

## ALASKA DEPARTMENT OF FISH & GAME

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### Not for Publication

(The results described in these reports are preliminary and often fragmentary in nature. Conclusions are subject to change with further investigation and interpretation.)



WORK PLAN A

MOOSE MANAGEMENT STUDIES

1956

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## SUMMARIES

### Job No. 1--Herd Composition Surveys--Susitna & Copper River Valleys

Aerial surveys to determine the sex and age composition of the moose populations inhabiting the Lower Susitna and Matanuska Valleys, and the Upper Susitna and Copper River basins were conducted between October 19th and 30th, instead of during November, as in previous years.

Aerial identification is limited to four categories: (1) young bulls (yearlings), (2) adult bulls, (3) cows, and (4) calves. Various sex and age ratios are calculated, as indices of productivity, survival, and effects of hunting in local moose populations.

In general, productivity was fairly good with overall calf:cow ratios of 40:100 and 27:100 in the Lower Susitna-Matanuska area and the Upper Susitna-Copper River basin area, respectively. Local areas, however, displayed great variations, with the Matanuska Valley having a high calf:cow ratio of 53:100 and the Watana-Coal Creek area having a low ratio of 23:100.

Survival of young bulls in the Matanuska Valley area was very poor, with a ratio of 4 young bulls per 100 total cows. Hunting is probably the principal decimating factor in this area. Elsewhere, survival varied, but, except for heavily hunted areas, was generally fair to good.

The effects of hunting are best illustrated in the Matanuska Valley and in the Willow area. These areas have bull:cow ratios of 10:100 and 28:100 respectively. In the Maclaren River and Lake Louise areas hunting is believed to be slightly reducing the bull:cow ratio. These ratios are 62:100 and 57:100 respectively, and are somewhat lower than the remainder of the Upper Susitna-Copper River basin area which has a ratio of 77:100. The removal of a large proportion of the bull population does not appear to affect the annual calf reproduction.

October composition counts seem to provide a good sample of the moose population, and do not sample bulls disproportionately, as the November counts were believed to do.

The incidence of twin calves is difficult to determine from aerial surveys in either October or November.

The areas which had good calf production in 1955 generally showed lesser production in 1956, and conversely those having lesser calf production in 1955 had greater production in 1956.



The October counts provided an opportunity to observe moose distribution and behavior associated with breeding activities. The largest "harems" occur in areas having the highest density populations and lowest bull:cow ratios; also, the calf:cow ratio of the animals present in the "harems" is lower than that of the other groups. The "harem" groups disperse in early November, concurrent with a general population realignment.

Sex and age characteristics indicate that the Matanuska Valley and Willow area moose respectively comprise identifiable local populations.

Reproductive data collected from railroad-killed moose during the period January-April, 1956, indicate an embryo:cow ratio of 117:100 cows (age class II and above), and an overall ratio, including yearlings and calves, of 87:100. This ratio, when compared to the October calf:cow ratio, indicates high calf mortality prior to the first winter.

A browse reconnaissance survey of the critical accidental kill areas along the Alaska Railroad indicates no definite relationship between moose fatalities and browse abundance alone. However, browse abundance, snow depth and high local moose populations together do show a high correlation with the distribution of moose fatalities.

The survey indicates that aspen and willow are the preferred winter browse species.

Examination of 30 sets of moose lungs revealed a 20 per cent incidence of Echinococcus granulosus, i.e., Hydatid disease.



### Job No. 2--Tanana Valley and Fortymile Herd Composition

Aerial surveys to determine sex and age composition of local moose populations were conducted during the period October 14-November 9 in the Tanana Valley and the Fortymile areas. In the Tanana Valley productivity continues good, with a calf:cow ratio of 47:100. Survival also appears excellent, with very little drop from 1955 bull calf proportions to 1956 yearling bull proportions in the samples. Hunting pressure is relatively light, and the bull:cow ratio in the area of heaviest hunting was 68:100.

The Fortymile area was covered for the first time in 1956. Productivity is high in the area, with a calf:cow ratio of 53:100. Survival appears fair, with a young bull:male calf ratio of 60:100. Hunting has had relatively little effect on the adult sex ratio which was found to be 66 bulls per 100 cows.

The Wood River area is subject to little or no hunting. Comparison counts were made in the area in mid-October and early November to discover any differences in sex and age composition observed at these times. The most obvious difference was a higher proportion of calves being recorded in November. Other differences also appeared, but the samples were small and conclusions tentative.

In general, moose populations in the areas surveyed appear to be in good condition. Limited access localizes hunting pressures, and hunting has had little effect on the moose populations studied.

### Job No. 3--Stikine River Valley Aerial Surveys and Hunter Harvest Information

The Stikine River area is one of the few locations where moose occur in Southeastern Alaska. To date, projected aerial surveys of this moose population have been prevented by adverse weather.

An estimated 125 hunters sought moose in the area in 1956, with 30 animals being taken for a success ratio of 24%. Kill data for previous years are presented.

Various tabulated reports indicate that there are probably at least 30 moose present in the Muddy River-Thomas Bay area, north of the Stikine.



Job No. 1

Herd Composition Surveys  
Susitna & Matanuska Valleys  
By: R. A. Rausch

## METHODS

Aerial surveys to determine sex and age composition of local moose populations were conducted during the month of October, 1956, instead of during November as in previous years. The Copper River area was covered between October 19 and 25 by Nystrom and Rausch, using a Super Cub; and the Susitna Valley was covered between October 21 and 31, using a combination of several pilots, observers and aircraft. Flying in the Copper River area totaled 30.8 hours, and in the Susitna area 19.7. The mean count of moose per flying hour was markedly different between areas and in comparison to last year's counts: 37.5 in the Copper and 64.7 in the Susitna; whereas the 1955 count was 75.3 in the Copper and 74.2 in the Susitna (Tables XV & XVI).

## Sex and Age Categories

Moose sex and age determination by aerial observers is limited to the following four categories:

1. Young Bulls--bulls with spiked or forked antlers, usually with little or no palm development. These animals are considered "yearlings," approximately eighteen months old, though it is realized there is some overlap in ages.
2. Adult Bulls--all bulls having greater antler development than the preceding age category.
3. Cows--all cows, including yearlings.
4. Calves--calves of the year, generally five to six months old when the counts are made.

## AREAS COVERED

The coverage of the Susitna Valley and the Copper River Basin was largely the same as in 1955, with the following exceptions:

1. The Fort Richardson Reserve was not counted due to the lack of snow cover when aircraft, personnel and time were available for counting.
2. The Mt. Drum portion of the Wrangell area was not adequately covered due to inclement weather.
3. Clear Creek counts of the Upper Susitna Valley were not completed because of inclement weather



4. The Peters Creek-Eagle River area was covered; however, poor snow conditions hampered the counts.

5. The Susitna Mt.-Alexander Creek portion of the Susitna Valley west of the river area was covered, and counting conditions were adequate, but very few moose were located--reason unknown.

#### RESULTS OF COUNTS

Summaries of moose actually tallied, by sex and age, are given in Table I for the Susitna area, and in Table II for the Copper area. Each table shows the counts identified by their respective local area. The sampling included 1150 moose in the Copper area and 1275 in the Susitna area.

#### COMPOSITION IN SUSITNA AND COPPER RIVER POPULATIONS

The data from the 1956 counts were analyzed for the indicators of productivity, survival and effects of hunting as described in the March 31, 1956, P-R Report. "Productivity" was defined to include both the initial incidence of live births to females in the population, and also, the subsequent survival of these young to the date of the aerial counts. "Survival" was defined as survival of the calves recorded on the annual sex and age composition counts to the same date one year later--i.e., survival to approximately 18 months.

The index used in the 1955 report to measure survival of young bulls to 18 months was the young bull:bull calves of the year ratio. The accuracy of this ratio is dependent upon uniform calf production from year to year. It is recognized that calf production does vary; however, the young bull:bull calves of the year ratio was the only index to young bull survival in 1955, as no comparative data from previous years were available.

The index to young bull survival uses as its base the cow population; and compares the bull calf:total cow ratio of 1955 to the young bull:total cow ratio of 1956. This yields an index to young bull survival to 18 months. A more complete discussion of this index is contained in another section of this report.

Effects of hunting here refers to the extent to which hunting removes a portion of the bull population; cow moose are not hunted.

Table III summarizes these data for the Susitna Valley and Table IV for the Copper River basin; Tables XVII & XVIII summarize previous years results for these areas in the Kenai and Tanana Valley as well.

The following discussion outlines some of the more important trends of this year's survey.



## PRODUCTIVITY

### The Matanuska Valley Area

The Matanuska Valley has a very high calf:cow ratio of 60:100 and a ratio of 53:100 if the Matanuska timberline counts are included. This indicates good calf production and survival to date. The young bull:adult bull ratio of 75:100 remains very high but is undoubtedly the result of great hunting pressures.

### Willow Area

The Willow area counts indicate poor calf production or poor calf survival to mid-October, as the combined calf:cow ratio was 27:100. A sample of 46 railroad-killed cow moose, largely from the Willow area, examined during the winter of 1955-56, revealed that over 90 per cent of all cows over 2 years old were pregnant. If this sample is representative of the Willow area moose population, then the low calf:cow ratio probably is due to poor calf survival and not to low initial production.

The Area West of the Susitna River (The majority of the moose in this sample represent the Kahiltna Flats area.)

The calf:cow ratio of 45:100 indicates fairly good production. The young bull:adult bull ratio of 23:100 may represent average production as hunting is not an important factor in this area.

### Copper Area

The overall calf:cow ratio of 27:100, although uniform, was appreciably lower than the 52:100 ratio of last year, and considerably below the Susitna-Matanuska Valley area's calf:cow ratio of 40:100. The following are several factors which could have caused this apparent decrease in calf production:

1. Good survival of last year's large calf crop, thus contributing a large number of non-producing yearling cows to the population.
2. An over-all expanding population with a large proportion of sub-adult cows, i.e., one, two and possibly three year olds.
3. Poor calf survival to late October.
4. Counting one month earlier in 1956 may have sampled the moose population in proportions different from 1955. The much lower bull:cow ratios suggest this.

One or several of these factors may have influenced this year's counts.



## EFFECTS OF HUNTING

### The Matanuska Valley Area

The bull:cow ratios of 5:100 on the valley floor; 18:100 above timberline, and an overall ratio of 10:100 further substantiates last year's conclusions that hunting is greatly affecting sex ratios in accessible areas. This very unbalanced sex ratio has apparently not lowered calf production as the Matanuska area this year had the highest calf:cow ratio recorded in any of the study areas.

### The Willow Area

The Willow area has a very unequal hunting pressure, varying from intense along the railbelt, the Willow and Huston roads, to moderate above timberline. Nevertheless, the bull:cow ratio is low, 28:100, and is probably a result of hunting.

### The Area West of the Susitna River

Hunting in this area is limited and well dispersed. The bull:cow ratio is 66:100.

### The Upper Susitna-Copper River Area

The most easily accessible areas--those along the Denali Highway, Lake Louise and the Glenn Highway--have a bull:cow ratio of 57:100 as compared to 77:100 for the remainder of the Copper basin. In addition, the young bull:adult bull ratio is twice that of the other Copper areas. This ratio could indicate good production, but in all probability represents an early indication of hunting pressure.

## SURVIVAL

An index to moose calf survival to 18 months is provided by comparing the 1955 bull calf:total cow ratio with the 1956 young bull:total cow ratio. These comparisons are illustrated in Table No. V.

The "total cow" segment was selected as the base for an index to young bull survival to 18 months. It was selected because cow moose are not subjected to hunting and therefore are the most constant group within the moose population. In computing the young bull:total cow ratio it is necessary to assume that the total number of cow moose in a local population is remaining relatively constant from one year to the next. All age classes of female moose are subject to various mortality factors, particularly during severe winters such as 1955-56. However, the inclusion of yearling females (1955 calves) in the 1956 sex and age composition counts probably more than offsets adult female mortality and in many local areas, particularly in the Copper River Basin, the total number of cow moose may have increased. In the areas where the moose population is increasing, the survival of young bulls, as measured by the bull calf:young bull index, represents



minimum survival. Therefore, the mortality figures cited in the following discussion represent a maximum estimate of young bull mortality in areas where the moose population is expanding, and, conversely, they represent a minimum estimate of mortality in areas of decreasing populations.

#### Survival to 18 Months

The data from the comparison of the 1955 bull calf:total cow ratio with the 1956 young bull:total cow ratio provides interesting survival data and also provides a cross check on the reliability of the aerial sex and age counts.

#### Lower Susitna and Matanuska Valleys

The 1955 counts indicated a bull calf:total cow ratio of 27:100 for the Matanuska Valley area and 17:100 for the Matanuska timberline area. The corresponding young bull:total cow ratios in 1956 were 3:100 and 6:100. The combined, valley and timberline, bull calf:total cow ratio in 1955 was 26:100, and the combined 1956 young bull:total cow ratio was 4:100. This indicates a young bull mortality of 85 per cent. In all probability hunting is a major decimating factor in this area.

#### Willow Area

The 1955 bull calf:total cow ratios in the Willow Valley and Willow timberline areas were 11:100 and 19:100 respectively. The corresponding young bull:total cow ratios in 1956 were 4:100 and 8:100. The combined Willow area 1955 bull calf:total cow and 1956 young bull:total cow ratios were 14:100 and 6:100. This indicates a young bull mortality of 57 per cent.

#### The Susitna-Copper River Basin Areas

The 1955 bull calf:total cow ratio in the Maclaren River area was 32:18. The 1956 young bull:total cow ratio of the same area was 15:100, indicating a 53 per cent mortality of young bulls. Hunting may have accounted for much of this mortality. In the Lake Louise areas the 1955 bull calf:total cow ratio was 27:100; the 1956 young bull:total cow ratio was 12:100 and indicates a young bull mortality of 56 per cent. The overall 1955 bull calf:total cow and 1956 young bull:total cow ratios in the Susitna-Copper River Basins were 26:100 and 10:100.

Several of the local areas had young bull:total cow ratios nearly as great or greater than the initial bull calf:total cow ratios. This was true in the St. Anne-Kiana Lakes and Wrangell Mountain areas. The 1955 counts indicated a predominance of bulls in these areas. It is possible that the counts did not sample the moose population in its true proportions. The 1956 counts on the same areas were much smaller than those made in 1955 and also may not be representative.



TABLE I

Summary of Moose Population Composition Counts  
Susitna - Matanuska Valley, October 1956

Area	Young Males	Adult Males	Total Males	Lone Females	Females 1 Calf	Females 2 Calves	Total Females	Total Calves	Total Moose
<u>SUSITNA-MATANUSKA VALLEYS</u>									
Matanuska Valley	6	3	9	72	103	2	177	107	293
Matanuska Valley Timberline	6	13	19	63	41	1	105	43	167
Willow	8	30	38	115	65	7	187	79	304
Sub-Total	20	46	66	250	209	10	469	229	764
Peters Cr. & Eagle River	3	3	6	4	1	0	5	1	12
Willow Cr. Timberline	16	52	68	176	19	3	198	25	291
Susitna Valley, West of River	12	53	65	57	39	3	99	45	209
Sub-Total	31	108	139	237	59	6	302	71	512
TOTAL	51	154	205	487	268	16	771	300	1276



TABLE II

Summary of Moose Population Composition Counts  
Susitna and Copper River Basins, October 1956

Area	Young Males	Adult Males	Total Males	Lone Females	Females 1 Calf	Females 2 Calves	Total Females	Total Calves	Total Moose
<u>UPPER SUSITNA-COPPER RIVER BASIN</u>									
Maclaren River	27	87	114	133	52	0	185	52	351
Lakes Louise & Susitna	15	46	61	90	31	2	123	35	219
Sub-Total	42	133	175	223	83	2	308	87	570
Oshetna-Tyone Creek, Nelchina River	7	58	65	66	27	0	93	27	185
Watana Creek & Coal Creek	16	68	84	87	26	0	113	26	223
St. Anne - Kiana Lakes	3	15	18	10	5	0	15	5	38
West Fork Gulkana River	4	22	26	43	7	0	50	7	83
Wrangell Mountains	3	26	29	15	4	1	20	6	55
Sub-Total	33	189	222	221	69	1	291	71	584
TOTAL	75	322	397	444	152	3	599	158	1154



TABLE III

Sex and Age Ratios in Susitna and Matanuska  
Valley Moose Populations, October 1956

Area	Total Bulls/ 100 Cows	Young Bulls/ 100 Adult Bulls	Calves / 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bulls % in Total Herd	Young Bulls per 100 Bull Calves	Total Moose
<u>SUSITNA-MATANUSKA VALLEY</u>								
Matanuska Valley	5	200	60	2	37	2	9	293
Matanuska Valley Timberline	18	46	41	2	26	4	27	167
Matanuska Valley Combined	10	75	53	2	31	3	17	460
Willow	20	27	48	10	29	3	18	304
Above Areas Combined	14	43	49	4	30	3	17	764
Peters Creek & Eagle River								12
Timberline Areas, Susitna to Montana Creek	34	31	13	16	9	5	133	291
Susitna Valley West of River	66	23	45	7	22	6	52	209
Above Areas Combined	46	29	24	9	14	6	89	512
<u>SUSITNA-MATANUSKA VALLEYS COMBINED</u>								
	27	33	40	6	24	4	33	1276



TABLE IV

Sex and Age Ratios in Susitna and Copper River Basin  
Moose Populations, October 1956

Area	Total Bulls/ 100 Cows	Young Bulls/ 100 Adult Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bulls % in Total Herd	Young Bulls per 100 Bull Calves*	Total Moose
<u>UPPER SUSITNA-COPPER RIVER BASIN</u>								
Maclaren River	62	31	28	0	15	8	103	351
Lakes Louise and Susitna	50	33	29	6	16	7	83	219
Above Areas Combined	57	32	28	2	16	7.5	95	570
Oshetna-Tyone Creek, Nelchina River	70	12	29	0	15	4	50	185
Watana-Coal Creek	74	24	23	0	12	7	123	223
St. Anne-Kiana Lakes	100	20	33	0	13	8	100	38
West Fork Gulkana River	52	18	14	0	8	5	114	83
Wrangell Mountains	152	12	31	5	11	6	100	55
Above Areas Combined	77	17	24	2	12	6	91	583
COPPER BASIN - ALL AREAS	67	23	27	2	14	7	95	1154

\*Assuming one-half the calves to be bulls



TABLE V

## YOUNG BULL:BULL CALF RATIOS

Upper Susitna and Copper River Basins

Area	1955 Total Cows	Total Bull Calves	1955 Bull Calves: Total Cows	1956 Total Cows	1956 Total Young Bulls	Young Bull: Total Cow
Maclaren River	132	42	32:100	185	27	15:100
Lakes Louise & Susitna	73	19	27:100	123	15	12:100
Sub-Total	205	62	30:100	308	42	14:100
Oshetna-Tyone Cr. & Nelchina River	159	59	37:100	93	7	8:100
Watana-Coal Cr.	113	27	24:100	113	16	14:100
St. Anne-Kiane L.	45	6	14:100	15	3	20:100
West Fork Gulkana River	191	51	27:100	50	4	8:100
Wrangell Mts.	107	19	18:100	20	3	15:100
Sub-Total	791	200	25:100	302	33	11:100
TOTAL	996	261	26:100	771	75	

Lower Susitna and Matanuska Valleys

Matanuska Valley	905	242	27:100	177	6	3:100
Matanuska Timber- line	63	10.5	17:100	105	6	6:100
Sub-Total	968	252.5	26:100	282	12	4:100
Willow Valley	265	29	11:100	187	8	4:100
Willow Timber- line	142	27	19:100	198	16	8:100
Sub-Total	407	56	14:100	385	24	6:100
Susitna Valley West of River	236	32	14:100	99	12	12:100
TOTAL	1611	340.5	21:100	766	48	6:100



## DISCUSSION

Several problems and observations of interest were revealed by the October counts. These are discussed below.

### October Sex and Age Composition Surveys

The counts made in October seem to provide a good overall sampling of the various moose populations; however, this year's surveys did not yield as great a count of moose per hour of flying as in 1955. This is most noticeable in the Copper Basin area and may have been caused, in part, by a change in personnel, both pilot and observer. The distribution of the moose populations in October is considerably different from November and may also have influenced the lower hourly counts. The distribution of the moose populations in 1955 and 1956 are illustrated in Figures 6, 7 and 8.

### Incidence of Twins

The October counts, made during and immediately following the rut, when the moose are generally banded into "harem-like" groups, did not provide an accurate twin calf:single calf ratio. These "harems" frequently were composed of 3 to 12 cows, their calves, and several bulls. The calves were generally scattered throughout the immediate area and identification of twins was impossible. The incidence of twins and some of the difficulties in obtaining accurate twin counts in November were discussed in the March 31, 1956, P-R Report. These problems are also present during the October counts.

It is highly doubtful that the present twin:single ratio is accurate enough to indicate true proportions.

### Calf Production

In general, areas of great calf production in 1955 were areas of poor or moderate production in 1956, and conversely areas of poor or moderate production in 1955 were areas of good production in 1956. This is best illustrated in the Copper Basin areas. In 1955 the Maclaren and Susitna areas had calf:cow ratios of 60:100, and the remaining areas showed a ratio of 50:100; the 1956 ratios are 28:100 and 24:100 respectively.

In the Susitna-Matanuska Valley areas the differences are not quite as great, but statistical analysis indicated not more than 1.5 chances per hundred that the differences were due to chance alone. The Matanuska Valley counts of 1955 had a combined calf:cow ratio of 37:100; the Valley proper had a ratio of 42:100. The 1956 counts show a combined ratio of 53:100; the Valley proper shows a ratio of 60:100. The Susitna area west of the river had a ratio of 27:100 in 1955 and 45:100 in 1956. The Willow Area is the lone exception, having a constant ratio of 27:100 in 1955 and 1956.



## GROUP COMPOSITION DATA

The October moose sex and age composition counts provided an unusual opportunity for observing moose breeding and seasonal grouping behavior. Moose groups or "harems" were frequently seen during mid-October when the earliest counts were made. Presumably, the peak of rut was past, although evidence of active rut was observed as late as October 30. Most of the "harems" were composed of cows, bulls and a few calves. In an effort to gain further understanding of moose breeding behavior and population structure, the data obtained from the October counts were re-examined. These data are presented in Tables VI and VII.

The sex and age composition counts made during the period between October 19 and October 31 do not represent a chronological sampling of any one local moose population. Instead, the counts represent a number of local moose populations from several distinct geographic areas. Although the data from the various areas are not directly comparable, several general principles concerning moose population density, sex composition, age composition and seasonal behavior are revealed.

In analyzing the group composition data it was necessary to select a uniform method of treatment which would allow the data from the various local moose populations to be compared. In addition, the method had to allow for comparisons of the groups within the local population itself. The method selected involved dividing the local populations into two portions: (1) the largest groups--comprising the upper 50 per cent of the population, and (2) the remaining, smaller, groups which comprised the lower 50 per cent of the population. Frequently, 50 per cent of a local population occurred in a relatively small proportion of the total groups. An example of this is the Willow area below timberline, Table VI. Here 50 per cent of the population occurred in 20 per cent of the groups. The method used for dividing the local populations is arbitrary, but it does reveal important differences between the bull:cow and calf:cow ratios of the upper and lower groups.

### Population Density

The counts in the Willow area made on October 21 have a group range of 1-34, a mean group size of 7.4, and an upper 50 per cent mean group size of 13.6. The Willow area group means are much greater than those from counts made on the same date in the Upper Susitna Valley. The counts made in the Black and Oshetna River drainages (a portion of the Upper Susitna) on October 21 had a group mean of 2.7, a range of 1-17, and an upper 50% group mean of 5.1. The Maclaren River area, counted on October 24, had a group range of 1-21, a mean group size of 3.4, and an upper 50 per cent mean group size of 6.8. The difference in mean group sizes between the Willow area and the Upper Susitna areas may represent differences in population densities, age structure and sex composition. The moose population per square mile in the Willow



area is estimated to be greater than in the Upper Susitna Valley. This estimate is substantiated by the moose per hour of flying data for the two areas. In the Willow area 117 moose per hour were observed, whereas, in the Black and Oshetna Rivers 32 per hour, and 50 per hour in the Maclaren River area (Tables XV and XVI). This apparent difference in population density could partially explain the group size differential.

#### Sex Composition

The Willow area above timberline has an overall bull:cow ratio of 29:100 and an upper 50 per cent ratio of 25:100. The Black and Oshetna Rivers had a bull:cow ratio of 96:100 and an upper 50 per cent ratio of 100:100. The Maclaren River area had a bull:cow ratio of 62:100 and an upper 50 per cent ratio of 68:100. If the groups represent "harems" it would be logical to expect larger harems in areas having few bulls and a great population density. The Willow area data seems to support this contention.

#### Age Composition

Differential age composition, assuming that the sub-adult or non-breeding females band together, may also account for some of the large groups of calfless female moose. These groups were particularly noticeable in the Willow area. The exact status of these groups is not known, but apparently they were non-breeding females. The majority of the large groups observed did contain several bulls and a few calves. This was also true in the upper Susitna counts, although the groups did not average as large and bulls occasionally outnumbered the cows.

#### Group Composition Change

As no large area was counted periodically, the changes in group composition are not directly comparable. However, a definite change in the sex composition of the groups was noted.

The sex composition and size of the groups observed in the Matanuska Valley on October 30 were quite different from those observed in the Willow area on October 21. These areas, while not directly comparable, do have two important similarities; (1) a high density moose population, and (2) a scarcity of bulls.

The Willow area had a mean group size of 6.5 compared to a mean group size of 3.9 in the Matanuska area. The smaller mean group size in the Matanuska area probably indicates the breakup of the harems.

#### Distribution of Bull Moose

Previous aerial counts made in November have, in some instances, indicated disproportionate sampling of bulls. This year's counts,



made in October, revealed that a great percentage of the bulls were at or above timberline but that the bulls were generally associated with several cows. In late October the "harems" were disbanding, and several small bands of bulls were seen. On October 30 a count was made of the Kahiltna Flats moose population. The mean group size was 3.9, the range 1-9, and the upper 50 per cent mean group size was 6.1. The bull:cow ratio of the upper 50 per cent was 98:100; the lower 50 per cent was 28:100. This could have indicated active rut but close observation revealed that many of the upper 50 per cent groups were composed entirely of bulls. The calf:cow ratio of the upper 50 per cent was only slightly lower than the lower 50 per cent; 45:100 vs. 51:100.

The unequal bull distribution plus the uniform calf distribution probably indicates the breakup of the "harems" and the initial forming of the bull groups.

In early November a reconnaissance flight over the timberline area above the Willow burn revealed that between 150 and 200 bull moose were scattered over an area where many large harems had been observed in October; very few cows were seen.

On December 29 on another flight over this timberline area only two moose were seen; one a bull with a medium sized rack, the other was presumed to be a very large bull which had shed his antlers. The whereabouts of the bulls previously located in this area are unknown.

#### The Willow Burn Check Plot

Periodic complete counts of the moose inhabiting a small burn located approximately 10 miles northeast of Willow, Alaska, have been made since October 21. Complete counts are possible because the burn is particularly well defined. The southern boundary of the burn is formed by the Willow road, and the three remaining sides are bounded by mature vegetation. Each count requires about 30 minutes flying. The transects are flown in such a manner as to allow the observer to pick guide posts from the prominent terrain features, thus preventing duplication in counting. The data obtained from these counts is listed in Table VIII.

The mean group size for this area decreased from 6.1 on October 21 to 3.1 on November 23. A slight increase to 4.4 was noted on December 3 when an influx of moose raised the total count by 90 per cent. The bull:cow ratio of 14:100 on October 21 had decreased to 10:100 by November 23. This may have been caused by the bulls shedding their antlers, or their shifting to a different area.



TABLE VI

## LOWER SUSITNA AND MATANUSKA VALLEY

Group Composition, Sex, Age and Distribution Data -- Arranged by Date &amp; Area

Area & Date	No. of Groups	Mean Group Size	Mean Group Size of Upper 50%	Group Range of Upper 50%	No. Groups Upper 50%	Bull:Cow Ratio of Upper 50%	Calf:Cow Ratio of Upper 50%	Bull:Cow Ratio of Lower 50%	Calf:Cow Ratio of Lower 50%	Total
10/21/56 Willow Area Timberline	53	7.4	13.6	7-34	15	25:100	8:100	33:100	12:100	390
10/27/56 Willow Below Timberline	30	6.4	12	8-16	6	19:100	31:100	21:100	45:100	153
10/29/56 Matanuska Valley										
Fishhook Area	33	4.7	15.4	11-18	5	10:100	50:100	2:100	48:100	157
Buffalo Mine & Other Areas in Palmer Vicinity	65	3.7	6.5	5-12	18	18:100	46:100	10:100	52:100	240
Wasilla Burn	14	3.2	5.3	4-6	4	0:100	91:100	0:100	55:100	45
SUSITNA WEST OF RIVER 10/30/56 Kahiltna Flats	48	3.9	6.1	5-9	16	98:100	45:100	38:100	49:100	189



TABLE VII

## UPPER SUSITNA AND COPPER RIVER BASIN AREAS

Group Composition Sex, Age and Distribution Data--Arranged by Date &amp; Area

Area & Date	No. of Groups	Mean Group Size	Mean Group Size of Upper 50%	Group Range of Upper 50%	No. Groups Upper 50%	Bull:Cow Ratio of Upper 50%	Calf:Cow Ratio of Upper 50%	Bull:Cow Ratio of Lower 50%	Calf:Cow Ratio of Lower 50%	Total
10/19/56 Oshetna, L. Oshetna & Black River	43	3.2	6.7	3-12		96:100	22:100	96:100	54:100	121
10/21/56 Upper Susitna	42	2.8	4.5	3-7	13	100:100	10:100	86:100	26:100	116
10/22/56 Watana Creek	41	2.7	6	3-17	9	63:100	17:100	47:100	47:100	111
Totals this Area	83	2.7	5.1	3-17	22	82:100	13:100	66:100	33:100	227
10/23/56 West Fork Gulkana	42	2.8	6.6	3-12	7	91:100	23:100	13:100	1:100	83
10/23/56 Mt. Drum	12	4.5	9	6-13	3	127:100	18:100	177:100	44:100	55
10/24/56 Maclaren River	104	3.4	6.8	5-21	26	68:100	23:100	56:100	33:100	351



The Calf:cow ratio between the upper and lower 50 per cent groups became more uniform as the "harems" disbanded. The groups forming the upper 50 per cent had a calf:cow ratio of 23:100 on October 21 and 46:100 on November 23. The groups forming the lower 50 per cent had a calf:cow ratio of 49:100 on October 21 and 44:100 on November 23. Comparisons of the bull:cow ratios and the calf:cow ratios suggest a general realignment of populations following the rut. Bulls had apparently shed their antlers or moved to other areas by December 12 as no bulls have been identified on this area since that date.

Several great fluctuations in moose numbers have occurred on this area since the counts started. On October 21, 123 moose were counted in the Willow burn. The total count varied but little until December 3 when 199 moose were tallied; a 90 per cent increase. On December 17 the total was 195, but on December 29 the total counted dropped to 119; a decrease of 40 per cent.

The presence of many trails indicate that many moose have left the burn area presumably for lower elevations.

The reasons for these sudden population shifts are not completely understood. Weather, particularly deep snow, is usually thought to be a determining factor in causing moose to abandon the higher elevations. However, the snow depths preceding these moose movements were not sufficiently deep to bother moose. No more than 24-30 inches of snow covered the ground. This period was also marked by unseasonably warm weather. It is possible that the high concentration of moose had greatly reduced the available browse and were moving in response to a food shortage. Another possible reason for the moose moving to lower elevations could be normal seasonal habitat preferences.



TABLE VIII

## WILLOW BURN CHECK AREA

O

Date	Mean Size	Upper 50% Mean Group Size	Bull:Cow Upper 50%	Bull:Cow Lower 50%	Calf:Cow Upper 50%	Calf:Cow Lower 50%	Total Moose	Flying Time	Moose Per Hour
10/21/56	6.1	10.8	18:100	10:100	23:100	46:100	122		
11/8/56	4.2	6.2	9:100	3:100	32:100	36:100	123	25 min.	295
11/23/56	3.1	6	6:100	4:100	44:100	46:100	103	27 min.	229
12/3/56	4.4	7		49:100***		44:100***	199*	30 min.	398
12/17/56					35:100****		195**	31 min.	377
12/29/56					32:100****		119**	30 min.	238

-18-

\* 12/3/56--8 bulls with antlers were counted

\*\* Bulls not distinguishable

\*\*\* Ratios represent calves:total adults

\*\*\*\* 12/17 and 29--No bulls with antlers were seen. These counts were not kept by group, but a running tally of adults:calves was recorded.



## LOCAL AREAS

The need for defining local moose populations was discussed in the March 31, 1956, P-R Report. At present two areas seem to have many of the necessary qualifications described for local moose populations; the Matanuska Valley and Willow areas. The data from these areas are presented in Tables IX and X.

### The Matanuska Area

The moose inhabiting the Matanuska Valley and associated timberline areas should, in all probability, be considered one local moose population. This contention is supported by the data obtained from the annual sex and age composition counts. These data have revealed a bull:cow ratio of 10:100 in both 1955 and 1956. The bull:cow ratio in this area has reportedly decreased consistently as hunting pressure increased. The percentage of young bulls taken by hunters and in comparison to old bulls counted has also increased steadily. These trends strongly suggest that this is a resident population, and that recruitment from adjoining populations is minimal. It is interesting to note that the Willow area has a bull:cow ratio nearly three times greater than the Matanuska Valley which it borders.

Another factor favoring the consolidation of the Matanuska timberline and valley moose populations is the seasonal population movements. The fall counts show that the bull:cow ratio above timberline is greater than the corresponding ratio below timberline, and that the calf:cow ratio is smaller above timberline. Late winter reconnaissance flights indicate that the timberline moose population and the valley population have joined. The differential sex and age ratios revealed by the fall counts suggest seasonal sex and habitat preferences and not identifiable local populations.

### The Willow Area

The location of a boundary between the Willow and Matanuska areas presents a difficult problem. However, at present the Little Susitna River appears to be the logical division. Observations made of moose tracks and numbers indicate that many of the moose inhabiting the northern portion of this drainage move into the Houston and Lake Nancy areas as winter progresses. Those moose inhabiting the headwaters and southern drainages move into the Fishhook, Wasilla and Big Lake areas. There must be some intermingling of moose along this drainage; however, this interchange does not materially affect the bull:cow or calf:cow ratios of the two areas. The calf:cow ratios in the two study areas are very different. The Willow area had a calf:cow ratio of 27:100 in both 1955 and 1956. The Matanuska area had corresponding ratios of 40:100 and 53:100.

The sex and age composition counts in the Willow area support the combining of the timberline and valley moose counts. Here, as in the Matanuska area, the bull:cow ratios above timberline are



greater than the corresponding valley counts and the timberline calf:cow counts are smaller than the same ratio in the valley.

The late November and December counts made of the moose inhabiting the Willow burn area (Table VIII) indicate a complete realignment of the timberline and valley populations. By mid-December the bulls had returned to the lower elevations and the calf:cow ratio was uniform throughout the area, although very few animals remained above timberline.

The Willow area is, for purposes of counting, that area bounded by the Little Susitna River on the south, Montana Creek on the north, the Talkeetna Mountains on the east and the Susitna River on the west.



TABLE IX

Summary of Moose Population Composition Counts  
Matanuska and Willow Areas, October 1956

Area	Young Males	Adult Males	Total Males	Lone Females	Females 1 Calf	Females 2 Calves	Total Females	Total Calves	Total Moose
<u>MATANUSKA-WILLOW</u>									
Matanuska Valley	6	3	9	72	103	2	177	107	293
Matanuska Timberline	6	13	19	63	41	1	105	43	167
Matanuska Combined	12	16	28	135	144	3	282	150	460
Willow Railbelt	8	30	38	115	65	7	187	79	304
Willow Timberline	16	52	68	176	19	3	198	25	291
Willow Combined	24	82	106	291	84	10	385	104	595
MATANUSKA-WILLOW COMBINED	366	98	134	426	228	13	667	254	1055



TABLE X

Sex and Age Ratios in Matanuska and  
Willow Moose Populations, October 1956

Area	Total Bulls/ 100 Cows	Young Bulls/ 100 Adult Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bulls % in Total Herd	Young Bulls per 100 Bull Calves	Total Moose
<b><u>MATANUSKA-WILLOW</u></b>								
Matanuska Valley	5	200	62	2	37	2	9	293
Matanuska Timberline	18	46	41	22	26	4	27	167
Matanuska Combined	10	75	53	2	33	3	17	460
Willow Railbelt	20	27	48	10	29	3	18	304
Willow Timberline	34	31	13	16	9	5	133	291
Willow Combined	28	29	27	11	17	4	46	595
<b>MATANUSKA-WILLOW COMBINED</b>	20	37	38	5	24	3	28	1055



## REPRODUCTIVE DATA

Between January and April of 1956 the reproductive tracts of 47 railroad-killed female moose were examined. The data obtained from these examinations is summarized in Tables XI and XII. Some of the railroad-killed moose were badly crushed, making examination for pregnancy data difficult; however, 41 (89 per cent) of the 46 moose above age Class I were definitely pregnant. Of the 5 remaining, 2 were definitely not pregnant, 3 were badly crushed, and although accurate pregnancy determination was difficult, were believed barren. This pregnancy data represents very successful potential reproduction.

The lone Class I (yearling) female is not considered in the computations because it is generally believed that yearling females are sexually immature. In addition, there is some doubt that many of the Class II (two year old) females breed; only 1 of the 3, supposed Class II individuals, examined was pregnant. Unfortunately, the Classes II and III are the most difficult to age, and at present no satisfactory criteria for separating the two exist. Because of the limited data and the confusion surrounding the Class II individuals they are included in the pregnancy data computations.

### Embryos

Sex determination of 32 embryos revealed 18 males and 14 females. The remaining embryos were either not available for examination or were partially destroyed and sex determination impossible. The measurements and weights of 16 embryos are summarized in Table XI. It is hoped that a sufficient number of embryos can be collected in 1957 to establish the growth curve for moose embryos. A tentative curve constructed from the measurements in Table XI was most promising.

### Reproductive Potential by Age Class

An accurate knowledge of the moose population sex and age structure, and of the contribution of each age group to the annual calf crop would be a valuable management tool.

The age classes and their relative calf contributions, of the railroad-killed moose, are shown in Table XII. As indicated in another portion of this report, the age classes are tentative, but combining the 8 breeding age classes into 4 age groups, for purposes of interpreting the pregnancy data, largely compensate for the uncertainties of aging criteria. The railbelt moose population has a predominance of aged female moose; 55 per cent of all breeding age females fall in or above age Class VI. Despite their age, the Group VIII and IX cows produced the highest embryo:cow ratio--144:100 (Table XII). Age group VI and VII had an embryo:cow ratio of 100:100, and is confusing; normally they would be expected to have an embryo:cow ratio similar to or slightly higher than age group IV and V. Possibly the sample is not adequate for this age group. The oldest group also had the highest incidence of twins; 62 sets per 100 pregnancies.



## Relationship of Pregnancy Data to Aerial Counts

If the fertility rate (the ratio of pregnant cows to total cows) is known, then the annual aerial sex and age composition counts should provide a measure of calf mortality to the date of the count.

Aerial observers cannot distinguish yearling females from female moose of other age categories. Therefore, in computing a theoretical fertility rate from the data collected in early 1956, female moose of all ages, including female calves, must be combined with the adults. The inclusion of female calves is necessary because they are counted as "adults" in the fall. In computing the fertility rate only those cows of known age which were examined for pregnancy data were included. Then by including the proportions of yearlings and calves found in the sample of 146 railroad-killed female moose a weighted average of fertility was computed. This average was 87 embryos per 100 total females (Table XIII).

The inclusion of all female calves undoubtedly causes the calculated fertility rate to be minimal. This occurs because the calves were collected from January to March, and undoubtedly considerable spring calf mortality occurred in 1956. Thus, since the female calves are not contributors to the reproducing portion of the female population their over-representation in computing the weighted average of fertility acts as a depressant on the fertility rate.

The Willow area calf:cow ratio computed from the October counts was 27:100. When this ratio is compared with the fertility rate of 87:100, a calf mortality of 69 per cent to October is indicated. The calf mortality in the Matanuska area was 39 per cent, and the combined Willow-Matanuska calf mortality was 56 per cent. The factors causing this seemingly great mortality are unknown, but probably represent both pre and post natal mortality.



TABLE XI

## MOOSE EMBRYO MEASUREMENTS\*

Date	Area	Sex	H.F.	Hind Leg	Front Leg	Zygomatic Arch	C.R. or F.R.	Weight
11/1/56	Houston Rd.						8-10	
11/20/56	Local						35	
11/24/56	182.2						37	
1/18/56	187.3	F	75	112	95	35	220	11 oz.
2/14/56	199.3	F	155	230	200	64	310	4 lb. 3 oz.
2/24/56	194	M	155	240	210	58	340	4 lb. 11 oz.
Feb. 56	209	M	165	250	215	65	350	---
3/2/56	202.3	F	185	280	240	65	360	5 lb. 15 oz.
March 56	208.7	M	195	290	255	67	400	---
3/3/56	212	F	195	315	260	69	410	7 lb. 2 oz.
3/4/56	208.4	M	195	310	260	69	400	6 lb. 11 oz.
March 56	Unk. R.R.	F	215	320	280	71	430	7 lb. 12 oz.
3/9/56	211.4	M	205	330	285	72	420	7 lb. 14 oz.
4/10/56	190.4	F	320	480	415	82	540	14 lb. 0 oz.
5/2/56	Susitna Lodge	F	335	500	435	81	580	14 lb. 0 oz.
5/2/56	Susitna Lodge	M	310	455	395	81	520	14 lb. 0 oz.

\*All measurements in MM.



TABLE XII

Comparative Reproductive Data, Winter of 1955-56.

Age Classification	Number of Cows	Per cent of 119 Cows	Per cent of this sample	Sets of Twins	Singlets	Barren or Probably Barren Cows	Total No. Calves	Per cent of Calves this sample	Calves per 100 Cows	No. of Pregnant Cows	Incidence of Twins i.e. per cent of Pregnancies of this sample
II-III	6	10	13.0	1	3	2**	5	10.7	100	4	25
IV-V	14	27	30.0	3	11	0	17	28.5	121	14	21
-26- VI-VII	9	32	19.5	1	7	1	9	16.0	100	8	12
VIII-IX	9	23	19.5	5	3	1	13	21.4	144	8	62
Unknown	8		17.0	3	4	1	10	17.8	125	7	43
Totals	46	92*	100.0	13	28	5	54	100.0	117***	41	32

\*8 per cent of the 119 females were Age Class I and were not included in this tabulation.

\*\*Both were considered Class II individuals--Only 1 of 3 Class II individuals was pregnant.

\*\*\*The weighted average embryo: cow ratio of this sample--118:100



TABLE XIII

## THE WEIGHTED AVERAGE EMBRYO:COW RATIO

<u>Age Classes</u>	<u>Number in Sample</u>	<u>Percent 146 Females</u>	<u>*Number in Sample of Posted Females</u>	<u>Per Cent of Posted Female Sample</u>	<u>Embryos/100 Cows in Posted Sample</u>	<u>Theoretical embryo:cow ratio by increments of each age group</u>
Calf	27	18	0	0	0	0
I	10	6	0	0	0	0
II & III	12	8	6	16	100	8
IV & V	32	22	14	37	121	27
VI & VII	38	26	9	23.5	100	26
VIII & IX	27	18	9	23.5	144	26
Totals	146	100	38	100		87

\*Using only the data from 38 animals--8 animals of unknown age were not included.



## MOOSE BROWSE SURVEY

A reconnaissance survey of moose browse was made during late February, March and April, 1956. The survey was made along that portion of the railroad between Mile Post 172 and 231. The Houston station at Mile Post 175 and the Talkeetna station at Mile Post 227 are the two inhabited stations most nearly defining the extremities of the study area. The section stations of Nancy, Willow, Kashwitna, Caswell and Sunshine are within the boundaries of the survey area. The segment of the Alaska Railroad traversing the survey area sustained the most critical railroad moose kill during 1956; accounting for 65 per cent of the total kill.

### Objectives.

1. To determine the browse species composition along the right-of-way.
2. To determine if a correlation between browse abundance and moose fatalities exists.
3. To determine the approximate utilization of available browse.

### Procedure

The individual browse sample plots had a diameter of 2 meters; 20 such plots were taken at each mile post. The individual plots were spaced 50 feet apart along a line horizontally perpendicular to the railroad; 10 plots were taken from each side of the right-of-way. Thus the sample area was approximately 1000 feet wide and 65 miles long.

The browse utilization estimates were visual, and were based on the utilization of individual plant's annual growth.

The following four browse use categories were recognized:

1. 0-25 per cent (light use)
2. 25-50 per cent (moderate use)
3. 50-75 per cent (heavy use)
4. 75-100 per cent (excessive use)

### Browse Composition

The overall composition of vegetation above the snowline, which averaged approximately 50 inches during February and March, is illustrated in Figure No. 1.



Birch and Willow comprise over 70 per cent of the total vegetation. Birch, which represents over 40 per cent of the total vegetation present, does not contribute in a like proportion to the available moose browse because much of the birch has grown beyond the reach of moose.

The browse composition by per cent of individuals present in each mile is represented in Figure No. 5.

#### Browse-Moose Fatality Relationship

The possibility of the existence of a direct correlation between moose fatalities and browse abundance and distribution was studied. The results of this study are shown in Figure No. 3. Browse availability was based on the number of individual plants of browse species present within reach of the moose. The individual plants grown too large to contribute browse were discarded.

There does not appear to be a definite correlation between availability of browse and moose fatalities. However, the combination of browse, deep snow and a great moose population does have a high correlation.

#### Browse Availability and Utilization

The availability and utilization of browse is illustrated in Figure 2. The correlation between browse availability and utilization is not consistent.

#### Browse Preference

Figure No. 4 illustrates the relative availability and utilization of the three major browse species found on the study area: (1) Willow Salix sp., (2) Birch Betula sp., and (3) Aspen Populus sp. The data is not a quantitative representation of the relative contribution of each species to the moose diet, but does indicate species preference. Aspen is favored (slightly) over willow, and birch is a poor third.

#### PARASITES

Observations of moose parasites were made as opportunity permitted. Table XIV summarizes the data obtained from examining 30 sets of moose lungs. Of the lungs examined 6, or 20 per cent, were infected with hydatid cysts Echinococcus granulosus. It is evident from even this small sample that the rate of infection is greater among the older age classes; 50 per cent of the combined VIII and IX age classes were infected, whereas no cysts were found in the calf--Class III animals.



### Other Parasites

While collecting moose stomach content samples three instances of rumen parasites were observed. The parasite, Paranthistomum sp., was identified by Dr. R. L. Rausch of the U. S. Public Health Service, Anchorage, Alaska.

TABLE XIV

<u>Age Class</u>	<u>No. Infected</u> <u>Lungs</u>	<u>Per Cent</u> <u>Infected</u>	<u>No. Clean</u> <u>Lungs</u>	<u>Per Cent</u> <u>Clean</u>	<u>Total</u> <u>Lungs</u>	<u>Per Cent</u> <u>of Total</u>
Calf	0	0	2	100	2	7
I	0	0	2	100	2	7
II & III	0	0	2	100	2	7
IV & V	1	17	6	83	7	23
VI & VII	1	14	7	86	8	26
VIII & IX	3	50	3	50	6	20
Unknown Age	<u>1</u>	<u>33</u>	<u>2</u>	<u>66</u>	<u>3</u>	<u>10</u>
Totals	6	20	24	80	30	100

### STOMACH SAMPLES

During the study 81 moose stomach content samples were obtained. The samples are stored in Fairbanks and will be analyzed during the next quarter.



TABLE XV

## MOOSE TALLIED PER HOUR OF FLYING

Area	Date	No. Moose	Flying Time	Moose Per Hour
<u>LOWER SUSITNA AND MATANUSKA VALLEYS</u>				
Willow Area (General)	10/21/56	561	4.8	117
Matanuska Valley (General)	10/29/56	460	4.5	102
Kahiltna Flats	10/30/56	189	1.7	112
Alexander Creek	10/30/56	18	2.3	7.8
Peters Creek & Eagle River	11/29/56	12	1.0	12
Total*		1240	13.3	93.2

\*This total includes only the time actually spent over the area. The complete total flying time was 19.7; total moose--1276; moose per hour--64.7.



TABLE XVI

## MOOSE TALLIED PER HOUR OF FLYING

Area	Date	No. Moose	Flying Time	Moose Per Hour
<u>UPPER SUSITNA AND COPPER RIVER BASINS</u>				
Oshetna, L. Oshetna & Black Rivers	10/19/56	136	4.1	33.1
Upper Susitna & Coal Creek and L. Nelchina	10/21/56	226	7	32.2
Watana Creek Area & Upper Susitna	10/22/56	266	7	38
Mt. Drum	10/23/56	54	1	54
West Fork Gulkana River	10/23/56	83	2.4	35.6
Maclaren River Area	10/24/56	351	7	50
St. Anne & Kiana Lakes	10/25/56	38	2.3	16.5
Totals		1154	30.8	37.5



TABLE XVII Comparison of Sex and Age Ratios in Moose Populations of Central Alaska

Area	Total Bulls/ 100 Cows	Young Bulls/ 100 Total Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bull % in Total Herd	Young Bulls/ 100 Bull Calves	Total Moose in Sample
<u>SUSITNA-MATANUSKA VALLEY</u>								
1956	27	25	40	6	24	4	33	1276
1955	28	25	35	4	21	4	39	2850
1954**	63	--	30	2	16	--	--	601
1953	48	14	39	8	21	3	33	2700
1952	42	27	44	10	24	6	51	1421
1951	61	28	60	13	27	8	56	1867
1950	--	--	--	--	16	--	--	1140
Mean	48	24	41	7	21	5	42	1693
<u>UPPER SUSITNA-COPPER R. BASIN</u>								
1956	67	19	27	2	14	7	95	1154
1955	98	29	52	10	21	12	108	2500
1954	109	26	79	16	27	10	72	1700
1953	107	36	90	17	29	12	85	1100
1952	61	22	40	17	20	7	67	683
Mean	88	26	58	12	22	10	85	1427

\*\*Limited sample may not be representative.



TABLE XVIII Comparison of Sex and Age Ratios in Moose Populations of Central Alaska

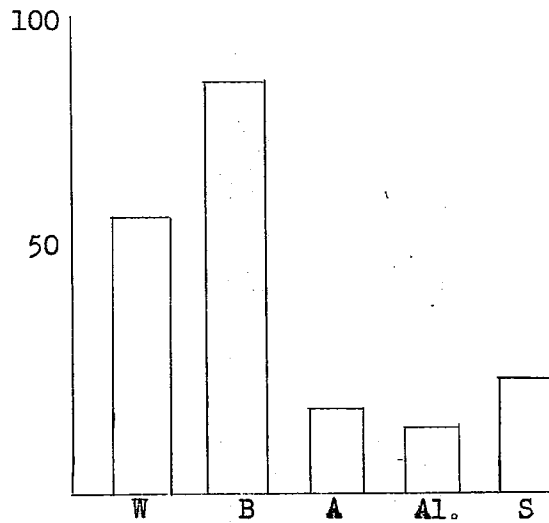
Area	Total Bulls/ 100 Cows	Young Bulls/ 100 Total Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bull % in Total Herd	Young Bulls/ 100 Bull Calves	Total Moose in Sample
<u>KENAI*</u>								
1956	51	13	24	10	14	4	54	3786
1955	50	14	19	10	13	4	75	3109
1954	84	14	27	6	12	6	90	2048
1953	62	12	26	7	14	4	39	2900
1952	50	33	21	6	12	10	156	1136
1951	69	18	23	16	12	7	108	1513
1950	--	--	--	--	7	--	--	1158
Mean	61	18	23	9	12	6	87	2236
<u>TANANA VALLEY***</u>								
1956	84	20	47	6	20	7	71	405
1955	123	40	53	13	19	18	186	410
1954	85	35	47	5	20	13	127	1109
Mean	97	32	49	8	20	16	128	308

\*Data from Refuge Supervisor Spencer.

\*\*\*Young bull-adult bull identification uncertain.



Figure 1--Combined Vegetation Composition Mile Post 172-231  
The Alaska Railroad



W--Willow; B--Birch; A--Aspen; Al.--Alder; S--Spruce

Figure 2--Browse Availability & Utilization, All Species Combined

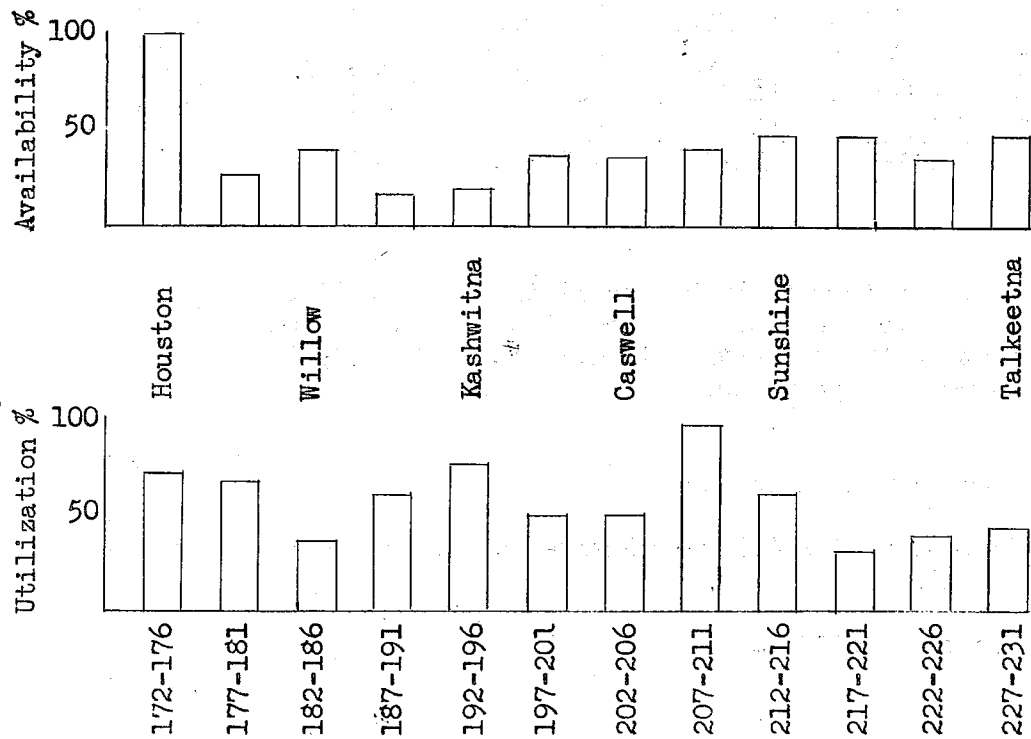
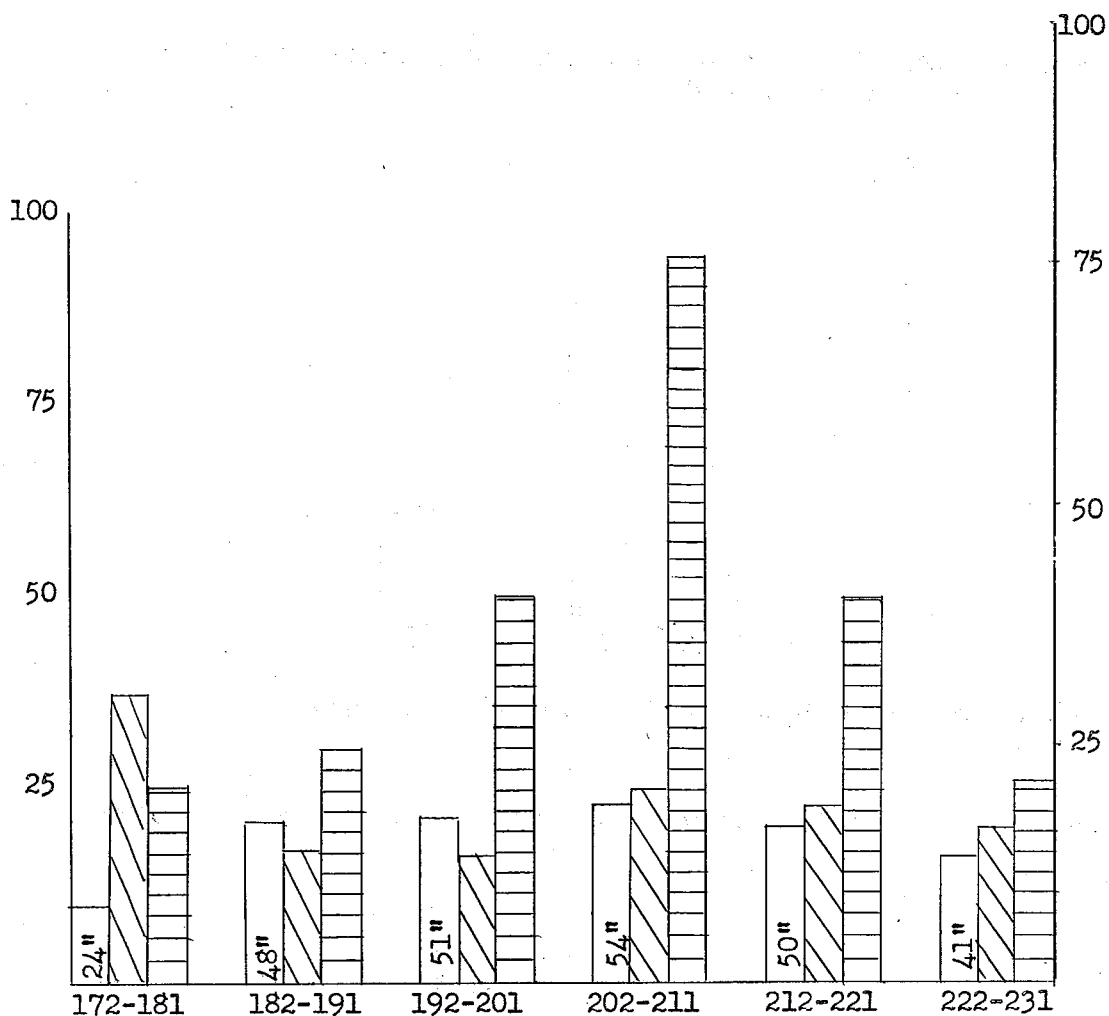




Figure 3--Comparison of Snow Depth, Browse Availability and Moose Fatalities



Scale on left refers to browse availability. Availability is based on the average number of individual browse plants per sample plot in the respective 10 mile segments. Scale on right refers to moose fatalities.




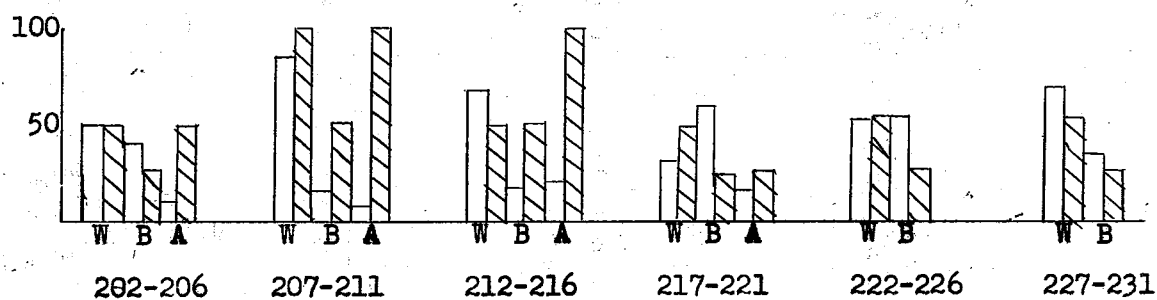
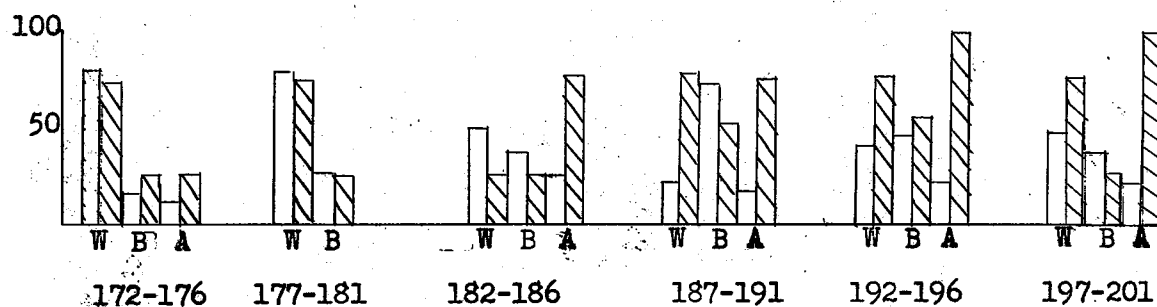
-  Snow depth in inches
-  Browse availability--relative number of plants per sample plot.
-  Moose fatalities



Figure 4--Moose Browse Availability and Utilization



W--Willow  
B--Birch  
A--Aspen

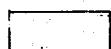
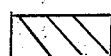
 Per cent of total browse available  
 Per cent utilization



Figure 5--Composition of Vegetation above the Snowline--Mile Post 172-231  
The Alaska Railroad

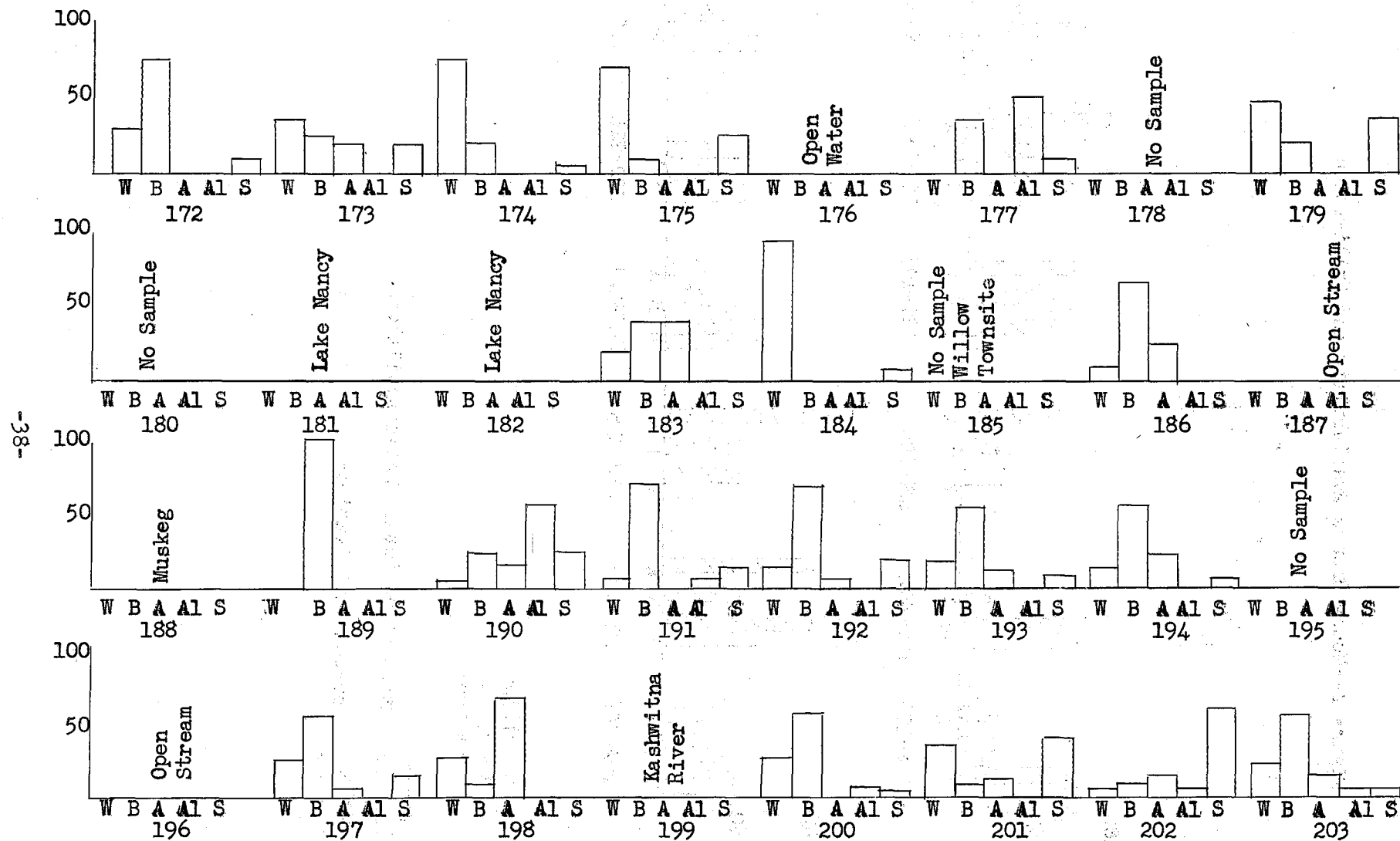
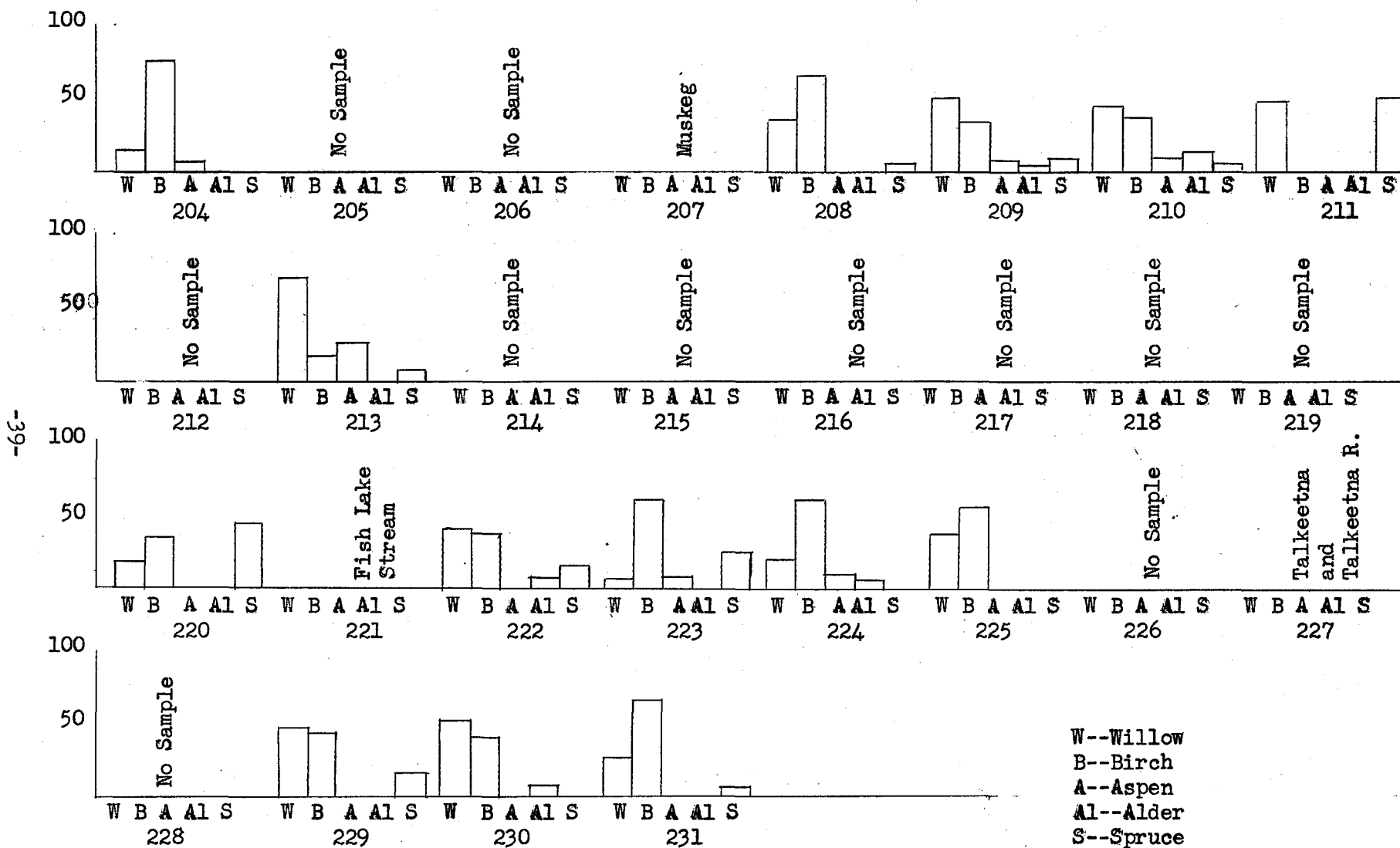
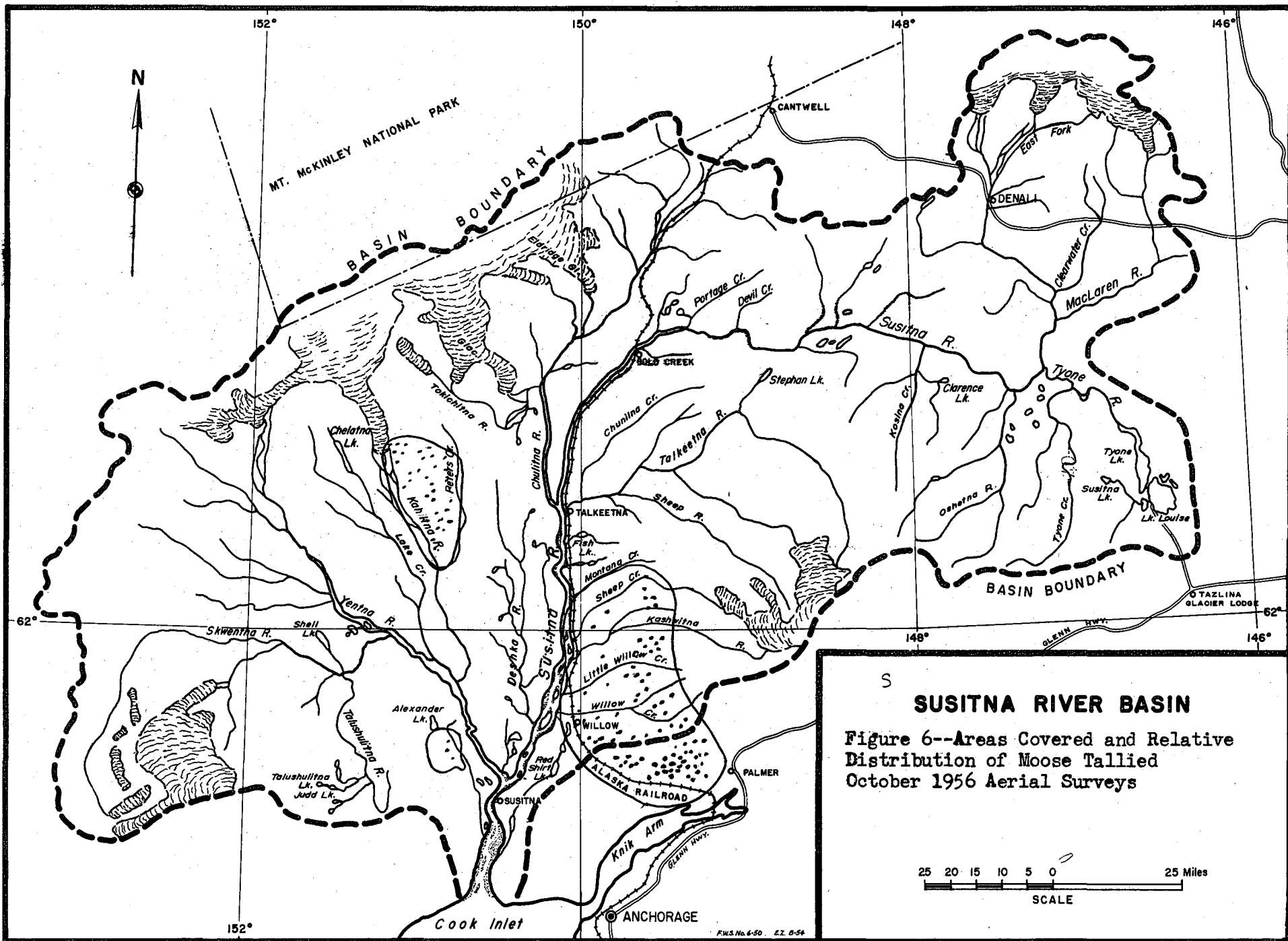




Figure 5 (Continued)



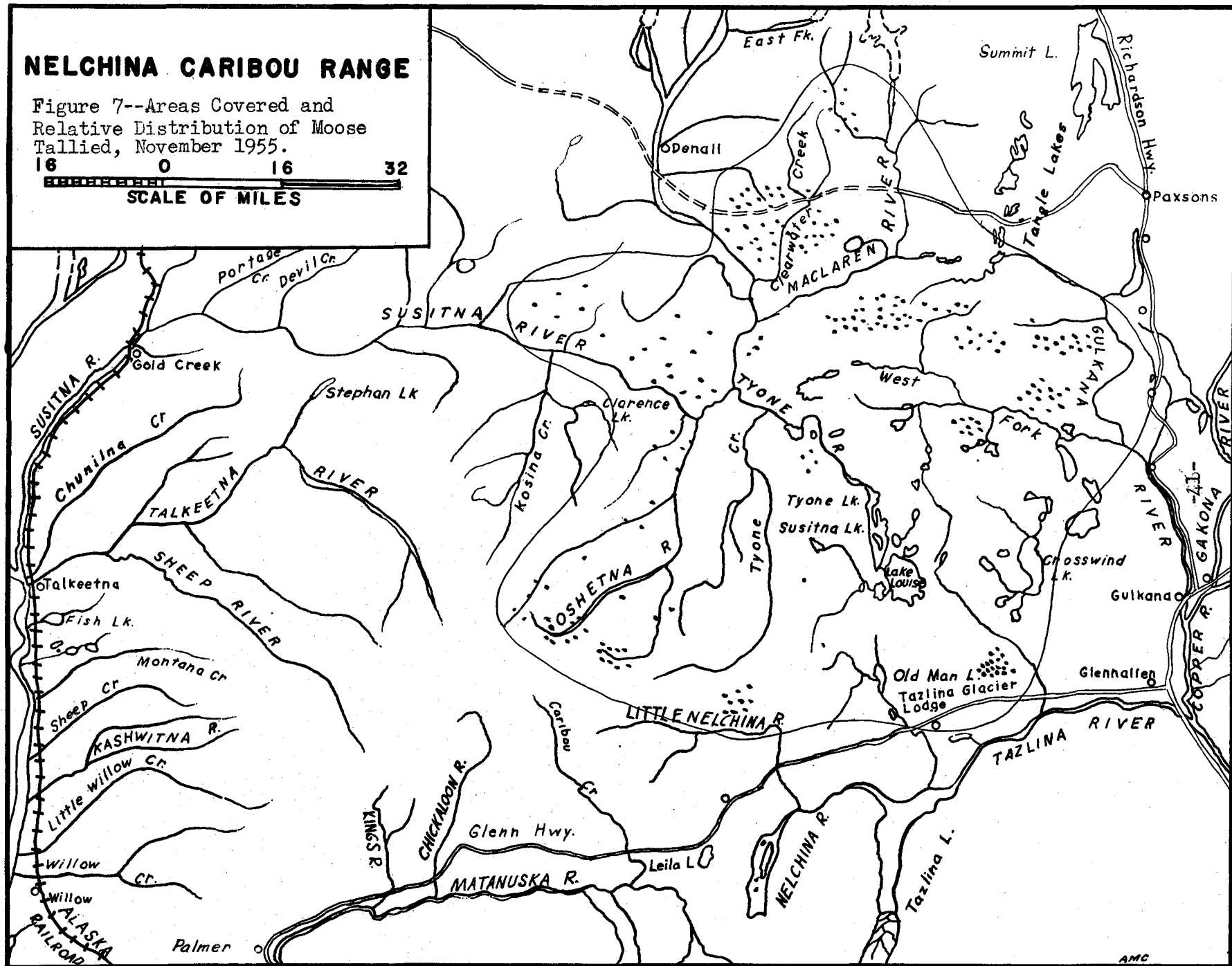






# NELCHINA CARIBOU RANGE

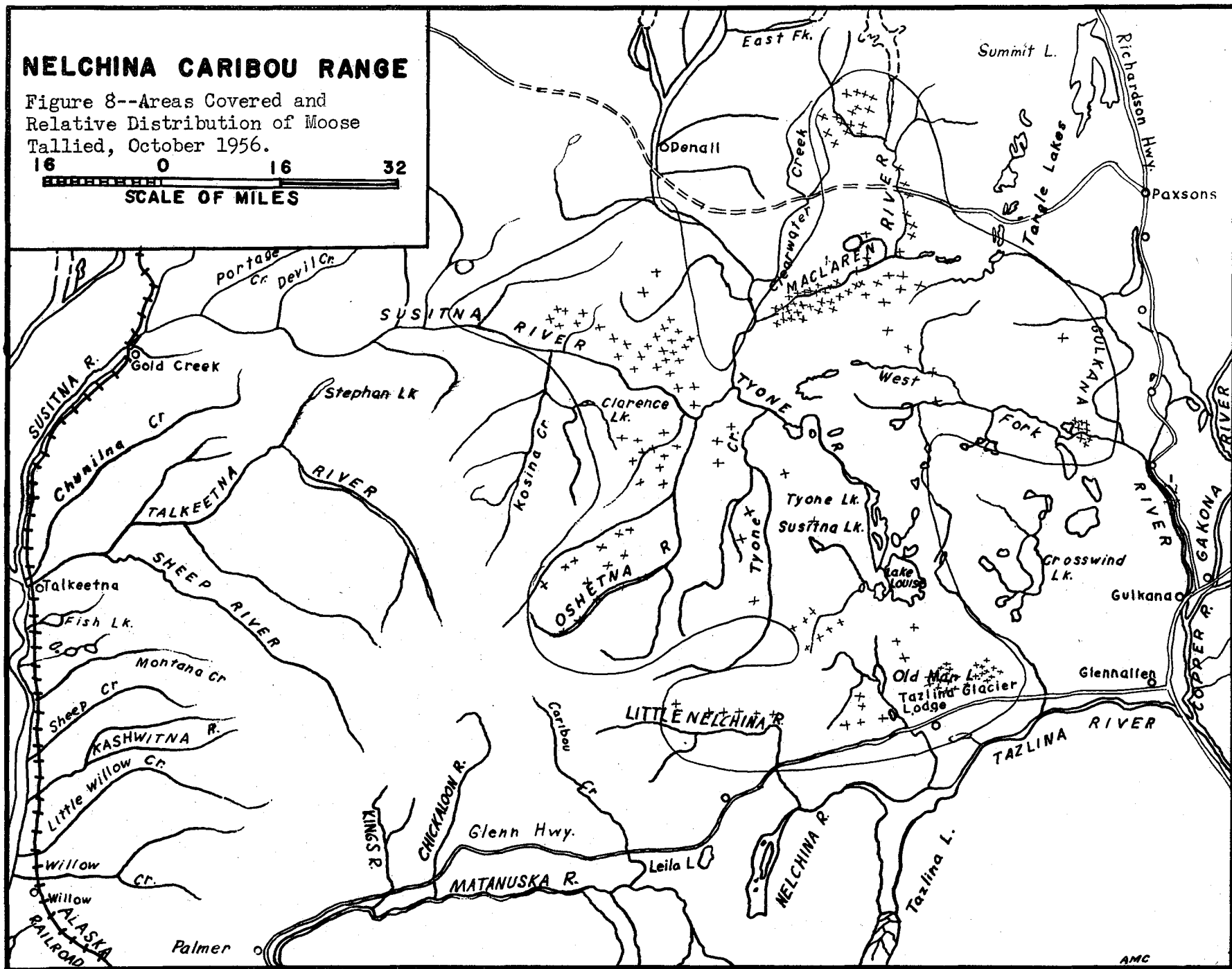
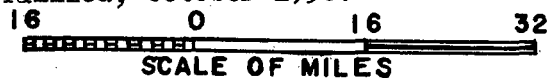
Figure 7--Areas Covered and  
Relative Distribution of Moose  
Tallied, November 1955.





# NELCHINA CARIBOU RANGE

Figure 8--Areas Covered and  
Relative Distribution of Moose  
Tallied, October 1956.





## METHODS

During the period October 14 - November 9, aerial surveys were conducted to determine age and sex composition. In addition to the usual counts made in November, a count was conducted in October during the rut to determine whether or not counts made during this period were feasible. This count was made in an area which was again surveyed in November. The Tanana Valley and tributary valleys were covered on October 14 and November 6, 7, and 9 by Olson, Jones, Shepherd and Miner using Piper Supercubs. The Forty-mile area was covered by Frost and Pinkham using a Piper Pacer on November 6th. Counting techniques used were basically similar to those used in previous years. By adding another class of bulls (mediums), it is believed there was less tendency to include medium sized or small adults in the yearling class of bulls. Counts were recorded by the various geographical areas in the Tanana Valley and its tributary valleys to determine whether or not differences in herd composition exist between these areas.

## AREAS COVERED

The Tanana Valley proper was covered between the Little Delta and the Nenana Rivers. Tributary valleys of the Chena River, Chatanika River, Salcha River and Shaw Creek were also covered as far up as their respective drainages were subject to hunting pressure. The Wood River coverage was generally confined to the area at its head and the foothills of the Alaska Range. The headwaters of the Tatlanika and Totalanika were also included in this area.

For the first time the Fortymile region was covered by this particular type of survey. Since only that part of the area penetrated by the Taylor Highway can be hunted, the country lying between Mt. Fairplay, Ketchumstuk Flats and Chicken was chosen as representative and given intensive coverage.

## RESULTS

A summary of all moose tallied by sex and for the Tanana Valley and Fortymile are presented in Table 1. The major areas are broken down into local units and the herd composition presented for each. A total of seven hundred and forty moose were tallied during the 17.4 hours of flying time devoted to the survey. The average number of moose seen per hour was 42.5.



## HERD COMPOSITION IN TANANA VALLEY AND FORTY MILE POPULATIONS

The data in this report will be presented in essentially the same form as that presented in the report by Scott on the Susitna and Copper River moose populations in the Quarterly Progress Report for 1955 (Vol. 10, No. 3). This has been done for the sake of uniformity and comparison between various areas being studied. The sex and age composition data for the Tanana Valley and Forty mile regions are shown in Table 2. The interpretations of these data are presented in the following discussion.

### TANANA VALLEY AREA

a. Productivity - Productivity in all areas in the Tanana Valley appeared to be fairly consistent and can be considered as good. The calf:cow ratio of 47:100 is slightly lower than the ratio of 53:100 in 1955 but on a par with 1954. The rate of twinning in 1956 is less than one-half of that in 1955 and in part explains the difference in the calf:cow ratios for the two years. The calf percentage (20%) of the total herd however, has not varied over one percent during the last three years and indicates therefore a fairly uniform level of productivity. Productivity in the Tanana Valley cannot measure up to the Copper River Area in 1952 (52 calves per 100 cows) but is considerably better than Kenai (19 calves per 100 cows) or the Susitna-Matanuska area (35 calves per 100 cows).

Young bull:total bull ratios are very similar throughout the Tanana Valley as a whole. In the Chena River, Chatanika River, and Shaw Creek areas, this ratio was somewhat higher than elsewhere and probably reflects the heavier hunting pressure in that area. There is no indication however, that hunting creates any problem in these areas as yet. The similarity of these ratios is another indication of the sameness of the productivity in the Tanana area. The slightly greater hunting pressure mentioned earlier in the Chena, Chatanika and Shaw Creek accounts for the slightly higher young bull ratio as compared to the rest of the area.

b. Survival - Young bull:male calf ratios indicate good survival and the overall light hunting pressure characteristic of most of the area. The survival as indicated by the young bull:male calf ratios is slightly higher in the Wood River area and lowest on the Tanana Flats, however, they are not so diverse as to suggest any significant dissimilarity of survival rates over the area as a whole.

A further check of survival can be made by comparing the ratios of young bulls recorded in 1956 to male calves recorded in 1955, by using either the number of calves and yearling bulls per 100 adults or their percentage of total animals. The premise involved is that the closer the current yearling bull ratio approaches last year's bull calf ratio, the better the survival.

One basic assumption must be made; namely, that to calculate the number of adults, that is, animals two years or older, it is necessary to assume a



TABLE 1.

Summary of Moose Population Counts  
Tanana Valley - 40 Mile - Oct. - Nov. 1956

Area	Young Bulls	Adult Bulls	Total Bulls	Lone Cows	Cows 1 calf	Cows 2 Calves	Total Cows	Total Calves	Total Moose
<u>TANANA VALLEY</u>									
Chena River, Shaw Creek, Chatanika, Olnes	7	23	30	28	13	3	44	19	93
Tanana Flats (S. of river)	15	65	80	55	40	0	95	46	221
Wood River (Hd. Tatlanika & Totatlanika )	7	30	37	21	15	1	37	17	91
Sub-Total	29	118	147	104	68	4	176	82	405
<u>FORTY-MILE</u>									
Fairplay, Westfork, Mosquito Fork	5	17	22	14	17	0	31	17	70
Ketchumstuk Flats	4	13	17	14	14	0	28	14	59
Sub-Total	9	30	39	28	31	0	59	31	129
<u>WOOD RIVER</u>									
(Oct. count in Rut)	12	75	87	65	26	0	91	28	206
GRAND TOTAL	50	223	273	197	125	4	326	141	740



TABLE 2.

Sex and Age Ratios in Tanana Valley - 40 Mile  
Moose Population - 1956 (1954-55 Sex and Age Ratios  
for Tanana Valley included for Comparison)

	Total Bulls/ 100 Cows	Young Bulls/ 100 Total Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bulls % in Total Herd	Young Bulls per 100 Bull Calves	Total Moose
<u>TANANA VALLEY</u>								
Chena, Shaw Creek, Chatanika	68	23	43	19	20	8	77	93
Tanana Flats	84	19	48	0	21	7	65	221
Wood River	100	19	46	6	19	8	87	91
<hr/>								
94- Above Areas Combined	83	20	47	5	20	7	71	405
1955	123	40	53	13	19	18	186	410
1954	85	35	47	5	20	13	127	109
<hr/>								
<u>FORTY-MILE</u>								
Fairplay, Westfork, Mosquito Fork	71	23	55	0	24	7	63	70
Ketchumstuk Flats	64	23	50	0	24	7	57	59
<hr/>								
Above Areas Combined	66	23	53	0	24	7	60	129
<hr/>								
<u>WOOD RIVER</u>	105	14	31	0	14	6	86	206
(Oct. count)								



50:50 calf and yearling sex ratio. This does not take the harvest of yearling bull moose into consideration, however it is felt that the hunting pressure is not heavy enough to alter it significantly in view of the overall bull:cow ratio for the Tanana Valley - Wood River Area. The above comparisons are presented in Table 3. The 1956 figures, of course, exclude the current calf crop.

On the basis of 100 adults, survival appears to be good with less than a one percent drop from calf to yearling stage. The same is true when comparison is made based on percent of total animals. Recognizing the obvious sources of error, such as disproportionate tally of bulls or a sex ratio possibly differing from the assumed one, it still seems apparent that yearling survival is good in the Tanana Valley. Herd composition data are not available for 1955 in the Fortymile area, thus similar comparisons are not possible.

It is believed, as pointed out earlier, that the current young bull figures are more reliable than in previous years due to improved classification techniques. This appears evident by the drop in the ratio of young bulls to male calves from 127 and 186 per 100 in 1954 and 1955 to 71 in 1956. The excessively high ratios in 1954 and 1955 indicate a disproportionate sampling of bulls in those years.

c. Effects of hunting - Hunting pressure in the Tanana Valley as a whole can be considered as light. The only areas surveyed which received any appreciable hunting pressure are the Chena, Chatanika, Shaw Creek areas. These areas are accessible in part by roads, trails, boat, or in case of Shaw Creek, numerous lakes provide landing places for aircraft. The sex ratio for this area of 68 bulls to 100 cows, as compared to 84 and 100 bulls per 100 cows for the Tanana Flats and Wood River areas suggests a moderate removal of bulls due to hunting. The effect however, cannot be considered significant beyond the fact that hunting pressure has not altered the sex ratio to a point where a shortage of bulls appears imminent.

#### FORTYMILE AREA

a. Productivity - Calf:cow ratio of 53:100 indicates good productivity in the Fortymile. This is about the same level of productivity as found in the Copper area in 1955 (52:100). Young bull proportions are about the same as found in the Tanana Valley. Calf percentages, calf:cow ratios and young bull ratios point to a slightly higher rate of productivity in the Fortymile as compared to the Tanana Valley.

b. Survival - Fair survival is apparent as shown by the young bull: male calf ratio of 60:100. The proportion of young bulls to total bulls (23:100) when cross-checked with the good rate of productivity also suggests fair survival.

c. Effects of hunting - The bull:cow ratio of 66:100 is indicative of light overall hunting pressure, being about the same as the Chena, Chatanika, Shaw Creek areas. Hunting in the Fortymile is confined principally to the areas immediately adjacent to the Taylor Highway. There are very few



accessible trails or roads branching from it and no lakes for landing back from the roads by aircraft. Thus, for all practical purposes the major portion of the Fortymile is unhunted. There is, then, no indication that hunting is having any appreciable effect on the moose population sampled in the Fortymile area.

Comparison of counts made in October and November-- These counts were made in the Wood River area where outside factors, particularly hunting, would not tend to distort the picture. The comparison is made on the basis of the data break-down in Table 2 and for convenience is shown in Table 4.

Examination of the ratios shows that some disparity in the counts exists between the two periods. The most obvious difference is the difference in calves per 100 cows. The ratio rises from 31 to 46 calves in less than one month. This represents a 33 percent change in the level of productivity. This same phenomena was noted in comparative counts made in 1955. Counts in the Tanana Valley in September-October showed a calf:cow ratio of 42:100 and by November it had risen to 53:100. The only explanation at hand seems to be that the cows are more in evidence in October due to the rut and their increased activity. The calves would tend to be missed being more in the background at this time. This is also borne out by the fact that the calf percent increased from 14 to 19 percent over this same period.

Increased activity of the larger bulls in October appears evident by virtue of the young bull:adult bull ratio being smaller in October than November. The difference in the number of bulls per 100 cows does not change enough to more than lend a little additional evidence to the foregoing.

It would seem that although it is possible to obtain composition counts in the rut prior to November, such counts would tend to be biased by the selective rutting activity. Bulls, particularly the larger ones, are on the move and the cows are also more in evidence. Calves seem to get pushed to the sidelines. Yearling bulls do not show up as well as the adult bulls since they do not have the antler development and are more or less found on the outskirts of any rutting activity.

There is also the possibility of lack of snow in October. Antlers of larger moose serve to catch the observer's eye at such times and disproportionate sampling of bulls can result. By November a good snow cover is invariably present and moose are usually spotted by seeing a black object on the landscape in deference to catching the flash of an antler.

It is believed that November 1 - 15 is the ideal period in which to obtain moose population data. At this time there appears to be less opportunity for bias than at any other time. The data is admittedly sketchy, but it tends to support general observations as well as similar data obtained in 1955 for this area (Quarterly Progress Report, Vol. 10 - No. 2, pp 16-20).



## DISCUSSION

It appears by examination and cross checking of the young bull ratios obtained in 1956 that the problem of disproportionate sampling of bulls has been overcome to a considerable extent. This seems particularly true when compared with the ratios obtained in 1954 and 1955. Although the "medium" class of bulls was not used in the final analysis of data it served its purpose by establishing more definitive limits on the "young" bull class. It was immediately evident that although it was quite easy to separate medium bulls from the young bulls, it was hard to know where to draw the line relative to large bulls, thus the dividing line between the medium and small classes was quite positive, however it became rather vague between the medium and large classes. For this reason, the medium and large classes were lumped together.

In an attempt to obtain a further check on the survival factor, cows without calves were supposed to be tallied as "adults" or "young". This proved to be practically impossible to do. The principal reason was lack of a "size or age gauge". Antler size sets yearling bulls apart and relative size often helps as a check, however, in the case of cows, particularly when seen alone, there is nothing to compare size with and a fairly small cow could be easily classed as an adult if there were no other moose to compare size with. It is believed that after enough experience one observer might be able to set up an index, however, when several observers are involved, differences in observational abilities are apt to convey considerable bias into the results.

Although the current counts in the Tanana area did not indicate extreme differences in population characteristics, it is believed that future surveys should continue along the same lines to prevent overlooking important local population changes which could feasibly be masked by an overall survey. This is particularly true of those limited areas accessible to hunters. Future surveys should be aimed principally at the latter areas. Occasional checks, perhaps one every two years, on the more remote areas like the Tanana Flats and the Wood River would serve to show any significant trends or changes in those areas.

The Fortymile counts indicate that the area surveyed has a relatively homogeneous population structure exhibiting the effects of light hunting pressure and a slightly higher level of productivity than the Tanana Valley.

Present data indicate that the moose population in the Tanana Valley and adjacent areas is relatively stable. Productivity continues to remain at a satisfactory level and fair to good survival as indicated by the various young bull ratios denotes a healthy moose herd. The data from the Fortymile area, though available for the first time, seems to indicate a similarly healthy condition for the moose population in that area.

Both the Tanana and Fortymile appear to continue to enjoy a higher level of productivity and survival than either the Kenai or the Susitna areas as of 1955. The Copper still seems to hold forth as the prime moose population in Alaska at present, however.



One problem in particular is characteristic of both the Tanana and Fortymile. Hunting is localized along certain accessible areas. Greater disbursement of pressure would result in a larger number of moose being taken without substantially changing the population characteristics of the herd as a whole. Bull ratios and bull:cow ratios would likely be altered somewhat, even so, productivity would not be affected adversely.



TABLE 3

Comparison of 1955 Male Calf Ratios With  
1956 Yearling Male Ratios

Year	No. Calves	No. ♂ <sup>1</sup> Calves	No. Adults	Total Moose	♂ Calves per 100 Adults	% ♂ Calves of Total
1955	79	39	331	410	11.7	9.5
<hr/>						
	Total <sup>2</sup> Yrlings	No. ♂ Yrlings	No. Adults (less ♂ & ♀ yrlings)	Total moose (less Calves)	♂ Yrlings per 100 adults	% ♂ Yrlings of Total
1956	58	29	265	323	10.9	8.9

Note:

1. Assume even sex ratio (100 ♂:100 ♀ calves)
2. Assume even sex ratio (29 ♂ represents actual count)  
Therefore ♂ + ♀ = 58



TABLE 4.

Comparison of Sex and Age Ratios in October and  
November of the Moose Population on Wood River

Period	Total Bulls/ 100 Cows	Young Bulls/ 100 Total Bulls	Calves/ 100 Cows	Twin Calves/ 100 Cows w/Calf	Calf % in Total Herd	Young Bulls % in Total Herd	Young Bulls per 100 Bull Calves	Total Moose
October 15	96	14	31	0	14	6	86	206
November 7	100	19	46	6	19	8	87	91



Job No. 3

Stikine River Valley Aerial  
Surveys and Hunter Harvest  
Information

By: David R. Klein

AERIAL SURVEYS

Continuing unfavorable flight conditions have prevented the completion of aerial surveys in the Stikine Valley. These surveys will be completed as soon as weather conditions permit.

EVALUATION OF THE 1956 HARVEST

The 1956 moose harvest on the Stikine River was distinguished by a heavier than normal kill. High waterlevels and favorable weather during the first week of the season partially contributed to the higher hunter success. However, falling waterlevels and heavy rains on the lower river discouraged many hunters during the last week of the season and accounted for fewer hunters in the area. Table 1 shows the total kill, hunter success and number of hunters on the Stikine River for the years 1952-1956.

Several parties of hunters from Wrangell met the Canadian requirements for hunting on the Stikine River in British Columbia and hunted with the Canadian guide, Walter Simpson. Success among this group was particularly high. Eleven moose were killed in the 10 miles of river valley from the international boundary to the Iskut River.

TABLE 1--Total Kill and Hunter Success Ratios on the Stikine River, Alaska, in Relation to Length of Season, 1952-1956

Year	Length of Season	Est. No. of Hunters	No. of Moose Taken	Percent Success
1952	4 weeks	300	31	10
1953	2 weeks	100	12	12
1954	3 weeks	125	14	11
1955	3 weeks	150	16	11
1956	3 weeks	125	30	24



# MUDDY RIVER-THOMAS BAY

Reports from loggers at Muddy River and Thomas Bay and moose hunters indicate that the size of the moose herd occupying the Muddy River-Thomas Bay area is considerably larger than was estimated in 1955. Two bulls were killed in the Muddy River valley near the Brown Cove Lakes during this year's open season. Observations of 18 different moose were made from the ground on October 3, 4 and 5 and hunters using a plane counted nine moose in the same general areas. A breakdown of these and other observations is shown in Table 2. Approximately nine tenths of the area is timbered with a mature spruce-hemlock forest and the remainder is open muskeg, gravel bars and marsh areas. Due to the relatively dense cover, conditions are not favorable for the observation of moose. Consequently, from the above observations it appears that only a small percentage of the total number of moose present in the area were seen. It seems quite likely that there are at least thirty moose present in this area.

TABLE 2--Observations of Moose in the Muddy River-Thomas Bay Area, 1956

Date	Observer	Location of Observation	Moose Observed				Total
			Bulls	Cows	Calves	Uniden.	
10/3	F. File	Brown Cove Lakes	4				4
10/3	B. File	Brown Cove Lakes to Patterson Glacier				9	9
10/4	G. Reid	2 mi. up Muddy River	1	4	2		7
10/4	G. Reid	Mouth Muddy River				Fresh tracks near camp	
10/5	Loggers	Patterson River	2			5	7
10/25	Loggers	Brown Cove	2				2