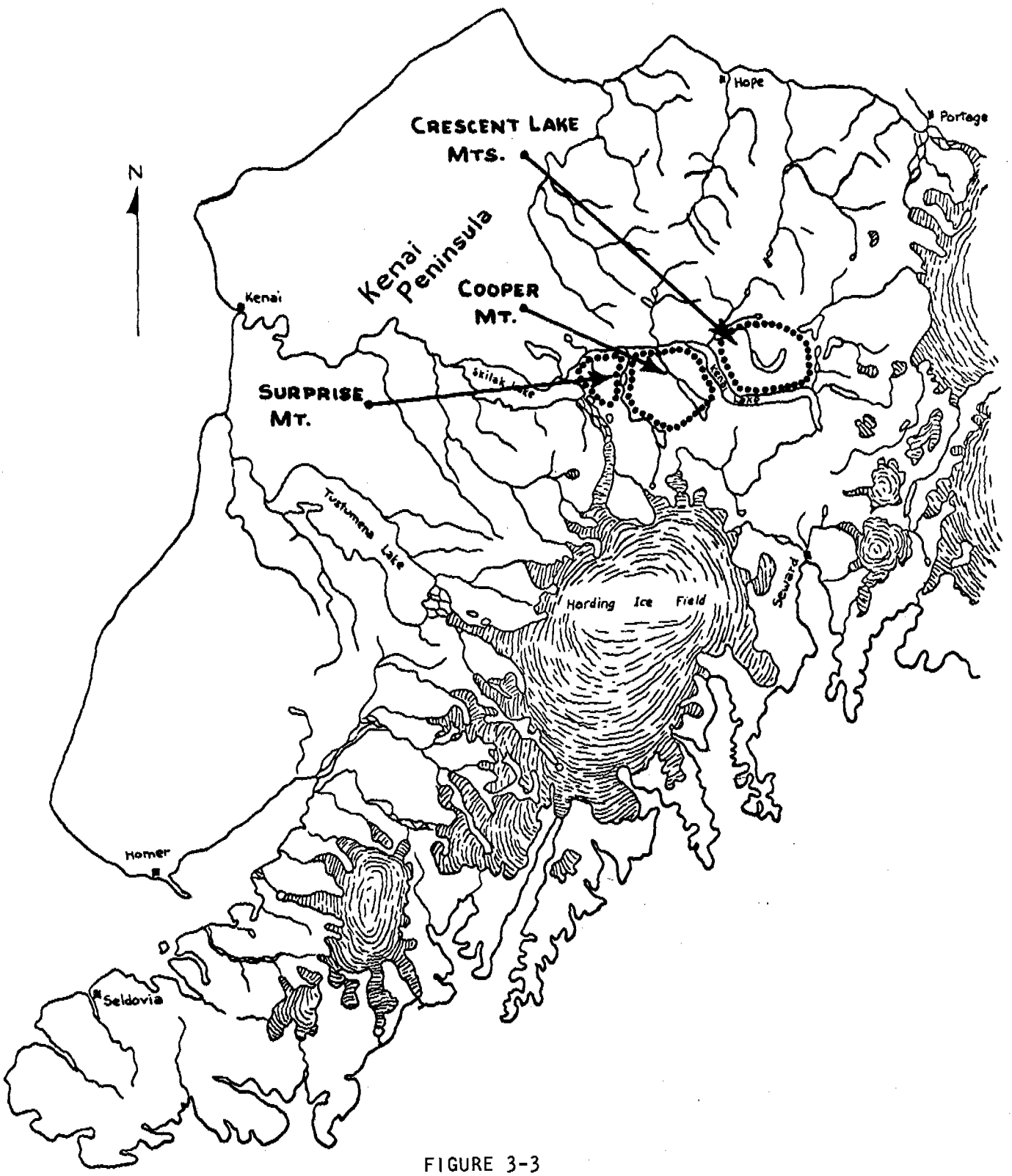


FIGURE 3-3
CRESCENT, COOPER AND SURPRISE MTS. STUDY AREA

are over with and before the arrival of new lambs, can result in an accurate classification of yearlings. Since most rams are still in their winter or spring habitat and are thus relatively easy to find, they can also be enumerated with accuracy in the spring although it is somewhat difficult to identify rams as to age class from the air at this time because of the difficulty in distinguishing horn tips against a darker background.

A survey in early May, for example, can thus result in a reasonably accurate determination of the proportion of rams to ewes and yearlings to ewes. Because of the difficulty in separating very young rams from ewes at any time, the terms "ewes" or "females", as used in these population discussions, probably include a certain unknown number of two-year-old rams, although in some cases even these may be separated from the ewes.

The best time of year to accurately classify the ram segment of the population is during the rutting season when the rams are well distributed among the ewe bands and when the new snow cover makes horn tips readily visible against the white background. Problems associated with cold weather and short periods of daylight at this time of year have made it difficult to obtain adequate sample sizes, however. Additionally, a certain portion of the ram population segment has been removed during the hunting season, and, unless this portion is accurately known, it is difficult to use these count data in examining the previous summer's sheep population for composition.

It appears necessary, therefore, to conduct at least two aerial surveys of a given sheep herd - one in the spring before lambing and one in the summer after lambing - in order to obtain sufficient data with which to determine survival and annual production as well as the proportion of rams in the herd. Comparison of these two counts makes it possible to reconstruct the overall population by sex and age class as it occurs during the summer.

Table 3-1 summarizes the results of the significant study area classification counts conducted during this segment as well as two counts conducted during the past segment in Dry Creek for comparative purposes. Examination of the Peters Creek count on May 20 and 21, 1968 shows that 174 ewes were counted (including a few unidentifiable young rams) as well as 33 lambs of-the-year and 29 yearlings. Since lambing is still in progress at this time, the number of lambs seen is meaningless. Winter mortality should be over by this season; therefore, the number of yearlings observed should be an accurate indicator of the number of previous year's lambs which have survived the winter. On this count the proportion of ewes to yearlings was observed at 17 yearlings per 100 ewes and should be accurate.

I will ignore the ram segment of the population for the moment, so the combined total of ewes, lambs and yearlings observed is 236 animals. The summer count made on July 25, 1968, after lambing had been completed, resulted in 242 ewes and 87 lambs being counted for a total of 329 sheep in the sample. In this case, the ewe segment also included yearlings because they could not be distinguished from adult ewes. No yearlings were classified as such.

In order to obtain the ewe-lamb ratio, it is first necessary to determine the number of yearlings in the ewe group and substract them, leaving only adult ewes for the comparison. Otherwise, the proportion of ewes to lambs as observed would be dependent upon the variable survival of yearlings, a factor which is not related to the current summer's lamb production. Since the sample of ewes, yearlings, and lambs was larger in July than it was in May, it is necessary to estimate the number of ewes and yearlings in this segment by comparing the ratio of ewes to yearlings as observed in May with the larger sample size. The combination of 203 ewes and yearlings observed in May is 39 animals less than the combined 242 ewes and yearlings observed in July. The 39 animals are assumed to contain the same proportion of ewes to yearlings as that observed in the May survey, resulting in an assumed 33 ewes and 6 yearlings having been observed during the second survey which were not seen in the smaller sample during the first survey. Thus, the population during the July survey should have included 207 ewes and 35 yearlings in the same proportion as in May. The composition of this segment of the herd during the summer can then be computed as follows: 207 ewes, 87 lambs, and 35 yearlings within the total of 329 sheep observed. The ratio of lambs to ewes is 42.0:100.0 and that of yearlings to ewes is 16.9:100.0.

In order to compute the male to female ratio and so complete the reconstruction of the July population, the best observed male to female ratio is used under the hypothesis that it is unlikely that ewes are ever mistakenly called rams while young rams may be somtimes classified as ewes. Thus, in classifications where reasonable care was used, the highest observed proportion of rams is probably the most nearly accurate. In this case, the highest proportion of rams was also seen on May 20, probably before many rams went off in small bachelor groups into the higher, rougher country where they were difficult to see in later counts. The number of rams seen at this time was 66; assuming a similar ratio present in July, the May ratio of 66 rams to 174 females would indicate 79 males to the 207 females computed in July. The assumption here is that 15 rams were missed in the July count since only 64 were seen. The ratio thus obtained of rams to ewes would be 38.0:100.0.

In order to further break down the ram segment of the reconstructed July population, it is necessary in this case to utilize the following winter's ram count. This count made on January 16 and 17, 1969 was made at the time of year when the most accurate ram classification is possible due to a good distribution of rams among or near the ewe bands and the white snow background making horn size readily visible. Results of this count are also summed in Table 3-1. A problem now encountered is that on a heavily utilized area of the size of Peters Creek the hunting harvest is large enough to significantly alter the ram ratios in one season. Thus, the observed ratios in January, 1969, while accurate for this time of year, cannot be used alone to help construct the previous July's population model unless hunter harvest is known. However, the reverse process may be useful in estimating hunter harvest.

The observed ratio of 42 rams to 131 ewes in January is equivilant to a ratio of 32 rams to 100 ewes, presumably accurate at this time. Assuming a minimum of 207 ewes still in the herd in January (based on the further assumption of a population of 393 sheep and no female mortality since July) this ratio would indicate 66 rams should be present in January. Since 79 rams were computed to be present in July, the estimated hunter harvest is 13 rams.

According to the harvest report cards, 25 rams were taken from the area of Eagle River, Peters Creek, and Eklutna River during the 1968 hunt. It is not possible at this time to determine how many of the 25 were removed from the actual study area. If this number were known, the accuracy of the foregoing computations could be checked.

The observed ratio of 31 legal rams to 100 total rams in January would indicate 20 legal rams remaining in the population of 66 rams plus 46 young rams. Legal rams are, of course, those rams with horn curls of 270¼ or larger: "3/4-curl rams". Since the 13 harvested rams should all have been legal rams, there then should have been 46 young rams and 33 legal rams in the pre-hunting season July population. This gives a proportion of 42 legal to 100 total rams at this time compared to an observed ratio of 46 legal to 100 total rams.

The entire reconstructed summer sheep population on Peters Creek study area can thus be presented by percentages of each class in the herd as shown in Table 3-2. Ratios of rams per 100 ewes, lambs per 100 ewes, and yearlings per 100 ewes can then be computed for the herd at this particular period. These ratios are also shown in Table 3-2.

Errors in this type of reasoning may include one or more of the following assumptions: no mortality of yearlings between May and July, no mortality of ewes or rams other than by hunting between May and January, no change in status between young and legal rams from May to January (the most obvious error). More work needs to be done to determine the extent of these and other possible errors so as to be able to take them into consideration when constructing summer populations. However, the method does appear promising as a means of obtaining data which can be used to compare herds and to compare a given herd from year to year.

By following the same reasoning, summer populations on other study areas upon which suitable counts have been made may be constructed. This has been done in Table 3-2 for McKinley Park, Watana Creek, and Dry Creek in addition to Peters Creek. The sheep population on Cooper Mountain on the Kenai is also shown in the same manner in Table 3-2, although this was an observed rather than a constructed population. Conditions were such that it is believed that the June 17, 1968 count on Cooper Mountain was sufficient in itself to use in determining the sex and age classes of this herd. Accuracy of the ram classification is indicated by a comparison between the June count and that made on January 22, 1969. Twenty-one legal rams and 8 young rams were observed on June 17. One legal ram and 8 young rams were observed on January 22. A reported 20 legal rams were removed from this mountain by hunters during the 1968 hunting season.

The sheep populations as actually observed on several aerial counts each in Peters Creek and McKinley Park have been converted to percentages by sex and age class in Table 3-3 and so may be compared directly to the reconstructed populations on these two areas. Differences are obvious between the formerly accepted observed sex and age class percentages and ratios and those as determined by reconstructing the summer populations.

Table 3-1. Summary of Significant Sheep Study Area Counts.

Study Area Date	Rams				Ewes	Lambs	Yearlings	Unclass. Sheep	Total	Comments
	Unclass.	Young ♂	Legal ♂	Total ♂♂						
Peters Creek										
5/20,21/68	31	23	12	66	174	33	29	-	302	
7/25/68	38	14	12	64	242	87	-	-	393	
1/16,17/69	-	29	13	42	131	51	-	-	224	
McKinley Park										
6/5/68	161	-	-	161	251	86	25	-	523	
8/12/68	229	-	-	229	256	101	-	-	586	
1/14,15/69	-	14	40	54	111	37	-	-	202	
Watana Creek										
6/5/68	6	-	-	6	94	40	10	-	150	
8/6/68	5	7	4	16	134	33	-	-	183	
Cooper Mt.										
6/17/68	-	8	21	29	65	20	3	-	117	
7/8/68	-	-	-	-	-	21	-	100	121	
1/22/69	-	8	1	9	58	27	-	-	94	

Table 3-1 (Cont.). Summary of Significant Sheep Study Area Counts.

Study Area Date	Rams				Ewes	Lambs	Yearlings	Unclass. Sheep	Total	Comments
	Unclass.	Young ♂	Legal ♂	Total ♂♂						
Dry Creek 6/9/67	-	41	24	65	158	56	18	21	318	Counted on foot. Duplications Probable.
6/13,14/67	45	35	32	112	281	73	3	25	494	
6/4/68	64	-	-	64	233	87	45	-	429	
6/11/68	40	49	24	113	231	145	29	72	590	Same as above.
Boulder Creek 5/21/68 and 6/2/68	2	25	24	51	265	42	46	-	404	
7/26/68	-	-	-	-	-	88	-	372	460	Classification for other than lambs not attempted.
Surprise Mt. 6/19/68	33	-	-	33	174	68	-	-	275	
1/22/69	-	15	-	15	107	38	-	-	160	Incomplete coverage due to weather.
Wrangell Mts. (Areas B & D) 6/26-28/68	128	-	-	128	415	100	-	9	652	
12/4,5/68	-	10	7	17	43	13	-	-	73	Inadequate sample due to weather.

Table 3-2. Reconstructed Summer Sheep Populations by Percentages of Herd.

Area and Applicable Date	1/ % Young ♂	% Legal ♂	% All ♂♂	2/ % ♀♀	% Lambs	% Yearlings
Peters Creek 7/25/68	11.3	8.1	19.4 (38.0 ♂:100.0 ♀)	50.7	21.3 (42.0 Lambs:100.0 ♀)	8.6 (16.9 Yrl.:100.0 ♀)
McKinley Park 8/12/68	10.1	29.0	39.1 (98.3 ♂:100.0 ♀)	39.8	17.2 (43.3 Lambs:100.0 ♀)	3.9 (9.9 Yrl.:100.0 ♀)
Watana Creek 8/6/68	-	-	8.8 (13.5 ♂:100.0 ♀)	65.0	18.0 (27.8 Lambs:100.0 ♀)	8.2 (10.6 Yrl.:100.0 ♀)
3/ (As observed) Cooper Mt. 6/17/68	6.8	18.0	24.8 (44.7 ♂:100.0 ♀)	55.5	17.1 (30.8 Lambs:100.0 ♀)	2.6 (4.6 Yrl.:100.0 ♀)
Dry Creek 6/13/67	-	-	23.9 (44.0 ♂:100.0 ♀)	54.3	15.6 (28.6 Lambs:100.0 ♀)	6.2 (11.4 Yrl.:100.0 ♀)
6/11/68	-	-	21.8 (51.8 ♂:100.0 ♀)	42.1	28.0 (66.5 Lambs:100.0 ♀)	8.1 (19.3 Yrl.:100.0 ♀)

1/ Young ♂ have less than 3/4 curl horns.
2/ ♀♀ may include some unidentified young ♂.
3/ Observed, non-reconstructed population. Possible errors in yearling identification resulting in lowered observed yearling numbers, higher observed ewe numbers, lower observed lamb:ewe ratios.

(Dry Creek - constructed from both foot and aerial counts both years. Accuracy of 6/13/67 aerial count doubtful; same with foot counts due to repeat observations. High lamb:ewe ratio in 1968 may be due to date--before initial lamb mortality.)

Table 3-3. Observed Sheep Populations by Percentages of Herd.

Area and Date	1/ % Young ♂	% Legal ♂	% All ♂♂	2/ % ♀♀	% Lambs	% Yearlings
Peters Creek						
5/21/68	-	-	21.9 (27.9 ♂:100.0 ♀)	57.6	10.9 (19.0 Lambs:100.0 ♀)	9.6 (16.7 Yrl.:100.0 ♀)
7/25/68	-	-	16.3 (26.4 ♂:100.0 ♀)	61.6	22.1 (36.0 Lambs:100.0 ♀)	- -
1/17/69	12.9	5.8	18.7 (32.1 ♂:100.0 ♀)	58.5	22.8 (38.9 Lambs:100.0 ♀)	- -
McKinley Park						
6/5/68	-	-	30.8 (64.1 ♂:100.0 ♀)	48.0	16.4 (34.3 Lambs:100.0 ♀)	4.8 (10.0 Yrl.:100.0 ♀)
8/12/68	-	-	39.1 (89.5 ♂:100.0 ♀)	43.7	17.2 (39.4 Lambs:100.0 ♀)	- -
1/15/69	6.9	19.8	26.7 (48.6 ♂:100.0 ♀)	55.0	18.3 (33.3 Lambs:100.0 ♀)	- -

1/ Young ♂ have less than 3/4 curl horns.
2/ Includes some unidentified young ♂ and yearlings when these have not been separated.

Table 4-1. Summary of General Sheep Inventory Counts.

AREA	DATE	RAMS	UNCLASSIFIED, EWES & YOUNG	LAMBS	TOTAL
Chugach Mts. (Knik River to Nelchina Glacier)	7/24-26/68	84	472	123	679
Kenai Mts. Area A	8/17/68	-	-	-	22
Area B	8/23/68	-	-	-	45
Area C	8/22/68	7	23	13	43
Area D	8/22/68	2	21	7	30
Area E	6/19/68	46	182	68	296
Area F (Cooper Mt.)	7/8/68	-	100	21	121
Area G (Surprise Mt.)	6/19/68	33	174	68	275
Area H	7/9/68	-	306	65	371
Area I	7/16/68	12	34	9	55
Area J	7/16,17/68	141	457	158	756
Area K	7/17/68	56	102	22	180
Area L	7/18/68	1	-	-	1
TOTAL (Kenai)					2,195
Nutzotin Mts. Area A	6/27/68	261	436	123	820
Wrangell Mts. Area B	6/26/68	84	199	52	335
Area C	6/25/68	42	89	12	143
Area D	6/27,28/68	44	225	48	317
Area E	6/26/68	5	96	28	129
TOTAL (Wrangell)					924

Before this reconstruction method is accepted as the best means of comparing populations, more work must certainly be done to determine its validity. The accuracy of individual classification surveys must be determined, in particular. This could be done by conducting replicate classification counts on a given area over a period of several days or by conducting careful ground classification counts just prior to or following the aerial counts.

In regards to ground classfication counts, the results of two which were made on the Dry Creek study area in June, 1967 and June, 1968 are shown in Table 3-1. It can be seen that the herd composition differs in each case from the aerial count made within a matter of a few days over the same area. There were several faults in the methods used during the ground counts which could have contributed to the differences between these and the aerial surveys. Because of the routes taken, an unknown number of duplicate observations were included in the totals. Attempts to classify animals too distant for accurate spotting-scope observation, or only partial classification of distant groups, also led to error. Methods will have to be refined for future ground surveys to obtain accurate classifications which can then be used for assessing the accuracy of aerial counts on the same area.

Distribution by Season

During the various aerial surveys, distribution of all sheep seen was marked on maps. These distributions on the Peters Creek and Dry Creek study areas have been plotted pictorially on maps of the areas in Figures 3-4 through 3-10. The variation in the number of sheep shown in each figure was the result of the variation in sheep actually seen during each survey.

During the winter, sheep were found to inhabit primarily the upper, windblown ridgetops and slopes of the Peters Creek area. The light, dry snows of early winter appeared to restrict their movements very little and they moved and fed on the slopes from brushline to ridge top with little apparent difficulty. Sheep were seen to travel freely from slope to slope across gullies containing deep powder snow and were observed to paw through snow at least 12 inches deep in order to feed. While feeding, sheep would typically dig craters several feet in diameter through the snow to get at the buried vegetation. After feeding for a few minutes in a crater, the animal would then move to another spot and repeat the performance. These feeding craters, with connecting trails, form an easily recognized spider-web pattern in the soft snow of early winter.

As strong winter winds blow the soft snow clear of the upper ridges, saddles, and slopes, and deposit deeper drifts on the lower slopes, the sheep move upwards to the open areas where feeding is easier. As winter progresses, the snow cover becomes packed and forms a hard crust, making it difficult if not impossible for sheep to dig through to their forage. When this occurs, they are restricted almost entirely to the windblown, upper slopes. Sheep are rarely seen in areas unaffected by these snow-removing winds; thus, the presence of wind in combination with relatively light snowfall appears to be an important factor in the ability of sheep to survive throughout the winter months.

The same general type of distribution was noted in the Dry Creek study area during the winter months. However, this area appeared to have even less snow than Peters Creek, and a type of topography which was more easily windblown. Consequently, the windblown areas in Dry Creek were larger than those in Peters Creek, allowing a wider distribution of sheep. The strong, northerly winds which affect the north slope of the Alaska Range in the Dry Creek area undoubtedly influence sheep survival and help account for the fact that they are found almost exclusively on the north slope of this range.

With the thawing of snow at the lower elevations in early spring, and subsequent baring of forage, most sheep move to the lower slopes on the Peters Creek area and remain at and just above the brush line, presumably because feeding is easier. They may also be seeking the first green vegetation of spring. As summer approaches, sheep move back up towards the higher elevations. This upward movement may be more influenced by the "greening-up" of vegetation than by the melting of snow on the upper slopes. Even though the upper slopes on the Peters Creek study area were largely snow-free by mid-May, 1968, few sheep were seen back on their "winter range" until the first week in June.

During the summer, sheep used almost all available areas of their habitat including low slopes, ridge tops, and in some cases, the higher rugged peaks. However, summer distribution in the Peters Creek and Dry Creek areas appeared to be strongly influenced by the presence of natural mineral licks. First use of the large lick in Peters Creek was noted on June 2, 1968. Use became heavy by June 11 and continued throughout the summer until at least October 19, the date the last sheep were observed in the lick. Sheep use of the lick in the fall ceased ceases with freeze-up.

During each summer survey, large numbers of sheep were seen either at the lick or in its general vicinity, including the headwaters of Thunderbird Creek which adjoin it to the north. A few sheep were noted using the main lick in Dry Creek on June 4, 1968, and use increased rapidly within the next few days.

During the heat of summer days, particularly in Upper Boulder Creek in the Talkeetna Mountains, sheep utilized caves and overhanging rocks in the cliffs, presumably for shade. This was also noted during the summer of 1967 in the Lake Clark area of the southwestern Alaska Range where caves were fairly common in the cliffs. During the summer Boulder Creek survey, it was necessary to examine each cliff face carefully in order to locate sheep because few could be seen by the ordinary method of flying over the area.

General distribution in the Peters Creek study area was further influenced by the hunting season which commenced on August 10. Prior to hunting season, a great number of sheep were concentrated in the vicinity of the lick (Figure 3-6). The next survey conducted on September 23, 1968, 3 days after the close of the sheep season, showed that the large concentrations had broken up for the most part and many sheep were to be seen in the more rugged and remote sections of the area (Figure 3-7).

Distributions of the ram segment of the sheep population, as noted on the aerial surveys, are plotted separately in Figures 3-11 through 3-14 for the Peters Creek study area and in Figure 3-16 for the Dry Creek study area. In general, ram distribution in May and July was similar to that of the entire population on Peters Creek even though most rams were segregated into bachelor groups and were not actually feeding or moving with ewe bands. The hunting season seemed to cause a shift in the distribution of the ram segment of the population in the same general manner as it did for the population as a whole. The concentration of rams in the upper Thunderbird drainage was broken up, partly through harvest and partly by driving the rams, along with other sheep, back into the more inaccessible higher peaks and glacial valleys. This particular area received heavy hunting pressure due to accessibility from the Eklutna Lake Road.

By late October and early November, the rams again began to mingle with the ewe groups; becoming well distributed among the sheep population as a whole and remaining so until at least mid-January when our last intensive survey was flown (Figure 3-14).

No surveys were flown in the Dry Creek study area after June 4, 1968, when the ram segment of the population was noted as in Figure 3-15. Further comments about seasonal distribution on this area cannot be made at this time.

Reproduction

Lambing in Peters Creek commenced between May 17 and May 20, 1968. No new lambs were seen on our preliminary flight on May 17; however, on May 20 a number of new lambs were noted. Many of these lambs were already with their mothers in groups indicating that they had been born a day or two earlier. Lambing must have thus started in this area approximately May 18 or 19. By June 2, the majority of lambs appeared to have been born. A few ewes were seen to be isolated in the rugged cliffs above Boulder Creek during the flight on June 2, 1968, appearing as if they were still waiting to give birth. Most ewes and lambs seen on date were already in groups. Lambing appeared to be completely completed on a June 4 flight over Dry Creek and a June 5 flight over McKinley Park. No lone ewes were seen on cliffs and all ewes with lambs were seen in groups.

An exception was noted on Surprise Mountain on the Kenai Peninsula where several ewes were observed alone in the high cliffs above Skilak Glacier on a June 19 flight. They appeared to have just had lambs. This would indicate an extended lambing season, which, in turn, could be related to the very heavy hunting pressure on this mountain and should be investigated further.

Parturient ewes typically appeared to seek isolation at protected spots in rugged cliffs or rock outcrops when ready to give birth. Sheep are rarely seen in such places at other times of the year except when they are trying to escape danger. Within one or two days after birth, the lamb is able to run and travel with its mother, and the ewe moves from the cliffs and joins other groups of ewes with lambs. The movement of lone ewes into and out of cliffs appears to be one means by which the biologist can recognize the commencement and ending of the lambing season with only a cursory survey.

By the time the ewes with their new lambs have formed groups, the lambs appear very nimble and are able in many cases to outrun their mothers when frightened, often leading the group in escape. Ewes with new lambs and with yearlings tend to remain in groups with others of their kind, while ewes without lambs also seem to remain together.

Groups of two or more young lambs are often seen resting in the company of one or two ewes while others of the group feed some distance away. Such "baby sitting" appears to be fairly common among sheep and could lead to the conclusion that twins are frequently encountered. Whether such "baby sitting" is an intentional behaviorism of the ewes is open to question. When frightened, the group of lambs generally runs to the nearby ewes and flees with them, even though some of the lambs may belong to distant mothers.

A good example of this activity was seen on July 17 near the Tustumena Glacier on the Kenai Peninsula where one lone ewe and four lambs were observed together at least a quarter of a mile from the nearest group of sheep. Obviously all four lambs did not belong to this ewe. When frightened by the airplane all ran off together, with all four lambs trying to get underneath the ewe at once while running. No effort could be seen on the part of the ewe to protect any one individual lamb, which might have been her own, and she seemed to accept all four equally.

This guardian-type behavior, deliberate or not, would be effective in allowing some ewes to feed away from their lambs while still leaving them with a certain amount of directed protection in the event of danger. The lambs would automatically run to the nearest ewes and run with them, being led to protective terrain even though their own mother might run a different direction.

Although some young rams may be seen with the ewe-lamb groups during the summer, most rams join in bachelor groups and remain separated from the ewes. This separation may be relative, however, in that groups of rams may be seen feeding on the same slope or ridge as groups of ewes and they may even intermingle temporarily while feeding. Yearling sheep are quite frequently seen with these groups of rams, and I would suspect that these would be male yearlings. Rams seem to segregate themselves somewhat by size although this behavior is not clearly defined. It appears most prevalent among older rams, which were more often seen alone or in small groups in more inaccessible habitat during the summer, than were the groups of younger rams of mixed ages.

The fact that older rams are often seen isolated in inaccessible country is frequently ascribed to their wisdom in escaping hunters. However, it is much more probable that self-isolation is merely a behavorism typical of older males of many species. Older rams were noted under the same circumstances in McKinley Park where they are never hunted, while others were seen there in more readily accessible areas. It could be that, in heavily hunted country, rams which habitually stay in the more rugged topography are the ones which survive, while those in accessible habitat are rapidly cropped off. It is certainly possible, however, that some of this isolation is a learned behavior by certain individual sheep which have been constantly harassed by hunters because of their size.

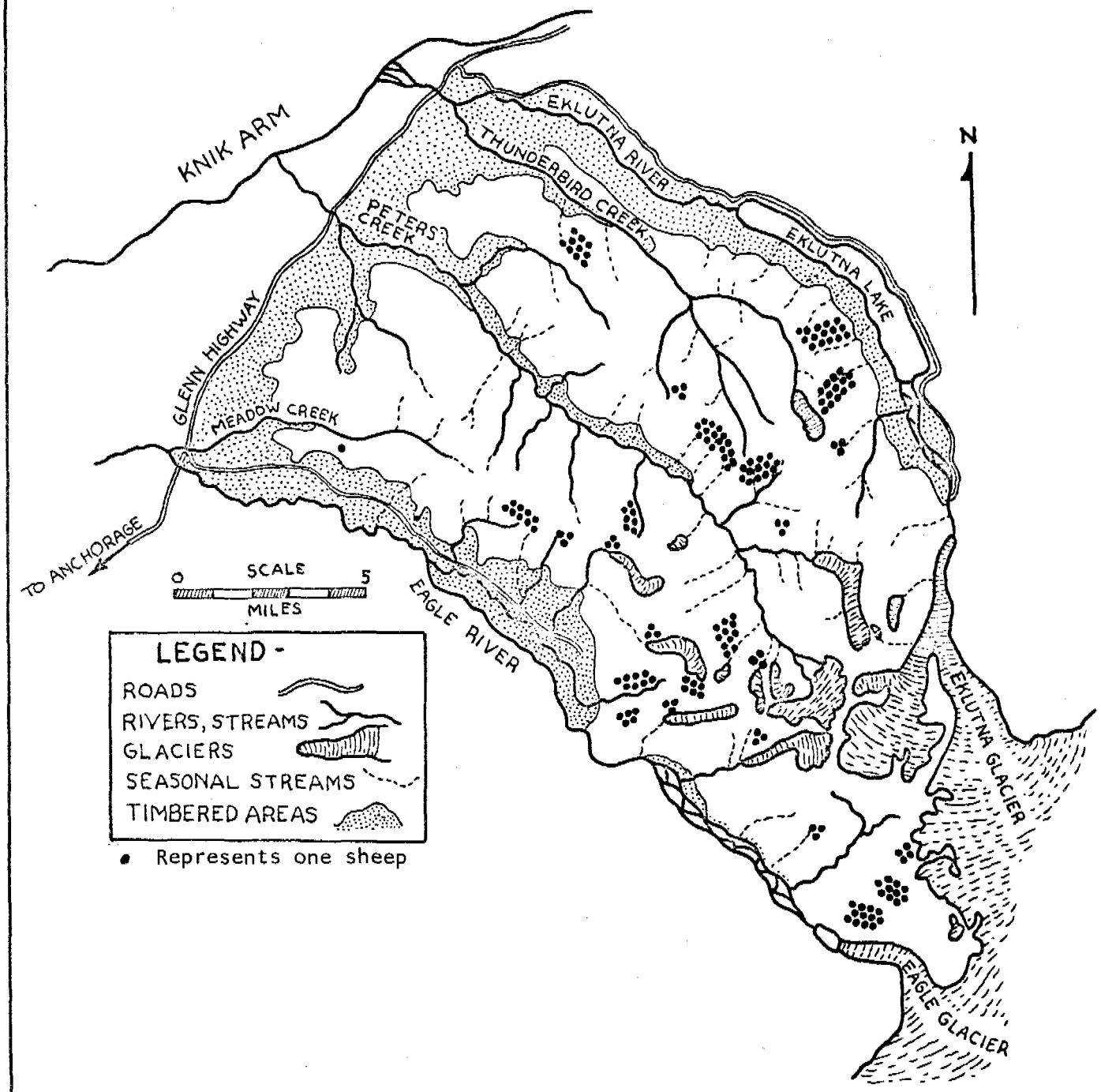


FIGURE 3-4
SHEEP DISTRIBUTION, MARCH 26, 1968

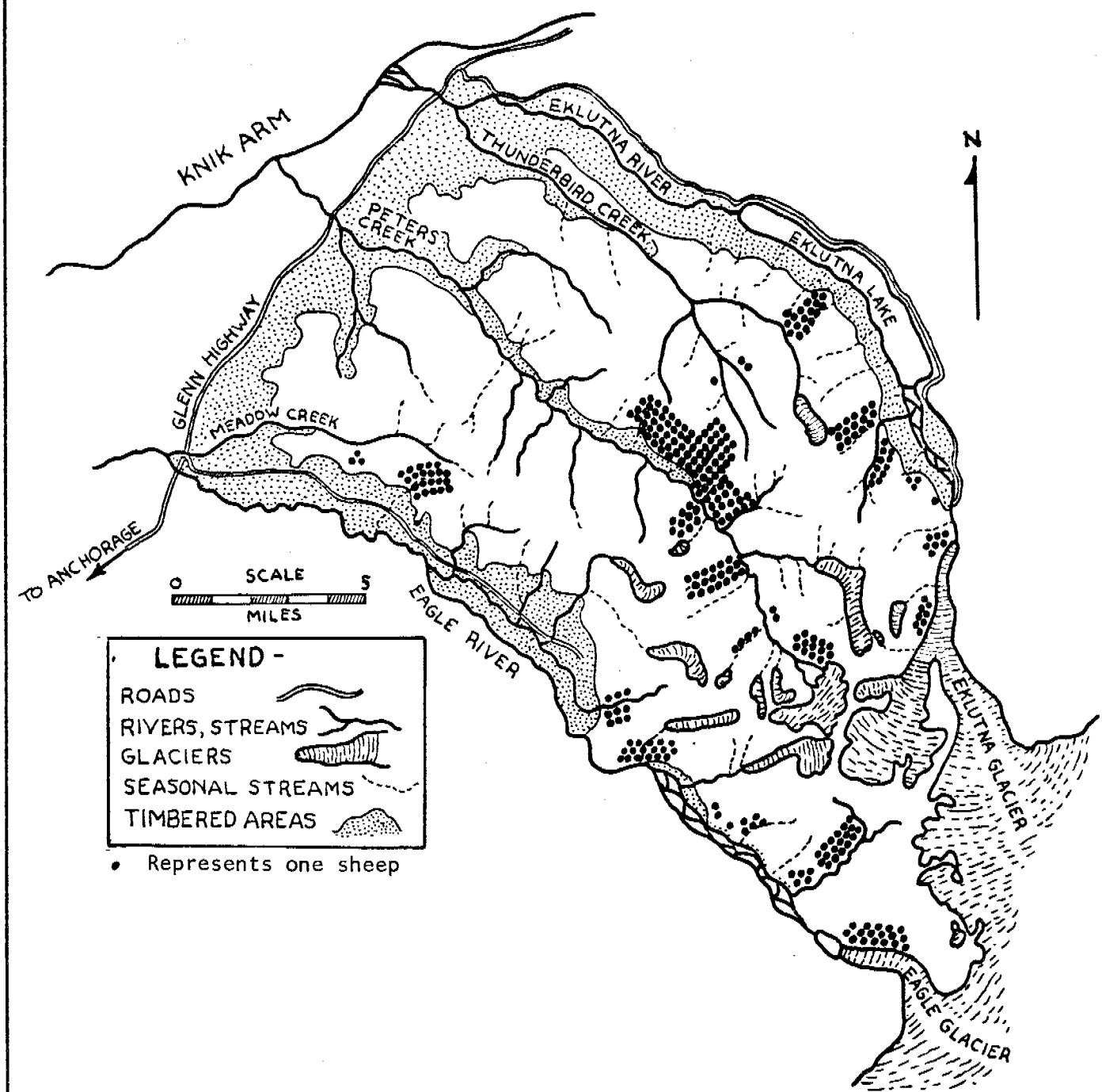


FIGURE 3-5
SHEEP DISTRIBUTION, MAY 20-21, 1968

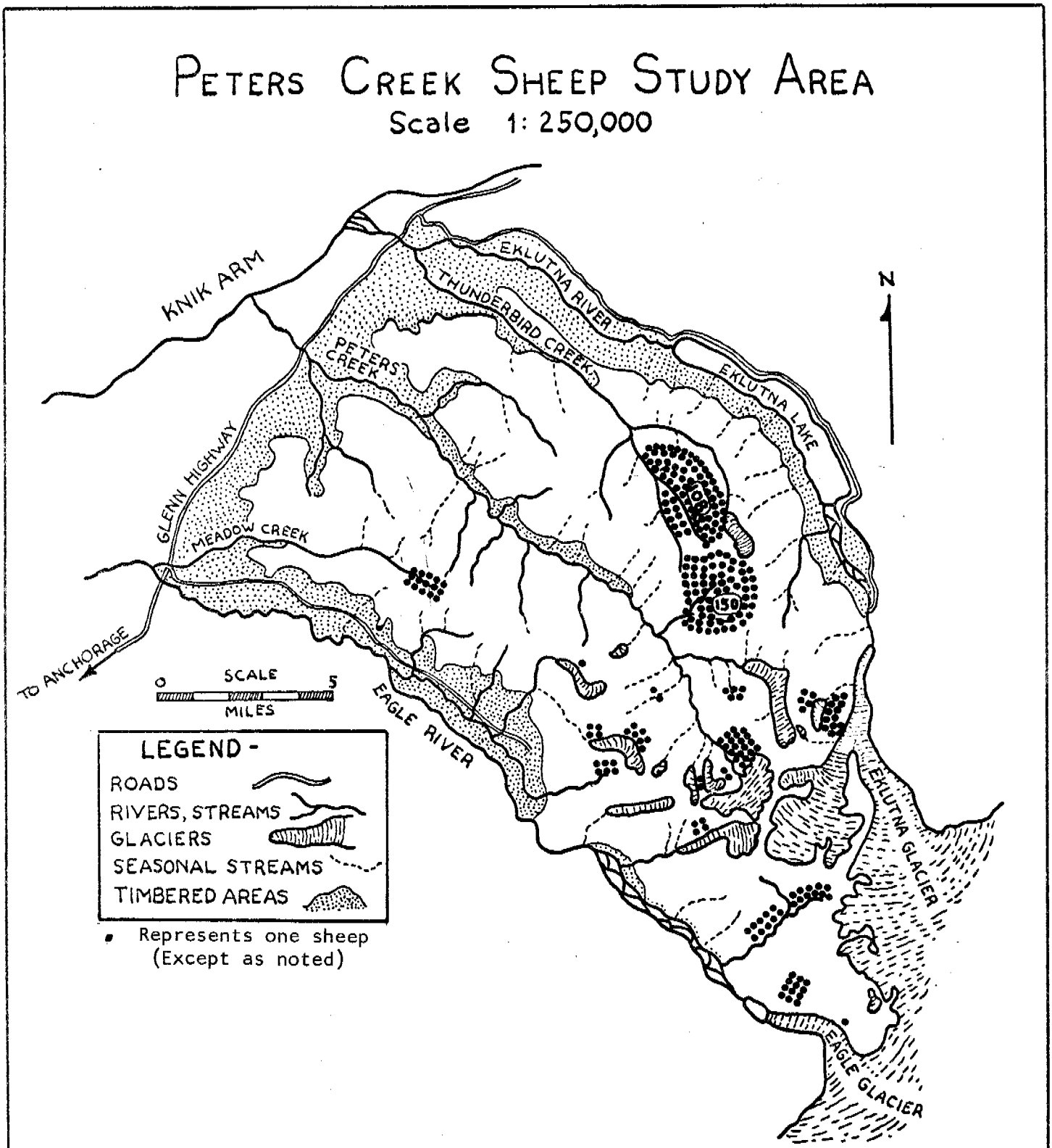


FIGURE 3-6
SHEEP DISTRIBUTION, JULY 25, 1968

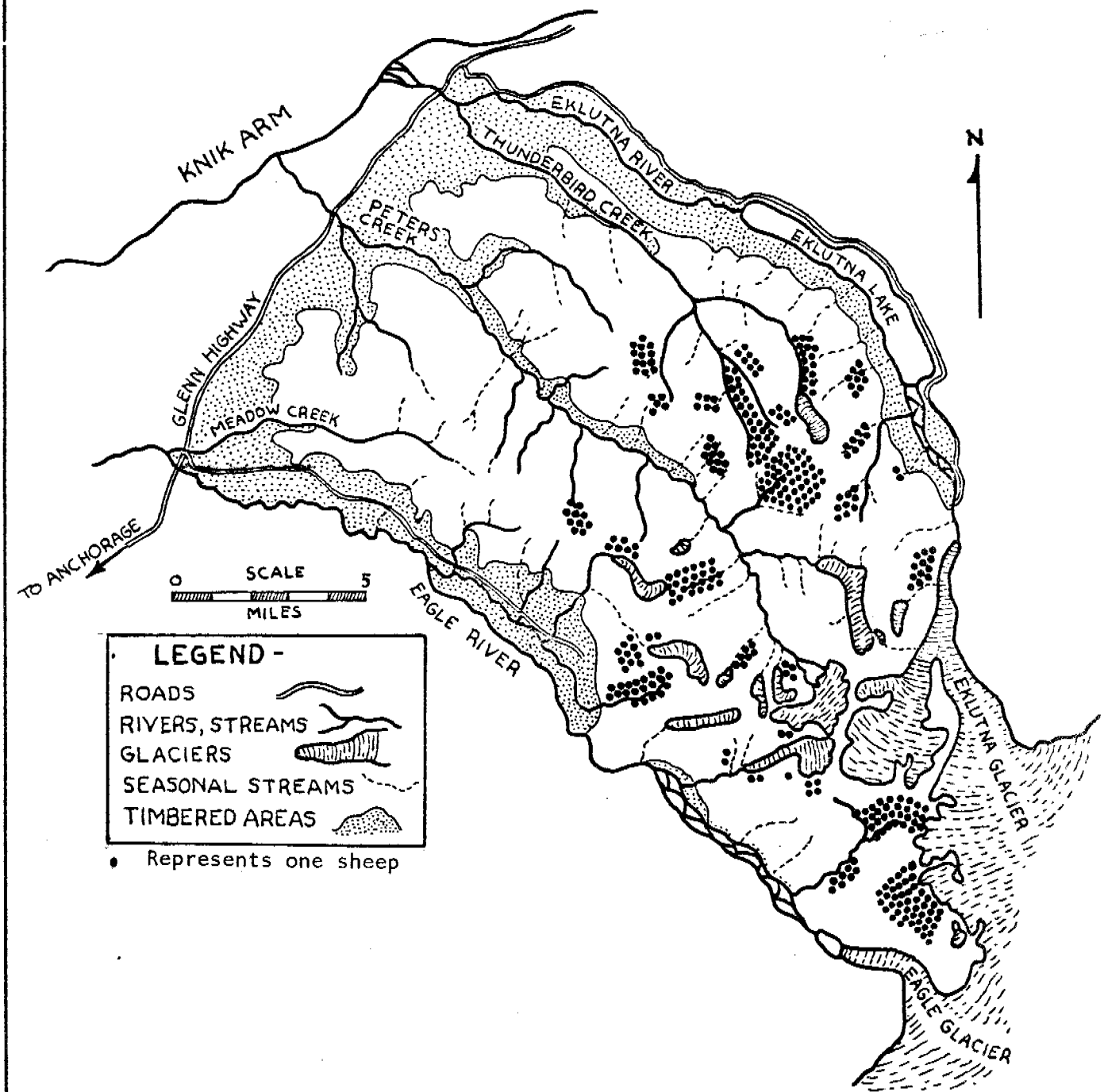


FIGURE 3-7
SHEEP DISTRIBUTION, SEPTEMBER 23, 1968

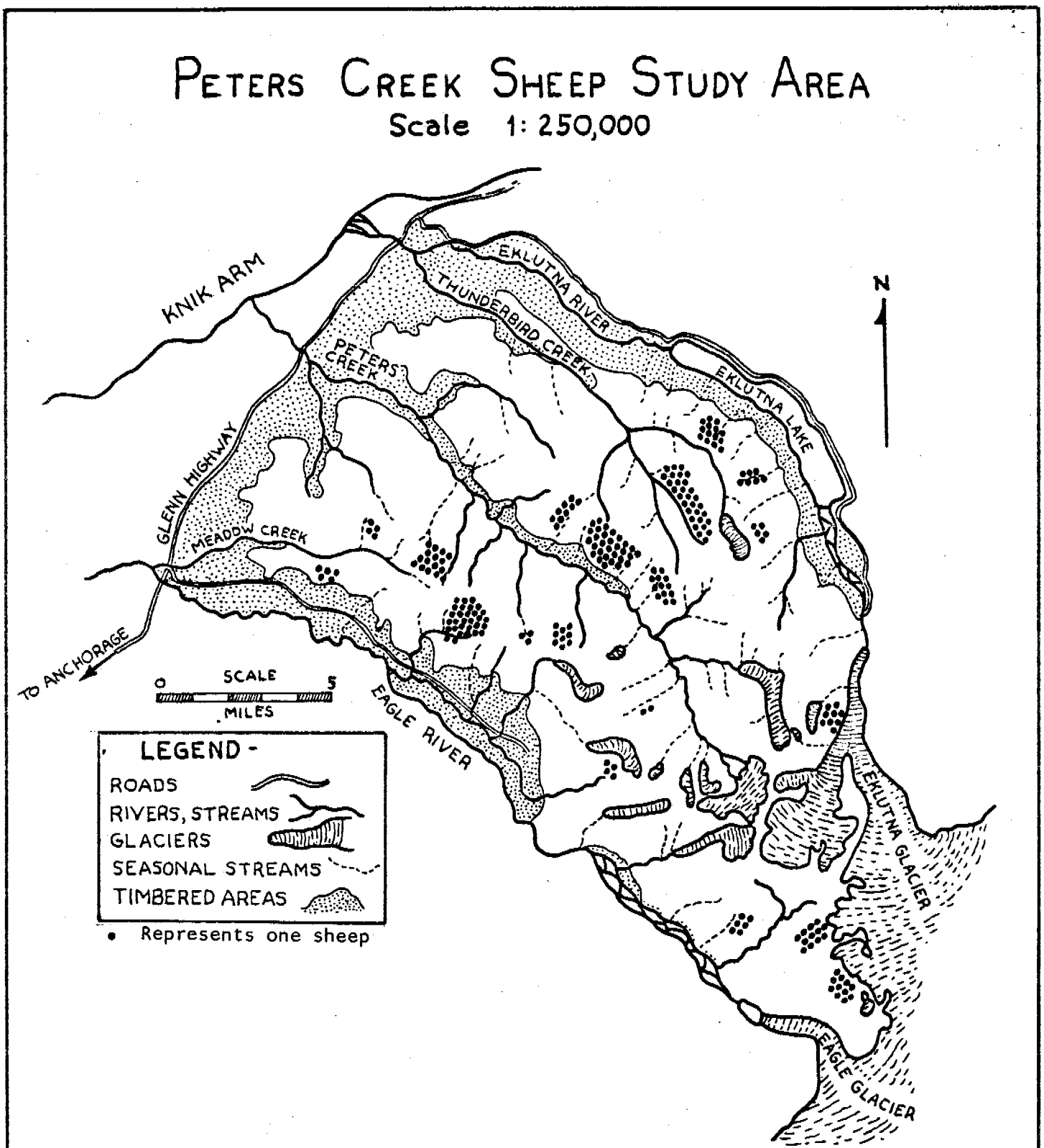


FIGURE 3-8
SHEEP DISTRIBUTION, JANUARY 16-17, 1969

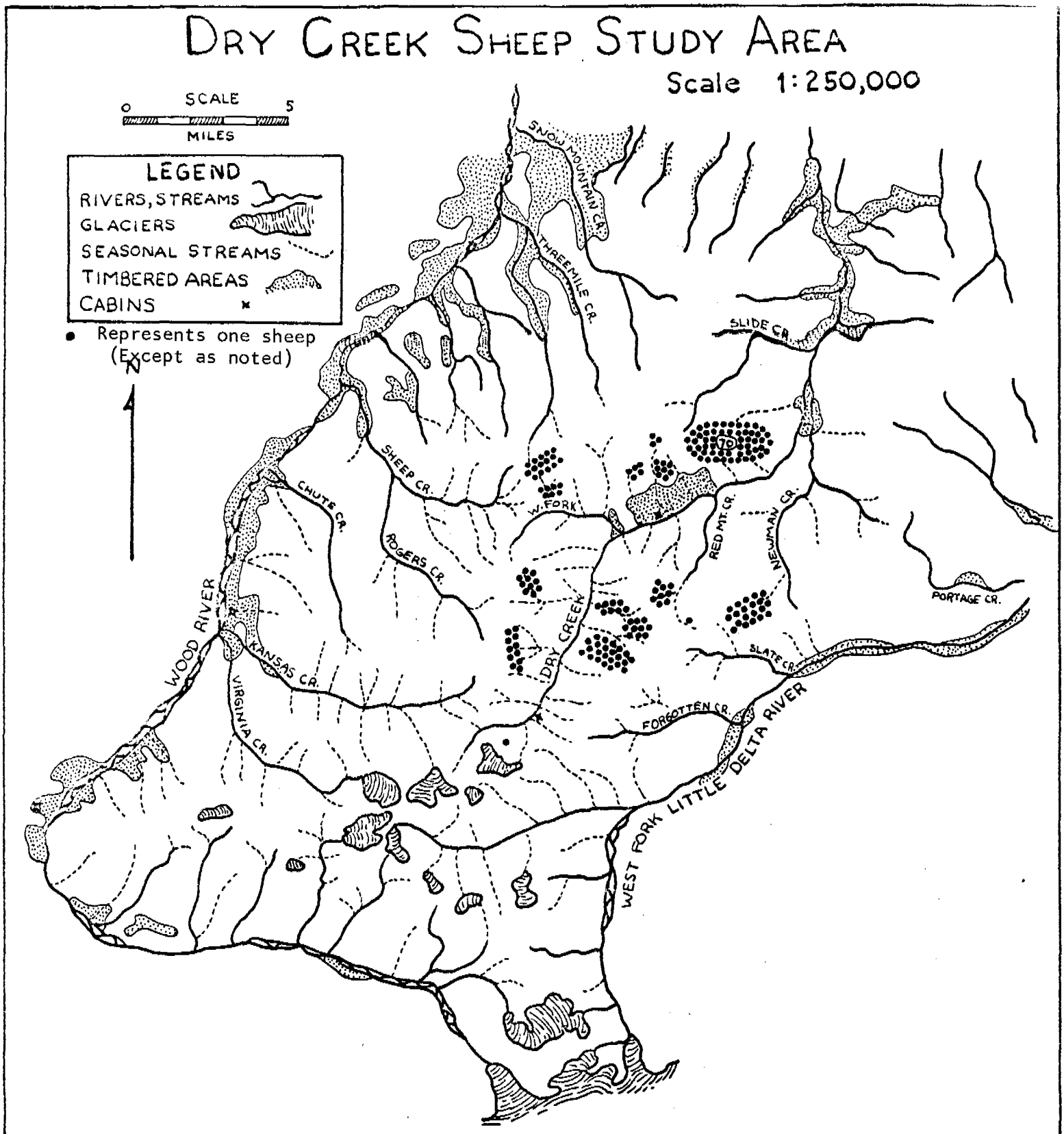


FIGURE 3-9
SHEEP DISTRIBUTION, MARCH 13, 1968

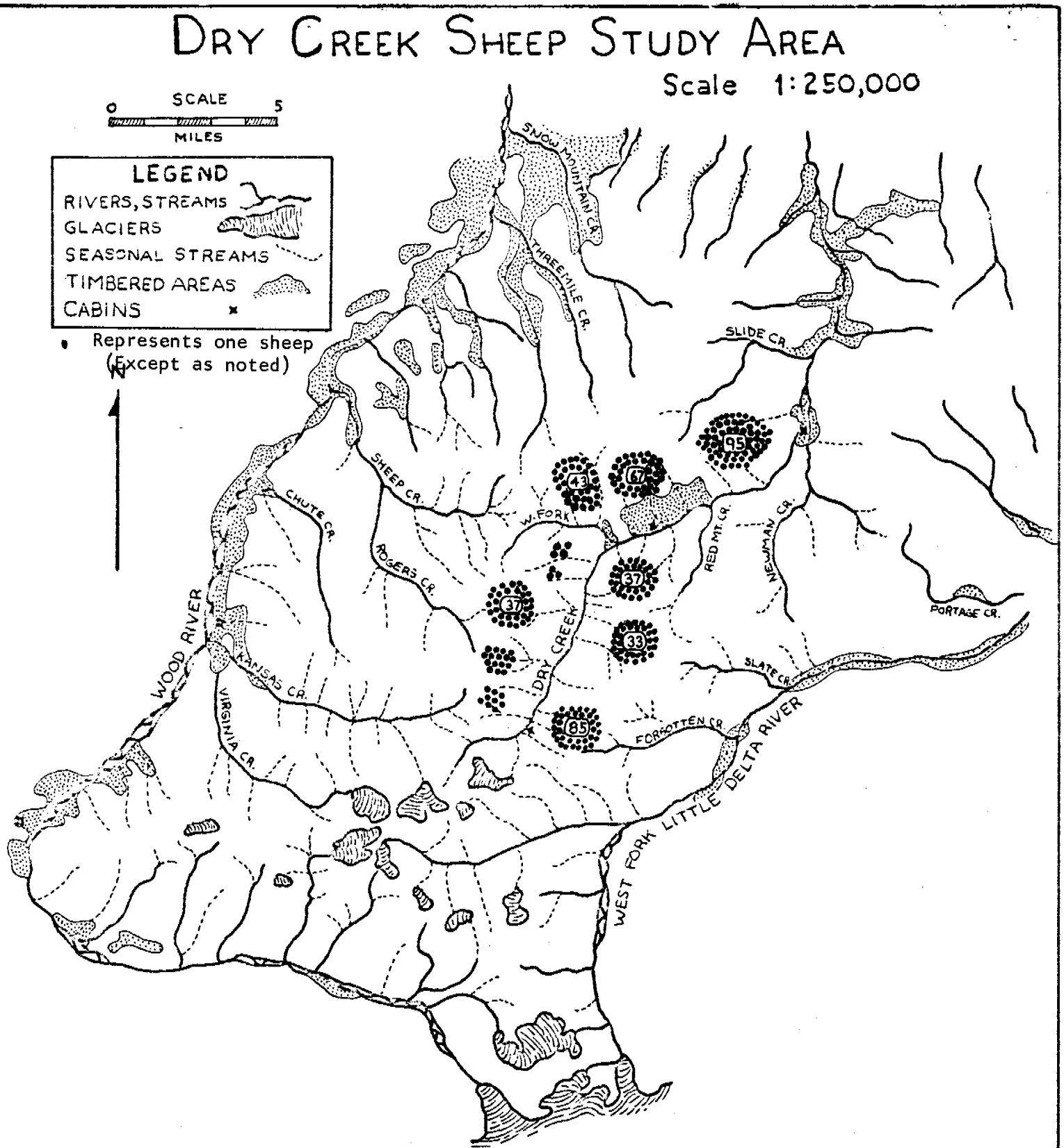


FIGURE 3-10
SHEEP DISTRIBUTION, JUNE 4, 1968

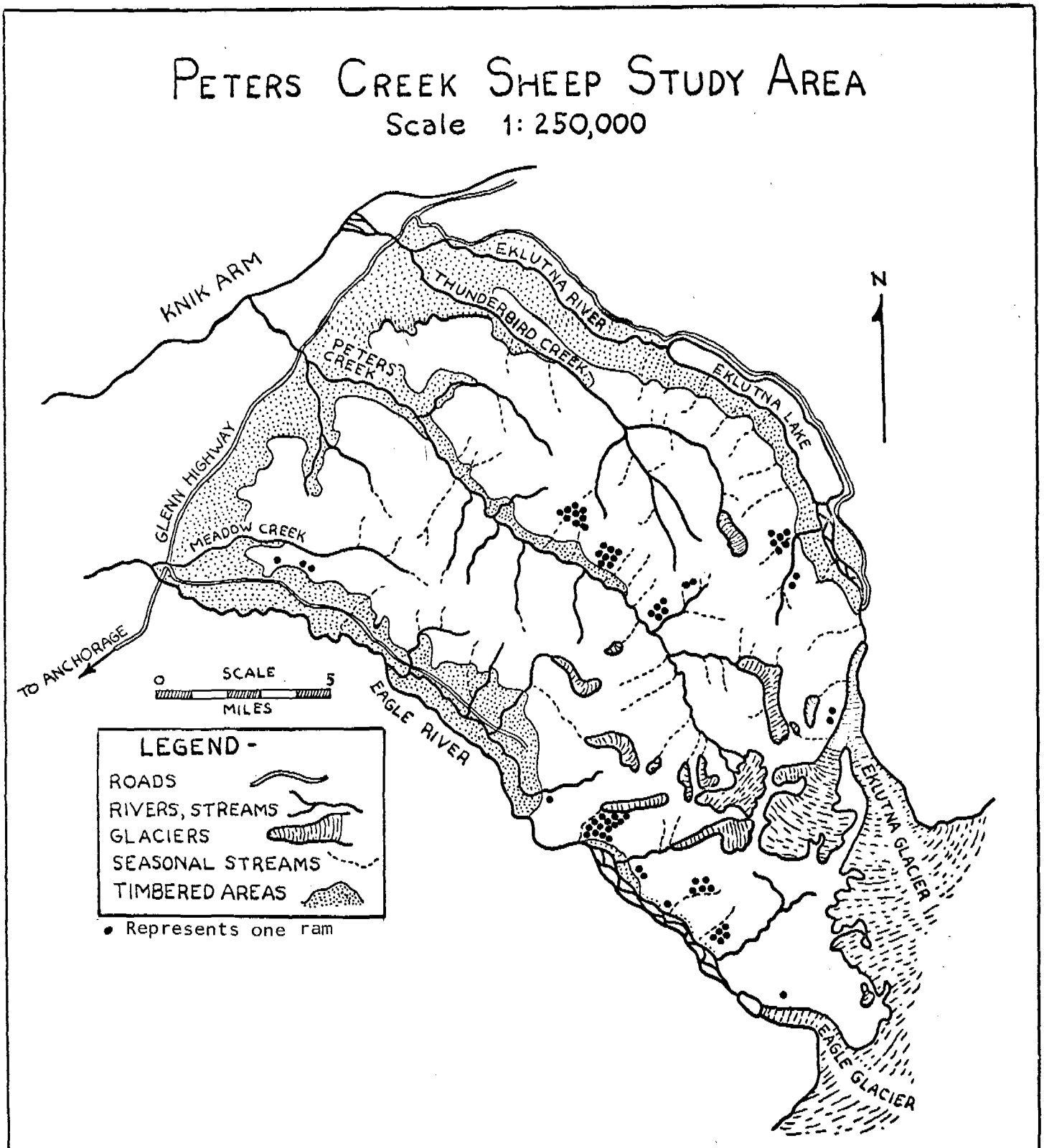


FIGURE 3-11
RAM DISTRIBUTION, MAY 20, 1968

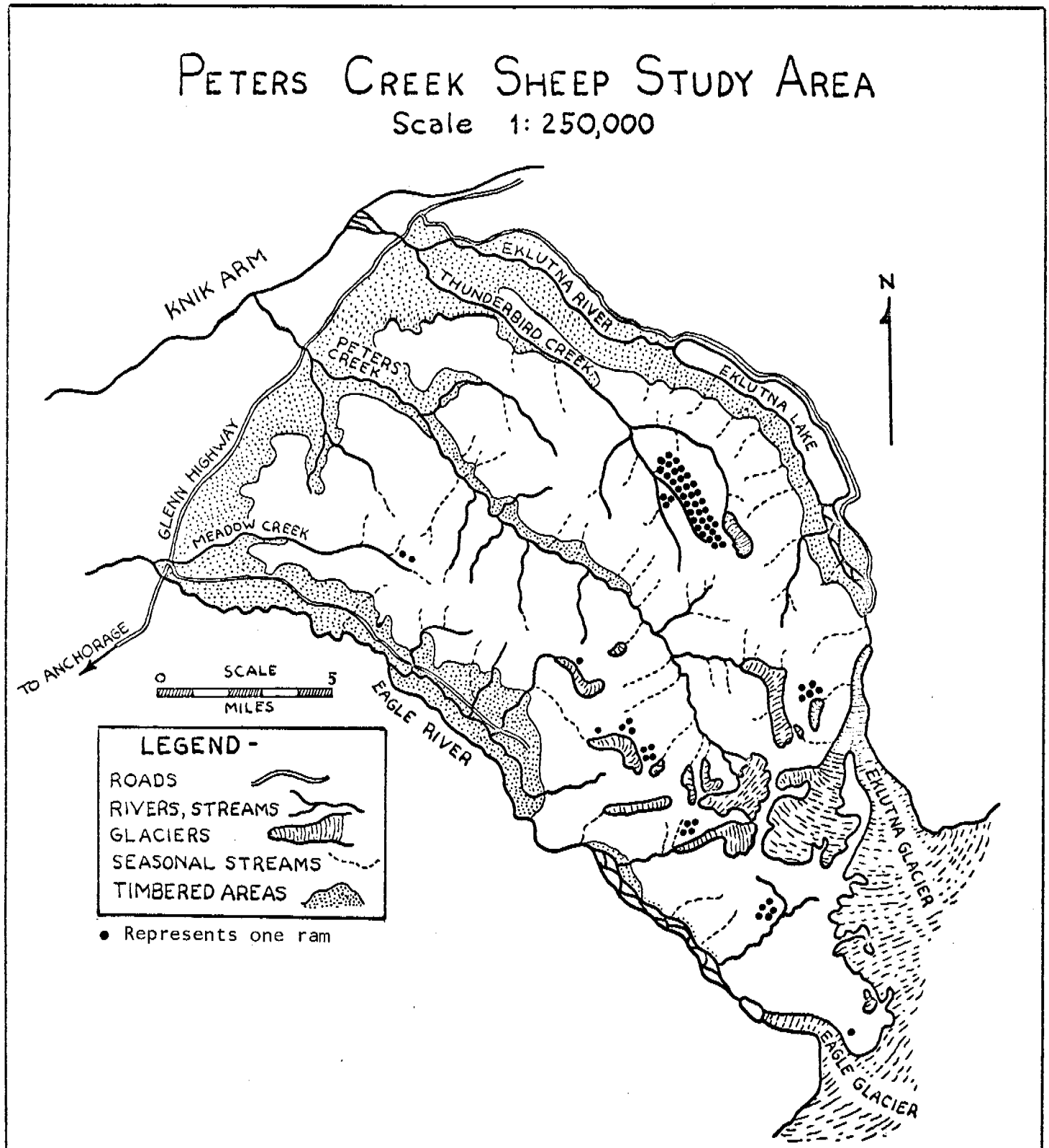


FIGURE 3-12
RAM DISTRIBUTION, JULY 25, 1968

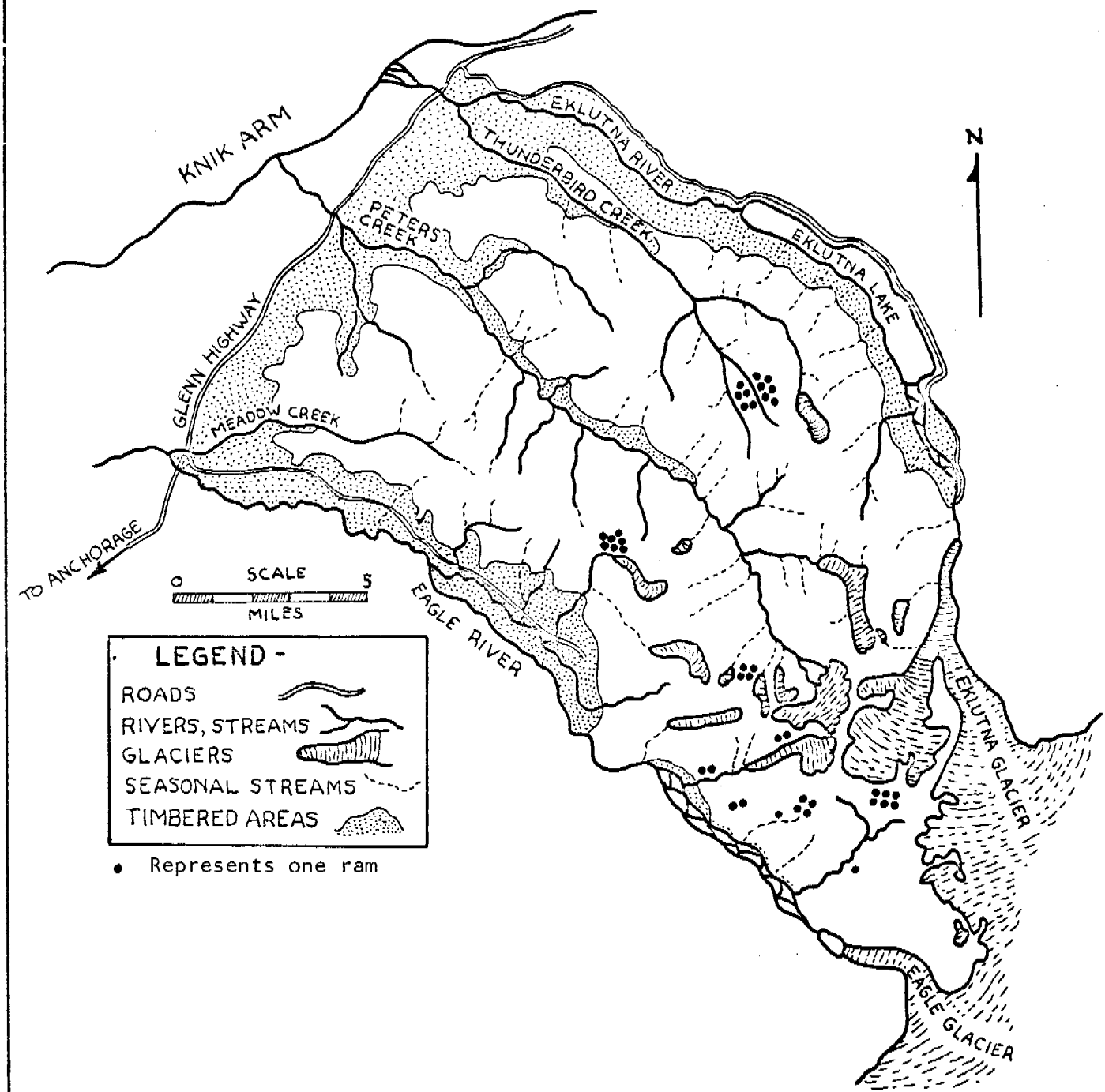


FIGURE 3-13
RAM DISTRIBUTION, SEPTEMBER 23, 1968

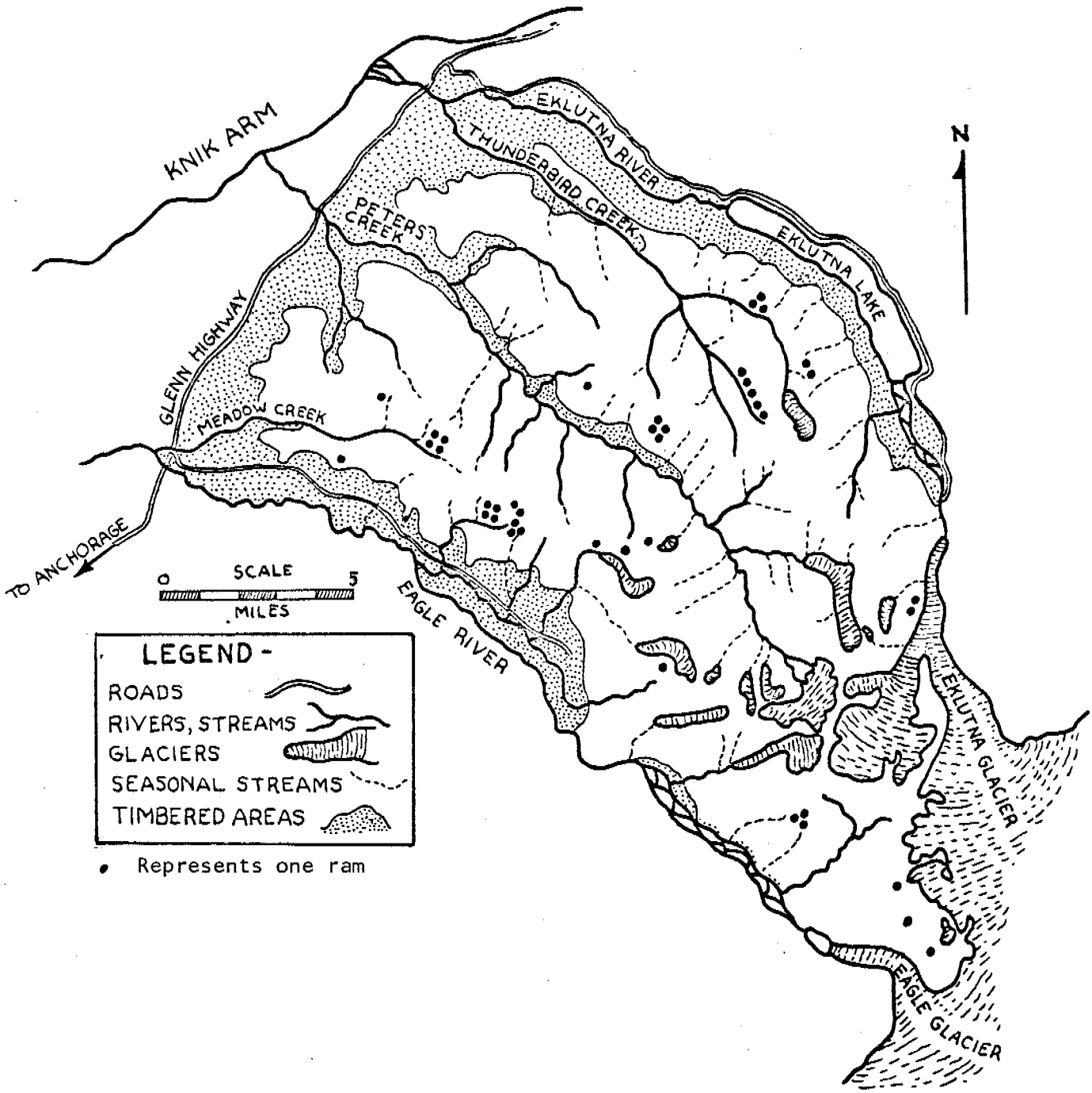


FIGURE 3-14

RAM DISTRIBUTION, JANUARY 16-17, 1969

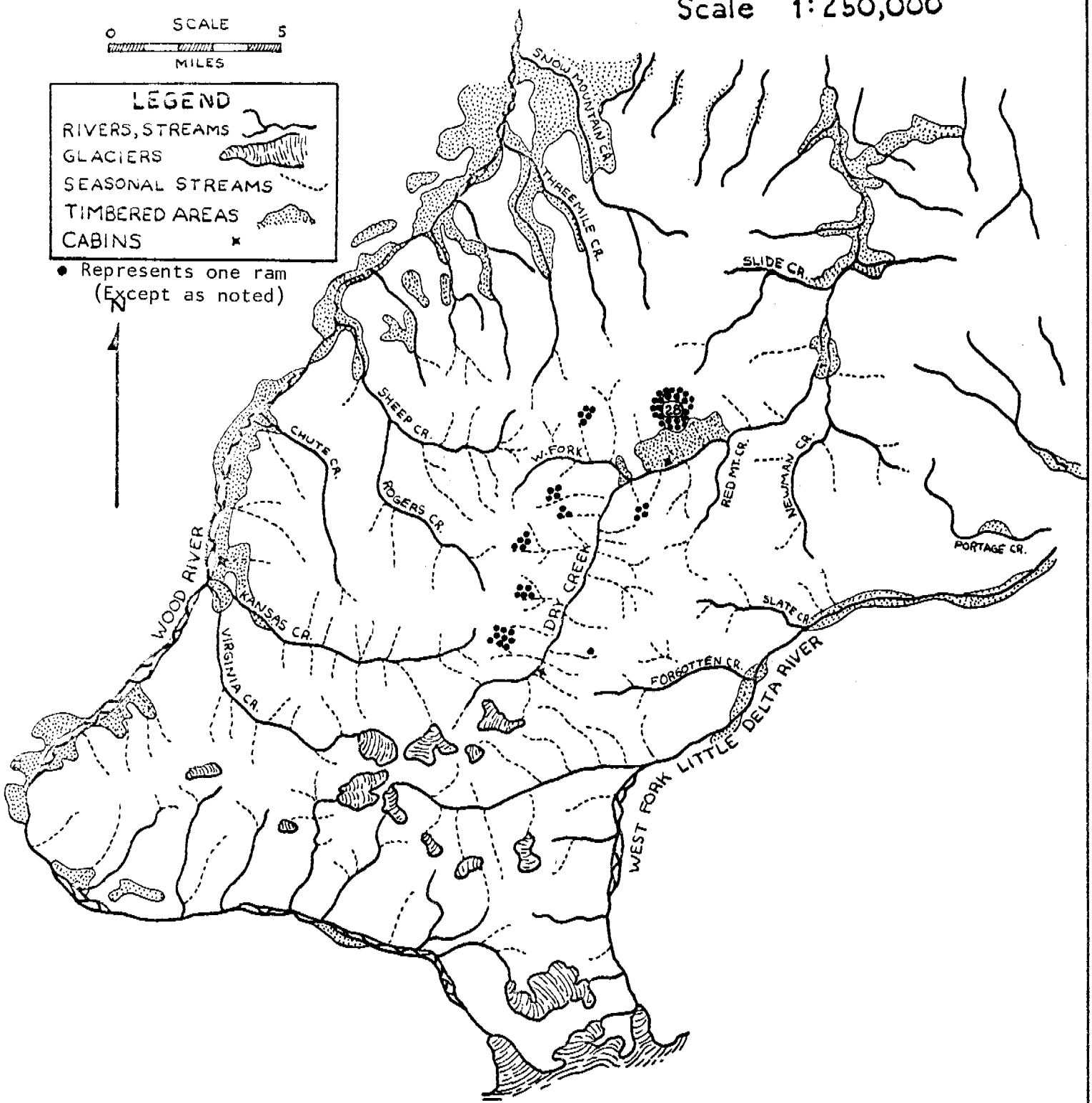


FIGURE 3-15
RAM DISTRIBUTION, JUNE 4, 1968

It was noted in 1967 that by October 20 many rams had joined the ewe groups, and by November 28, 1967 no lone rams were seen, all being mixed with the groups of ewes and young. A similar observation was made on November 15, 1968 when rams were seen to be well mixed with the ewe bands. No actual breeding was observed during our observations of November 15-18 on Peters Ridge. Several times rams were observed to check ewes to determine their state of estrous. Rams would trot for some distance to check urinating ewes by tasting and smelling their urine. Several larger rams were observed to apparently force ewes to urinate for this checking by prodding the ewes with horns or presenting their horns to the ewes. No animosity between rams was observed nor were any fights seen or heard at this time. On one occasion, a 3/4-curl and a 1/2-curl ram both checked a urinating ewe at the same time with no sign of competition or antagonism.

A further observation made on November 25, 1968 showed that the rut was in actual progress and mounting of ewes was seen. A 2 1/2-year-old ram (1/2-curl) was collected on this date and it was found that his testes were swollen and turgid. Mature sperm were very abundant in the seminal fluid, indicating that the animal was in full breeding condition.

Further checks could not be made at this time to determine the extent of the rut. During the ram classification flight made on January 15, 1969 in Mt. McKinley National Park, it was noted that rams were already beginning to segregate themselves into bachelor groups to some degree, indicating that the rut was well over with by this time. This segregation, as noted on several reconnaissance flights made during the latter part of the winter on the Peters Creek study area, was not nearly as clear-cut as it appeared to be later in the summer. Many rams apparently remained with or near groups of ewes and young during most of the winter.

Mortality Factors

Although wolves have been blamed for much predation on sheep, we have noticed little direct evidence of this so far in this study. A number of sheep "kills" have been found during various surveys. Wolves were seen feeding on only two of these carcasses: one in the Twin Lakes area north of Lake Clark during the winter of 1967, and one in McKinley Park in January of 1969. Tracks around other carcasses indicated that wolves had fed upon them, but cause of death could not be determined. In only one case, that observed on January 15, 1969 in McKinley Park, was it reasonably certain that wolves had actually killed the sheep involved. In this case, tracks in the snow showed that wolves had chased a lone sheep downhill and apparently caught it at the base of a rock outcrop. One wolf was still feeding on the remains when it was found. It was not possible to determine the sex or age of the sheep from the air since little remained but a few scraps of hide and bone.

An interesting observation was made in McKinley Park on this same date of a pack of 13 wolves attempting to capture sheep. In this case the wolves were first observed running down a high windblown ridge in a loose pack. Several hundred yards ahead of them sheep were seen running into a rock outcrop on the otherwise open slope. Further observation showed that a small group

of sheep had gotten into the ledges of this isolated outcrop, apparently having been chased there by the wolves. The wolves then refused to go out onto the face of the outcrop after the sheep, but merely sat around and waited.

Two of the wolves had cornered a lone sheep in another smaller outcrop approximately 300 yards upslope from the main one. This sheep was standing on a small ledge some 10 feet above the two waiting wolves when seen. They appeared to make no effort to get to it. One of them remained sitting and watching it, the other was lying down. Upon our approach in the plane, the sheep jumped off this outcrop, ran past the waiting wolves and down the open slope toward the main outcrop. One of the wolves immediately gave chase but was easily outdistanced. One of the other wolves, which had been waiting around the lower, larger outcrop, attempted to intercept this fleeing sheep but was also avoided, apparently with little effort. The lone sheep ran over the edge of the outcrop onto a ledge below, joining the other group already there. The closely pursuing wolf stopped at the edge of the small cliff and merely stared at the sheep 10 or 15 feet away on the ledge before turning away. When we left, some 15 or 20 minutes later, the wolves were still sitting around above and below the outcrop and the situation appeared an impasse.

Thus, it would appear that healthy sheep are able to avoid wolves under normal circumstances providing they have some form of escape cover nearby. This might amount to no more than small outcrops and cliffs as mentioned in the above incident. Certainly some sheep are taken by wolves, and their depredations might become serious to individual bands under certain conditions of snow and topography or perhaps when animals are weakened because of disease or malnutrition. But so far, our observations point to the wolf as being a relatively minor factor in sheep population fluctuations as a whole.

One fresh carcass of a ram, approximately 3 years of age, was found in an open alpine basin on top of Surprise Mountain on June 19, 1968. Cause of death could not be determined from the air; however, no sign of predation could be observed and the carcass appeared undisturbed. Upon again flying over the site on July 9, nothing remained of the carcass but a large patch of hair. Nearby, a black bear was seen. The bear was probably responsible for eating the carcass as carrion, but it could not be determined whether the bear had actually killed the ram. The lack of disturbance to the carcass when it was first found would tend to indicate that it was not killed by a predator.

In September in the same area a black bear sow with two cubs was seen feeding on an open grassy slope less than 100 feet from a group of sheep which were also feeding with apparent calm. The bear did not appear to be approaching the sheep nor did they seem to pay any outward attention to it. Black bear probably play a very small role in sheep mortality. No evidence of grizzly predation has been observed as yet during this study.

Eagles are quite common in sheep habitat. We have noted them to be especially so in the southern Talkeetna Mountains. Although golden eagles are frequently blamed for predation on young lambs, little evidence to this effect has been presented. I have on several occasions watched eagles dive on ewes or very young lambs, merely making low approaches on them. The behavior of ewes

in seeking rocky ledges during lambing, particularly ledges in the face of a cliff or just below a cliff, might indicate that they are seeking shelter from winged predators for their newborn lambs as well as from earth-bound predators. In almost all cases when approached by a plane, young lambs will make every effort to get underneath the ewe, or the ewe will crowd the lamb between its own body and a cliff face if such happens to be present. This behavior would indicate an inborn fear of attack from above and could have developed from eagle predation. Although eagles might not be able to actually carry away a lamb, they might under some circumstances be able to frighten it over a cliff by diving closely at it or hitting it and then later feed upon it as carrion. The behavior of both eagles and ewes and lambs indicates that some sort of attack must occasionally be successful, although how important a factor that is in lamb survival is not known.

Avalanches may account for some mortality in the early spring. One observation, made in the Wrangell Mountains in early June 1968, indicates that sheep might be well aware of avalanche paths and so avoid them. In this case, two rams were seen lying down on a steep slope. Apparently the vibration of the passing airplane set off a small avalanche which slid down what must have been a traditional avalanche chute less than 100 feet from the bedded sheep. Neither animal stood up or even turned his head when the avalanche occurred.

From the number of carcasses found at the base of cliffs I assume that falls are responsible for some mortality, particularly during the winter when many of the rocks are ice-covered and slippery. Sheep killed or crippled because of such falls could then be found by predators and fed upon. Tracks and signs may then convince the casual observer that the sheep was actually killed by the predator, which could, of course give rise to stories of extensive predation.

Sheep and goats often occupy the same habitat and seem to be compatible. I have several times seen both species feeding together. On one such occasion on July 8, 1968 in the Kenai Mountains, a group of 5 rams, 6 ewes, and 3 lambs, plus 3 goats assumed to be large males, were observed all feeding in one mixed group. When flown over, all ran together as a group across the flat mountain summit until they reached the cliff edge. The sheep stopped on the flat just at the edge of the cliff and milled about, appearing reluctant to drop into the cliffs. The goats, however, immediately ran down into the cliffs leaving the group of sheep. This difference in escape behavior has been noted on several occasions. Goats attempt to get away from a nearby airplane and try to get under something, such as an overhanging rock or bush or under each other, while sheep tend to run up on top of a ridge or a rock outcrop. This difference in behavior might indicate that goats fear aerial predation more than do sheep, and thus that eagles are more of a predator upon young kids than they are upon lambs.

Distribution and Abundance

A general inventory flight was made in July, 1968, covering the north slope of the Chugach Mountains from the Knik River and the Knik Glacier to

the Nelchina River and Nelchina Glacier. Figure 4-1 illustrates the extent of this survey (detailed maps are on file in the Anchorage office). The survey was flown so as to cover all sheep habitat within the area as carefully as possible, and numbers of sheep were recorded as to location and group size. Summarized results of this and other inventory counts are shown in Figure 4-1.

A similar inventory of sheep was conducted in the Kenai Mountains. Figure 4-2 shows the extent of coverage and illustrates a rough breakdown of the Peninsula by areas. Total numbers of sheep seen in each area are listed. Results of the survey are also summarized in Table 4-1.

It may be seen in Figure 4-2 that there were apparent gaps in coverage; however, the entire area was covered by air in a combination sheep and goat survey, and the gaps on the map merely indicate areas where no sheep were found. No survey was attempted southwest of Area L in the Seldovia region nor to the southeast of the Harding Ice Field because it is generally assumed, and probably true, that no sheep inhabit this range. Results of the Cresent Lake, Cooper, and Surprise Mountains study area counts (Sections E, F, and G) are included in this general inventory survey so that the entire Kenai sheep population may be examined as a whole.

Coverage of the Kenai Mountains, and particularly Sections E through L representing the primary sheep habitat, was done with great care under generally good weather conditions. I believe that we obtained an accurate inventory of the Kenai sheep population and would estimate that we counted at least 90 percent of the animals present. One small herd known to inhabit Area L was missed due to low clouds on the day we flew. There are probably less than 50 sheep in this herd according to unconfirmed reports.

One other inventory flight was flown in June, 1968 in the southeastern portions of the Wrangell and Nutzotin Mountains. Areas of coverage and total numbers of sheep seen are illustrated in Figure 4-3 and the results are summarized in Table 4-1. The count in Area C is probably low because poor weather prevented complete aerial coverage of that area. I believe that thorough coverage was obtained of the other areas and that counting results are reasonably accurate. However, the rugged topography probably caused us to miss some sheep and the overall accuracy may not be as good as it was in the Kenai Mountains.

One of the main purposes in the survey was to locate and choose a study area suitable for future investigation of population trends and general hunting effects. Areas B and D were tentatively chosen for this purpose since they appeared to lend themselves to repetitive aerial counting and contained a large sample of sheep--over 650. Sections of both the north and south slopes of the Wrangell Mountains are encompassed in this selection. Area A in the Nutzotin Mountains contains a larger sample of sheep, is smaller and is easier to survey from the air. However, it was felt that the study area should be selected in the Wrangell Mountains proper where more hunter attention is focused.

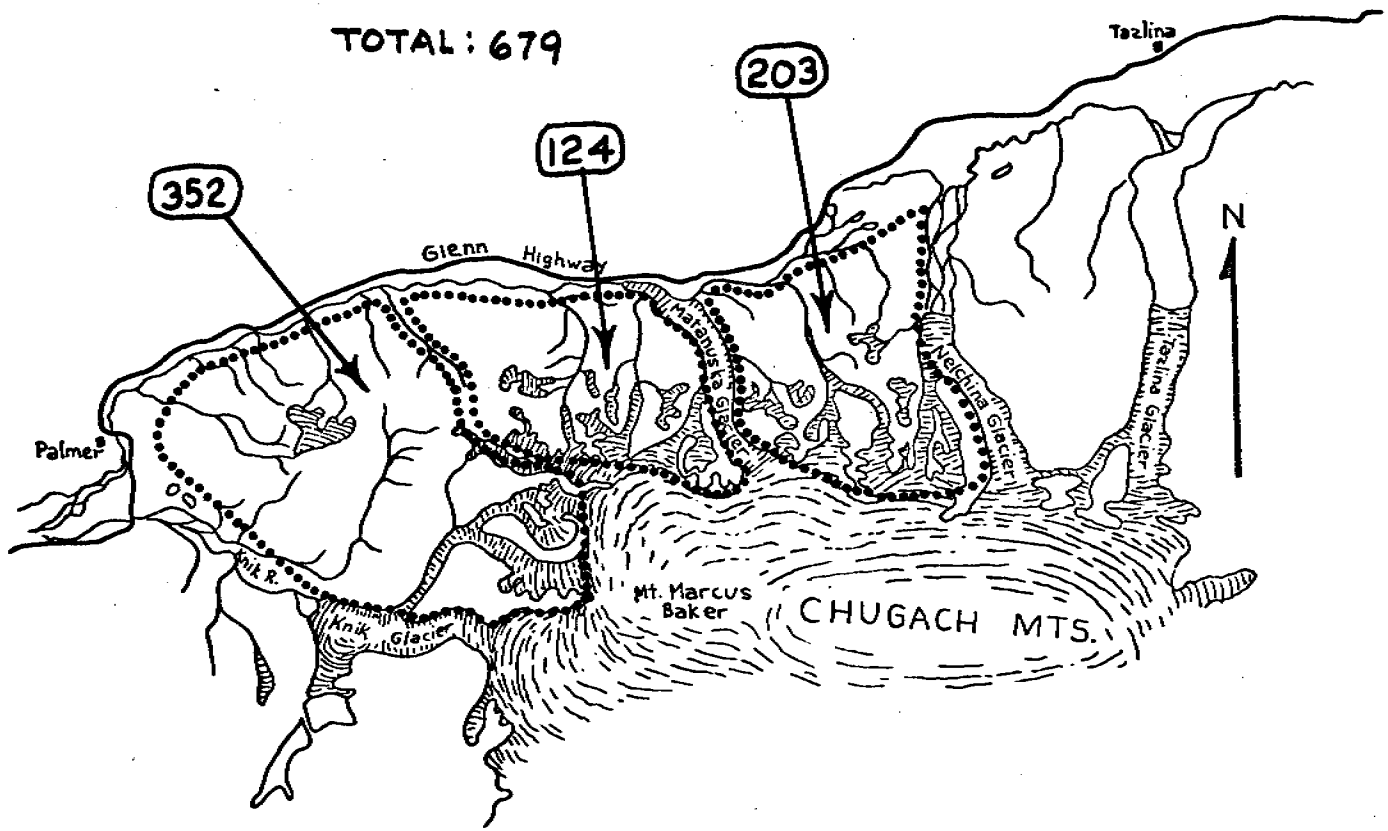


FIGURE 4-1
AREA COVERED BY CHUGACH MOUNTAINS SHEEP INVENTORY SURVEY, JULY 24-26, 1968

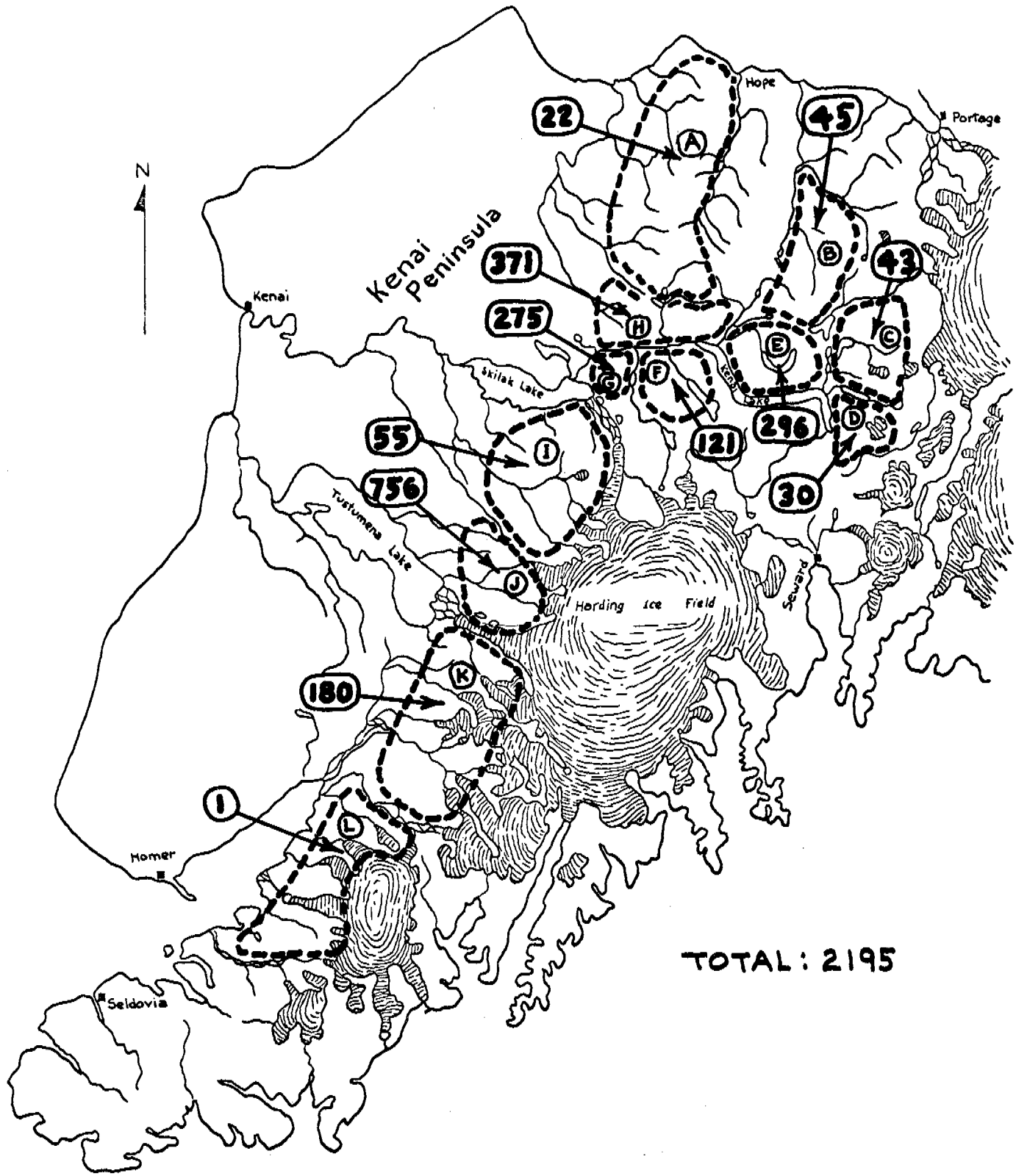
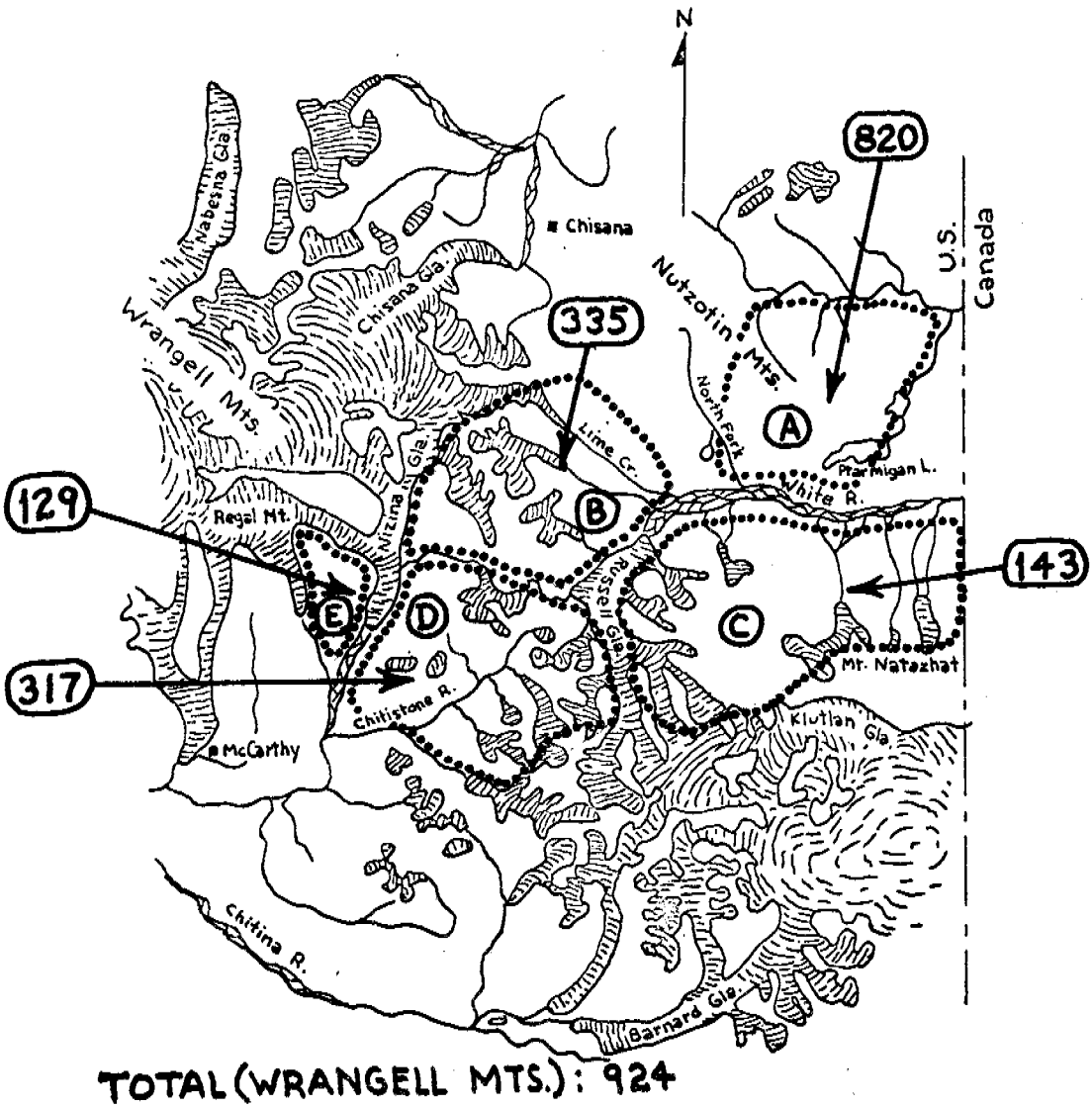


FIGURE 4-2
AREAS COVERED BY KENAI MOUNTAINS SHEEP INVENTORY SURVEYS, SUMMER, 1968



TOTAL (WRANGELL MTS.): 924

FIGURE 4-3

AREAS COVERED BY WRANGELL/NUTZOTIN MOUNTAINS SHEEP INVENTORY SURVEY, JUNE 25-28, 1968

The Brooks Range survey, conducted in the last two weeks of August, 1968, was perfunctory in nature and no inventory or classification counts were attempted, nor was coverage of all drainages in sheep habitat possible. In general, it appears that the south slope of the Brooks Range has a relatively low and spotty sheep population with concentrations around the heads of the Alatna, Wind and North Fork of the Chandelar Rivers. According to local residents, there seems to have been a general decline in sheep numbers in this area in recent years. Possible confirmation of this belief was seen in the form of numerous sheep trails in many areas but relatively few sheep. The largest concentration observed on the south slope was in the headwaters of the Alatna River, where hunters also report them abundant.

The sheep population appeared generally high on the north slope of the Brooks Range. Numerous groups were seen in most drainages from the Canadian Border westward to the Sagavanirktok River. Few were seen in the vicinity of the Anaktuvuk River, but populations again increased from Chandler Lake westward to the head of the Noatak River. No survey was conducted west of the headwaters of the Noatak River nor were sheep distribution or abundance determined.

The most northerly sheep seen were in the Sadlerochit and Shublik Mountains, which lie north of Peters and Schrader Lakes. This probably represents the most northerly extension of Dall sheep habitat.

My general impression is that these sheep on the north slope of the Brooks Range would be very succeptible to hunting pressure due to the gentle topography in most cases and to the ease of access by aircraft to lakes, rivers, and gravel bars in sheep habitat. Hunter pressure is generally light in the Brooks Range at this time but several guides have already established permanent camps on the north slope and are exerting pressure on the sheep herds in their vicinities. A large influx of people to the north slope due to the oil discoveries promises much heavier future hunting pressure on sheep as well as on other game species. More effort should certainly be directed towards this area as soon as possible in order to inventory sheep herds as well as to study populations in relation to increased hunting and to Arctic conditions.

Harvest of Dall Sheep

The reported harvest of Dall sheep rams in 1968 was 1,122 as of March 17, 1969. Based on a 92 percent return of the 8,857 harvest tickets issued, 3,353 or 38 percent of ticket holders actually hunted, about 4,409 did not hunt and about 1,095 gave no information (676 no reports; 388 blank reports; 28 lost reports) prior to computer analyses. Of the 3,353 hunters, 1,122 or 33 percent killed a sheep. Of 2,722 Alaska resident hunters, 694 (25 percent) killed a sheep, while of 631 nonresident hunters, 428 (68 percent) killed a sheep (Table 5-1). Table 5-2 lists the harvest by Game Management Unit for 1962 through 1968. The 1968 figures are not directly comparable for all Units because some hunters gave locations assignable to mountain

range, but not to Unit so a Unit within the Mountain range was arbitrarily chosen. Figure 5-2 shows the numbers of rams harvested, numbers of hunters and numbers of harvest tickets issued, 1962 through 1968. The 1962 coverage was known to be incomplete.

The mean lengths of longer horns as reported by hunters and separated by mountain area are given in Table 5-3. The sample of horns ADF&G measured represents well the harvest of sheep in terms of origin (Table 5-4) and mean measurements (Table 5-3). The mean difference between ADF&G measurements and those of hunters on the same 214 horns was 0.8 inches; hunters' measurements were larger. If 0.8 inches is subtracted from 33.3 inches, the mean of 1,054 hunter-reported horn lengths, the result is 32.5 inches, 0.3 inches different from the 32.2 inch mean of 265 horn measurements of ADF&G. Mean, modal class(s) and range of horn lengths by mountain area are given in Table 5-5. Table 5-11 compares the measurements of some pre-1951 horns with those of the 1968 season.

The mean number of days spent hunting sheep by successful and unsuccessful hunters for certain mountain areas are given in Table 5-6. The percent of hunters spending X number of days hunting is given in Table 5-7.

Sheep were killed on every day of the 1968 season. However, excluding the Brooks Range, 39 percent of the kill was made during the period of August 10-16, the first of the 6 weeks of hunting: August 10 to September 20, 1968. The Brooks Range and the Ogilvie Mountains northeast of Eagle, were open August 1 to September 20, 1968. Table 5-8 gives the chronology of the kill in weekly intervals for eight mountain areas. The chronology is presented graphically in Figures 5-3 and 5-4.

The general addresses of those who hunted in eight mountain areas are given in Table 5-9, and the number of hunters from specific addresses are given in Table 5-10.

The reported harvest of rams has varied about as much (between +17% and -8% of the mean) for the years 1963-1968 as the number of hunters (between +22% and -15% of the mean). However, the changes are not all positively correlated. For example, the number of hunters rose in 1965 while the number of rams killed, declined (Figure 5-2).

The mean horn lengths of sheep from various mountain ranges were obtained by Scott (1951) from guided-hunt reports. The mean horn length of sheep killed by nonresidents (mostly guided hunts) for these same areas in 1968 are compared with Scotts' measurements in Table 5-11. The overall trend is toward horns of shorter lengths if the two samples are comparable (note that the Chugach trend and that from the Alaska Range west of McKinley Park appear up from 1951 to 1968). None of the trends may reflect what is available in the sheep population as much as it does the attitudes and standards of sheep hunters.

Table 5-1. Reported kill of Dall sheep rams, numbers of hunters, and success of hunters for eight mountain areas in Alaska, 1967 and 1968.

Area	Year	ALL HUNTERS			RESIDENTS			NON-RESIDENTS		
		Kill	No. Hunters	Success	Kill	No. Hunters	Success	Kill	No. Hunters	Success
Alaska Range E. of McKinley Pk. (ARE)	1967	120	310	39%	73	231	32%	47	79	59%
	1968	195	578	34%	142	476	30%	53	102	52%
Alaska Range W. of McKinley Pk. (ARW)	1967	65	97	67%	27	47	52%	38	50	76%
	1968	95	151	63%	52	99	53%	43	52	83%
Brooks Range (BRR)	1967	105	156	67%	56	100	56%	49	56	88%
	1968	144	201	72%	64	112	57%	80	89	90%
Chugach Range (CRR)	1967	115	521	22%	67	455	15%	48	66	73%
	1968	133	630	21%	99	570	17%	34	60	57%
Kenai Mountains (KMR)	1967	68	358	19%	56	335	17%	12	23	52%
	1968	104	469	22%	86	447	19%	18	22	82%
Talkeetna-Chulitna Mtns.-Watana Cr. Hills (TCW)	1967	84	272	31%	50	224	22%	34	48	71%
	1968	110	343	32%	64	273	23%	46	70	66%
Tanana Hills-White Mtns. (THW)	1967	8	23	35%	4	17	24%	4	6	67%
	1968	22	58	38%	19	53	36%	3	5	60%
Wrangell-Mentasta-Nutzotin Mtns. (WMN)	1967	315	609	52%	152	417	36%	163	192	85%
	1968	313	624	50%	165	429	38%	148	195	76%
Unknown (UNK)	1967	42	497	8%	25	447	6%	17	50	34%
	1968	6	299	2%	3	263	1%	3	36	8%
All of Alaska (TOT)	1967	922	2843	32%	503	2273	22%	412	570	72%
	1968	1122	3353	33%	694	2722	25%	428	631	68%
Percent Return of Harvest Tickets	1967	90%								
	1968	92%								

Table 5-2. Reported kill of Dall sheep rams in Game Management Units for the years 1962 through 1968 in Alaska.

Game Mgmt. Unit	1962[1]	1963	1964	1965	1966	1967	1968
7	15	25	8	22	18	21	52[3]
9	0	1	2	0	0	6	10
11	117	131	151	131	125	149	215[3]
12	92	149	128	141	180	165	115
13	107	132	156	143	154	152	159[3]
14	99	110	67	62	49	72	76[3]
15	35	43	26	35	48	47	52
16	4	15	20	16	6	4	9
17	9	1	12	11	9	7	17
19	24	27	26	44	66	48	59
20	74	157	182	165	148	132	206[3]
23	7	20	15	11	13	14	15
24	38	52	57	43	47	24	33
25	12	23	20	19	38	30	16
26	28	83	41	26	35	37	82[3]
?	6	1	8	16	19	14	6
TOTAL	667	970[2]	919[2]	885	955	922	1122

1 1962 was first year of harvest ticket regulation. Coverage is known to have been incomplete.

2 Includes at least 17 second sheep legal in Brooks Range in 1963 and 1964.

3 U. 7 includes some U. 15; U. 11 includes some U. 12; U. 13 includes some U. 14; U. 14 includes some U. 13; U. 20 includes some U. 12 and 13; U. 26 includes some U. 23, 24, and 25.

Table 5-3. The mean lengths of longer horns from our (ADF&G) measurements and those of hunters; and a comparison of measurements of the same horns for rams killed in 1968, Alaska, with some data from 1967.

AREA	LENGTH OF LONGER HORN IN INCHES: BY ADF&G AT TAXIDERMY SHOP n	$\bar{Y}$	HUNTERS' REPORTS n	$\bar{Y}$	COMPARISON OF SAME HORNS: HUNTER n	HUNTER $\bar{Y}$	ADF&G $\bar{Y}$	d
Alaska Range E. of McKinley Pk.	37	34.0	183	33.9	30	34.1	33.8	0.6+
(1967)	16	33.2						
Alaska Range W. of McKinley Pk.	21	33.4	86	34.7	19	35.0	33.8	1.2+
(1967)			60	34.5				
Brooks Range	22	31.2	131	32.6	18	31.4	30.9	0.5+
(1967)			95	32.7				
Chugach Range	41	33.1	128	33.2	35	33.8	32.9	0.9+
(1967)	24	33.0			23	33.3	32.6	0.7+
Kenai Mountains	31	32.0	97	32.0	29	32.2	32.1	0.1+
(1967)	15	31.8	59	32.3	12	32.9	31.3	1.6+
Talkeetna-Chulitna Mtns.-Watana Cr. Hills	28	30.6	103	32.4	23	33.8	31.9	1.9+
(1967)	14	32.6			12	34.4	33.1	1.3+
Tanana Hills-White Mtns.	3	30.5	21	32.8	1	32.0	31.8	0.2+
Wrangell-Mentasta-Nutzotin Mtns.	64	32.4	301	33.7	59	34.3	34.1	0.2+
(1967)	49	32.6	293	33.8	44	34.0	33.1	1.3+
Unknown	18	32.3	4	32.5				
(1967)	27	33.1						
All of Alaska	265	32.2	1054	33.3	214	33.7	32.9	0.8+
(1967)	145	32.7	830	33.4	100			0.9+

Table 5-4. Comparison of the origins of the horns measured in the 265-set sample with the distribution of the 1968 sheep harvest, Alaska.

AREA	PERCENT OF SAMPLE	PERCENT OF HARVEST
Alaska Range E. of McKinley Pk.	14	17
Alaska Range W. of McKinley Pk.	8	8
Brooks Range	8	13
Chugach Range	15	12
Kenai Mountains	12	9
Talkeetna-Chulitna Mtns.-Watana Cr. Hills	11	10
Tanana Hills-White Mtns.	1	2
Wrangell-Mentasta-Nutzotin Mtns.	24	28
Unknown	7	1
TOTAL	100 of 265	100 of 1122

265 is 24% of 1122

Table 5-5. Modal classes and ranges of hunters' horn measurements for Alaska mountain areas, 1968 season.

Area	$\bar{Y}$	n	Reported Horn Lengths in Inches modal class(s)	range
Alaska Range E. of McKinley Pk.	33.9	183	33.01 - 34.00 (22=12%) 34.01 - 35.00 (22=12%)	18.01 - 43.00
Alaska Range W. of McKinley Pk.	34.7	86	33.01 - 34.00 (11=13%) 36.01 - 37.00 (11=13%)	22.01 - 48.00
Brooks Range	32.6	131	31.01 - 32.00 (24=18%)	20.01 - 41.00
Chugach Range	33.2	128	35.01 - 36.00 (20=16%)	22.01 - 41.00
Kenai Mountains	32.0	97	34.01 - 35.00 (10=10%)	21.01 - 40.00
Talkeetna-Chulitna Mtns.-Watana Cr. Hills	32.4	103	34.01 - 35.00 (14=14%)	19.01 - 43.00
Tanana Hills-White Mtns.	32.8	21	36.01 - 37.00 (4=19%)	23.01 - 42.00
Wrangell-Mentasta-Nutzotin Mtns.	33.7	301	36.01 - 37.00 (33=11%)	17.01 - 46.00
TOTAL	33.3	1054	35.01 - 36.00 (109=10%)	17.01 - 48.00

Table 5-6. The number of days hunted by successful and unsuccessful hunters in various mountain areas of Alaska in 1968, with some data from 1967.

	NUMBER OF DAYS HUNTED											
	SUCCESSFUL HUNTERS						UNSUCCESSFUL HUNTERS					
	Resident		Nonresident		total		Resident		Nonresident		total	
AREA	n	$\bar{Y}$	n	$\bar{Y}$	n	$\bar{Y}$	n	$\bar{Y}$	n	$\bar{Y}$	n	$\bar{Y}$
Alaska Range E. of McKinley Pk.	137	4.1	52	4.1	189	4.1	253	4.4	41	7.0	294	4.8
Alaska Range W. of McKinley Pk.	51	2.8	37	4.9	88	3.7	38	4.6	7	7.4	45	5.0
(1967)	27	3.2	38	5.6	65	4.6	11	5.6	9	7.0	20	6.3
Brooks Range	67	3.9	74	3.6	141	3.8	38	7.2	9	6.6	47	7.1
(1967)	53	3.7	43	3.3	96	3.5	37	7.3	4	7.7	41	7.4
Chugach Range	94	3.3	27	4.8	121	3.6	383	3.7	20	5.5	403	3.8
Kenai Mountains	80	2.5	20	3.7	100	2.7	278	3.7	4	5.5	282	3.7
(1967)	52	3.0	.2	3.0	64	3.0	211	4.5	11	5.6	222	4.6
Talkeetna-Chulitna Mtns.-Watana Cr. Hills	64	4.8	42	4.4	106	4.6	151	4.5	22	5.6	173	4.6
Tanana Hills-White Mtns.	17	3.5	3	3.3	20	3.5	21	5.3	1	4.0	22	5.2
Wrangell-Mentasta-Nutzotin Mtns.	158	3.8	142	4.4	300	4.1	206	5.1	37	6.8	243	5.4
(1967)	143	3.4	152	4.0	295	3.7	189	4.3	22	8.1	211	8.1
Unknown	3	3.3	1	10.0	4	5.0	126	5.2	16	7.0	142	5.4
All of Alaska	672	3.6	398	4.2	1070	3.9	1496	4.4	157	6.5	1653	4.6
(1967)	471	3	384	4	855	4	1057	4	92	8	1149	5

Table 5-7. Percent of hunters who hunted X number of days, 1968, Alaska.

Days Hunted	PERCENT OF HUNTERS			
	Successful		Unsuccessful	
	Resident	Nonresident	Resident	Nonresident
1	21	17	8	3
2	22	21	19	3
3	20	17	25	13
4	10	13	15	8
5	10	8	11	15
6	6	6	4	13
7	5	4	6	9
8	2	4	3	6
9	1	1	1	1
10	2	4	4	16
11				
12			1	4
13				
14		2		4
15+	1	3	2	3
	n=666	n=404	n=2169	n=150

Table 5-8. Chronology of the kill in weekly intervals Saturday through Friday (except 1-9 August) for resident (R), nonresident (NR) and combined categories, 1968 sheep season, Alaska.

	Brooks Range				Kenai Mountains				Wrangell-Mentasta-Nutzotin Mtns.				Tanana Hills-White Mtns.			
	R	NR	T	%	R	NR	T	%	R	NR	T	%	R	NR	T	%
1- 9 August	17	24	41	29												
10-16 August	11	16	27	19	47	4	51	50	78	38	116	38	3	3	6	29
17-23 August	10	16	26	18	13	4	17	17	26	24	50	17	10	0	10	48
24-30 August	11	7	18	13	6	5	11	11	17	26	43	14	1	0	1	5
31 Aug-6 Sept	8	9	17	12	5	4	9	9	13	23	36	12	2	0	2	9
7-13 Sept	6	3	9	6	7	0	7	7	15	20	35	12	2	0	2	9
14-20 Sept	1	3	4	3	6	1	7	7	12	11	23	8	0	0	0	0
	64	78	142		84	18	102		161	142	303		18	3	21	
Totals including those with no date			144				104				313				22	

Table 5-8. (Continued)

	Alaska Range E. of McKinley Pk.				Alaska Range W. of McKinley Pk.				Chugach Range				Talkeetna-Chulitna Mtns.-Watana Cr. Hills			
	R	NR	T	%	R	NR	T	%	R	NR	T	%	R	NR	T	%
10-16 August	44	8	52	28	15	5	20	23	56	13	69	56	35	13	48	44
17-23 August	21	5	26	14	4	4	8	9	10	2	12	10	7	0	7	6
24-30 August	24	3	27	14	4	5	9	10	2	4	6	5	4	9	13	12
31 Aug-6 Sept	23	11	34	18	9	8	17	19	11	5	16	13	6	6	12	11
7-13 Sept	16	16	32	17	10	10	20	23	6	4	10	8	5	11	16	5
14-20 Sept	9	6	15	8	8	6	14	16	8	3	11	9	6	7	13	12
	137	49	186		50	38	88		93	31	124		63	46	109	
Totals including those with no date			195				95				133				110	

Table 5-9. Addresses of hunters who hunted in certain mountain areas, 1968 sheep season Alaska.

AREA	ADDRESS OF HUNTER	NUMBER OF HUNTERS Successful	Unsuccessful	Total
Alaska Range E. of McKinley Pk.	Fairbanks-Tanana Valley	109	269	378
	Out of State	53	49	102
	Anchorage Area	17	26	43
	Southeast Alaska	9	12	21
	Matanuska-Susitna Valley	3	8	11
	Miscellaneous other areas	4	18	22
		195	382	577
Alaska Range W. of McKinley Pk.	Out of State	43	10	53
	Anchorage	24	25	49
	Kuskokwim R.-Bristol Bay	13	14	27
	Kenai Peninsula	7	2	9
	Southeast Alaska	4	0	4
	Matanuska-Susitna Valley	1	3	4
	Fairbanks-Tanana Valley	1	1	2
	Miscellaneous other areas	2	2	4
		95	57	152

Table 5-9. (Continued)

AREA	ADDRESS OF HUNTER	NUMBER OF HUNTERS Successful	Unsuccessful	Total
Brooks Range	Out of State	80	8	88
	Fairbanks-Tanana Valley	24	19	43
	Yukon R. & North	15	12	27
	Anchorage Area	14	9	23
	Kenai Peninsula	1	3	4
	Matanuska-Susitna Valley		1	1
	Southeast Alaska		1	1
	Miscellaneous other areas	10	4	14
		144	57	201
Chugach Range	Anchorage Area	80	415	495
	Out of State	34	26	60
	Matanuska-Susitna Valley	6	24	30
	Fairbanks-Tanana Valley	7	4	11
	Copper R. Valley	3	3	6
	Kenai Peninsula	2	5	7
	Southeast Alaska	0	2	2
	Miscellaneous other areas	2	19	21
		134	498	632

Table 5-9. (Continued)

AREA	ADDRESS OF HUNTER	NUMBER OF HUNTERS Successful	Unsuccessful	Total
Kenai Mountains	Anchorage Area	52	233	285
	Kenai Peninsula	29	100	129
	Out of State	18	4	22
	Matanuska-Susitna Valley	1	2	3
	Southeast Alaska	0	6	6
	Fairbanks-Tanana Valley	0	6	6
	Miscellaneous other areas	3	14	17
		103	365	468
Talkeetna Chulitna Mtns.-Watana Cr. Hills	Anchorage Area	47	148	195
	Out of State	46	24	70
	Matanuska-Susitna Valley	6	31	37
	Fairbanks-Tanana Valley	2	13	15
	Kenai Peninsula	2	8	10
	Southeast Alaska	2	2	4
	Miscellaneous other areas	5	7	12
		110	233	343

Table 5-9. (Continued)

AREA	ADDRESS OF HUNTER	NUMBER OF HUNTERS Successful	Unsuccessful	Total
Tanana Hills-White Mtns.	Fairbanks-Tanana Valley	15	29	44
	Out of State	3	2	5
	Yukon R. and North	2	3	5
	Anchorage Area	2	0	2
	Kenai Peninsula	0	1	1
	Southeast Alaska	0	1	1
		22	36	58
Wrangell-Mentasta-Nutzotin Mtns.	Out of State	148	47	195
	Anchorage Area	88	149	237
	Fairbanks-Tanana Valley	27	64	91
	Southeast Alaska	14	20	34
	Copper River Valley	11	20	31
	Kenai Peninsula	6	2	8
	Matanuska-Susitna Valley	3	2	5
	Miscellaneous other areas	16	8	24
		313	312	625

Table 5-10. Number of hunters from various addresses who hunted Dall sheep in Alaska, 1968.

ADDRESS OF HUNTER	NUMBER OF HUNTERS		
	SUCCESSFUL	UNSUCCESSFUL	TOTAL
Allakaket		2	2
Anaktuvuk Pass	1		1
Anchorage	279	900	1179
Anchor Point		3	3
Angoon		1	1
Aniak	1		1
Auke Bay	2		2
Barrow	4		4
Bethel	4	1	5
Cantwell		3	3
Chitina		6	6
Chugiak	5	34	39
Clear	9	29	38
College	21	43	64
Cooper Landing	2	5	7
Copper Center	2	5	7
Cordova	2	2	4
Delta Junction	14	25	39
Dillingham		4	4
Dot Lake	1		1
Douglas	1	5	6
Eagle	2	2	4
Eagle River	14	51	65
Eska		1	1
Ester		1	1
Fairbanks	101	202	303
Fort Yukon		1	1
Gakona	6	11	17
Galena	1		1
Girdwood		4	4
Glennallen	6	12	18
Haines	1	2	3
Healy	2	8	10
Homer	6	4	10
Hope	1		1
Huslia		1	1
Indian		1	1
Juneau	13	20	33
Kaktovik		1	1
Kasilof	2	3	5
Kenai	15	41	56
Ketchikan	8	12	20
King Salmon	1		1
Kobuk	1		1
Kodiak	15	8	23
Kotzebue	6	8	14
McGrath	9	7	16

Table 5-10. (Continued)

ADDRESS OF HUNTER	NUMBER OF HUNTERS		
	SUCCESSFUL	UNSUCCESSFUL	TOTAL
Moose Pass	1	3	4
Mt. Edgecumbe	1		1
Nenana	1	3	4
Newtok		1	1
Ninilchik		2	2
Nome	1	1	2
North Pole	1	2	3
Northway		7	7
Palmer	15	63	78
Paxon		1	1
Petersburg	1	3	4
Seward	3	23	26
Shungnak		1	1
Sitka	1	5	6
Soldotna	15	44	59
Summit		2	2
Sutton	2	9	11
Tanana		2	2
Togiak		1	1
Tok	6	15	21
Tuluksak		1	1
Unalaska	1	1	2
Usibelli	5	10	15
Valdez		4	4
Ward Cove		1	1
Wasilla	3	18	21
Wildwood		1	1
Willow		4	4
Wrangell	1		1
Eielson AFB	12	44	56
Elmendorf AFB	19	114	133
Fort Greely	7	26	33
Fort Richardson	11	61	72
Fort Wainwright	6	39	45
Kodiak NAS	2		2
APO-FPO	4	35	39
Bush Towns (misc.)	2	1	3
Unknown		1	1
Alabama	2	1	3
Arizona	1		1
Arkansas		2	2
California	70	27	97
Colorado	6	3	9
Connecticut	4	1	5
Delaware		1	1
District of Columbia	3		3

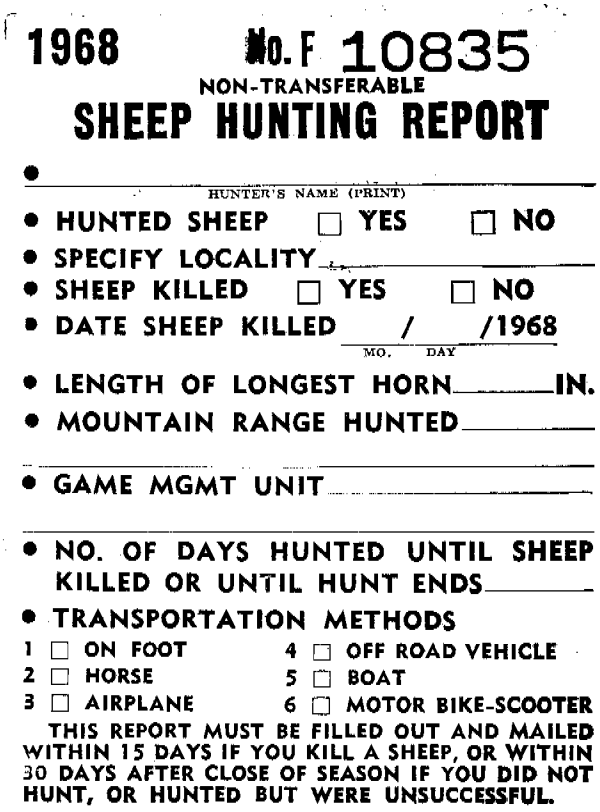
Table 5-10. (Continued)

ADDRESS OF HUNTER	NUMBER OF HUNTERS		
	SUCCESSFUL	UNSUCCESSFUL	TOTAL
Florida	6	3	9
Georgia	2	6	8
Idaho	7	1	8
Illinois	15	3	18
Indiana	3	4	7
Iowa	6	2	8
Kansas	3	1	4
Kentucky	1		1
Louisiana	9	3	12
Maine		3	3
Maryland	2	1	3
Massachusetts	5		5
Michigan	36	20	56
Minnesota	16	6	22
Mississippi	1		1
Missouri	6	3	9
Montana	5	6	11
Nebraska		1	1
Nevada	8	1	9
New Hampshire	5		5
New Jersey	4	3	7
New Mexico	2		2
New York	11	15	26
North Carolina	2		2
Ohio	16	19	35
Oklahoma	3	3	6
Oregon	10	13	32
Pennsylvania	45	9	54
South Carolina	2		2
South Dakota	4	2	6
Tennessee	7	1	8
Texas	22	5	27
Utah	1	2	3
Virginia	4	1	5
Washington	26	10	36
West Virginia	1	1	2
Wisconsin	20	5	25
Wyoming	1	1	2
Austria	2	4	6
Canada	1		1
Germany	7	6	13
Mexico	1	1	2
Switzerland	2	1	3
Italy	1		1
Norway	2		2
Spain		2	2
(Unknown)	15	13	28
Total	1122	2234	3356

Table 5-11. Comparison of 1951 and 1968 mean measurements of longer horns for six mountain areas, Alaska.

AREA	LENGTH OF LONGER HORN: Scott (1951) Guided Hunt Reports 1951 and Earlier Seasons $\bar{Y}$	n	Nonresident Hunters' Reports (Mostly Guided) 1968 Season $\bar{Y}$	n
Alaska Range E. of McKinley Pk.	34.7	50	34.3	52
Alaska Range W. of McKinley Pk.	34.9	50	35.9	40
Chugach Range	31.2	16	34.3	33
Kenai Mountains	34.5	50	32.0	20
Talkeetna-Chulitna Mtns. Watana Cr. Hills	34.8	38	32.8	44
Wrangell-Mentasta-Nutzotin Mtns.	35.7	25	33.6	143
	34.6	229	33.9	332

Figure 5-1. The 1968 sheep hunting report card for Alaska.



1968 No. F 10835

NON-TRANSFERABLE

SHEEP HUNTING REPORT

• _____
HUNTER'S NAME (PRINT)

• HUNTED SHEEP ☐ YES ☐ NO

• SPECIFY LOCALITY _____

• SHEEP KILLED ☐ YES ☐ NO

• DATE SHEEP KILLED ___ / ___ /1968
MO. DAY

• LENGTH OF LONGEST HORN _____ IN.

• MOUNTAIN RANGE HUNTED _____

_____

• GAME MGMT UNIT _____

_____

• NO. OF DAYS HUNTED UNTIL SHEEP KILLED OR UNTIL HUNT ENDS _____

• TRANSPORTATION METHODS

1 ☐ ON FOOT
2 ☐ HORSE
3 ☐ AIRPLANE
4 ☐ OFF ROAD VEHICLE
5 ☐ BOAT
6 ☐ MOTOR BIKE-SCOOTER

THIS REPORT MUST BE FILLED OUT AND MAILED WITHIN 15 DAYS IF YOU KILL A SHEEP, OR WITHIN 30 DAYS AFTER CLOSE OF SEASON IF YOU DID NOT HUNT, OR HUNTED BUT WERE UNSUCCESSFUL.

Figure 5-2 The sheep harvests, numbers of hunters, and numbers of harvest tickets issued for 1962-1968, Alaska.

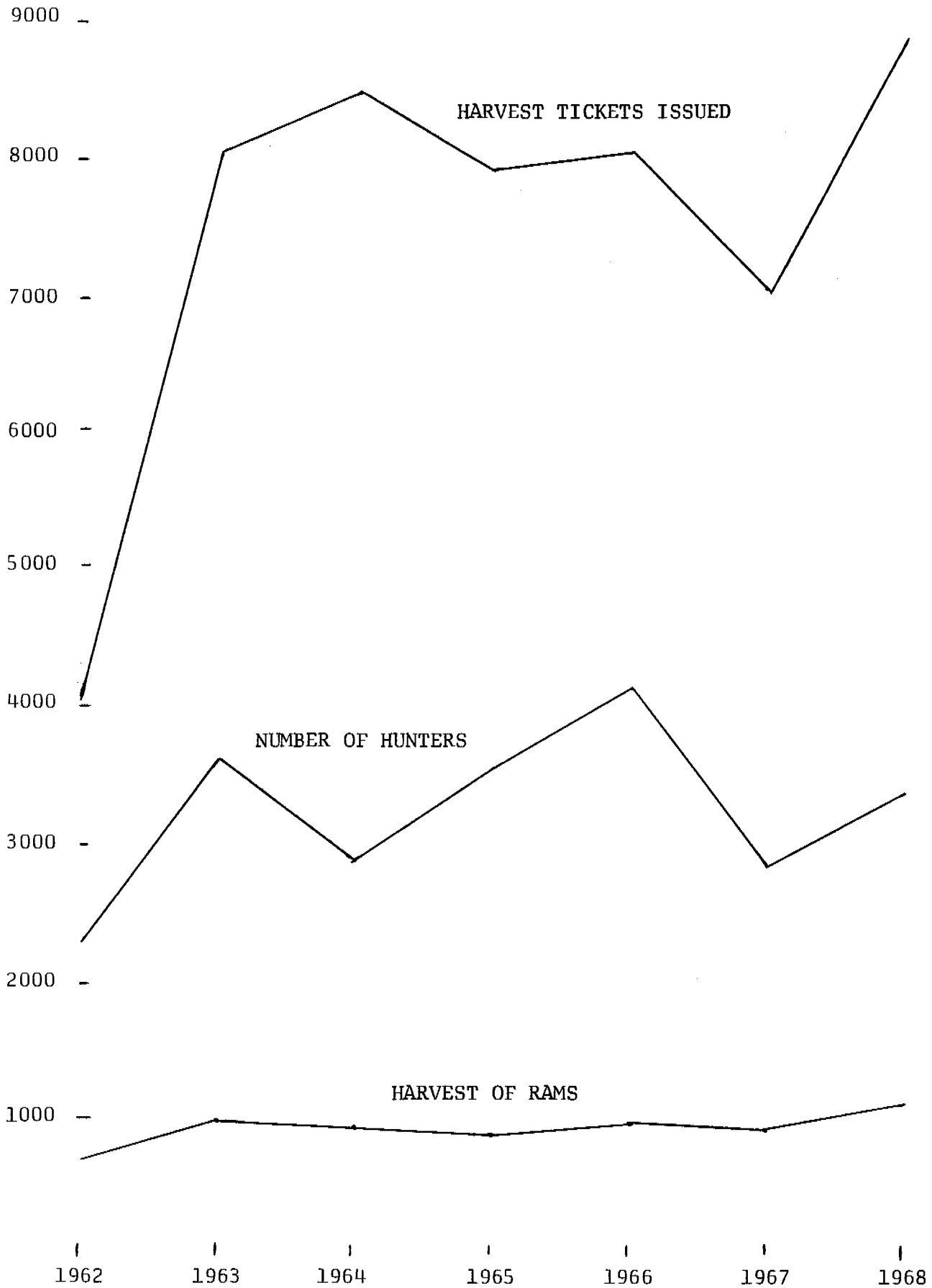


Figure 5-3. Percent of total sheep kill separated by weekly intervals for three areas which showed a steady decline from the opening week, 1968, Alaska.

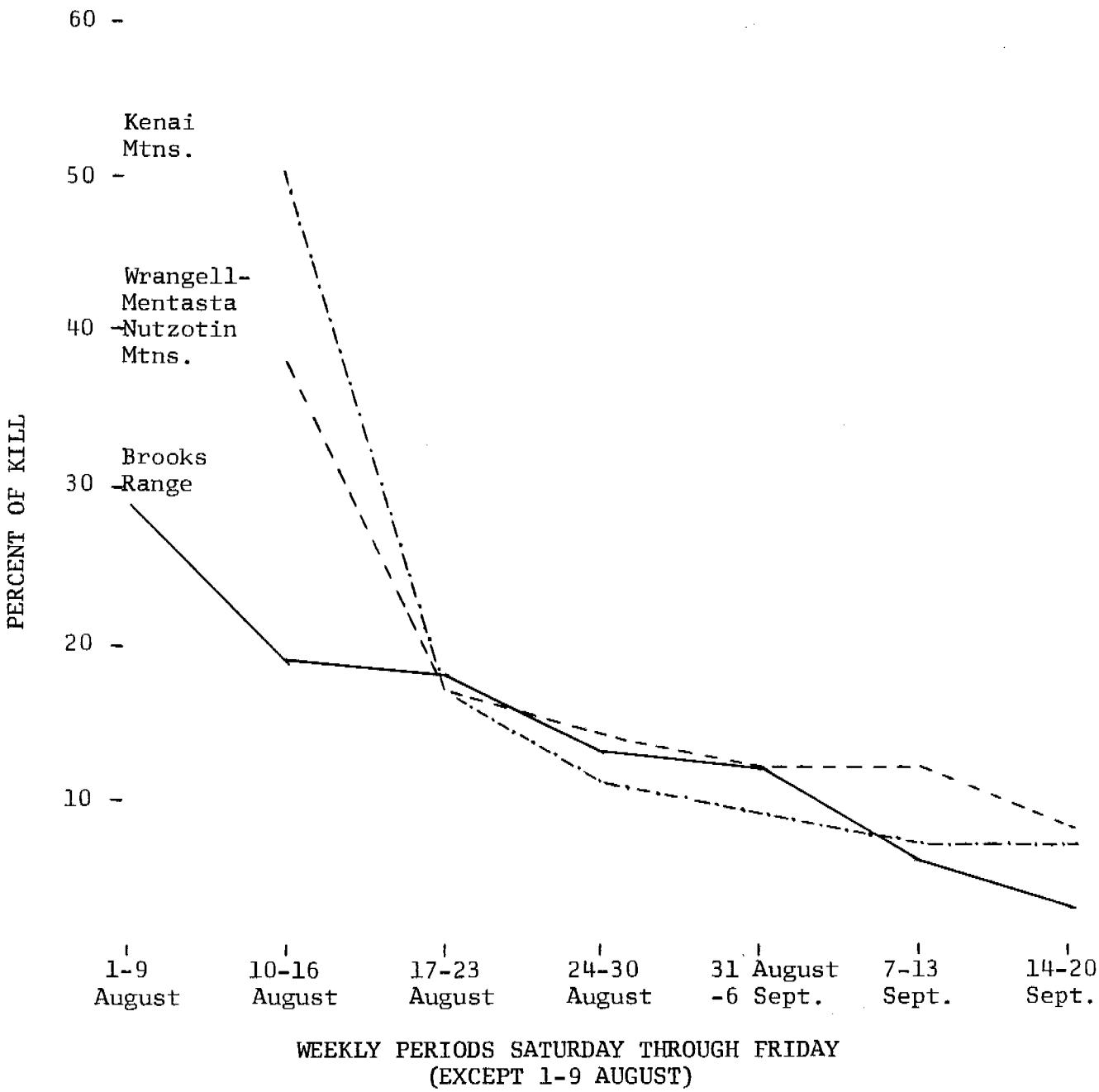


Figure 5-4. Percent of total sheep kill separated by weekly interval, for four areas which showed mid- or late-season rises in kill percentages following a high at season opening, 1968, Alaska.

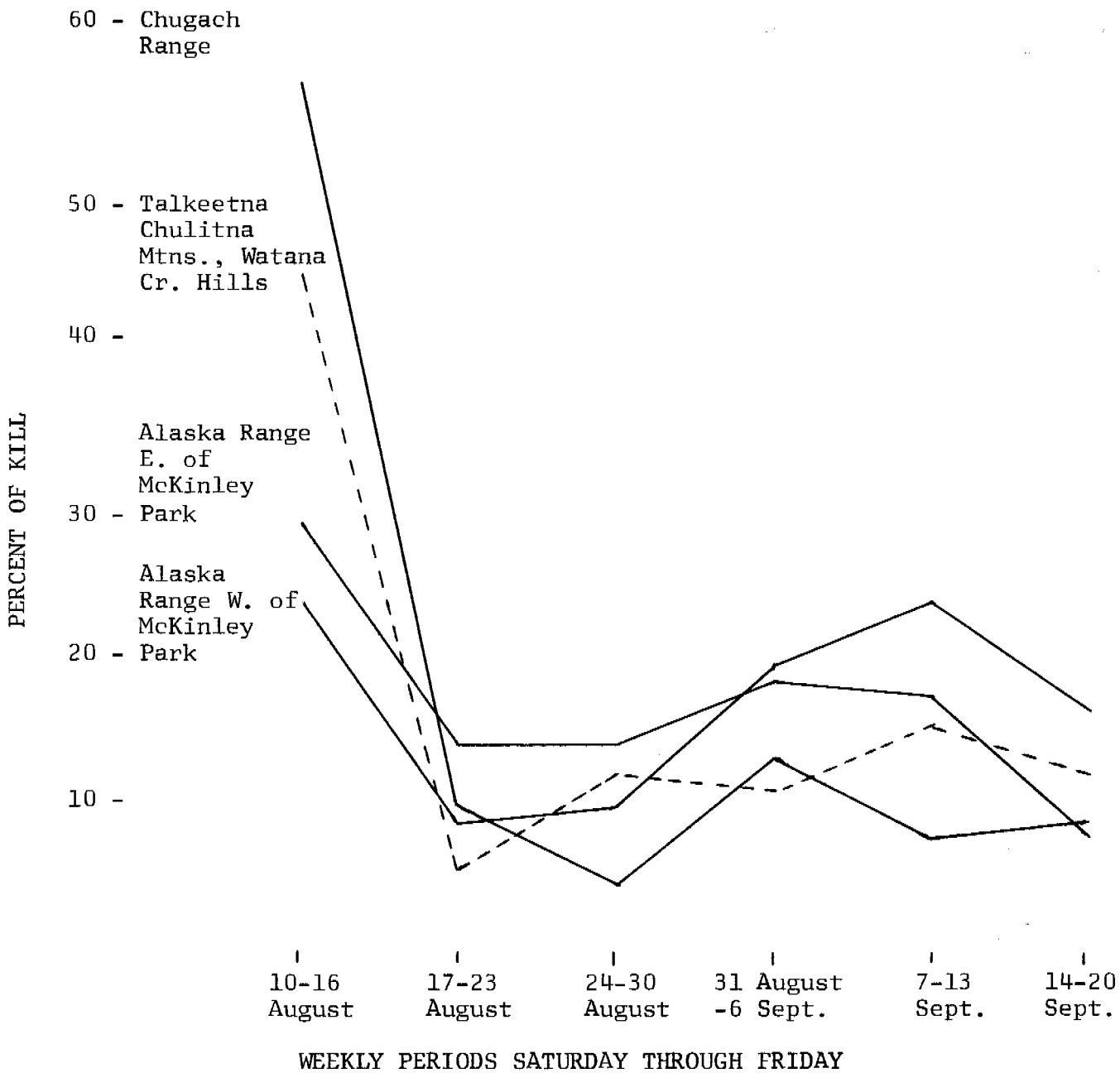


Table 7-1. Potential and actual captures of sheep with drop net in Dry Creek mineral lick, Alaska Range, June 1968.

Date	Time	Collar; Pendant No.	Ear Tag(s)	Sex	Age	Notes
23 June	0815	rope; 24	007R, 008L	Female	2 yr.	
23 June	0815	rope; 25	010L	Male	1 yr.	smaller body than #23
23 June	0815	rope; 22	none	Female	2 yr.	lactation not checked
23 June	0815	rope; 23	none	Male	1 yr.	
23 June	1100				1 yr.	we had no expandable collar ready for this small yearling so he was not caught.
23 June	1110	rope; 26	none	Female	2 yr.	lactating
23 June						3 rams under net but intentionally not caught
24 June	0910	strap; 27	012R	Female	3 yr.	lactating
26 June	0928	rope; 28	none	Male	5 yr.	3/4 curl left horn = 640mm hind foot = 410mm
28 June	0825					1 ram under net but not caught because of communication failure.

Means for days hunted and for horn length can be misleading when considered apart from other statistics such as the modes. For instance, from Tables 5-6 and 5-7, the mean number of days hunted by successful hunters was about 4, but more than half the successful hunters killed a sheep in 3 days or less, and while the mean of reported longer horn lengths for sheep killed in 1968 was 33.3, one out of four of the sheep were reported larger than 35 inches.

Taxidermy shops appear to be good points for sampling the harvest of sheep; the sample available is large and appears representative. It is conceivable that the total kill could be estimated from the number of horns received in taxidermy shops. An estimate of the number from each mountain range could be obtained as well, based on the close correlation of the sample percentages to the reported kill percentages.

The harvest is concentrated in the early part of the season in places like the Kenai Mountains (Figure 5-3). Attempting to reduce the kill and/or hunting pressure by shortening the season, might not be effective in such an area where most hunters are residents and not restricted as to when they hunt. Where guided non-residents constitute a large proportion of the hunters, with hunts of a week, 10 days or more contracted for, the number of hunters that guides can handle is limited and the hunting pressure is more evenly distributed through the season (Figure 5-4). The chronology of the kill is probably affected by the desire to be out opening day, preferred vacation times, availability of rams, weather conditions, coincidence of sheep season with other hunting seasons, and numerous other social and environmental factors.

Dall Sheep Habitat

The aerial photography work was intended to provide photographs suitable for charting the instantaneous snow-free habitat. It was hoped that through a series of these charts, the dynamics of snow cover could be studied as an aid in identifying areas for the study of range available in winter. Although snow-free areas could be grossly charted, the charts lacked detail. Furthermore, vegetated and non-vegetated areas within the snow-free areas could not be reliably separated. Snow cover through which sheep could feed also complicated the problem. The identification of available vegetated range, the objective of the photography, could not be accomplished.

The Cooper Mountain (Chugach National Forest) range transect data were processed and analyzed by the Forest Service and are on file at the U.S. Forest Service office, Seward, Alaska.

Movements of Dall Sheep

On June 23 the first sheep were captured (Table 7-1). The sheep seemed much less wary in the natural lick than on the open slope. The first sheep were captured after the following events: A yearling male went under the net and started to eat the clay material there. This seemed to make some other sheep in the vicinity of the net less wary of it, and several others started for the net. When four sheep were under, the blasting caps were exploded

and the net fell on the sheep. More sheep were heading for the net and could probably have been caught, but we were not sure how many we could handle without jeopardizing the sheep's chances for survival.

The sheep were essentially immobilized by the net. Only one obvious hazard to sheep health existed; muddy water from a shallow 3m diameter mud puddle could be inhaled if a sheep's head was pulled into it.

Rapid heart beats, audible several meters away, were characteristic of the captured sheep; violent struggling was not. Upon release, 10-15 minutes from time of capture, the sheep first escaped down hill and seemed dazed and fatigued. Most turned parallel to the slope and then started up hill after traveling about 25m from the release site. The net can be rehung and recharged in about 30 minutes.

The sheep urinate and defecate in the lick. Since parts of the lick are naturally muddy, it probably could be important in the spread of disease. Because we did not have sufficient supplies of disinfectant and were not sure if tagging would lead to infection, tags were not put on ears which had been immersed in the clay-mud of the lick. Table 7-1 lists the information about each captured sheep and about sheep which were under the net but not captured.

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