file

R. O. SKOOG

ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

STATE OF ALASKA
William A. Egan, Governor

DEPARTMENT OF FISH AND GAME
Walter Kirkness, Commissioner

DIVISION OF GAME
James W. Brooks, Director
Don H. Strode, P-R Coordinator

MOOSE INVESTIGATIONS

by

Garry C. Atwell, Leader
Harry R. Merriam
Robert A. Rausch

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

(Printed June 1963)

TABLE OF CONTENTS

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 1-a Title: Moose Investigations, Southeast Alaska

PERIOD COVERED: September 1, 1961 to March 1, 1962

ABSTRACT

Populations of moose in Southeast Alaska, large enough to support hunting pressure, are found in the Chilkat, Taku and Stikine River valleys. Berners Bay has a herd of less than 50 animals stemming from transplants in 1958 and 1960.

Composition counts on the Stikine River gave a calf-adult ratio of 19:100. Wolves are common in the area and may be killing a significant number of calves, but there is presently no conclusive substantiating evidence. Predation by bear and drowning may also be important mortality factors. Only total counts were made on the Chilkat River where the average of 3 counts made in December and February was 155.

The hunting season for moose was open from September 15 through October 15 in all areas of Southeast Alaska except Berners Bay where no hunting was allowed. The total kill was at least 126 animals: Chilkat River - 63; Taku River - 24; Stikine River - 28; and Thomas Bay - 11. Hunter success was best in the Chilkat area where 51 per cent was experienced. Success on the Stikine River was 19 per cent which is lower than average. Sixty-five per cent of the moose taken on the Stikine River were less than 2 years of age while on both the Taku and the Chilkat Rivers about 50 per cent were less than 2 years old. The largest percentage of older-age animals in the Chilkat herd is indigenous to the area; however, that on the Taku may be influenced by intermingling of Canadian and American moose herds. The high proportion of young bulls on the Stikine reflects the heavy hunting pressure received in this locality.

RECOMMENDATIONS

The Chilkat River moose herd is apparently in thrifty condition. Age classes show over 50 per cent of the kill to consist of animals more than 1-1/2 years of age and the 1961 hunter success was exceptional (51 per cent). Hunting seasons could be liberalized in this area with no forseeable harm.

The low hunter success on the Stikine River in 1960 and the low calf-adult ratio indicate that this herd warrants special attention. An effort should be made to obtain bull-cow ratios in November before antlers are shed and to determine the causal factors for the low calf-adult ratio. Predation by wolves and other mortality factors should be investigated.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 1-a Title: Moose Investigations, Southeast Alaska

PERIOD COVERED: September 1, 1961 to March 1, 1962

OBJECTIVES

To determine seasonal population distribution and movements; to obtain an estimate of total numbers or establish population density indices of resident moose populations; to determine herd composition; to collect and evaluate hunter harvest data; and to utilize the information obtained from the first three objectives directly in the management of Southeast Alaska moose populations.

TECHNIQUES

Aerial composition counts were made immediately prior to the hunting season and again during the winter months when leaves had fallen and snow cover improved visibility. Counts in December and March on the Stikine River were jointly financed by the Department and the U. S. Forest Service utilizing a Hiller E-12 helicopter. All other counts were made from a Piper Cruiser or a Cessna 180 aircraft. Counts from the Chilkat River locality were conducted by the Protection Division during routine patrols.

Hunter information was obtained through hunter checks in the field and post-season hunter interviews. Lower jaws, for age determination, were collected whenever possible. Other data obtained included hunter success, location of kills, antler development and hunting pressure. The hunting season for moose in all of Unit 1 was open from September 15 through October 15.

FINDINGS

Composition Counts

Composition counts are summarized in Table 1. Pre-hunting season counts on the Stikine River proved of little value because of inadequate sample size and were abandoned in favor of winter counts when animals are more readily observed. Attempts to make counts in this area prior to December were thwarted by poor visibility and high wind velocities. On the December count, 65 moose were observed as compared to 169 in March. The observed calf-adult ratio for the December count was 20:100 and for the March count 19:100. Conditions and methods used in both counts were similar and the much larger number seen in March is attributed to animals moving out of small tributaries of the Stikine proper. There is no reason to believe that there is an influx of animals from the Canadian side of the boundary as moose are distributed all along the river throughout the winter. Hunting pressure is confined almost entirely to the Stikine River Valley itself and the movement into the valley as the winter progresses suggests that a sizable portion of the herd is not being hunted.

All surveys in the Chilkat Valley were made by Protection Officer Fred Wolstad and consisted of total counts only. Flights were made on December 30 and February 2 and 28. The respective counts were 211, 177 and 122. Moose were relatively evenly distributed all along the river from Haines to the boundary with very few seen along the Klehini River.

Hunter Harvest

The known hunter harvest in Southeast Alaska in 1961 was 126 moose compared to 118 in 1960. The kill on the Stikine River dropped from 39 in 1960 to 28 in 1961; however, an exceptionally good hunter success of 51 per cent was experienced in the Chilkat River area where 63 moose were taken in 1961 compared to 45 in 1960. Hunter kill, success, and other harvest data are shown in Table 2.

In an area such as the Stikine where the annual kill is very small, causal factors for a lower kill are difficult to isolate. Very high waters were prohibitive to hunting during the last two weeks of the season. Predation by wolves may or may not be an important factor. Assuming a realistic bull-cow

Table 1. Moose composition counts in Southeast Alaska, 1961-1962.

Vicinity	Date	Adults			Calves	Total
		Bulls	Cows	Unid.		
Stikine R.	9-9-61	3	8	3	1	15
"	12-13-61	2		52	11	65
"	3-14-62			142	27	169
Chilkat R.	12-30-61			211		211
"	2-2-62			177		177
"	2-28-62			122		122
Taku R.	1-23-62			13	2	15
Berners Bay	1-20-62	5		11	1	17
"	2-15-62	2		7	2	11

Table 2. Moose hunter harvest data for Southeast Alaska, 1961.

Vicinity	Total Kill	Hunter Success	Ave. No. Days Hunted	Age Classes (%)		
				1-1/2	2-1/2	3-1/2+
Chilkat R.	63	51	2.5	46	36	18
Stikine R.	28	19	5.2	65	26	9
Taku R.	24					
Thomas Bay	11					

ratio of 20:100 and applying it to the 19:100 calf-adult ratio obtained in the March 14 count, the calf-cow ratio would be 24:100, only fair productivity. Two family groups of wolves (constituting at least seven animals) were known to be on the river during the winter of 1961-62. During surveys, two carcasses of calves were found which had been fed on by wolves and one adult cow was observed which had been badly cut about the face and was very weak from loss of blood.

The Thomas Bay vicinity, about 30 miles north of the Stikine River, produced 11 moose in 1961, the largest number on record for that area. This is not typical moose habitat and consists of approximately 25 square miles of forested glacial moraine, much of which has now been logged. That there is considerable travel to and from this locality from the Stikine River is evidenced by the abundance of moose tracks in the passes through the mountains which moose travel to get from the Stikine River to Thomas Bay. At least a portion of the Thomas Bay kill probably is composed of animals moving through the area rather than from the resident population.

The relatively large proportion (54 per cent) of the harvest over 1-1/2 years of age in the Chilkat River kill indicates a herd which is not being heavily cropped. The opposite is true on the Stikine where 65 per cent consisted of 1-1/2 year age animals. No jaws were available from the Taku River; however, 13 antlers measured indicated that approximately 50 per cent of the adult bulls taken were over 1-1/2 years old. Both the Taku and Stikine drainages are hunted equally hard and the greater portion of older bulls in the Taku is attributed to the small amount of moose range on the American side of the International Boundary and the constant intermingling of the American herd with an older age class of animals from Canada where hunting pressure is light. This is further substantiated by the fact that the Taku River produces almost as large a kill as the Stikine, but from an area only about one third as large. On the Stikine there is definitely a greater abundance of older age animals on the Canadian side of the boundary. Intermingling is confined to the boundary area and it has little affect on the age class of the hunter harvest.

SUBMITTED BY:

Harry R. Merriam
Game Biologist

APPROVED BY:

Donald H. Stroh
P-R Coordinator

James W. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State:	Alaska		
Project No:	W-6-R-3	Name:	Alaska Wildlife Investigations
Work Plan:	B	Title:	Moose Investigations
Job No:	2-a	Title:	Determination of Herd Status (data analysis), Southcentral Alaska

PERIOD COVERED: March 1, 1962 to June 30, 1962

ABSTRACT

The results of the various field investigations of moose in Southcentral Alaska are discussed in this report. An abstract follows:

Breeding

Composition counts of 6,805 animals revealed a sharp decline in the bull-cow ratios from 1960; these ratios were also below the averages of the past 7 years.

Production

The total estimated 1962 calf crop was 101 calves per 100 cows.

Calf survival, determined from fall composition counts, was normal.

Mortality

Nine hundred and nineteen moose were known to have been taken during the general season.

One thousand, one hundred and sixty-six moose were harvested by participants of 2 special seasons: an antlerless season (1,034 moose) and an either-sex season (132 moose).

Three hundred and seventy-seven moose were known to have died from causes other than legal hunting.

RECOMMENDATIONS

A report of success (harvest ticket) should be required from each moose hunter.

Accumulated specimen material should be studied to gain a better understanding of moose population dynamics.

Composition count techniques should be developed which would not only allow a statistical analysis of the data but would also provide estimates of the total numbers of moose in the population surveyed.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-a Title: Determination of Herd Status (data analysis), Southcentral Alaska

PERIOD COVERED: March 1, 1962 to June 30, 1962

OBJECTIVES

To compile and analyze all pertinent data resulting from field investigations of moose in Southcentral Alaska in accordance with the needs of management.

FINDINGS

Breeding

During November 1961, aerial surveys were conducted to determine the sex and age composition of several Southcentral Alaska moose populations. Surveys were made in the lower Susitna-Matanuska Valleys, the upper Susitna-Copper River Valleys, and on the Kenai Peninsula.

Department biologists catagorized 4,491 animals and personnel of the U. S. Fish and Wildlife Service tallied another 2,314.

Bull-cow ratios declined sharply from the fall of 1960. The adult bull-cow ratios were below the averages of the last few years in all three of the survey areas (Tables 1, 2 and 3); however, the young bull-cow ratio remained quite constant.

Unusually early and deep snow accumulations may have had some influence on the results of the counts but at present the fluctuations can not be explained.

Extremes in bull-cow ratios were present in the lower Susitna-Matanuska Valleys where 6 bulls per 100 cows were counted in the Matanuska Valley as versus 107 bulls per 100 cows in the Mt. Susitna-Beluga area. The average for the entire Susitna-Matanuska Valley population was 28 bulls per 100 cows (Table 1). Ratios of 64 bulls per 100 cows were obtained in the upper Susitna-Copper River Valleys and 37 bulls per 100 cows on the Kenai Peninsula (Tables 2 & 3).

These sex ratio data indicate a continued and moderately high bull element in the populations despite a decrease in 1961 from the average of the last few years.

As in the past, accessible areas near human population centers exhibited a skewed sex ratio, demonstrating heavy pressure on the bull element of the populations but having no affect on the total number of animals present from year to year. Such areas constitute a very small proportion of the moose range in Southcentral Alaska.

Production

Productivity, determined from the spring parturition counts and the November composition counts, remained high and was comparable to the average of the past 11 years (Tables 4, 5 & 6).

The total estimated 1962 calf crop of 101 calves per 100 cows, based on spring aerial counts in the lower Susitna-Matanuska Valleys, shows a slight increase when compared with the estimated calf crop for 1961 of 99 calves per 100 cows.

Although calf survival was slightly below that of 1960 in the upper Susitna-Copper River Valleys and on the Kenai Peninsula the per cent of calves in the herd was equal to or above the average of the last 11 years in all 3 of the areas.

Calf tagging was continued in the lower Susitna-Matanuska Valleys. One hundred and twenty calves were ear-marked with metal cattle tags and colored plastic strips, denoting the sex of the animal and the geographic area within which it was tagged. Tagging efforts were concentrated on calving grounds, where it was believed the highest number of returns would be realized.

Mortality

The general hunting season for moose in 1961 was divided into two parts: the early portion extended from August 20 through

BREEDING

Table 1. Comparison of moose sex ratios in the lower Susitna-Matanuska Valleys, 1955-61.

Year	Total Bulls: 100 Cows	*Adult Bulls: 100 Cows	**Young Bulls: 100 Cows
1961	28	17	11
1960	54	39	15
1959	34	31	3
1958	32	24	8
1957	31	24	7
1956	27	-	-
1955	28	-	-
Average	33	27	9

Table 2. Comparison of moose sex ratios in the upper Susitna-Copper River Valleys, 1955-61.

Year	Total Bulls: 100 Cows	*Adult Bulls: 100 Cows	**Young Bulls: 100 Cows
1961	64	43	20
1960	85	65	20
1959	67	57	10
1958	71	60	11
1957	69	53	16
1956	67	-	-
1955	98	-	-
Average	74	56	15

*Adult Bulls - antlers with decided palmation ranging from small to large.

**Young Bulls - antlers spiked or forked with little or no palmation. These animals were considered yearlings.

Table 3. Comparison of moose sex ratios on the Kenai Peninsula, 1954-61.

Year	Total Bulls: 100 Cows	*Adult Bulls: 100 Cows	**Young Bulls: 100 Cows
1961+=	37	27	10
1960	44	29	15
1959	-	-	-
1958	44	-	-
1957	43	-	-
1956	51	-	-
1955	50	-	-
1954	84	-	-
Average	50	28	13

*Adult Bulls - antlers with decided palmation ranging from small to large.

**Young Bulls - antlers spiked or forked with little or no palmation - these animals were considered yearlings.

+=Determined from U. S. Fish & Wildlife Service data.

Table 4. Comparison of age ratios of moose in the lower Susitna-Matanuska valleys, 1950-61.

Year	Calves: 100 Cows	Twin Calves:100 Cows with Calves	Per Cent Calves
1961	40	7	24
1960	35	9	18
1959	42	8	25
1958	42	8	24
1957	44	8	25
1956	40	6	24
1955	35	4	21
1954	30	2	16
1953	39	8	21
1952	44	10	24
1951	60	13	27
1950	-	-	16
Average	41	8	22

Table 5. Comparison of age ratios of moose in the upper Susitna-Copper River Valleys, 1952-61.

Year	Calves: 100 Cows	Twin Calves:100 Cows with Calves	Per Cent Calves
1961	46	10	22
1960	55	11	22
1959	51	2	24
1958	37	4	18
1957	42	6	23
1956	27	2	14
1955	52	10	21
1954	79	16	27
1953	90	17	29
1952	40	17	20
Average	52	10	22

Table 6. Comparison of age ratios of moose on the Kenai Peninsula, 1950-61.

Year	Calves: 100 Cows	Twin Calves:100 Cows with Calves	Per Cent Calves
1961*	35	10	20
1960	46	9	23
1959	-	-	-
1958	42	15	23
1957	35	12	20
1956	24	10	14
1955	19	10	13
1954	27	6	12
1953	26	7	14
1952	21	6	12
1951	23	16	12
1950	-	-	7
Average	30	10	16

*Determined from U. S. Fish & Wildlife Service data.

September 30 and the late season ran from November 1 through November 30. The bag limit was one bull for the year. Nine hundred and nineteen animals were known to have been taken.

Special antlerless moose hunts were conducted the first half of December on the Kenai Peninsula and in the lower Susitna-Matanuska Valleys. Permittees killed 1,034 animals during these hunts.

An emergency either-sex registration hunt was held on the Alexander Creek drainage in late December and early January; 132 animals were harvested.

Participants in the antlerless and either-sex hunts then killed 1,166 animals for a total known harvest.

Three hundred and seventy-seven moose were known to have died from causes other than legal hunting: 244 were train kills; 56 were highway kills; 23 were depredation kills; and 54 died from miscellaneous causes. Various specimen materials were collected from 133 of the carcasses; body measurements were made on 82; and weights were recorded from 27.

SUBMITTED BY

Gerry C. Atwell
Game Biologist

APPROVED BY:

Don H. Strade
P-R Coordinator

James W. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-b Title: Abundance and Composition Surveys

PERIOD COVERED: October 1, 1961 to December 15, 1961

ABSTRACT

During 61.3 hours of aerial composition counts in November 1961, 4,491 moose in Southcentral Alaska were sexed and aged by Alaska Department of Fish and Game Biologists. In addition,the U. S. Fish and Wildlife Service catagorized 2,314 animals on the Kenai National Moose Range. The Matanuska Valley continued to be an extreme example of a depressed bull population through heavy hunting pressure; however, calf production actually remained higher than in the other surveyed populations of the lower Susitna River drainage. The young bull:adult bull ratio climbed proportionately to the hunting pressure and the Matanuska Valley was a prime example of this too. The bull:cow ratio of the upper Susitna and Copper River Valleys dropped 64:100 in 1961 but calf production remained good. On the Kenai Peninsula the bull:cow ratio continued in a downward trend and reflected moderately heavy hunting pressure. Calf production on the Kenai Peninsula, though below that of many areas in Southcentral Alaska, was still good.

RECOMMENDATIONS

None.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-b Title: Abundance and Composition Surveys

PERIOD COVERED: October 1, 1961 to December 15, 1961

OBJECTIVES

To determine the herd composition of moose populations in relation to hunting and wolf predation and to establish an index to relative moose abundance in the area surveyed.

TECHNIQUES

From November 11 through November 30, 1961, aerial surveys were conducted to determine the sex and age composition of several Southcentral Alaska moose populations. Herd composition data were obtained from the upper Susitna and Copper River valleys, the lower Susitna River drainage, the Matanuska Valley, the Anchorage area, and the northcentral Kenai Peninsula. As in previous years no attempt was made to determine total numbers, rather counts were made of the various predesignated populations in an endeavor to obtain samples representative of the sex and age composition of the populations. A miniumum goal of 100 animals was set for each sample and this was attained in all but 3 instances.

Concentrations of moose once located were censused by drainages, utilizing parallel flight paths 1/4 to 1/2 mile apart. When there was any doubt as to an animal's sex or age a low level pass was made.

All moose observed were placed in one of five categories:

1. Young bulls--antler spiked or forked, usually with little or no palm development. These animals were considered to be yearlings.

2. Adult bulls--antlers with palmation ranging from small to large.

3. Cows--all antlerless moose other than calves.

4. Calves--young of the year.

Sixty-one hours and 17 minutes were flown during these counts (Table 1). Aircraft utilized included a Cessna 170, a Cessna 180, and Supercub 150's. Participating personnel were: Jack Didrickson, Albert Erickson, Ronald Skoog, Ronald Batchelor and Gerry Atwell, all Game Biologists with the Alaska Department of Fish and Game.

Aerial surveys were also flown by the U. S. Fish and Wildlife Service on the Kenai National Moose Range.

FINDINGS

Table 2 is a compilation of the sex and age data obtained from the aerial counts. Four thousand four hundred and ninety one (4,491) moose were catagorized by Department Biologists: upper Susitna and Copper River Valleys, 2,977; lower Susitna and Matanuska Valley, 888; Anchorage area, 185; and Kenai Peninsula, 441. In addition, data are included from surveys flown on the National Moose Range by the U. S. Fish and Wildlife Service during which 2,314 moose were tallied.

Sex and Age Ratios

The sex and age ratios appear in Table 3.

Lower Susitna-Matanuska Valley Area

The different degrees of accessibility which govern the hunting pressure continue to be obvious in the counts: in Table 3 both the

Table 1. Dates and hours flown for the moose herd composition counts.

AREA	DATES FLOWN	HOURS FLOWN
Lower Susitna and Matanuska Valleys		
Matanuska	11/27/61	0 hrs - 55 min
Willow	11/28/61	2 hrs - 15 min
Talkeetna	11/27/61	1 hr - 10 min
Kashwitna	11/27/61	1 hr - 10 min
Mt. Susitna - Beluga	11/11/61	2 hrs - 40 min
Anchorage - Eklutna	11/30/61	2 hrs - 37 min
Upper Susitna and Copper River Valleys		
North Lake Louise Flats	11/20/61	3 hrs - 40 min
	11/21/61	2 hrs - 25 min
South Lake Louise Flats	11/11/61	3 hrs - 00 min
	11/11/61	3 hrs - 50 min
North Maclaren & Clearwater Rivers	11/19/61	3 hrs - 00 min
South Maclaren & Clearwater Rivers	11/21/61	2 hrs - 25 min
Alphabet Hills	11/14/61	3 hrs - 05 min
	11/17/61	2 hrs - 35 min
	11/18/61	1 hr - 15 min
Black, Big & Little Oshetna Rivers, Sanona Creek	11/18/61	3 hrs - 10 min
Little Nelchina River	11/16/61	5 hrs - 00 min
Kiana & Klutina Lakes	11/16/61	3 hrs - 45 min
Paxson	11/19/61	2 hrs - 15 min
Upper Gakona & Chistochina Rivers	11/18/61	0 hrs - 45 min
	11/21/61	2 hrs - 10 min
Kenai Peninsula	11/11/61	4 hrs - 40 min
	11/30/61	3 hrs - 30 min
		61 hrs - 17 min

Table 2. Summary of moose composition counts, November 1961.

	Young Bulls	Adult Bulls	Total Bulls	Cows w/o Calves	Cows w/1 Calf	Cows w/2 Calves	Total Cows	Total Calves	Total Moose
Upper Susitna-Copper River Valleys									
N. Lake Louise Flats	4	30	34	68	53	2	123	57	214
S. Lake Louise Flats	42	82	124	113	41	5	159	51	335
N. Maclaren & Clearwater Rivers	3	16	19	14	2	1	17	4	40
S. Maclaren & Clearwater Rivers	50	67	117	99	66	12	177	90	384
Alphabet Hills	23	96	119	133	76	3	212	82	413
Black, Big & Little Oshetna Rivers, and Sanona Creek	68	90	158	123	122	10	255	142	555
Little Nelchina River	49	40	89	117	84	16	217	116	422
Kiana & Klutina Lakes	11	40	51	56	16	3	75	22	148
Paxson	8	34	42	32	31	6	69	43	154
Upper Gakona & Chistochina Rivers	31	119	150	75	41	2	118	45	313
TOTALS	289	614	903	830	532	60	1,422	652	2,977
Lower Susitna-Matanuska Valleys									
Matanuska Valley	8	6	14	137	101	3	241	107	362
Willow Area	7	3	10	59	31	4	94	39	143
Kashwitna Area	15	13	28	42	22	0	64	22	114
Mt. Susitna-Beluga Area	33	87	120	80	27	5	112	37	269
Anchorage Area	7	1	8	82	40	5	127	50	185
TOTALS	70	110	180	400	221	17	638	255	1,073

Table 2 continued .

	Young Bulls	Adult Bulls	Total Bulls	Cows w/o Calves	Cows w/1 Calf	Cows w/2 Calves	Total Cows	Total Calves	Total Moose
Kenai Peninsula									
Kenai Peninsula Headwaters of Big & Little Indian Creeks & Headwaters of Chickaloon River	*NA	*NA	80	140	30	1	171	32	283
Juneau Flats	3	4	7	41	21	2	64	25	96
Resurrection River	2	1	3	35	12	0	47	12	62
TOTALS	-	-	90	216	63	3	282	69	441
National Moose Range by USFWS	132	357	489	923	374	43	1,340	464	2,314**

* Not Available

** Total includes 21 unidentified moose not otherwise included in these data.

Table 3. Sex and age ratios of moose populations as determined from aerial count data, November 1961.

	Bulls/100 Cows	Young Bulls/100 Adult Bulls	Calves/100 Cows	Twin Calves/100 Cows/Calves	% Calves in Herd	% Young Bulls in Herd	Young Bulls/100 Bull Calves	Young Bulls/100 Cows	Total Moose
Upper Susitna-Copper River Valleys									
N. Lake Louise Flats	28	13	46	4	27	2	14	3	214
S. Lake Louise Flats	78	51	32	11	15	13	162	26	334
N. Maclaren & Clearwater Rivers	112	19	24	33	10	8	150	18	40
S. Maclaren & Clearwater Rivers	66	75	51	15	23	13	111	28	384
Alphabet Hills	56	24	39	4	20	6	56	11	413
Black, Big & Little Oshetna Rivers, & Sanona Creek	62	76	56	8	26	12	96	27	555
Little Nelchina River	41	123	53	16	27	12	84	23	422
Kiana & Klutina Lakes	68	28	29	16	15	7	100	15	148
Paxson	61	24	62	16	28	5	36	12	154
Upper Gakona & Chistochina Rivers	127	26	38	5	14	10	135	26	313
TOTAL									2,977
Lower Susitna-Matanuska Valleys									
Matanuska Valley	6	133	44	3	30	2	15	3	362
Willow Area	11	233	41	11	27	5	35	7	143
Kashwitna Area	44	115	34	0	19	13	136	23	114
Mt. Susitna-Beluga Area	107	38	33	16	14	12	174	29	269
Anchorage Area	6	700	39	11	27	4	28	6	185
TOTAL									1,073

Table 3 continued.

	Bulls/100 Cows	Young Bulls/100 Adult Bulls	Calves/100 Cows	Twin Calves/100 Cows/Calves	% Calves in Herd	% Young Bulls in Herd	Young Bulls/100 Bull Calves	Young Bulls/100 Cows	Total Moose
Kenai Peninsula									
Kenai Peninsula Headwaters of Big & Little Indian Creeks & Headwaters of Chickaloon River	47	*NA	19	3	11	*NA	*NA	*NA	283
Juneau Flats	11	75	39	9	26	3	23	5	96
Resurrection River	6	200	26	0	19	3	33	4	62
TOTAL									441
National Moose Range by USFWS	36	37	35	10	20	6	57	10	2,314**

* Not Available

** Total includes 21 unidentified moose not otherwise included in these data.

Anchorage area and the Matanuska Valley are shown to have 6 bulls:100 cows while the less accessible Mt. Susitna-Beluga section is represented by 107 bulls:100 cows.

Heavy hunting pressure, as has frequently been noted in the past and especially when the harvest is confined to bulls, also expresses itself in terms of an inflated number of young bulls. Again the Matanuska Valley and the Mt. Susitna-Beluga areas may be used as examples for the young bulls:100 adult bulls ratios are 133:100 and 38:100, respectively.

Productivity in the lower Susitan drainage is good with a mean of 38 calves:100 cows. The percentage of calves in the herd continues to be higher in the more heavily hunted areas.

Upper Susitna and Copper River Valleys

Although the average bull-cow ratio of 64:100 for 1961 is below the previous 9 year mean of 83:100 (Norberg, 1961), the 1961 ratio still is not indicative of heavy pressure. Calf production continues to be good and the percentage of calves in the herd is identical with the mean of 22 for the past 12 years (Norberg, 1961).

Kenai Peninsula

The bull-cow ratio reflects a moderately heavy hunting pressure and the trend continues in that direction. Calf production is good though less than in the previously discussed areas.

LITERATURE CITED

Norberg, Elmer R. 1961. Moose Management Investigations. W-6-R-2.

SUBMITTED BY:

Gerry C. Atwell
Game Biologist

APPROVED BY:

Don H. Stead
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-c Title: Productivity Studies

PERIOD COVERED: May 1, 1962 to July 31, 1962

ABSTRACT

The total estimated calf crop for 1962 is 101 calves per 100 cows, as compared to 109 calves per 100 cows in 1961.

Twins occurred in approximately 20 per cent of the pregnancies. This reflected a decrease in the twinning rate in comparison with the past two years.

Calving progression peaked on approximately June 5, at an observed ratio of 53 calves per 100 cows.

One hundred and twenty calves were tagged on selected calving grounds during late May and early June.

Of the 120 calves tagged, males comprised 58 and females 62. Nineteen sets of twins were tagged.

Distances traveled by moose from the tagging area to recovery sites ranged from as low as 0 miles to as high as 50 miles. Generally moose exhibited a high degree of mobility and were recovered more than ten miles from their tagging sites.

Thirty known-age jaws were collected during the 1962 hunting season.

RECOMMENDATIONS

This project should be continued in order to follow annual production trends and to investigate important production facets not currently understood. Also, project should so be extended in length so that it follows calf survival from parturition to the following spring. Late winter and/or early spring aerial counts should be conducted to assess first winter survival.

Techniques to more fully understand the meaning of parturition data should be developed.

Calf tagging should be continued. This tagging should be done on an intensified area basis, preferably in areas adjacent to population centers and offering easy hunter access. Tagging on this basis will offer more tag returns and information on movements and mortality.

The possibility of tagging moose while concentrated on winter ranges should be explored. Through the application of "Saflag" plastic markers it would then be possible to determine the range of these animals at other times of year.

The accuracy of spring parturition counts should be evaluated. The results of simultaneous plane and helicopter counts should be compared, also the results of simultaneous counts by different observers should be compared.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-c Title: Productivity Studies

PERIOD COVERED: May 1, 1962 to July 31, 1962

OBJECTIVES

To tag moose calves to determine pattern of movement and obtain known age jaws; and to determine pattern of calving, initial productivity, and calf survival.

TECHNIQUES

Calving Progression

A Piper Super Cub and a Hughes 269A Helicopter were utilized to conduct aerial calving progression counts with during May, June, and July. Pilots were Dick Hamilton, Hamilton Flightways, and Ray Simmons, Bill Moore Air Service. Observers were Gerry Atwell, Jack Didrickson, Ron Somerville, and John Crawford, Biologists of the Alaska Fish and Game Department.

Counting time totaled 34 hours and 25 minutes. On 6 counting flights in a Super Cub, 25 hours and 35 minutes were expended. Nine hours counting time was equally divided among three trips in a helicopter. Nine counts were made from May 16 through July 3.

The calf counts were conducted in the Lower Susitna and Matanuska Valleys. Counting effort was intensified in the Palmer Hay Flats area. Counting areas are seen in Figure 1.

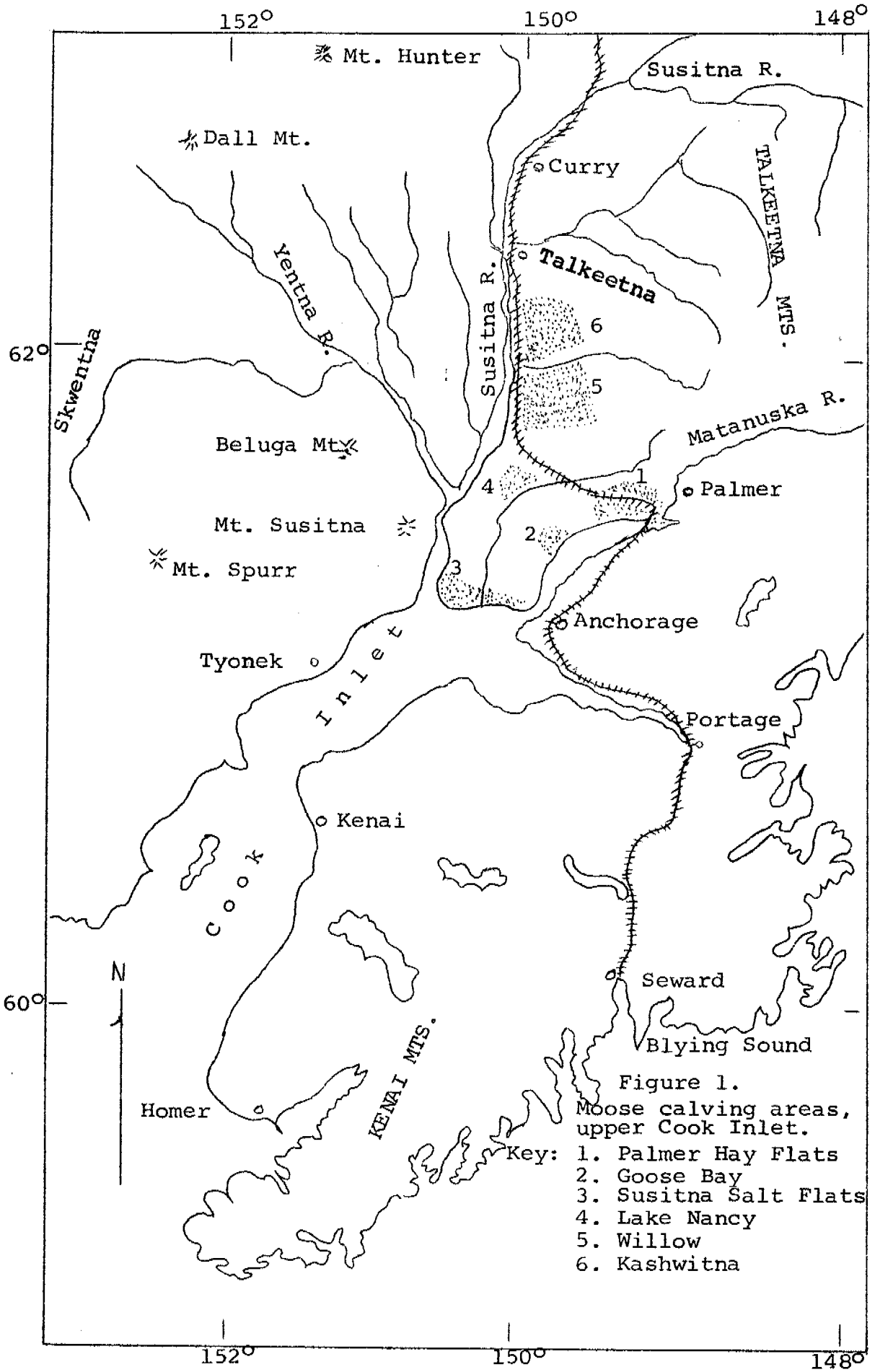

Figure 1.
Moose calving areas, upper Cook Inlet.

Key:
1. Palmer Hay Flats
2. Goose Bay
3. Susitna Salt Flats
4. Lake Nancy
5. Willow
6. Kashwitna

Calf Tagging

Military H-21 helicopters and one civilian Hiller 12-E helicopter were used on the late May early June tagging effort. Tagging crews were comprised of the following Department personnel: Gerry Atwell, Don Tetzlaff, Lee Miller, Ron Somerville, Jack Didrickson, and Richard Winters. Crew members of the military helicopters were Major Sayers, Captains McGonigle, Wright, and Amodt, Lieutenants Schwab, and Hayden and Sergeants Reese and Keller, all of the U. S. Air Force. Piloting the civilian helicopter was Bert Johnson of Johnson Helicopters, Inc.

Except for not using a spotting aircraft, tagging methods were essentially the same as described by Didrickson.[1] Helicopter flying time totaled 28 hours and 58 minutes. Military time totaled 13 hours and 39 minutes and private time totaled 15 hours and 19 minutes. Sixty-five calves were tagged from the private helicopter and 55 through the military assistance.

Unforeseen emergencies limited the availability of the military helicopter assistance during the early stages of the tagging program. Without the use of the civilian helicopter the 1962 tagging program would have been a failure.

Tagging was concentrated in the Palmer Hay Flats and the Jim-Swan Lakes Flats. Other tagging areas were Eagle River Bay and the Susitna Salt Flats. Tagging areas are seen in Figure 2.

All calves were tagged with standard livestock ear tags. Tags were ordered from the National Band and Tag Company, 721 York Street, Newport, Kentucky. Tags were the manufacturer's standard style 6-19, and were applied with the same company's tagging pliers (6-19S).

Calves were additionally tagged with three inch by six inch plastic strips folded around the ear and secured by the metal ear tag. The plastic material used is marketed under the trade name of Saflag and is available from Vogue Textiles, Inc., Barton and Pine Streets, Pawtucket, Rhode Island. To facilitate obtaining additional information from follow-up aerial observations, male calves were

[1] Didrickson, Jack. Breeding Biology and Productivity Studies, W-6-R-1, pp. 88-105.

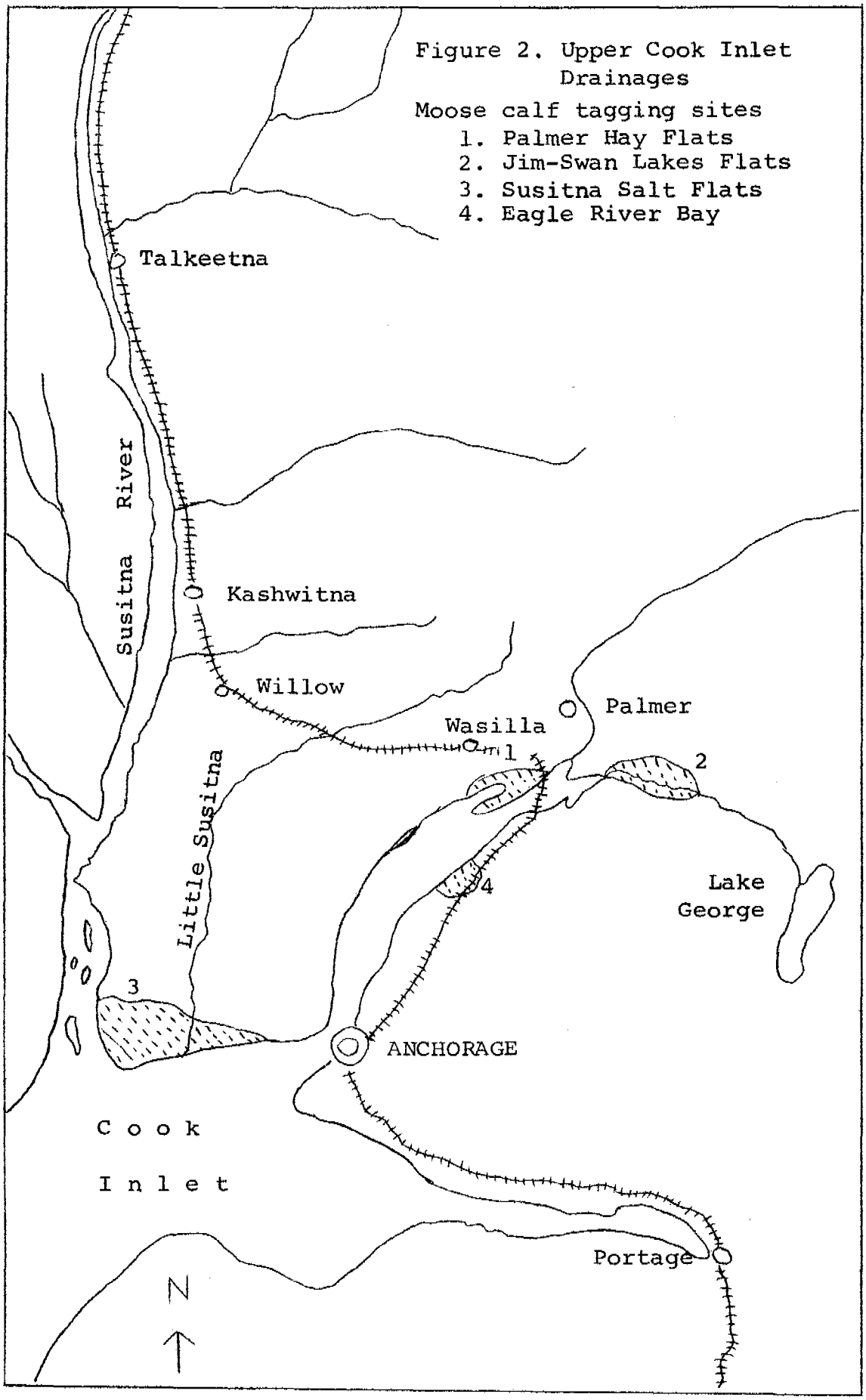
Figure 2. Upper Cook Inlet Drainages
Moose calf tagging sites
1. Palmer Hay Flats
2. Jim-Swan Lakes Flats
3. Susitna Salt Flats
4. Eagle River Bay
Talkeetna
Susitna River
Kashwitna
Willow
Wasilla
Palmer
1
2
Little Susitna
4
Lake George
3
ANCHORAGE
Cook Inlet
Portage
N

tagged with plastic in the left ear and females in the right ear.

FINDINGS

Progression of Calving

Periodic aerial counts were utilized to determine the pattern of calving. Calves were observed during the first count on May 16, when a set of twins and three singletons were sighted. The progression of calving is presented in Table 1, which shows the results of the periodic counts. Progression of calving and parturition on ratios per 100 cows is seen in Table 2.

A graphical interpretation of the data is presented in Figure 3, which illustrates the observed progression rate of calving. Figure 4 represents the estimated progression of calving with "status unknown cows" included with the "cow with calves" segment. Curves on both graphs were fitted visually and follow the techniques described by Skoog.[1] That a peak of calving occurred on approximately June 5, is shown in both Figures 3 and 4. This points to a peak date of approximately one week later than in the past two years.

The actual and estimated parturition rate per 100 cows is higher than in 1961. However, a decrease in the twinning rate per 100 cows in comparison with 1961 reflects a lowered estimated calf production rate.

Magnitude of Calving

The calf crop estimate for 1962 was based upon parturition counts, past *in utero* examinations, and standard productivity estimations by Rausch The 1962 parturition counts revealed a twinning ratio of 19.5 sets of twins per 100 parturitions. This figure was rounded off to 20.

Past *in utero* examinations revealed that 95 per cent of the cows older than 30 months were pregnant. Rausch's estimate, based on a normal winter survival, showed that 12 per cent of the adult cow population would be comprised of 24 month old, nonproductive cows. To standardize and lend continuity to production data, this 12 per cent figure has been used in past reports as it is in this one.

1 Skoog, R. O. Alaska Federal Aid Report, Caribou Management Studies, pp. 56-70, 1958 .

2 Rausch, R. A. Moose Calving Studies, Alaska PR Report, Vol. 13, No. 2, pp. 27-41, 1959 .

Table 1. Progression of moose calving in the Lower Susitna and Matanuska Valleys during May, June, and July, 1962.

Date	COWS					Total Calves	Adult Bulls	YEARLINGS					Total all Animals
	W/O Calves	Stat Unkn	W/1 Calf	W/2 Calves	Tot.			Male	Fem	Unkn	Tot	Unkn	
5-16	60	1	3	1	65	5	6	6	11	0	17	0	93
5-18	72	3	2	1	78	4	2	7	21	0	28	0	112
5-22	94	0	9	3	106	15	1	-	-	35	35	0	157
5-26	36	3	13	3	55	19	0	-	-	20	20	4	98
5-29	34	6	16	1	57	18	1	-	-	14	14	0	90
6-5	32	22	39	7	100	53	16	-	-	34	34	0	203
6-8	24	3	13	5	45	23	10	10	11	23	44	1	123
6-15	34	9	17	4	64	25	16	17	16	0	33	2	140
7-3	18	3	7	4	32	15	2	14	20	0	34	0	83
TOTALS	404	50	119	29	602	177	54	54	79	126	259	7	1,099

Table 2. Progress of calving in the Lower Susitna and Matanuska Valleys as indicated by the various parturition ratios.

Date	Observed Parturitions: 100 Cows	Estimated Parturitions: 100 Cows	Observed Calves: 100 Cows	Observed Twins:100 Parturitions	Total Cows in Sample
May 16	6.1	7.7	7.7	25.0	65
May 18	3.8	7.7	5.1	33.3	78
May 22	11.3	11.3	14.1	25.0	106
May 26	29.1	34.5	34.5	18.7	55
May 29	29.8	40.3	31.6	5.9	57
June 5	46.0	68.0	53.0	15.2	100
June 8	40.0	46.7	51.1	27.8	45
June 15	32.8	46.9	39.1	19.0	64
July 3	34.4	43.7	46.9	36.4	32

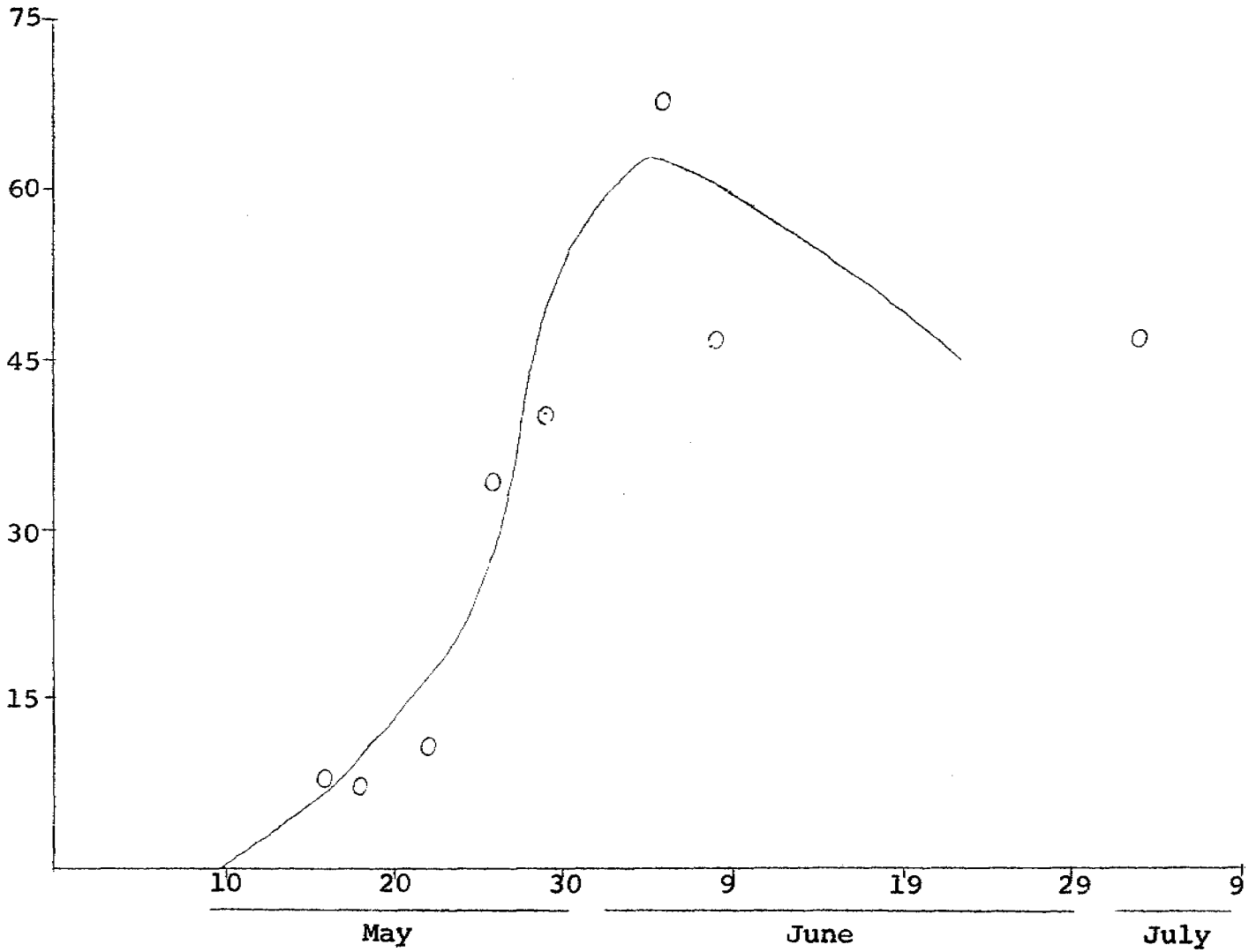

Figure 3. Estimated parturition:cow observation made in May, June, and July, 1962, lower Susitna and Matanuska Valleys.

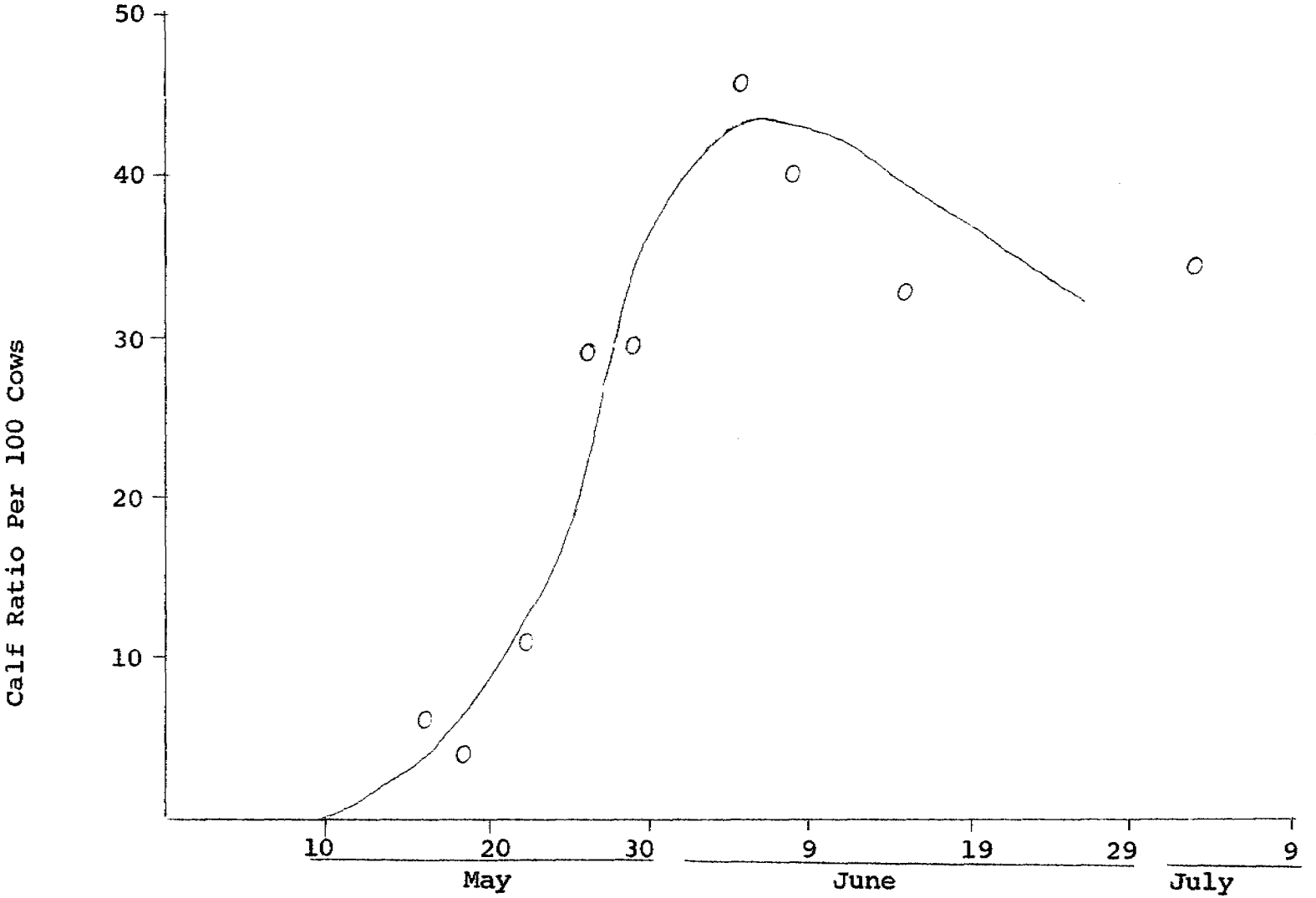

Figure 4. Actual parturition:Cow observation made in May, June, and July, 1962, lower Susitna and Matanuska Valleys.

Hence, if we take a figure of 100 cows, subtract the 12 or 12 per cent figure of 24 month old nonproductive cows we would then have 88 cows. From these 88 cows we know that only 95 per cent or 84 of these cows are pregnant as revealed by in utero examinations.

Based upon a twinning ratio of 20 sets of twins per 100 parturitions, the 84 pregnant cows would have 17 sets of twins, and 67 singletons. Then by adding 34 calves to the 67 singletons, our estimated production would be 101 calves per 100 cows.

The 1962 estimated calf crop of 101 calves - 100 cows reflects a decrease from the 1961 crop of 109 calves - 100 cows.

Calf Survival

Subsequent aerial calf counts after the peak of parturition were conducted to assess calf survival. The ratios of calves to cows dropped off slowly from the peak date of 53 calves- 100 cows on June 5 to 47 calves - 100 cows on July 3. A small sample of cows (32) counted on July 3 may well negate any positive conclusions from this final count. If we ignore the small sample size, then it appears that early survival was excellent.

Evaluation of Techniques

Comparison of conventional aircraft counting results with helicopter counts cast some doubt into the complete validity of aircraft counts. Results of the counting by aircraft type are seen in Table 3. It is of note that the ratio of male to female yearlings as obtained by conventional aircraft is greatly distorted in favor of the female. Counts obtained by helicopter show an almost even yearling sex ratio.

The "adult bull" and "cow without calf" categories are other segments of the counts upon which the helicopter observations cast doubt. Through the use of conventional aircraft it is difficult early in the spring to identify cows without calves from adult bulls. This type of error would influence the productivity conclusions.

Calf Tagging

One hundred and twenty calves were tagged in the lower Susitna and Matanuska Valleys during late May and early June. Results of the tagging by areas are seen in Table 4.

Table 3. Moose calving progression counts, methods, flying time, and observers, Lower Susitna and Matanuska Valleys, 1962.

Date	Aircraft Type	Observer	Counting Time	# of Cows	# of Calves	# of Bulls	Yearlings			Total Animals*
							Male	Female	Total	
May 16	Supercub	Didrickson	5 hrs. 0 min.	65	5	6	6	11	17	93
May 18	Cessna 170	Didrickson & Crawford	4 hrs. 30 min.	78	4	2	7	21	28	112
May 22	Supercub	Atwell	5 hrs. 40 min.	106	15	1	-	-	35	157
May 26	Supercub	Crawford	2 hrs. 15 min.	55	19	0	-	-	20	98
May 29	Supercub	Crawford	3 hrs. 0 min.	57	18	1	-	-	14	90
June 5	Supercub	Didrickson	5 hrs. 0 min.	100	53	16	-	-	34	203
June 8	Helicopter	Crawford	3 hrs. 0 min.	45	23	10	10	11	44	123
June 15	Helicopter	Didrickson	3 hrs. 0 min.	64	25	16	17	16	33	140
July 3	Helicopter	Somerville	3 hrs. 0 min.	32	15	2	14	20	34	83
TOTALS:	Nine flights		34 hrs. 25 min.	602	177	54	54	79	259	1,099

* Includes animals unidentified as to age and sex not included in this table.

Table 4. Calf tagging results by area, Southcentral Alaska, 1962.

	Total Calves	No. of Males	No. of Females	Sets of Twins	One of Set	Color Marker	Tagging Efforts
Palmer Hay Flats	50	24	26	7	2	Orange	4
Jim-Swan Lakes Flats	31	17	14	5	2	Yellow	3
Susitna Salt Flats	37	17	20	7	2	Red	1
Eagle Bay	2	0	2	0	0	White	2
TOTALS	120	58	62	19	6		10

Most of the tagging was done in the Palmer area as an effort was made to gain a concentrated sample of tagged animals. Fifty calves were tagged on the Palmer Hay Flats and 31 calves were tagged on nearby Jim-Swan Lakes Flats.

Aerial observations of the Palmer tagging areas after the tagging showed that 27 per cent of the calves observed were tagged. This figure is based on 63 observations of calves on June 8, June 15, and July 3, of which 17 calves were tagged. This information may be biased toward untagged animals as it is believed that soon after parturition the cow and calf leave the calving grounds. If this is the case then aerial counts were sampling a segment of the population that had generally calved after the tagging operations.

The "Saflag" plastic strips attached to the ears appeared to be retained to a high degree by the animal during the first six months after tagging. Seven calves checked in during the following hunting season had all retained the plastic tagging material. The material also afforded excellent aerial observations as it was easily visible from the air.

Movements

Tag recovery information is summarized for all known tag recoveries dating from 1960 to the current date. A tabular summary of this information is seen in Table 5. Little pattern is noted

Table 5. Calf tag recovery data, Southcentral Alaska, 1960-1962

Tagging Data				Recovery Data		
Tag Numbers	Date	Sex	Location	Date	Miles From Tag Site	Location
91 - 93	1960	M	One mile NE of Birchwood	1961	2	Mile 22 Glenn Highway
70 - 71	1960	F	Palmer Hay Flats	1961	5	One mile east of Wasilla
55 - 56	1960	M	Palmer Hay Flats	1962	0	Palmer Hay Flats
31 - 32	1960	M	Mile 195, Alaska Railroad	1961	7	Mile 190, Alaska Railroad
267 - 268	1960	M	Goose Bay	1960	18	Two miles SE of Wasilla
251 - 252	1960	M	Palmer Hay Flats	1961	11	Eklutna Lake
237 - 238	1960	F	Palmer Hay Flats	1962		No Location
235 - 236	1960	F	Palmer Hay Flats	1962		No location
223 - 325	1960	M	Willow Flats	1960	15	Between Peters and Willow Creeks
209 - 210	1960	M	Susitna Flats	1961	26	Two miles south of Knik
203 - 204	1960	M	Susitna Flats	1961	5	Little Susitna near tidal flats
201 - 202	1960	M	Susitna Flats	1961	5	Little Susitna near tidal flats
340 - 341	1960	M	Palmer Hay Flats	1961	16	Willow Wiway at Little Susitna Bridge
330 - 331	1960	M	Palmer Hay Flats	1961	12	Southwest side of Big Lake
306 - 308	1960	F	E. of ARR, N. of L. Willow Cr.	1961	13	Goose Creek on Alaska RR
474 - 475	1960	M	Palmer Hay Flats	1961	15	Buffalo Mine Road
419 - 420	1960	M	Palmer Hay Flats	1961	5	Eight miles SW of Wasilla
443 - 444	1960	M	West of ARR near Willow Creek	1961	11	Mile 195 Alaska Railroad
445 - 446	1960	M	SW of Willow near Big Susitna R.	1961	25	One mile north of Lucile Lake
467 - 468	1960	M	Palmer Hay Flats	1962	6	Barry Lake
469 - 470	1960	F	Palmer Hay Flats	1962	10	Dewey West Farm, Fishhook Road
551 - 552	1961	F	Lake Nancy Flats	1962	31	Buffalo Mine Road
587 - 600	1961	F	Palmer Hay Flats, Quad. No. 24	1962	13	Two miles west of Pittman
584 - 585	1961	M	Palmer Hay Flats, Quad. No. 24	1962	14	One mile east of Houston
579 - 598	1961	F	Palmer Hay Flats, Quad. No. 23	1962	3	Eight miles SW of Wasilla
566 - 567	1961	M	Palmer Hay Flats	1962	9	Between Palmer and Wasilla, at end of pavement.

Table 5. Calf tag recovery data, Southcentral Alaska, 1960-1962. (Continued)

Tagging Data				Recovery Data		
Tag Numbers	Date	Sex	Location	Date	Miles from Tag Site	Location
660-669	1961	M	Palmer Hay Flats, Quad. No. 25	1962	17	Buffalo Mine Road
792-793	1961	M	Mouth of Little Susitna	1962	3	Figure Eight Lake
790-791	1961	M	Potter Flats	1962	5	Potter Station
717-P25	1961	F	West Fork of Moose River	1962	16	Gas Line near Chickaloon River
549-550	1961	F	Lake Nancy Flats	1962	34	Mile 60 Glenn Highway
2104-2105	1962	F	Palmer Hay Flats, Quad. No. 17	1962	13	Buffalo Mine Road
2017-2018	1962	M	Palmer Hay Flats, Quad. No. 12	1962	5	One mile south of Wasilla
488-489	1961	M	Susitna Flats, Quad. No. 33	1962	51	Glenn Hiway and Moose Creek
257-258	1960	F	Palmer Hay Flats	1962	8	Mile eight, Glenn Hiway
317-318	1960	F	Willow Flats	1962	16	Top of Mt. Baldy
1138-1139	1962	F	Palmer Hay Flats, Quad. No. 16	1962	14	Mile 52, Glenn Hiway
2015-2016	1962	F	Palmer Hay Flats, Quad. No. 12	1962	3	Two miles south of Wasilla
471-472	1960	F	Palmer Hay Flats	1962	6	Wasilla Cemetery
409-410	1960	F	Goose Bay	1961		Wilford
866-P44	1961	M	Big Lake	1962	8	Red Shirt Lake
C-172	1959	F		1962		Four and $\frac{1}{2}$ miles east of Willow
336-337	1960	F	Palmer Hay Flats	1962		No location
79-88	1960	F	Palmer Hay Flats	1962	6	Ten miles SW of Wasilla on Knik Road
580-581	1961	F	Palmer Hay Flats, Quad. No. 23	1962	1	Eight miles SW of Wasilla
114-115	1960	F	Ten miles NE of Willow	1962	3	Three miles north of Willow
261-262	1960	F	Palmer Hay Flats	1962	7	Miller Farm, Fishhook Road
480-481	1961	M	Susitna Flats	1962	5	Eight miles above mouth of L. Susitna R.
1167-1168	1962	M	Palmer Hay Flats, Quad. No. 15	1962	6	Wasilla, City Center
328-329	1960	F	Palmer Hay Flats,	1962	15	Shrock Rd. (Bailey Bridge crosses little Susitna River)
1163-1164	1962	F	Palmer Hay Flats, Quad. No. 15	1962	5	Two miles south of Wasilla
651-652	1961	F	Palmer Hay Flats, Quad. No. 17	1962	14	Three Mile Lake, Knik Road
1171-1172	1962	F	Palmer Hay Flats, Quad. No. 34	1962	12	Rainbow Lake Road

at this time in movements from calving grounds except that the moose exhibited a much higher degree of mobility than previously expected. Distances traveled from the tagging site to recovery site ranged from zero miles to 50 miles and averaged 11.5 miles for 48 recoveries. Major patterns, directions and distances traveled for tag recoveries are seen in Figure 5. It must be noted that Figure 5 does not show all tag recoveries, just major patterns.

Known-Age Jaws

Thirty jaws from tagged animals were recovered during the 1962 hunting season. These jaws were cleaned, labeled, and painted with a lacquer preservative, then placed in storage.

SUBMITTED BY:

Gerry C. Atwell
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James H. Brooks
Director, Division of Game

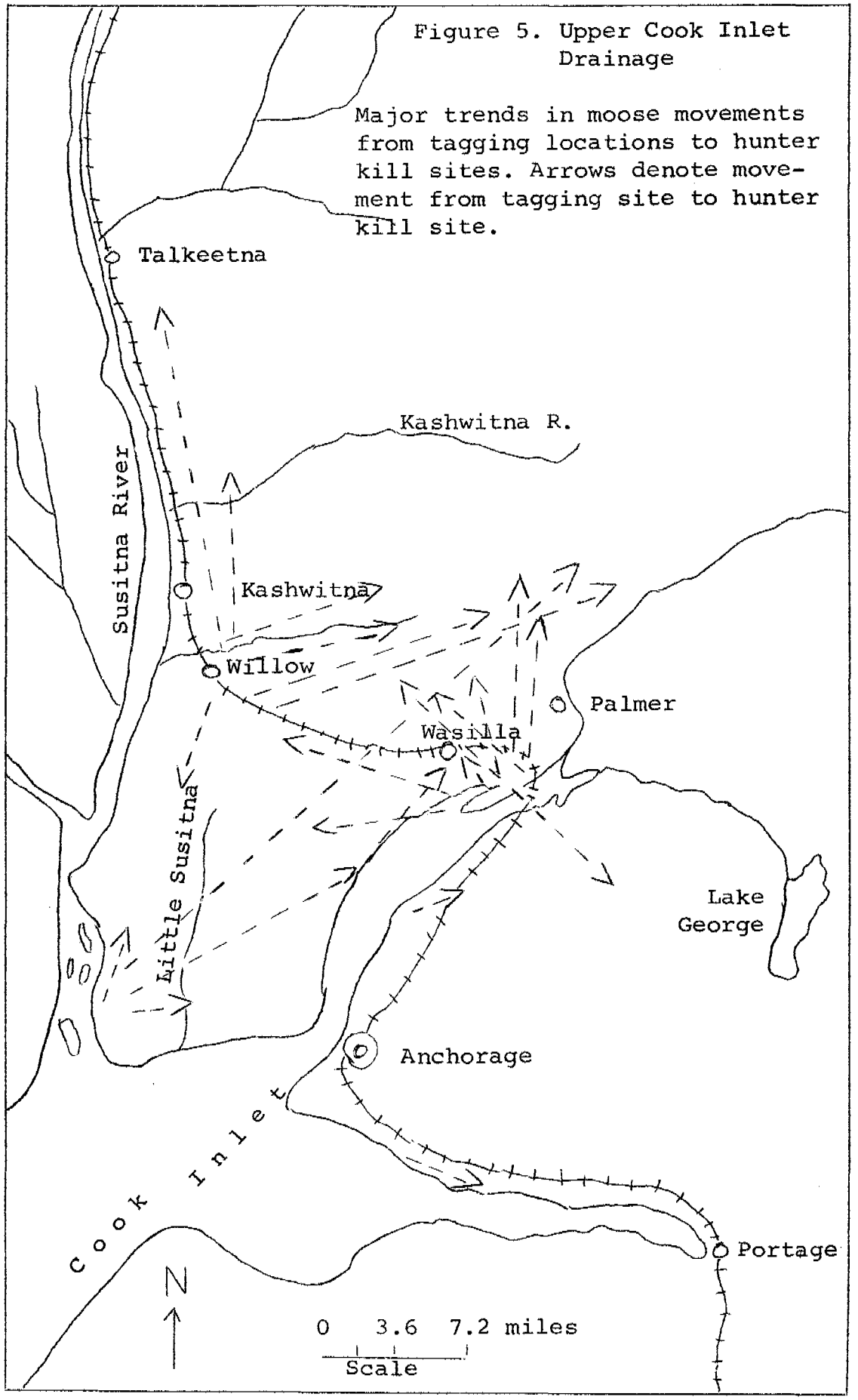

Figure 5. Upper Cook Inlet Drainage

Major trends in moose movements from tagging locations to hunter kill sites. Arrows denote movement from tagging site to hunter kill site.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-d Title: Characteristics of the Moose Hunter Harvest

PERIOD COVERED: August 15, 1961 to April 30, 1962.

ABSTRACT

The general moose season in Southcentral Alaska extended from August 20 through September 30, and November 1 through November 30 in most of the game management units. The season's bag during the general hunt was one bull.

A special permit hunt allowing the taking of antlerless moose was held during the first week of December. Areas open to the taking of antlerless moose were located on the Kenai Peninsula and in the lower Susitna and Matanuska Valleys.

An emergency season was held in the Alexander Creek drainage during late December and early January. The taking of antlerless moose was open to anyone desiring to register. All hunters, regardless of whether they had killed a moose during earlier hunts, were eligible to take one moose.

Results of the 1961 moose harvest were evaluated through means of check stations and mandatory reporting of permit holders. Findings are summarized in the following statements:

Three check stations intercepted 3,592 hunters who had expended 9,283 man-days in harvesting 919 moose during the general season.

Twenty-six per cent of the hunters checked during the regular season were successful.

Hunters spent an average of 2-1/2 days hunting with most of the effort occurring on weekends and holidays.

Nine hundred and two of the 1,015 permit hunters who actually hunted during the December antlerless season were successful for an 89 per cent success ratio.

Sixty-eight per cent of the hunting pressure originated from Southcentral Alaska during the general season, 27 per cent from the Interior, and the remaining 5 per cent from out-of-State.

Ninty-nine per cent of the permit holders for the antlerless hunts were from Southcentral Alaska.

During the regular season, 4 per cent of the hunters utilized guides. Success was 54 per cent higher for those hunters utilizing guides.

Highest hunter success was realized during the week of September 10-16, during the onset of the rut.

Calves comprised 14 per cent of the kill during the special hunts, yearlings, 13 per cent, and adults, 73 per cent.

Two hundred and sixty registrants killed 132 moose during a December and January emergency season in the Alexander Creek area.

RECOMMENDATIONS

This project should be continued in order to follow harvest trends.

Check station locations and operations should be standardized in order to lend more continuity to following harvest trends from year to year.

It should be mandatory for all hunters to stop at any check station encountered in their normal route of travel. This would be reflected in a more accurate measure of hunter success, effort, and kill.

A mandatory reporting system should be established for all hunters. This would provide the presently lacking information on area hunting pressure, effort, and overall hunter success.

A survey of aircraft hunting is necessary to judge the importance and impact of aircraft hunting upon moose populations in more remote areas.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-d Title: Characteristics of the Moose Hunter Harvest

PERIOD COVERED: August 15, 1961 to April 30, 1962

OBJECTIVES

To obtain information indicative of the hunter kill, area hunting pressure, age composition of the kill, hunter success, and the chronological distribution of the kill.

TECHNIQUES

Check Stations

Check stations were maintained on the Denali Highway, Palmer, and the junction of the Seward and Sterling Highways. Check stations were operated from August 20 through September 30. Hunters voluntarily stopped at the check station encountered in route and filled out a card which requested hunter's residency and residency status, date, if they hunted, species hunted, days hunted, type of transportation, guide use, method of butchering, species killed, sex and age of the kill, kill date, and kill location. All data gathered were coded for IBM machines and the final tabulations were done by the statistical branch in Juneau.

Permits

Permit hunts were held for antlerless moose during the first week of December. Upon the close of the hunts all hunters were required to check into local Department stations. Successful hunters were additionally required to bring in the ears and lower jaws. Returning hunters filled out a card which requested hunter's

name and address, residency status, if he hunted, area hunted, transportation type, type of weapon, if successful, kill date, age of kill, sex, and butchering method.

Registration

An emergency moose season, open to all applicants, was held in late December and early January. All registrants were required to check into the Anchorage office at the close of the season. Successful hunters were required to bring in the ears and the lower jaws. All hunters checking in were required to fill out a data card similar to the permit hunt card.

FINDINGS

General Season Kill

Nine-hundred and nineteen bulls were checked at the three check stations in 1961. This compares with 824 moose checked at 3 check stations in 1960. Kill figures reported by the individual check stations are seen in Table 1.

Although 824 moose were checked at 3 stations in 1960, comparative data between 1960 and 1961 lack value as station locations were shifted and operated for different time periods. As all check stations are voluntary there appears to be a bias in information gathered. This bias favors successful hunters as check station observations indicate that a higher percentage of the unsuccessful hunters fail to stop than the successful hunters.

The heaviest kill was made during the opening weekend. The chronological distribution of the kill for individual check stations and the overall hunt is seen in Table 2, and graphically presented in Figure 1.

Pressure

The greatest hunting pressure (33 per cent) occurred during the opening weekend of the season and then declined throughout the remainder of the season as seen in Figure 1. Hunting pressure figures, by weeks of the season for individual areas, are seen in Table 2.

Table 1. Number of hunters and moose checked during the general season at Kenai, Palmer, and Denali check stations, Southcentral Alaska, 1961.

Check Station	Number of Moose Hunters	Number of Moose and Caribou Hunters	Number of Moose Checked	Hunter Success (Per Cent)
Kenai	583	3	208	36
Palmer	729	162	380	52
Denali	2,280	2,188	331	14
Totals	3,592	2,353	919	26

Table 2. Chronological distribution of hunting pressure and kill. General moose season Kenai, Palmer and Denali check stations, Southcentral Alaska, 1961.

Week of Season	Date	Kenai No. Hunters	Kenai Moose Checked	Palmer No. Hunters	Palmer Moose Checked	Denali No. Hunters	Denali Moose Checked	Total No. Hunters	Total Moose Checked
1	8/20-26	233 (40) *	74 (36)	247 (34)	122 (33)	690 (31)	77 (25)	1170 (33)	273 (31)
2	27- 2	104 (18)	28 (14)	112 (16)	58 (16)	381 (17)	39 (12)	597 (17)	125 (14)
3	9/3- 9	80 (14)	22 (11)	127 (18)	47 (13)	460 (21)	42 (13)	667 (19)	111 (12)
4	10-16	42 (7)	28 (14)	65 (9)	57 (15)	244 (11)	56 (18)	351 (10)	141 (16)
5	17-23	64 (11)	30 (14)	93 (13)	52 (14)	255 (11)	57 (18)	412 (12)	139 (16)
6	24-30	58 (10)	23 (11)	72 (10)	34 (9)	194 (9)	44 (14)	324 (9)	101 (11)
Totals		581	205	716	370	2224	315	3521	890

* Numbers in parenthesis are percentages.

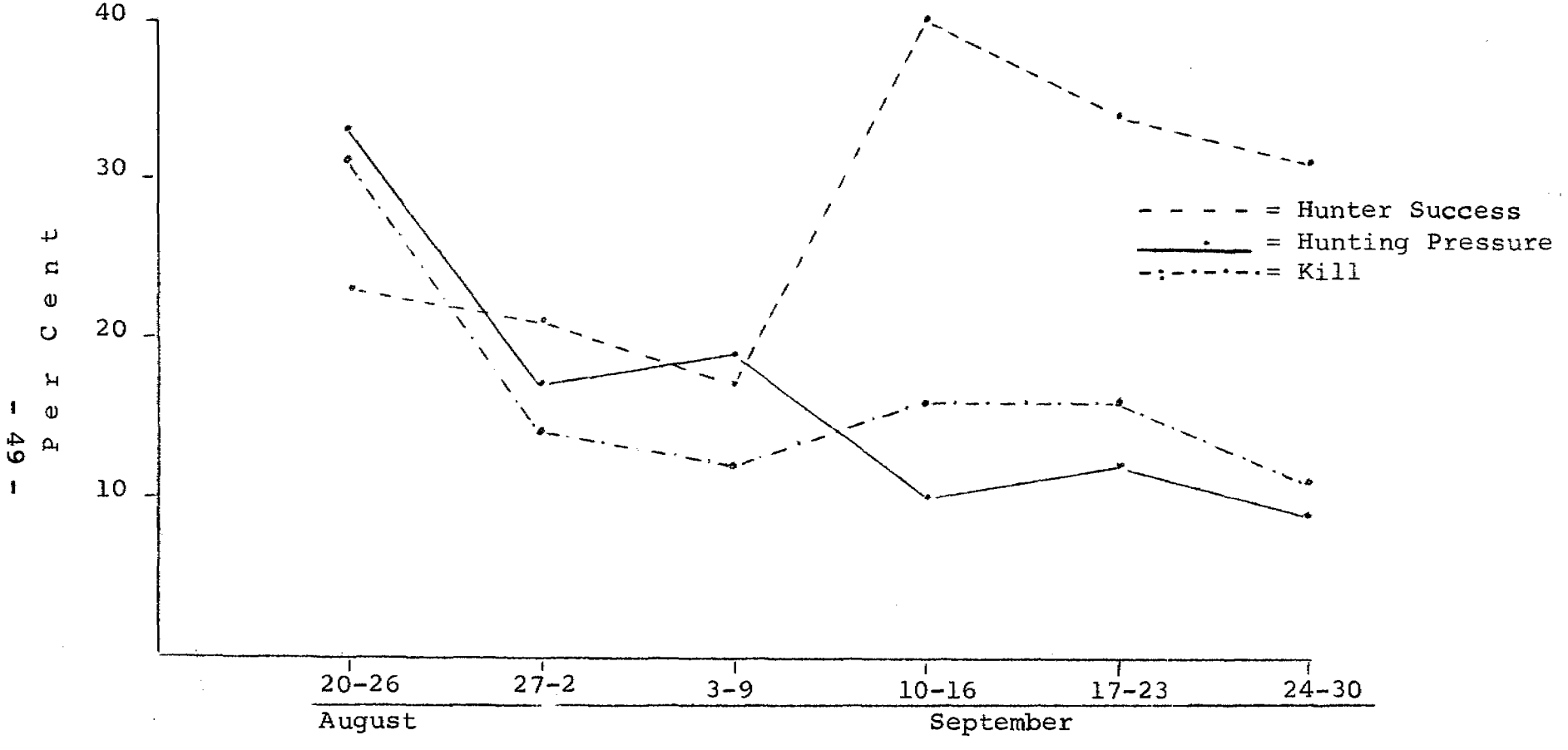

Figure 1. Kenai, Palmer, and Denali check stations, combined, moose hunter success, hunting pressure, and kill. General season, Southcentral Alaska, 1961.

Hunting pressure was primarily of local origin. Sixty-eight per cent of the hunters were from Southeastern Alaska, and 4 per cent from out-of-State. As seen in Table 3, the impact of the Interior hunters who share the Denali Area with Southcentral hunters tends to give a false picture of hunting pressure origin. Hunting pressure is more local than shown in Table 3.

Hunting effort averaged 2.6 days per hunter. Non-resident effort averaged 3.9 days as compared to 2.5 days for residents. Hunting effort obtained at the individual check stations is seen in Table 4.

Hunter Success

Twenty-six per cent of the hunters intercepted at check stations were successful. As seen in Table 1, hunter success ranged from a low of 14 per cent at Denali to a high of 52 per cent at Palmer.

Hunter success was generally lowest during the first week of the season and highest during the fourth week, September 10-16. Table 5 shows the hunter success by weeks as recorded by the three stations. Hunter success is seen graphically in Figure 2.

As seen in Table 6, 4 per cent of the hunters intercepted at check stations utilized guides. Further breakdown of guide utilization shows that 29 per cent of the non-residents used guides in comparison with 3 per cent of the resident hunters using guides. Hunting success of hunters utilizing guides (Table 7) was much higher than hunters not using guides. Success for hunters employing guides averaged 75 per cent as compared to 21 per cent for hunters without guides.

Permit Hunts

Five areas (Figure 3) were designated open to the taking of antlerless moose from December 1 through 7. One thousand two hundred and forty-seven permits were issued after a public drawing. One thousand and fifteen of the permit holders who actually hunted killed 902 moose for an 89 per cent success ratio. Total permits issued, moose killed and hunter success for individual areas are shown in Table 8.

Table 3. Residency of moose hunters checked during the general moose season at Kenai, Palmer and Denali check stations, Southcentral Alaska, 1961.

Residency	Check Station						Total	
	Kenai		Palmer		Denali			
ALASKA								
Southcentral	541	(91)*	562	(97)	1,254	(55)	2,357	(68)
Central (Interior)	3	(1)	5	(1)	925	(41)	933	(27)
Northern (above tree line)	0		0		1	(T)	1	(T)**
Southeastern (Pt. Riou south)	0		1	(T)	10	(1)	11	(1)
Total Alaskans	544	(92)	568	(98)	2,190	(97)	3,302	(96)
NON-RESIDENTS								
Out-of-State	44	(7)	10	(2)	65	(3)	119	(3.5)
Alien	4	(1)	0		4	(T)	8	(0.5)
Total Non-residents	48	(8)	10	(2)	69	(3)	127	(4.0)
Totals	592		578		2,259		3,429	

* Figures in parenthesis are percentages.
** "T" indicates trace.

Table 4. Moose hunting effort during the general season. Kenai, Palmer and Denali check station, Southcentral Alaska, 1961.

Check Station	Number of Hunters	Number of Days Hunted	Average Number of Days Hunted
KENAI			
Residents	533	1,044	2.0
Non-residents	47	155	3.3
Total	580	1,199	2.1
PALMER			
Residents	704	1,600	2.3
Non-residents	19	60	3.2
Total	723	1,660	2.3
DENALI			
Residents	2,170	6,001	2.8
Non-residents	96	423	4.4
Total	2,266	6,424	2.8
Total Residents	3,407	8,645	2.5
Total Non-Residents	162	638	3.9
Total Combined	3,569	9,283	2.6

Table 5. Moose hunter success by week of season, Kenai, Palmer, and Denali check stations. General season, Southcentral Alaska, 1961.

	Week of Season	Kenai Hunter Success (Per Cent)	Palmer Hunter Success (Per Cent)	Denali Hunter Success (Per Cent)	Total Hunter Success (Per Cent)
Aug. 20-26	1	33	49	11	23
27-2	2	27	52	10	21
Sept. 3-9	3	28	37	9	17
10-16	4	67	88	23	40
17-23	5	47	56	22	34
24-30	6	40	47	23	31

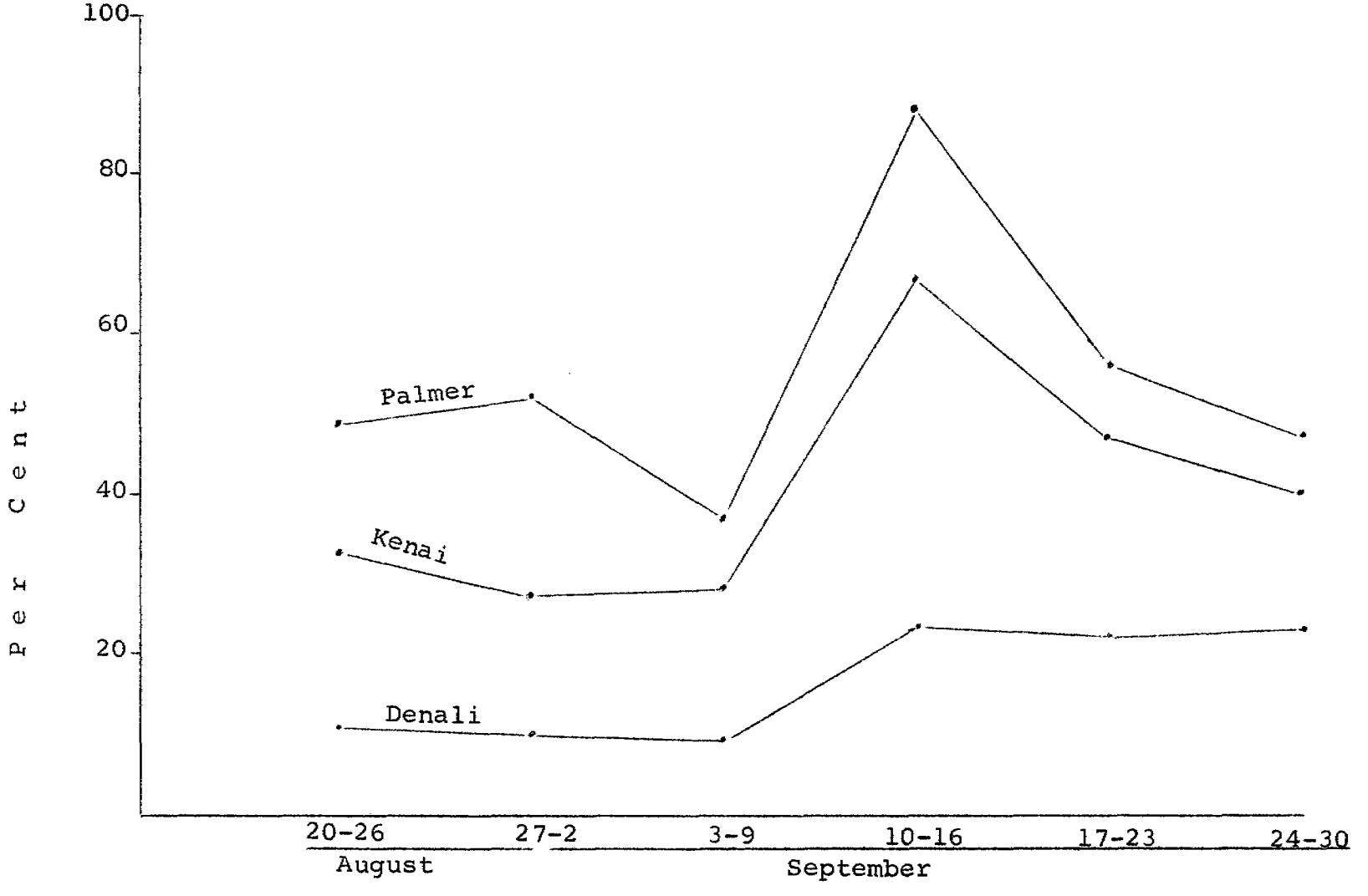

Figure 2. Moose hunter success by weeks of the season. Kenai, Palmer, and Denali check stations. General season, Southcentral Alaska, 1961.

Table 6. Moose hunter guide utilization. Kenai, Palmer, and Denali check stations, general season, Southcentral Alaska, 1961.

Check Station	Residents W/Guides	Residents WO/Guides	Non-residents W/Guides	Non-residents WO/Guides	Total W/Guides	Total WO/Guides
Kenai	19 (3.6)*	514 (96.4)	16 (34)	31 (66)	35 (6)	545 (94)
Palmer	27 (4.0)	677 (96.0)	9 (47)	10 (53)	36 (5)	687 (95)
Denali	42 (2.0)	2124 (98.0)	22 (23)	74 (77)	64 (3)	2198 (97)
Totals	88 (3.0)	3315 (97.0)	47 (29)	115 (71)	135 (4)	3430 (96)

* Figures in parenthesis denote percentages.

Table 7. Hunting success of hunters using and not using guides. Kenai, Palmer, and Denali check stations, general season, Southcentral Alaska, 1961.

Check Station	Residents Success W/Guides (Percent)	Residents Success WO/Guides (Percent)	Non-resident Success W/Guides (Percent)	Non-resident Success WO/Guides (Percent)	Total Success W/Guides (Percent)	Total Success WO/Guides (Percent)
Kenai	79	28	87	48	83	29
Palmer	93	44	89	20	92	44
Denali	45	12	91	18	61	13
Totals	67	21	89	26	75	21

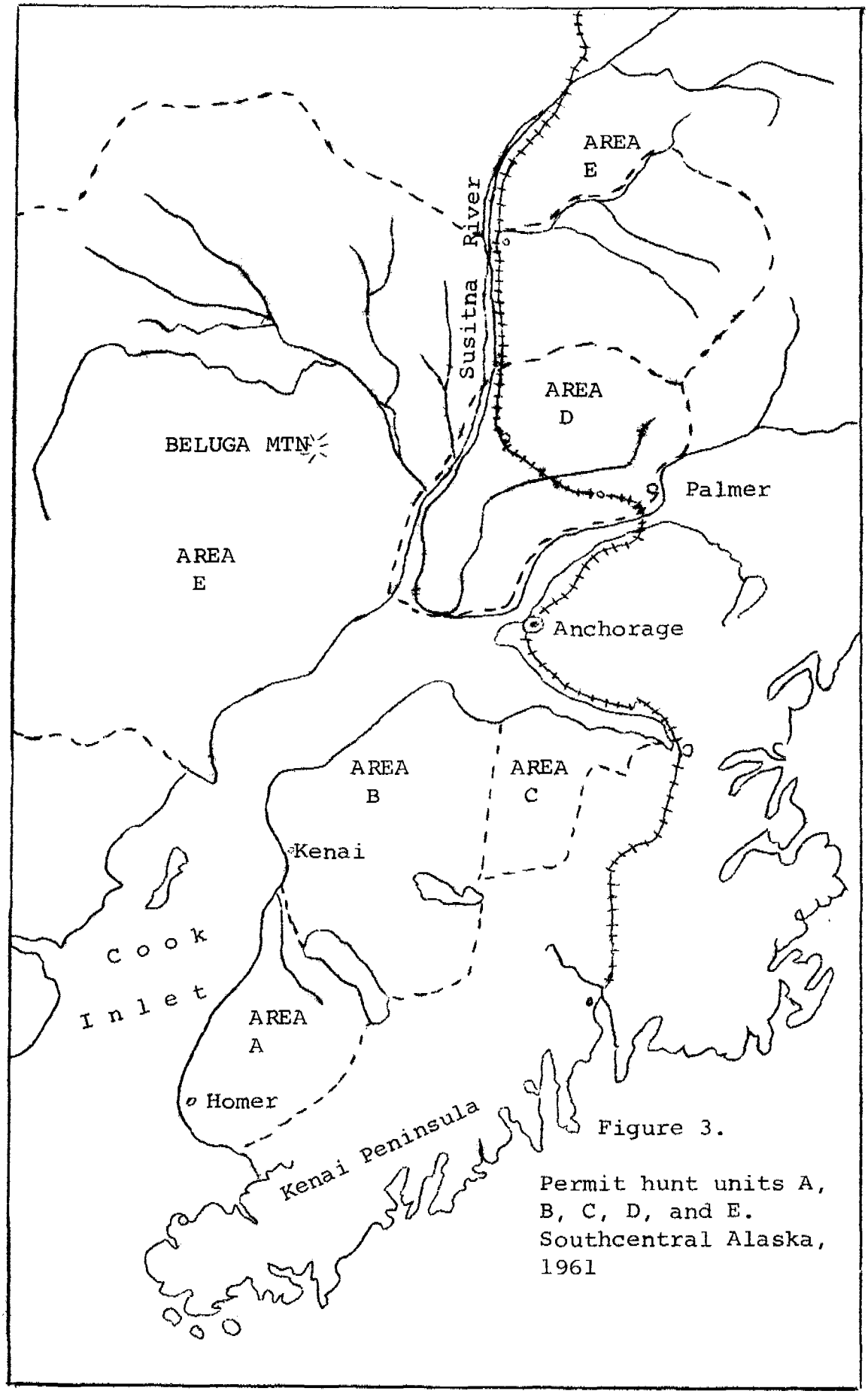

Figure 3. Permit hunt units A, B, C, D, and E. Southcentral Alaska, 1961

Table 8. Antlerless moose hunt permits, number of hunters, moose kill, and hunter success, Southcentral Alaska, 1961.

Permit Area	Number of Permits	Number of Hunters	Moose Killed	Hunter Success (Per Cent)
A	130	125	118	94
B	125	120	118	98
C	42	37	30	81
D	430	408	388	95
E	520	325	248	76
Totals	1,247	1,015	902	89

Table 9. Residency of antlerless moose hunters, Southcentral Alaska, 1962.

Residence	Number of Hunters	Per Cent Of Hunters
Anchorage	914	73
Matanuska Valley	114	10
Whittier-Portage	6	T
Kodiak	3	T
Fairbanks	1	T
Talkeetna	8	1
Cordova	2	T
Kenai-Kasilof	71	6
Seward	60	5
Homer	64	5
Out-of-State	2	T
Unknown	2	T
Totals	1247	100

Table 10. Methods of transportation used by antlerless moose hunters, Southcentral Alaska, 1961.

Method	Number of Hunters	Per Cent of Hunters
Car	656	64
Plane	161	16
Train	136	13
Tracked Vehicle	54	5
Foot	5	1
Unknown	5	1
Totals	1017	100

As seen in Table 9, hunting pressure was almost entirely of local origin. Transportation methods (Table 10) favored private automobiles. Train and aircraft were the other significant means of transportation.

Based upon hunter age estimates, adults comprised 81 per cent of the kill, yearlings, 10 per cent, and calves, 9 per cent. Further breakdown of age and sex composition of the kill based upon hunter identification is seen in Table 11.

Table 11. Sex and age composition of the kill based upon hunter identification, antlerless moose season, Southcentral Alaska, 1961.

	Males				Females			
Area	Calf	Yearling	Adult	Total	Calf	Yearling	Adult	Total
A	4	6	1	11	3	7	96	106
B	6	3	6	15	3	7	91	101
C	1	2	0	3	0	4	23	27
D	26	10	22	58	24	28	274	326
E	7	11	55	73	7	12	154	173
Totals	44	32	84	160	37	58	638	733

A sample of 784 jaws from the permit hunts was aged at the Anchorage field office. Based upon aging results from this sample some error is noted in the hunter's aging estimates. Thirteen per cent of the kill was found to be calves, 14 per cent yearlings, and 73 per cent adults. An additional class rated as old adults was segregated from the adult samples. Criteria for the old adult aging were based upon Lensink's Class IX wear class. Old adults comprised 10 per cent of the kill. Age breakdowns for individual areas are recorded in Table 12.

Most of the hunters (68 per cent) reported that they intended to do their own butchering. Twenty-five per cent indicated that they would use commercial butchering, 4 per cent reported that they would use a combination of private and commercial butchering facilities, and 3 per cent were undecided as to their butchering methods (Table 13).

Table 12. Sex and age composition of the antlerless moose kill, Southcentral Alaska, 1961.

Area	Calves	Yearlings	Adults	Old Adults
A	12	17	82	7
B	11	15	90	3
C	5	3	19	0
D	47	47	163	44
E	28	24	140	27
Totals	103 (13)	106 (14)	494 (63)	81 (10)

Table 13. Intended butchering methods reported by successful antlerless moose hunters, Southcentral Alaska, 1961.

Method of Butchering	Number of Moose	Per Cent of Moose
Private	609	68
Commercial	225	25
Combination	37	4
Unknown	31	3
Totals	902	100

Registration Hunt

An emergency moose season was declared from December 30 to January 17, 1962, in the Alexander Creek drainage. An abnormal concentration of moose in this area opposed to a minimal amount of winter forage prompted this season.

Hunters were permitted to take either sex and for the first time in this modern era it was legally possible for a hunter to take two moose in one calendar year. To be eligible for this hunt, hunters had to register in the Anchorage field office.

Two hundred and sixty hunters registered for this hunt, but only 145 actually hunted. Of the 145 hunters who hunted, 132 were successful for a 91 per cent success ratio. Aircraft was the most important means of transportation during this hunt.

Based upon a sample of 120 jaws, calves comprised 18 per cent of the kill, yearlings, 9 per cent, adults, 66 per cent, and old adults, 7 per cent.

SUBMITTED BY:

Gerry C. Atwell
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James W. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-e Title: Mortality Studies Southcentral Alaska

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

ABSTRACT

Three hundred and seventy-seven moose were reported to have died from causes other than legal hunting from July 1, 1961, through June 1, 1962. Of this total, 244 were train kills, 56 highway kills, 1 predation kill, and 15 were animals which died from unknown causes. Sixty-eight (85 per cent) of 80 moose livers examined for cysts were found to be infected. Fifty-four reproductive tracts, 95 jaws, and 16 fetuses were collected from the kills.

RECOMMENDATIONS

Early spring foot surveys to ascertain the number of train-killed animals should continue in those areas where the Alaska Railroad passes through wintering concentrations of moose.

A greater effort should be expended towards complete autopsies by competent personnel.

More emphasis should be placed on acquiring information on winter kills in outlying areas.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 2-e Title: Mortality Studies Southcentral Alaska

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

OBJECTIVES

To record the incidence and effect of the various causes of mortality other than hunting, which operate against moose populations subject to significant hunting pressure.

TECHNIQUES

All instances of moose mortality other than the hunter harvest were investigated. Carcasses were autopsied, weights and measurements were recorded, and reproductive and other specimen materials were collected and preserved. One man with a specialized heavy duty vehicle was available at any hour to salvage moose carcasses for study purposes and for the meat which was donated to charitable organizations.

FINDINGS

Railroad Mortality

From July 1, 1961, through May 31, 1962, 244 moose were known to have been killed by trains. This figure was determined through monthly mortality reports submitted by officials of the Alaska Railroad and from a survey conducted on foot by Department biologists.

Table 1 summarizes the kills by mile post and report source. As in past years, the area from Willow to Talkeetna (Mile posts 181 to 230) sustained the heaviest kill. Seventy-one moose or

Table 1. Train-killed moose related to milepost.

A. R. R. Milepost	Report Source A. R. R.	Alaska Dept. of Fish & Game	
0-10	1		
11-20	2		
21-30	2		
31-40	1		
41-50	0		
51-60	1		
61-70	0		
71-80	1		
81-90	1		
91-100	0		
101-110	1		
111-120	0		
121-130	1		
131-140	0		
141-150	3		
151-160	3		
161-170	5		
171-180	7		
Subtotal	29		
181-190	6	16	
191-200	19	47	(Only portions
201-210	20	70	walked by ADF&G)
211-220	14	42	
221-230	12	17	
Subtotal	71	192	
231-240	3		
241-250	4		
above 250	15		
Subtotal	22		
Total	122	192	
Minimum Total Kill - *244			

*Total includes 1 reported A. R. R. kill picked up by moose wagon.

58 per cent of the total kill reported by the Railroad occurred there even though this section represented only 20 per cent of the line.

Figure 1 is a monthly comparison of the mortality reported by the Alaska Railroad. Almost half of the 122 train-killed moose were reported in December concurrent with unusually deep snow and temperatures of 25 to 50 degrees below zero. Sufficient moose were removed by trains during December to cause a sharp decline in January's kill. It appears that by February the number of animals frequenting the tracks had again risen; consequently, the number of moose reported killed during that month was second only to December and represented about one-quarter of the year's total.

Department personnel surveying the 49 miles between Willow and Talkeetna on foot from May 7 through May 10 tallied 192 carcasses or 4.7 per mile of track. This was 121 more animals than the 71 reported by Alaska Railroad officials.

Tables 2 and 3 point out the age and sex composition of the moose carcasses observed during the foot survey. The totals indicate that moose of no one age or sex were particularly susceptible to being killed or not being killed by trains. The one exception is the per cent of males in age classes II through V (62 per cent) in Table 2 where it would seem a bull-only hunting season prior to 1959 would have encouraged a lower bull ratio than that represented by the train kill.

One hundred and fifty miles of track were surveyed by foot during the winter of 1959-1960 and of 150 train-killed moose, 41 (27 per cent) had been salvaged by the section crews (Didrickson, 1960). In 1962, 49 miles were censused on foot and 40 (21 per cent) of 189 moose examined had been salvaged (Table 4).

Weather conditions often dictated the amount of time section crews were able to devote to salvaging operations. When deep snow tended to accumulate animals on the tracks the kill increased; however, Railroad personnel were at the same time burdened with proportionately larger track clearance and maintenance problems which meant moose salvaging assumed a secondary priority.

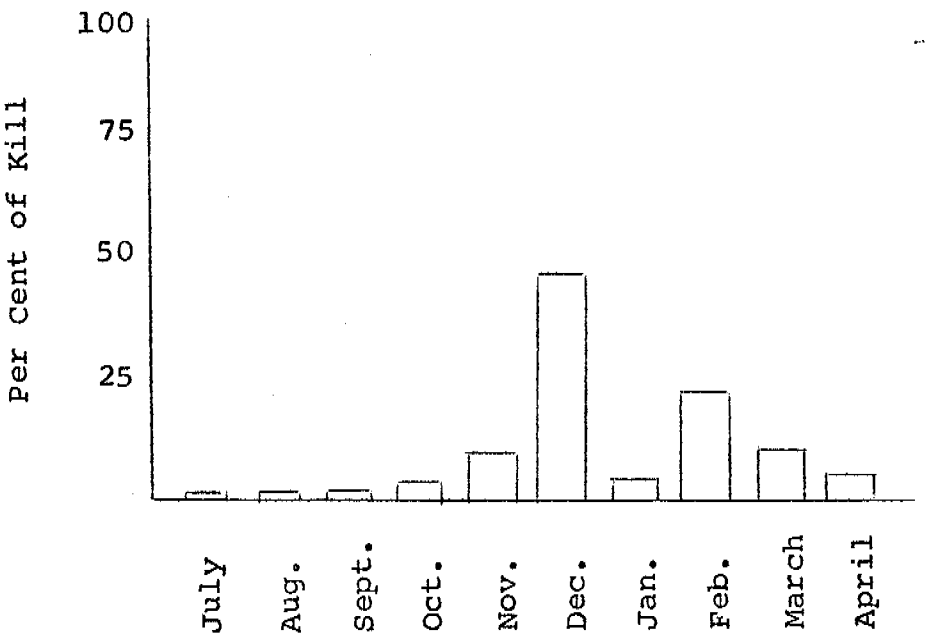

Figure 1. Alaska railroad reported kills - percentage of kill by month.

Table 2. Sex and age ratios of 116 Alaska Railroad moose kills as determined by Alaska Department of Fish and Game foot survey.

*Age Classes	♂♂	% of Total	♀♀	% of Total	% ♂♂	% ♀♀
Calves	10	18	12	19	45	55
I	9	16	17	28	35	65
II-V	30	55	18	29	62	38
VI +	6	11	15	24	29	71
Totals	55	100	61	100	47	53

*Peterson, Randolph L. 1955. North American Moose. University of Toronto Press. 280 pp.

Table 3. Age composition of 158 Alaska Railroad moose kills as determined by Alaska Department of Fish and Game foot survey.

*Age Classes	No. of Animals	Per Cent of Total
Calves	27	17
I	28	18
II-V	72	45
VI +	31	20
Total	158	100
Unknown Age	34	
Grand Total	192	

* Peterson, Randolf L. 1955. North American Moose. University of Toronto Press, 280 pp.

Table 4. Moose salvaged by milepost as indicated on the Alaska Railroad foot survey.

Milepost	Salvaged	Unsalvaged	Part Salvaged	Total Moose Examined	Per Cent of Total	Per Cent Salvaged
181-190	4	10	0	14	7.4	28.6
191-200	11	33	2	46	24.4	28.3
201-210	10	60	0	70	37.0	14.3
211-220	7	34	1	42	22.2	19.0
221-230	2	12	3	17	9.0	29.4
Totals	34	149	6	189	100	*21

* Percentage includes partial salvage.

Didrickson (op. cit.) has briefly discussed the possibilities of determining the number of train-killed moose from aerial censuses. On April 30 an aerial count was made of train-killed moose in the area walked one week later. Sixty-three carcasses were tallied or one-third of the number (192) observed from the ground. This technique needs further study before its feasibility as a management tool may be ascertained.

Highway Mortality

A minimum of 56 moose were killed on Southcentral Alaska highways from July 1961 through May 1962 (Figure 2). This mortality was second only to the railroad kill. Thirty (54 per cent) of these 56 animals were calves, indicating a greater vulnerability of this age class.

Depredation Kills

Twenty-three moose were reported as depredation kills (Figure 3), 10 occurring on one ranch. A wet summer and an early winter caused the grain to be left in the fields through November into December and in some instances into January and February. Heavy snow in the mountains forced more moose than usual on to the agricultural areas, resulting in crop depredations and occasionally, dead moose.

Department Kills

Twenty-two moose were killed by the Department: cripples - 12, public safety - 7, and others - 3.

Illegal Kills

Sixteen instances of moose being taken illegally were brought to the Department's attention.

Predation

An incidence of predation was witnessed on May 28, 13 miles southeast of Palmer. An adult wolf easily outmaneuvered a cow and then killed and commenced to feed upon the cow's two to three day old calf. When autopsied, the calf had a crushed skull.

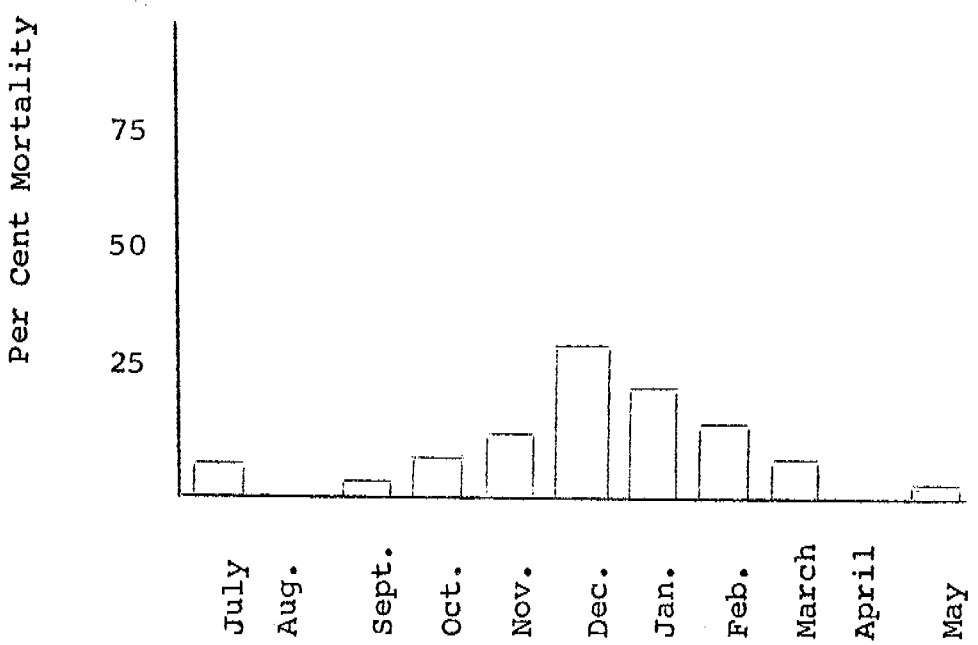

Figure 2. Moose highway mortality related to month.

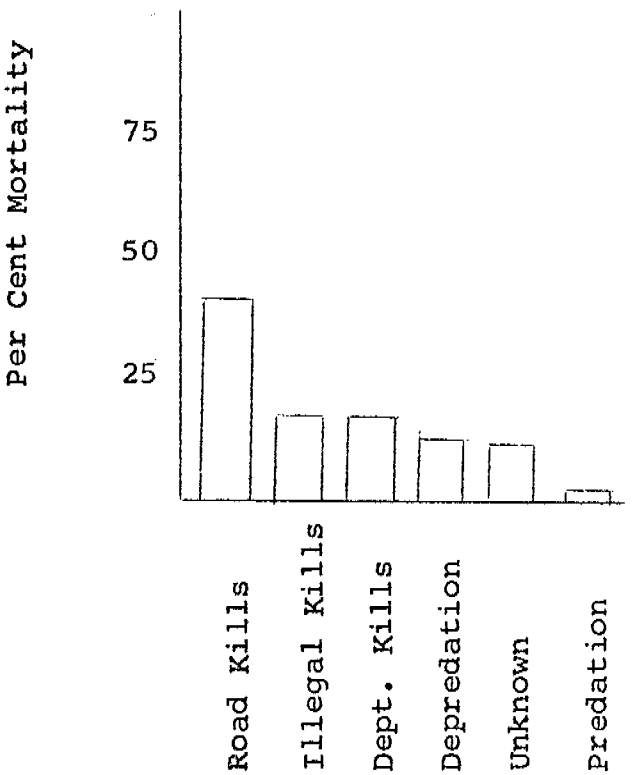

Figure 3. Moose mortality by percentage, excluding Alaska Railroad kills.

Unidentified Mortality

Fifteen moose died from unknown causes.

Parasitism

Eighty moose were examined for liver cysts; 68 (85 per cent) were infected; 29 (78 per cent) of 37 calves examined were infected; all 11 yearlings inspected were harboring cysts; and of 32 livers examined for adult animals, 28 (88 per cent) yielded cysts. Forty-nine (89 per cent) of the 55 females in the sample bore encysted tapeworm larvae and 19 (76 per cent) of the 25 males were likewise infected.

The Arctic Health Research Center examined four infected moose livers and reported that the encysted parasite was Taenia hydatigenia.

Specimen Material

The 133 moose examined yielded the following specimens:

Reproductive tracts	- 54
Jaws	- 95
Fetuses	- 16

Body measurements were taken on 82 animals and weights were recorded on 27 (Table 5). The measurements follow those of Rausch (1958).

LITERATURE CITED

Didrickson, Jack. 1960. Moose management investigations. P-R Project W-6-R-1. p. 116.

Rausch, Robert A. 1958. Moose management investigations. P-R Project W-3-R-12. p. 91.

SUBMITTED BY:

Gerry C. Atwell
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James W. Brooks
Director, Division of Game

Table 5. Weights and measurements of moose, 1961-1962.

	MEASUREMENTS *						WEIGHTS**			
Date	Age Classes	Girth	Ht. Sh.	Body	H. F.	Total	Ear	Total	Dressed	Sex	Accession Number
7/5	Calf	32	44	25.5	19.5	50	6.5	73.5		F	Released
7/9	I	59	62	48	31	89	9			F	0688
7/25	II+	73.5	70.5	57.5	31.5	98	10			F	0691
9/19	II+	79	71	66	31	101	10			F	Unknown
10/1	Calf	53	56.5	56	26.5	74	9			M	0692
10/5	II+	77	66	52	31	89	10			F	0693
10/5	II+	73	69.5	55	30.5	98	10			F	0694
10/11	II+	73.5	73.5	60	32.5	108	10			F	0695
10/13	I	67	66.5	50.5	30.5	100	10			M	0696
10/24	Calf	56	59	46	27.5	82	9.5			M	0697
11/3	Calf	57	54	39.5	26	80.5	8.5			M	0698
11/6	II+	75	65.5	61	33.5	111	11			F	0700
11/9	Calf	55	60	44.5	27.5	82	8.5			F	0702
11/9	II+	73.5	70	55.5	30.5	98	10.5			F	0703
11/11	Calf	57	59	46.5	27.5	83.5	9.5			M	0704
11/14	Calf	58	62	43	30	83	9.5			M	0705
11/15	II+	76	69	56.5	39	108	11			F	0706
11/16	I	65	68	58	30	98	10			F	0707
11/18	II+	88	80	66.5	32	112	10.5			F	0708
11/19	Calf	56.5	61	48.5	26.5	78	9			F	0709
11/21	II+	78	77	63	32.5	112	10.5			F	0710
11/22	I	77	74.5	57.5	32	106	10.5			F	0711
11/28	I		71	60.5	34	110	10			F	0712
11/29	I		70	54.5	33	98	9.5			F	0713
12/2	II+	66	69	54	31.5	100	10			F	0715
12/7	I	72	72	53	32.5	105	10			F	0716
12/9	Calf	58	62.5	46	28	88.5	9			M	0717
12/9	II+	73	72	57.5	30.5	98	9.5			F	0718

* Measurements in inches

** Weights in pounds

Table 5 Continued.

	MEASUREMENTS *							WEIGHTS**			
Date	Age Classes	Girth	Ht. Sh.	Body	H. F.	Total	Ear	Total	Dressed	Sex	Accession Number
12/12	II+	73.5	71	58.5	33	103.5	10			F	0719
12/13	Calf	42	48	41	23	63	7			F	0720a
12/16	II+	79	71	60	30	98	10			F	0720b
12/18	II+	78	70.5	61.5	32	106	10			F	0721
12/20	II+	77.5	70	62	31	105	10			F	0722
12/20	II+	79	71.5	53	31	109	10.5			F	0723
12/20	Calf	58	61	48	29	70.5	9			M	0724
12/23	II+	68	72.5	51.5	30.5	97	9			F	0725
12/26	Calf	54	58	46	27	77	9			F	0726
12/29	Calf	64	65.5	39.5	31	78	10			F	0728
12/30	II+	71	71.5	56	31.5	97	10.5			F	0729
1/1/62	II+	79.5	72	56	31	103	10			F	0730
1/2	I	70.5	69.5	48.5	31	104	11			M	0731
1/3	I	70.5		47	34	100	10			F	0732
1/3	II+	78.5	76	62.5	31	112	10			F	0733
1/3	Calf	61	66.5	52	29	86	9			F	0734
1/4	II+	75	74	60	32	102	10			M	0735
1/5	II+	78	77.5	60.5	32	114.5	10			F	0737
1/6	Calf	58	62	43	28	79	9			M	0738
1/7	Calf	47	49	36	22	68	7			F	0745
1/20	II+	72	73	44	31	104	10.5			F	0751
1/23	II+	84	77	61	31	106	10.5			F	0752
1/24	I	70.5	69.5	54	31	106	9.5			M	0753
1/29	I	68.5	67.5	61	30.5	106	9.5			M	0754
1/30	I	62	63	46.5	30	91	9			M	0755
1/30	Calf	53	59	47.5	28	96	9			M	0756
2/1	II+	72	67	53	31.5	99	10			F	0759
2/2	II+	79	76	55	32	115	10.5	998	553	F	0760

* Measurements in inches
** Weights in pounds

Table 5 Concluded.

		MEASUREMENTS *						WEIGHTS**			
Date	Age Classes	Girth	Ht. Sh.	Body	H. F.	Total	Ear	Total	Dressed	Sex	Accession Number
2/6	Calf	53	57.5	49	28.5	82	9	335		F	0761
2/6	Calf							250		F	0762
2/12	Calf	55	59	54	29	82	8	375	220	M	0763
2/13	II+	75	71	66	32	103	10	830	500	F	0764
2/14	I	59	57	57	29	82	8	395	205	M	0765
2/15	Calf	56	58	53	28.5	83	8	405	240	M	0766
2/16	II+	70	61	63	32.5	102	10		475	F	0767
2/21	Calf	55	58	54	28.5	82	9	370	245	M	0768
2/23	Calf	60	58	57	30	84	9	440	265	M	0769
2/25	Calf	50	58	53	28	82	9	345	215	F	0770
2/26	II+	72	71	69	31.5	99	10	755	445	F	0771
3/3	Calf	52	58	53	29.5	91	9	395	240	M	0773
3/4	II+	67	70	65	32.5	103	10	765	470	F	0774
3/4	Calf	48	54	47	27	76	8.5			M	0776
3/6	Calf	58	62	52	29.5	82	9			M	0777
3/7	Calf	52	53	52	27	75	8	325	215	M	0778
3/8	Calf	53	56	51	27.5	80	8.5	265	170	F	0779
3/10	I	66	71	62	32.5	103	10	510	355	F	0780
3/16	II+	74	74	66	31	105	10	825	535	F	0782
3/18	I	73	70	69	33	102	10	770	490	F	0783
3/21	Calf	56	55	52	28	80	8.5	350	220	F	0784
3/21	Calf	61	61	53	29	81	8	395	250	M	0785
4/3	Calf	58	56	52	27	78	8	325	205	M	0786
4/4	Calf	50	55	45	27.5	75	8.5	240	180	F	0787
4/18	II+	77	67	64	32	99	9.5	760		M	0788
4/25	I	66	66	62	31	96	9.5	580	380	M	0789
4/25	II+	70	69	64	30.5	104	9.5	655	445	F	0790

* Measurements in inches

** Weights in pounds

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 3-b Title: Abundance and Composition Surveys, Interior Alaska

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

ABSTRACT

Aerial surveys conducted in June 1962, on the Tanana Flats, to determine calf production in 1962 and survival of 1961 calves revealed an average of 58 calves-of-the year per 100 cows and an average of 26 yearlings (1961 calves) per 100 cows. The yearling-cow ratio indicates that 56 per cent of the calves born in 1961 did not survive.

Approximately 8 moose were observed for each square mile surveyed; 1,187 moose were counted on 150 square miles.

RECOMMENDATIONS

The high mortality of calves plus the observed abundance of moose indicate that a greatly increased annual harvest should be effected soon if a serious shortage of winter foodstuffs and subsequent malnutrition induced mortality are to be avoided.

The following management procedures would possibly alleviate the situation.

1. Either-sex seasons during September and November.
2. Construction of airstrips to create access.
3. Return of Ladd Airforce Gunnery and Bombing range to the Public Domain.
4. In lieu of above (3), a cooperative agreement with the U. S. Army opening all of the range considered reasonably safe to public hunting.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 3-b Title: Abundance and Composition Surveys, Interior Alaska

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

OBJECTIVES

To determine the sex and age composition of moose populations in relation to hunting and predation; to establish an index to relative abundance in areas where herd composition counts are conducted; and to determine the relative mortality and survival of moose to the yearling age.

TECHNIQUES

Aerial surveys of moose populations inhabiting a portion of the Tanana River flats, conducted immediately after calving, was estimated to be completed. The surveys consisted of a series of four flights made on June 8, 9, 11, and 12, 1962. A chartered PA-18 "150" Supercub piloted by Harace Black was used on all flights. Joe Nava observed on June 8 and 9 and the writer observed on June 11 and 12. The pilot, though experienced in low-level flight techniques used in counting game, had not assisted on spring calf-cow counts previously. The combination of an inexperienced pilot and observer are believed to have biased the sex composition and calf observations made on the June 8, 1962, flight. The biases probably resulted from a failure to observe transect widths and failure to search intensively for newborn calves. The area surveyed (Figure 1) was divided into two segments primarily to facilitate the survey efforts. Each segment required approximately four hours per survey thereby utilizing the effective fuel load of the aircraft and the period in the morning when moose are most actively feeding. With the exception of the June 9 flight, which was conducted in the evening, the flights commenced at 3:30 a.m., a period when moose are believed most active. The actual searching for moose was along and within one quarter mile of transects spaced approximately one

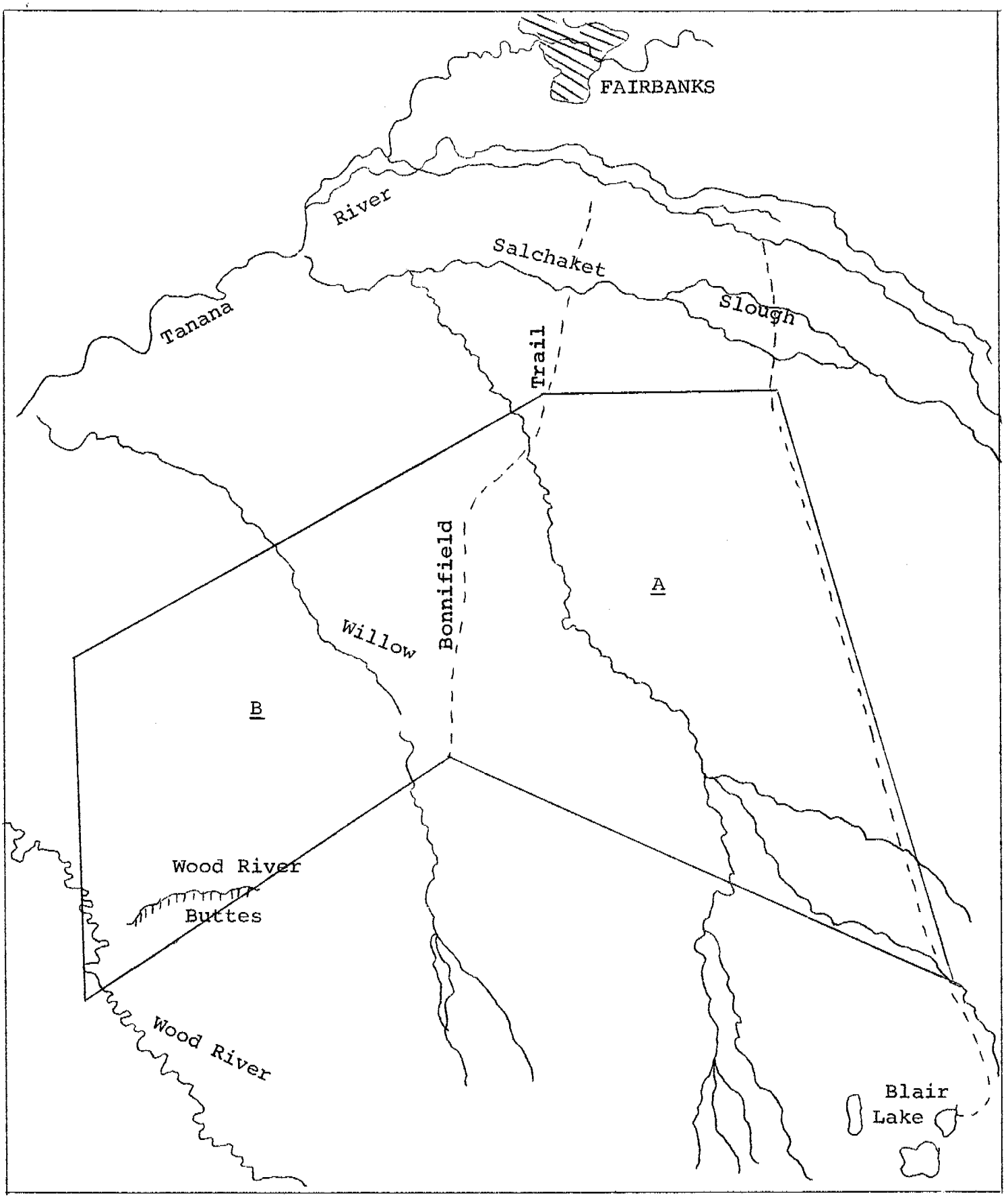

Figure 1. Segments surveyed to determine moose populations in Tanana River flats, June 1962.

mile apart. Each moose or group of moose observed was inspected to determine sex, age and presence or absence of newborn calves if the animal appeared to be an adult female. The sex and age categories recognized are as follows: males, females without calves, females with one calf, females with two calves and yearlings.

FINDINGS

Survival

Survival of calves through the first year of life is one measure of herd productivity that is useful in making management decisions, particularly when, as in moose yearlings (12 to 24 months old), animals may become legal quarry for hunters or contribute significantly to the reproductive segment of the herd. The aerial surveys conducted immediately after calving is completed, afford an opportunity to assess survival of the 1961 calves (Tables 1 and 2). Survival of calves born in 1961 as measured in this manner was not good. A computed yearling-adult female ratio of 26 yearlings per 100 females is indicated. When this computation is compared to the initial production of calves, 59 calves per 100 females in June of 1961, a loss of 56 per cent of the observed calf production is evident. The factors influencing survival are not known but are probably related to the unusual severity of the previous winter. Although snow accumulations were not particularly severe on the Tanana Flats, prolonged periods of exceptional low temperature did occur and while no great number of dead animals were observed during the June surveys, an unusual number of animals succumbed to malnutrition and associated causes in the vicinity of Fairbanks and Eielson Air Force Base, both of which abut the areas surveyed. Predation inflicted by the few wolves and black bear is not considered an important factor in the relatively poor survival of the 1961 calves.

Production of Calves

The production of calves is 58 calves per 100 females, nearly identical to the figure derived in 1961. While the production has been consistent for the Tanana Flats, the observed initial production of calves here is considerably lower than that for certain South-central ranges. The apparent lower production on the Interior ranges is not verified by in utero examinations nor by fall sex and age composition counts. There is a possibility that the spring counts sample disproportionately of the male and non-productive female segment. This supposition is advanced under discussion.

Abundance

A minimum population of 1,187 moose was observed on areas A and B (Figure 1). The area contains approximately 150 square miles suggesting an observed population of 8 moose per square mile.

DISCUSSION

The problems attendant to making and interpreting aerial composition counts of moose are many and have been discussed in previous progress reports by Scott (1955), Rausch (1956, 1958, 1959) and Bentley (1961). The technique provides an opportunity to obtain a large sample quickly; samples that could not be obtained with other techniques. Once the problem of bias and standardizing data gathering have been solved, the technique should provide an estimate of initial production, sex and age composition, the effects of hunting, winter-induced mortality, predation and other facets of population dynamics. Parturition counts are beset with an unusual number of variables probably differing from one area to another. One of these has become apparent on the Tanana Flats. Male moose are consistently over-represented in the counts made in the spring, reference the 1960 and 1961 segment reports. In addition, non-producing females, believed to be largely two-year olds, associate with the pods of males thereby causing them to also be represented disproportionately in the sample. The problem seemingly did not exist in Southcentral Alaska where the male proportion of the population is exceedingly small. Apparently, the non-breeding females were dispersed randomly throughout the calving area. However, even if the sample is biased it does not affect year to year comparison of counts made on the same area, at the same time and in the same manner. But, the possibility of one non-producing segment of the population being disproportionately represented does cast doubt on the validity of making unweighted comparisons of summer, fall and winter counts. Fortunately, most past counts were recorded by individual sightings, i.e. if one moose was sighted, it constituted one observation. Conversely, if a compact group was sighted, it constituted one observation; thus the records can be analyzed to determine the validity of the presumed bias.

SUBMITTED BY:

Robert A. Rausch
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James W. Brooks
Director, Division of Game

Table 1. Summary of moose survival and production surveys, June 1962.

Date	Total ♂♂	Total ♀♀	♀/0 Calf	♀/1 Calf	♀/2 Calf	♀/? Calf	Yearlings (12 mo. old)	Singleton Newborn Calves	Twin Newborn Calves	Total Parturitions	Total Moose	Flying Time	Moose Per Hour
June 8	252	174	117	44	1	12	28	44	2	45	500	4 hr 24 m	113.6
June 9	113	103	48	47	3	5	27	47	6	50	296	4 hr 40 m	63.5
June 11	172	182	72	90	7	13	48	90	14	97	506	4 hr 0 m	126.5
June 12	208	213	75	96	15	27	54	96	30	111	601	4 hr 20 m	138.7
June 11 & 12	380	395	147	186	22	40	102	186	44	208	1,107	8 hr 20 m	132.8

Table 2. Analysis of moose survival and production surveys, June 1962.

Date: June 8	June 9	June 11	June 12	June 11 & 12	
145	110	94.5	97.6	96.2	♂/100 ♀'s (adults)
59	52.3	48.5	49.4	49.0	% ♂'s in sample
117	48	72	75	147	♀'s w/o calves
67	46.6	39.5	35.2	37.2	% ♀'s w/o calves
44	47	90	96	186	♀/1 calf
25	45.6	49.4	45.0	47	% ♀/1 calf
1	3	7	15	22	♀/2 calves
.6	3	3.8	7.0	5.5	% ♀/2 calves
12	5	13	27	40	♀/? calves
7	4.8	7.1	12.6	10.1	% ♀/? calves
26.4	51.4	57.1	59.1	58.2	Calves/100 ♀'s observed
2.2	6.0	7.2	13.5	10.5	Twin Calves/100 ♀'s/calves
9.2	17.8	20.5	20.9	20.7	% calves in sample
16.0	26.2	26.3	25.3	25.8	Yearlings/100 ♀'s
				59.0*	Calves/100 ♀'s 1961
				39	Estimated % survival 1961 calves to 1 yr.
6.1	11.1	12	11.3	11.6	% yearlings in sample excluding calves
25.9	48.5	53.2	52.1	52.6	Observed parturitions/ 100 ♀'s
28.3	54.0	61.5	67.7	64.7	Calves/100 females excluding ?/♀
500	296	506	601	1,107	Sample Size

* Estimated by combining June 9 and 16, 1961, flights.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State:	Alaska		
Project No:	W-6-R-3	Name:	Alaska Wildlife Investigations
Work Plan:	B	Title:	Moose Investigations
Job No:	3-d	Title:	Characteristics of the Hunter Harvest, Interior Alaska

PERIOD COVERED: August 15, 1961 to March 30, 1962

ABSTRACT

Approximately 3,000 moose were taken by hunters in the Interior-Arctic region. An increased checking station effort resulted in contact with 1,924 hunters who utilized the Taylor, Steese or Elliott Highway Systems.

Hunter success along the Steese and Elliott Highways increased from 5.7 per cent in 1960 to 16 per cent in 1961.

No change was noted in the chronology or distribution of the kill from that reported by Bentley, 1960. Utilization of moose by certain villages was calculated. The reported sex composition of the harvest is considered accurate only from those areas where either-sex harvests are legal.

RECOMMENDATIONS

The reliability of the information obtained from the villages would be increased by the initiation of an antlerless moose season in the outlying areas. A harvest ticket to be filled out and mailed to the Department by all moose hunters would provide more accurate harvest information.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: B Title: Moose Investigations

Job No: 3-d Title: Characteristics of the Hunter Harvest, Interior Alaska

PERIOD COVERED: August 15 1961 to March 30, 1962

OBJECTIVES

To obtain information indicative of the total hunter kill, areas hunted, age composition of the kill, hunter success, and the chronological distribution of the kill.

TECHNIQUES

Data relative to the harvest of moose in Interior Alaska were obtained through the use of checking stations, post-season interviews, registration hunts and estimation.

FINDINGS

Information obtained from the Steese-Elliott and Taylor Highway checking stations is presented in Table 1. The number of hunters contacted at checking stations increased by 58 per cent over 1960. This increase was due primarily to a more intensive checking station operation on the Steese-Elliott Highways and to an unexplained influx of hunters to the Taylor Highway area.

In 1961, 14 per cent of the hunters contacted at checking stations took moose. The percentage of success was nearly identical to that of 1960 at the Taylor Highway station, but success along the Steese and Elliott Highways was greatly increased over that of 1960, being 5.7 and 16 per cent, respectively. The increased success probably reflects the efficiency of the checking station operation and the favorable weather conditions which prevailed during the latter portion of the season.

Neither the chronology of the kill nor distribution of the kill differed from that reported by Bentley (1960). The kill increases in mid-September concurrent with the onset of breeding activities when the male moose are actively seeking females and are seemingly impervious to other stimuli, and when the deciduous trees are shedding leaves making observations easier.

Village Interview Survey

Interviews to determine annual utilization of moose were conducted in selected villages (Table 2). The reported number of moose used by each village is believed to be reasonably accurate; however the sex composition of the harvest is considered accurate only for those areas where either-sex regulations are in effect. The attitude of the village toward the Department and law enforcement in general may also influence the accuracy of the total reported take. Estimates were made for those villages not surveyed in 1960. The estimates were based on results of past surveys, personal knowledge of the abundance of moose and the number of families in each village. If moose are readily available, families residing in Interior Alaska villages use two to five moose per year.

The estimates for the Fairbanks and Delta Junction areas are pure "guesswork."

Antlerless-Permit Hunt

The first legal hunt for antlerless moose in Interior Alaska was conducted from December 1-10, 1961, on the Tanana flats directly across the Tanana River from Fairbanks. One hundred and fifty permits were issued, lottery style, to 425 applicants. One hundred of the 150 permittees actually hunted and 31 were successful. Inclement weather, temperatures ranging to a -40° F, and lack of access were directly responsible for low success. The area has no roads and hunters can gain access only with aircraft, tracked vehicles or dog teams. With the present access of the area, seasons and bag limits will have little effect on the utilization of the moose population.

The hunt did provide another benefit in that it represents the first time military authorities have permitted public entry to the area for recreational purposes.

DISCUSSION

The present systems for gathering information relative to the harvest of moose in Interior Alaska are imperfect and at best provide

a minimum estimate of the annual utilization of the most important ungulate in Interior Alaska. As the intensity of recreational and subsistence uses increase, probably in direct proportion to the increases in human populations and to the creation of access to moose populations, more refined estimates of annual harvest must be instigated.

If regulations providing for the harvest of animals of either sex are promulgated for more management units, and they should be, and if harvests in local accessible areas equal the annual increment to the herd, and they will, then techniques that will reveal the impact of the regulations and increased harvests should be employed. The most obvious apparent solution to obtaining adequate data on harvest would be to employ a "harvest ticket."

SUBMITTED BY:

Robert A. Rausch
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James W. Brooks
Director, Division of Game

Table 1. Checking station results, Interior Alaska, 1961.

Station	No. of Hunters	No. of Moose	% Successful Hunters
Steese-Elliott	1,033	164	16
Taylor	891	121	14
Totals	1,924	285	15

Table 2. Village interviews and estimates, 1962.

Game Management Unit 18

Village	Number of Moose	
Chevak	3	
Goodnews Bay	5	
Nyac	4	
Platinum	1	
Tintutuliak	4	
Bethel	47	(Some from Unit 19)
Akiak	5	
Tuluksak	9	
Kwiguk	2	
Hamilton	2	
Mt. Village	37	
Fortuna Lodge and Marshall	14	
Russian Mission	10	
Total	143	

Table 2 continued.

Game Management Unit 19

Village	Number of Moose
Lower Kalskag	8
Aniak	14
Little Russian Mission	1
Crooked Creek	12
Sleetmute	6
Red Devil	7
Stony River and Lime Village	25
Tatalina	2
McGrath, Medfra, Nikali	32 (50) Some taken in Unit 21
Total	107 - 125

Game Managment Unit 20*

Village	Number of Moose	
	Male	Female
Fairbanks area (Eielson AFB College Ft. Wainwright North Pole)	750	31
Nenana	100	
Healy (Railbelt area)	50	
Delta Junction (Ft. Greely)	400	
Dot Lake	25	
Tanacross	25	
Tok	75	
Total	1,425	31

* Harvest figures are estimates for these villages and units.

Table 2 continued.

Game Management Unit 21

Village	Number of Moose Male	Female
Napakuk	3	
Aniak	11	
Tatalina	2	
Alakanuk	2	
Holy Cross	14 (45)	
Anvik	24	
Shageluk	22	
Holikochuk	20 (based on 1960 material)	
Ruby	75*	
Galena	75*	
Tanana	125*	
Manly Hot Springs	25*	
Rampart	30*	
Lake Minchumina	30*	
Kaltag	50*	
Flat	10*	
Nulato	20	20
Total	558-589	20

Game Management Unit 22*

Village	Number of Moose Male	Female
Nome	10-15	-
Unalakleet	20-25	-
Other Villages Combined	30-35	-
Total	60-75	

Table 2 continued.

Game Management Unit 23

Village	Number of Moose	
	Male	Female
Kotzebue	25	?
Shungnak	7	-
Kiana	12	-
Noorvik	10	?
Kobuk	9	-
Ambler	12	-
Selawik Village area	15	1/2 of total
Noatak Village area	15	
Total	105	?

Game Management Unit 24

Village	Number of Moose	
	Male	Female
Bettles	25	-
Wiseman	5	-
Allakaket - Alatna	40	6
Hughes	15	(?)
Huslia	60	15
Koyukuk	33	15
Utopia	1	-
Wild Lake	4	-
Anaktuvuk Pass	1	-
Total	184-220	36

Table 2 continued.

Game Management Unit 25*

Village	Number of Moose	
	Male	Female
Fort Yukon	50 -	50
Arctic Village	5 -	5
Chalkytsik	15 -	15
Birch Creek	20 -	20
Eagle	10 -	5
Circle	25 -	15
Central	20 -	
Circle Hot Springs	5 -	
Beaver	25 -	15
Venetie	10 -	10
Stevens Village	15 -	15
Subtotal	200 -	150
Total	350	

Table 3. Total harvest of moose by unit.

Unit	Male	Female	Unit	Male	Female
18	143	?	22	60 (75)	?
19	107 (125)	?	23	105	?
20*	139	31	24	184	36
21*	558 (589)	20?	25	200	150?
Sub Total	2,751 (2,825)	Males			
	237?	Females			
Total	2,988 - 3,062				

* Harvest figures for Unit 20 reflect take by people of Fairbanks and Delta Junction areas - they hunted primarily in Units 12, 13, 20, 21 and 25.

APPENDIX I

Game Checked - Taylor Highway, 1961

Moose	121
Caribou	22
Black bear	8
Snowshoe hares	37
Spruce grouse	180
Ptarmigan	39
Ducks	8
Little brown crane	1
Number of hunters	891*
Hunter success	13.6%
Total man-days of hunting for moose	1,834
Number of hunter-days per hunter	2.1
Number of hunter-days per moose	15

* 20 estimated before August 26

APPENDIX 2

Game Checked - Steese-Elliott Highways, 1961

Moose	164
Caribou	40
Black bear	25
Wolf	6
Coyote	1
Snowshoe hares	344
Squirrel	1
Grouse	987
Ptarmigan	233
Ducks	54
Geese	4
Number of hunters	1,033
Hunter success	16%
Total man-days of hunting	2,216
Number of hunter-days per hunter	2.1
Number of hunter-days per moose	13.5