ALASKA DEPARTMENT OF FISH & GAME

1959-60 Pittman-Robertson Project Report

DIVISION OF GAME **VOLUME I**

Juneau, Alaska

Wise management of polar bears is pertinent if this resource is to remain a renewable one. The value of the annual harvest by resident and non-resident sport hunters totals approximately $300,000.

Ageing moose jaws turned into the Dept. of Fish & Game by hunters is one of the methods used to determine herd composition for future hunting regulations.

A sample plot is utilized to evaluate the potential forage available per unit area for an increasing caribou herd.

A calf moose-tagging program was undertaken in the Anchorage-Palmer area with the assistance of military helicopters.

Volume 1 1959-1960

STATE OF ALASKA

William A. Egan, Governor

Alaska Department of Fish and Game

Clarence L. Anderson, Commissioner

Division of Game

James W. Brooks, Director

ANNUAL REPORT OF PROGRESS, 1959-1960

FEDERAL AID IN WILDLIFE RESTORATION PROJECT W-6-R-1

ALASKA WILDLIFE INVESTIGATIONS

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INTRODUCTION

This report of progress consists of Job Completion Reports on investigations conducted under the State of Alaska's Federal Aid in Wildlife Restoration Project W-6-R-1.

In 1959 the Alaska Department of Fish and Game became eligible for participation in the Federal Aid in Wildlife Restoration program. Prior to this time, under Territorial status, the program was a function of the U. S. Fish and Wildlife Service.

The new State program under the Pittman-Robertson Act was activated July 1, 1959, and a considerably larger operation was possible than under the Federal government. Seventy separate jobs, included under twelve work plans, made up the "Alaska Wildlife Investigations Project." These include studies of all of the major big game species (deer, moose, caribou, elk, mountain sheep, mountain goat, brown bear, polar bear, and walrus), as well as studies of fur bearers, snowshoe hares, seals, sea otters, and game birds.

Presently the most pressing needs of wildlife management in Alaska are for basic information of productivity, welfare, and harvest of our game populations upon which sound management programs can be based. Consequently the major effort of the Federal Aid in Wildlife Restoration work in Alaska is directed toward investigational studies designed to yield the vital statistics of our game populations. Alaska's many unique wildlife forms pose problems in the understanding of their biology which are not met in other areas of North America.

These first reports are limited in scope because of the problems of personnel recruitment and project initiation which accompanied the period of transition from Federal to State jurisdiction and limited the work accomplished.

The enclosed reports are incomplete in many respects and interpretations contained therein are subject to re-evaluation as the work progresses.

ANNUAL REPORT OF PROGRESS

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Volume 1 Report No. A-1a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 1a Title: Determination of Population Levels, Structures and Trends

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Age composition of the kill, hunter success, browse utilization and climatic conditions all indicate the deer populations of Southeast Alaska are continuing to increase. Productivity remains high while the total harvest is relatively low, showing little impact on the age structure of the total population. A conservative estimate of the present deer population in Southeast Alaska is 125,000 animals.

Objectives:

To determine current population levels, structures and trends of deer in Southeast Alaska.

Findings:

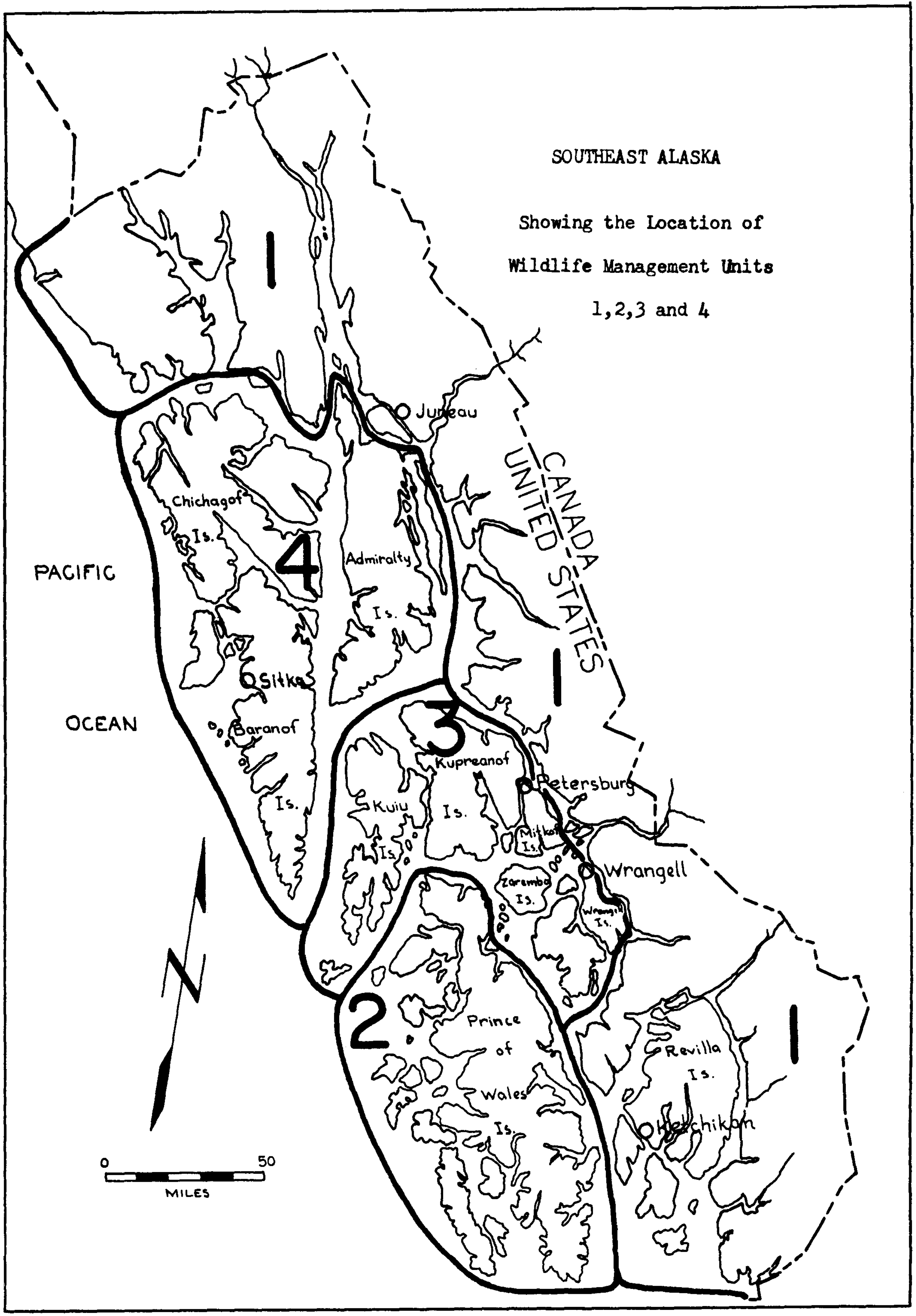
The deer population in Southeast Alaska has been increasing steadily since 1954. An accurate estimate of the total population is impossible, but is considered to be in excess of 125,000 animals. For three consecutive years, 1957-1959, winters have been very mild and consequently winter mortality has been light. Excellent summer range conditions, coupled with mild winters, are reflected by a higher productivity as shown by an increased proportion of young animals in the fall harvest.

Sex ratios in the kill show that about 76 percent of the animals taken are bucks. This indicates that bucks are easily obtainable and are usually preferred to does. The 1959 harvest contained 48 percent animals 3-1/2 years of age and older. This high proportion of older animals in the harvest indicates an under-harvest for, in a herd in which the annual increment is being cropped, most of the young animals are taken before reaching the older age classes.

The hunter harvest for 1959 was an estimated 11,000 animals, compared to 13,000 in 1958. Hunter success was slightly lower than in 1958, but still averaged 74 percent for all of Southeast Alaska. Nineteen percent of the hunters took their limit of four deer. The lower kill in 1959 than in 1958 was attributed to mild weather conditions which enabled deer to remain at higher than normal elevations throughout most of the hunting season. The average hunter killed 1.8 deer in 6.1 days of hunting, averaging a deer for each 3.6 days in the field. Sixty-four percent of the kill was made in muskeg and low timbered areas.

Range utilization throughout Southeast Alaska was fairly high, averaging 66 percent in 1959, in spite of a relatively mild winter. In Southeast Alaska, winter range is very critical and even moderate snowfalls may cause heavy utilization along the beach fringe. Heavy utilization usually coincides with greater than average fawn losses which show up in the lower proportion of 1-1/2 year age animals in the following fall harvest.

In summation, excellent hunting was enjoyed by most hunters throughout Southeast Alaska in 1959. The annual increment of the deer population is much larger than the annual harvest. Browse species utilized on winter range show fairly heavy utilization in spite of mild winters. The age composition of the kill shows a high proportion of older age animals, an indication of an under-harvest. A renewed vigor in productivity is indicated by the increased proportion of young animals in the harvest. There is no question that Southeast Alaska has a surplus of deer which should be utilized to the fullest extent possible.


SOUTHEAST ALASKA
Showing the Location of
Wildlife Management Units
1,2,3 and 4
PACIFIC
OCEAN
Juneau
CANADA
UNITED STATES
Chichagof
Is.
4
Admiralty
Is.
Sitka
Baranof
Is.
1
3
Kupreanof
Is.
Petersburg
Kuiu
Is.
Mitkof
Is.
Wrangell
Zarembo
Is.
Wrangell
Is.
2
Prince
of
Wales
Is.
Revilla
Is.
Ketchikan
1
0
50
MILES

Submitted by:

Harry Merriam
Research Biologist
30 June 1960

Approved by:

Sigurd T. Olson
P-R Coordinator

James W. Brooks, Director
Division of Game

Volume 1 | Report No. A-lb

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 | Name: Game Investigations of Alaska

Work Plan: A | Sitka Black-Tailed Deer Studies

Job No: 1b | Title: Abundance and Composition Surveys

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Limited deer composition counts were conducted in Southeast Alaska during the fall and winter months of 1959-1960. Winter beach counts reflected the mild weather conditions rather than deer population trends. Large local and seasonal variations were observed in fawn-adult ratios. Mild winter weather precluded the use of aerial beach surveys. The estimated total deer population for Southeast Alaska is in excess of 125,000 animals.

Objectives:

To determine population abundance and sex and age composition of Southeast Alaska deer herds.

Techniques:

Alpine, forest and beach counts were utilized to obtain data on population composition and trends. Alpine counts were conducted before killing frosts in the late summer when deer were concentrated in the alpine areas. An observer usually spent about four hours traveling through, and scanning from vantage points, the open areas above timber line. Forest counts were made in December after the close of the regular hunting season. At this time of the year snow has forced the deer to lower levels, concentrating them in a strip between the beach and the 1,000 foot elevation level. Winter beach counts were made from a low flying aircraft, or by following the beach in a boat close enough to make observations.

Findings:

Composition Counts: Forest and aerial beach counts were found to be unsatisfactory methods of censusing deer populations in Southeast Alaska. Forest counts were made in December, long enough after the hunting season to be free of hunter influence. By this time of the year snow depths at higher altitudes have forced the deer below the 1,000 foot elevation level. In spite of an abundance of fresh tracks and pellet groups, it was difficult to observe enough deer to make this method valid. Aerial beach counts rely, to a large extent, on deep snow conditions which force the deer to open beaches. To be effective, deep snow must be experienced from year to year, a situation which has been conspicuously absent in Southeast Alaska for several years.

Three late summer alpine counts were made in the Petersburg district during which 203 deer were observed. The fawn-adult ratio was 16 fawns per 100 adults. As bucks tend to concentrate in the high country during the summer and fall months, this observed fawn-adult ratio is quite likely much lower than that of the total deer population. Alpine counts appear to have definite merits for use in Southeast Alaska where, because of the dense forest cover, it is difficult under the best conditions to observe deer. The results of the late summer alpine counts are summarized in Table 1.

Table 2 summarizes beach counts made from boats in Wrangell Narrows during January and in Seymore Canal during March. The fawn-adult ratio in Wrangell Narrows was 68 fawns per 100 adults while the ratio in Seymore Canal was 8 fawns per 100 adults. Browse utilization in Seymore Canal has been comparatively heavy for several years, and perhaps is being reflected by a lowered productivity in the deer herd. Insufficient beach counts were conducted to formulate definite conclusions.

Population Estimates: It is impossible to arrive at an accurate estimate of the deer population in Southeast Alaska with the data which is currently available, however, the information in hand does give an insight as to the relative abundance of deer. The total kill estimate for Southeast

Table 1. Late summer alpine deer counts, 1959.

DATE	LOCATION	FAWNS	ANTLERED	ANTLERLESS	UNIDENTIFIED	TOTALS
8/11/59	Woronkofski Is., Sunrise Peak	6	12	6	7	31
8/20/59	Kupreanof Is., Sherman Peak	12	56	34	47	149
9/20/59	Kupreanof Is., Kupreanof Mt.	3	13	7		23
	Totals	21	81	47	54	203
	Fawns per Adult - 16:100					

Table 2. Winter deer composition counts, 1960.

DATE	LOCATION	FAWNS	ADULTS	TOTALS
1/11/60	Wrangell Narrows	3	2	5
1/15/60	Wrangell Narrows	12	19	31
1/16/60	Wrangell Narrows	13	18	31
2/ 8/60	Wrangell Narrows		2	2
	Totals	28	41	69
	Fawns per Adult - 68:100			
3/14/60	Pybus Bay		27	27
3/15/60	Mole Harbor	2	9	11
3/16/60	Mole Harbor	5	45	50
3/17/60	Windfall Harbor		5	5
	Totals	7	86	93
	Fawns per Adult - 8:100			

Alaska has increased steadily from an estimated 4,600 in 1954 to 13,000 in 1958. The estimated kill for 1959 dropped to 11,000 animals. No serious winter mortalities have occured since the winter of 1955-56. For three consecutive years, 1957 to 1959, winters have been very mild, resulting in increased productivity reflected by the higher proportion of young animals in the kill. A large portion of the kill is composed of older age animals, 3-1/2 years of age and older, indicating an under-harvest. High productivity, coupled with an under-harvest, indicates an increasing herd. The estimated total population in 1958 was 123,000 animals. There is no reason to believe the population has decreased in 1959, in spite of the lower kill figure. The Washington State Game Department estimates that 10 to 12 black-tailed deer are left in the field for each buck taken. In some areas of British Columbia, it is estimated that at least 20 deer remain for each buck shot. In Southeast Alaska, where hunting pressures are much lighter than either Washington or British Columbia, it would seem safe to venture that 15 deer are left in the field for each buck taken. The estimated buck harvest in 1959 was 8,350. If 15 deer remain for each buck taken, the estimated population would be 125,250 animals. A net increase of 20 to 35 percent is usually used in calculating expected yields from average mule deer herds. Using a net increase figure of 25 percent, and starting with the minimum population figure of 4,600 deer in 1954 (the estimated kill for 1954 was 4,600), the deer herd in Southeast Alaska would contain 156,000 animals in 1960. More important than total population figures is the fact that deer herds in Southeast Alaska are being under-harvested. Under-harvest, coupled with high productivity, will inevitably lead to depletion of the range unless some artificial or natural factor intervenes. It would, therefore, be wise management to utilize as large a segment of the population as possible with the hunting pressure which is available.

Recommendations:

Aerial beach surveys and forest counts should be discontinued, except in special circumstances where these methods may be used to accomplish an immediate objective.

Fall alpine counts should be increased. Enough counts should be made in local areas to determine the usefulness of this method.

Other index methods for determining population trends should be investigated.

Fragmentary information is of little value in determining population composition and trends. It is, therefore, recommended that, until sufficient biologists are available to adequately cover Southeast Alaska, surveys be concentrated in important local areas where enough information may be obtained to determine the status of these populations.

Prepared by:

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30 June 1960

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James W. Brooks, Director
Division of Game

Volume 1 Report No. A-1c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 1c Title: Natural Mortality Surveys

Period Covered: March 1, 1960 - June 30, 1960

Abstract:

Natural mortality surveys were conducted throughout Southeast Alaska during the months of March and April. Only three cases of mortality were observed, reflecting the mild weather conditions which enabled excellent winter survival throughout the deer range.

Objectives:

To determine the sex and age composition, the extent and area-wise breakdown of the natural mortality as an index of the winter welfare of the deer herds.

Techniques:

Approximately 15 miles of beach fringe were examined for deer carcasses during late March and early April. Beach transects inspected were the same as those outlined in Federal Aid Job Completion Report, June 30, 1957, Job No. 2. Two trips were made over each transect, one about 50 to 75 feet within the beach fringe and one along the immediate edge of the beach fringe. Carcasses were examined for cause of mortality, condition, age and sex.

Findings:

Table 1 summarizes the results of the natural mortality

Table 1. Deer natural winter mortality in Southeast Alaska, 1959-60.

Locality	Sex	Age	Condition of Bone Marrow	Remarks
Helm Bay	Male	Fawn	Pink-jellatinous	Heavy infest. nasal bots and lungworms.
Wrangell Narrows	?	Fawn	Pink-jellatinous	Apparent wolf kill, fresh wolf sign at carcass.
Big John Bay	Female	1-1/2	White-solid	At high tide mark, only skeleton remained.

surveys in Southeast Alaska. Only three carcasses were observed during the entire survey. One, a male fawn found in Helm Bay, was heavily infested by both nasal bots (Cephenemyia jellisonia)* and lungworms (Dictyocaulus filaria)*. Sixty-one nasal bots were counted in the pharyngeal pouches, trachea and bronchial passages. The lungs showed evidence of severe hemorrhaging. Mild weather conditions permitted the deer to range over large areas resulting in a wide dispersal of the carcasses, whereas, during severe winters carcasses are concentrated along the beach fringe. Mortality, therefore, during a mild winter may be much higher than the beach surveys indicate.

Recommendations:

Natural mortality surveys should be continued.

*Species subject to confirmation.

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30 June 1960

Approved by:

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James W. Brooks, Director
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Volume 1 Project No: A-1d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 1d Title: Characteristics of Hunter Harvest

Period Covered: August 20, 1959 - March 31, 1960

Abstract:

In 1959 the regular deer hunting season in Southeast Alaska was open for 103 consecutive days, extending from August 20 to November 30. The last 47 days of the season, from October 15 to November 30, were open to animals of either sex. The bag limits were four deer of either sex except in Game Management Units 1 and 5 where the limit was four bucks or three bucks and one doe. Hunter success averaged 74 percent for all Southeast Alaska, ranging from 59 percent in Sitka to 89 percent in Petersburg. The largest portion of the deer were killed in the low timbered areas below an elevation of 1,000 feet. The total estimated hunter harvest was 11,000 animals, of which the female segment was 24 percent. Ninety-one percent of the total harvest was obtained during the last six weeks of the season. The 2-1/2 year age class comprised the largest portion of the male kill, while the 1-1/2 year age class was the greatest in the female kill. The average dressed weight for male deer, including all age classes, was 100 pounds, while that of females was 68 pounds.

Objectives:

To secure information relative to the total deer kill, area and chronological distribution of the kill, and hunter success, and to determine and evaluate the sex and age composition and physical characteristics of the deer harvested.

Techniques:

Hunter success surveys were conducted in Sitka, Juneau, Petersburg, Wrangell and Ketchikan following the regular hunting season. Each of the 425 hunters contacted was asked the number of deer killed, number of days hunted, sex, date and location of kill and the number of deer observed while hunting. Age classes, determined by tooth wear, were obtained from a sample of 284 jaws collected from hunters. Information including date, locality, dressed weight, chest girth and hind foot measurements, was obtained from vaious members of the Department and from cooperating organizations. The 1959 hunting season fell during the transitional period from Federal to State control of the game resources in Alaska and few men of either organization were able to be in the field to aid in jaw collection. Consequently the total number of jaws collected was quite low. Dressed weights were taken from evicerated animals with feet, head and hide attached. Chest girth measurements were taken immediately behind the forelegs with the chest cavity closed. Hind foot measurements were taken from the tip of the hoofs to the proximal end of the calcaneus.

Findings:

Hunter Success: The results of the post-season hunter interveiws are presented in Table 1. Hunters in Southeast Alaska averaged 1.8 deer per hunter, with an average hunter success of 74 percent. A high success of 89 percent was enjoyed by Petersburg hunters, while Sitka showed a low of 59 percent. Success by hunters in 1959 was about 10 percent lower than in 1958, but about the same as in 1956 and 1957. The average hunter spent 6.1 days in the field, averaging a deer for each 3.6 days hunted. The average number of deer seen while hunting was 13 animals for all of Southeast Alaska with a high of 17 by Petersburg hunters and a low of 10 by Juneau hunters. Although hunter success was lower in Wrangell than Petersburg, 30 percent of Wrangell hunters obtained limits of four deer compared to 24 percent in Petersburg. In spite of the fact that the largest number of deer were found at a higher elevation, the largest proportion of kills were made in the low timbered areas. The distribution of hunting pressure for each major town is shown in Table 2.

Table 1. The deer hunter success for 1958 and 1959 - Southeastern Alaska.

	Juneau		Sitka		Petersburg		Wrangell		Ketchikan		All Alaska	
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
Hunter Success	72%	65%	79%	59%	93%	89%	92%	80%	89%	76%	74%	84%
Ave. No. Deer per Hunter	1.3	1.9	1.2	2.2	2.4	2.8	2.2	3.1	1.8	2.3	1.8	2.1
Percent Kill of Does	18%	27%	27%	35%	24%	19%	33%	39%	16%	14%	24%	29%
Ave. No. Days Hunted	5.1	5.2	6.1	5.8	7.9	7.5	6.4	5.9	6.1	6.7	6.1	6.2
Ave. No. Days per Deer	3.8	2.7	5.0	2.7	3.3	2.7	2.9	1.9	2.9	2.9	3.6	2.6
No. Deer per Hunter												
None	35%	41	41%		11%		20%		24%		26%	
One	30%		24%		15%		10%		21%		20%	
Two	14%		17%		24%		28%		24%		21%	
Three	9%		6%		26%		12%		16%		14%	
Four	12%		12%		24%		30%		15%		19%	
Ave. No. Deer Seen per hunter while hunting	10		11		17		16		10		13	
Location of Kill												
Alpine	24%		15%		7%		5%		4%		11%	
High Timber	11%		24%		18%		23%		8%		17%	
Low Timber	48%		37%		35%		23%		43%		37%	
Muskeg	15%		14%		32%		37%		34%		26%	
Beach	2%		10%		8%		12%		11%		9%	
Percent New Hunters	22%	30%	20%	40%	14%	26%	20%	24%	28%	15%	21%	27%
Sample Size	100	100	75	75	100	100	50	50	100	104	425	429

Total Estimated Kill: 1958 - 13,000
1959 - 11,000

Table 2. Distribution of 1959 hunter harvest - Southeastern Alaska.

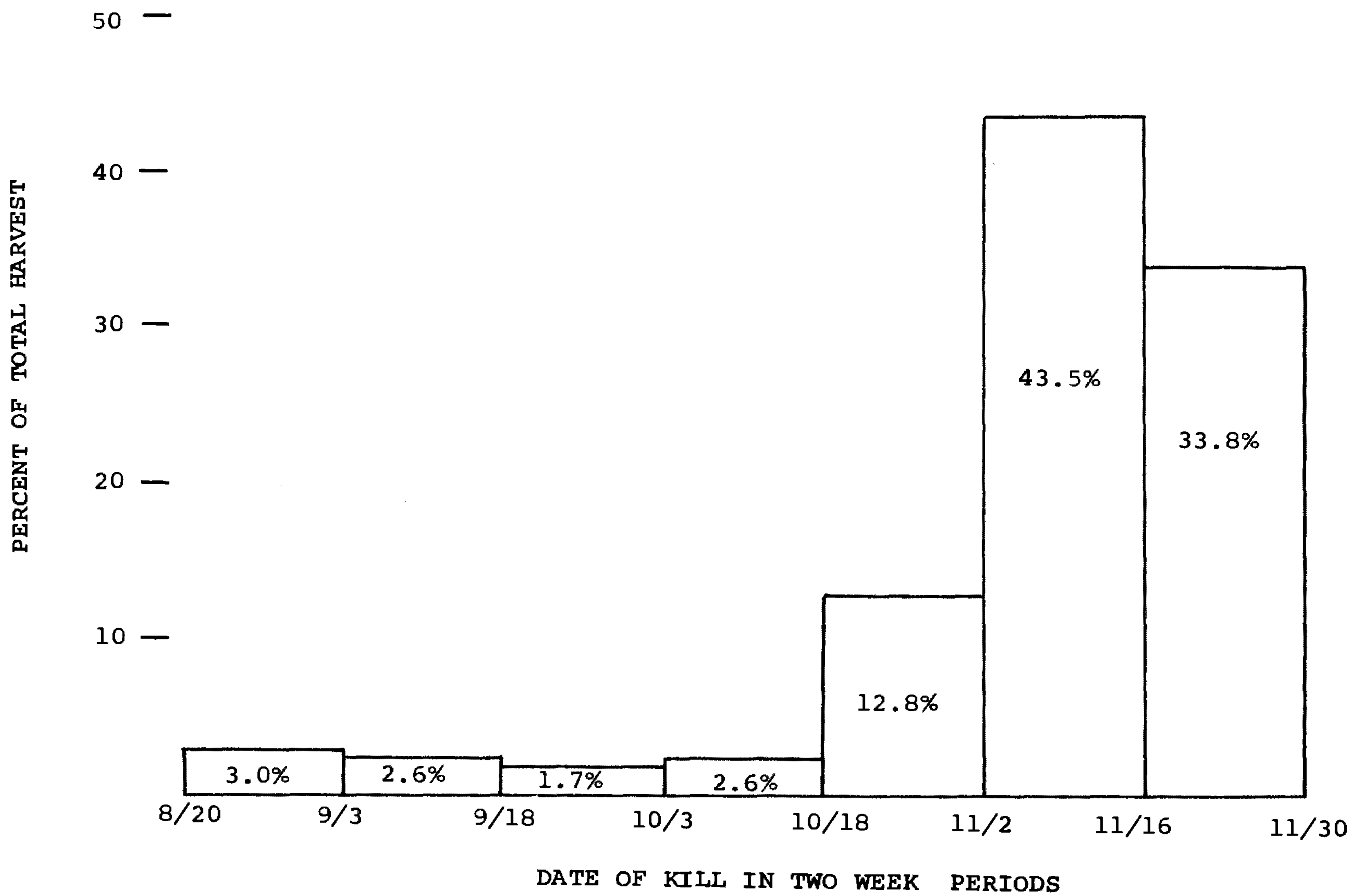
Location of Kill	Kill in Percent for Hunters from Each Town				
	Juneau	Sitka	Petersburg	Wrangell	Ketchikan
Management Unit No. 1					
No. of Cape Fanshaw					
Mainland	12				
Douglas Island	9	1			
So. of Cape Fanshaw					
Mainland			4		
Cleveland Penn.					15
Revilla Is.	1			1	40
Gravina Is.					8
Grant Is.					1
Bell Is.					2
Bold Is.					1
Ruth Is.			1		
Total in Unit No. 1	22	1	5	1	67
Management Unit No. 2					
Prince of Wales Is.				3	18
Kosciuske Is.		4			2
Total in Unit No. 2		4		3	20
Management Unit No. 3					
Kupreanof Is.	12		61	5	3
Mitkof Is.	3		29		
Kuiu Is.				2	4
Level Is.	1				
Etolin Is.			1	27	3
Wrangell Is.				18	
Zarembo Is.				19	
Woronkofski Is.				17	
Vank Is.				7	
Stone & Onslow Is.			1	1	2
Keene Is.					
Woewodski Is.			1		
Total in Unit No. 3	16		93	96	12
Management Unit No. 4					
No. Admiralty Is.	35	2			
So. Admiralty Is.	10		2		1
Chichagof Is.	15	12			
No. Baranof Is.		48			
So. Baranof Is.		22			
Pleasant Is.	2				
Halleck Is.		5			
Kruzof Is.		2			
Krestof Is.		2			
Moser Is.		2			
Total in Unit No. 4	62	95	2		1

It is quite unlikely that the deer population has decreased below that of 1958, as the winter of 1958-59 was mild and the winter mortality light. The decreased harvest in 1959 was therefore probably due to factors other than the numbers of deer potentially available. The largest portion of deer harvest in Southeast Alaska is usually obtained during the last two weeks of the season, however, in 1959 the kill during this period was only 34 percent of the harvest as compared to 43 percent in 1958. Most hunters attributed poorer success to the extremely mild weather conditions which persisted throughout the hunting season, allowing deer to remain at higher elevations than normal and to be dispersed over large areas. Coupled with mild temperatures were windy conditions during the last two weeks of the season which discouraged traveling by small boats at the time when hunting pressure is usually the greatest.

Estimate of Hunter Harvest: The estimated deer harvest for 1959 is 11,000 animals. This was arrived at by multiplying the average deer per hunter by the number of hunting licenses sold. (Six thousand one hundred and sixty three hunting licenses were sold in Southeast Alaska in 1959.) It is realized that there are some license buyers who do not hunt deer, but unfortunately this information is not available at present. The illegal kill is also unknown and it is quite possible that these two variables will about balance each other. The 1958 estimated legal hunter harvest was 13,000 animals. If this figure is adjusted by the change in average number of deer per hunter, a harvest of 10,200 is obtained. However, the 1958 figure was obtained by adjusting estimates of previous years which were origionally based on an estimate arrived at in 1956 by a hunter questionnaire. As the validity of the hunter questionnaire is dubious, as well as recent changes in the nonlicensed kill by the requirement of Indians to purchase hunting licenses, it is felt that the best approach is to base the kill on the known data available, namely license sales and the average number of deer killed per hunter. These figures can be adjusted as more information is acquired.

Chronological Distribution of the Kill: The chronological distribution of male deer killed in Southeast Alaska in 1959 is shown in Figure 1. The trend is similar to preceding years, showing a very light harvest during the first eight weeks and increasing rapidly toward the end of the season.

Figure 1. Chronological distribution of the male deer in the 1959 hunter harvest in Southeastern Alaska.



Ninety-one percent of the total harvest was obtained during the last six weeks of the 14-week season. Contrary to normal circumstances, the final two weeks of the season showed a smaller kill than the two weeks immediately preceding. This was probably due to the abnormal weather conditions previously discussed. The chronological distribution curve for 1959 follows closely to that of 1957 when similar weather conditions prevailed.

Sex Ratio of the Kill: The sex ratio of the 1959 kill, obtained from hunter success surveys, was 76 percent bucks compared to 71 percent in 1958 and 74 percent in 1957. There is no indication that the sex structure of the population has changed significantly. Most Southeast Alaskan hunters prefer to take bucks, even during the rut when does are in much the better condition. It is unlikely that the percent of does taken in the harvest can be materially increased without instigating a special antlerless season.

Male Age Distribution: The male age distribution for deer taken in Southeast Alaska in 1959 is shown in Table 3. Comparison of age classes represented in the 1959 harvest and previous years is presented in Figures 2 and 3. Figure 4 shows the age distribution for male deer taken in Management Units 1, 3 and 4. The sample of jaws from other areas of Southeast Alaska was too small to be significant.

Age distribution in the 1959 hunter harvest shows three major items of significance:

1. A lower proportion of 1-1/2 year age animals than in 1958.

2. A high proportion of 2-1/2 year age animals.

3. A continued high percentage of older animals (3-1/2 years of age and older) in the harvest.

In 1959, the 1-1/2 year age class comprised 17 percent of the harvest, compared to 30 percent in 1958. The lower proportion of 1-1/2 year age animals in 1959 than in 1958 is probably due to fawn losses during the winter of 1958-59. This winter, though generally considered very mild, had, for a period of two to three weeks, some snow accumulation during the month of February. Even though this period was of short

Table 3. Age groups by percent of male deer represented in the 1959 legal harvest.

	AGE IN YEARS						Sample
	Fawn	1-1/2	2-1/2	3-1/2	4-1/2	5-1/2	Size
Management Unit No. 1	6	6	31	20	31	6	16
Management Unit No. 3							
Mitkof Is.		30	30		30	10	7
Lindenberg Penn.		12	27	36	21	4	33
Wrangell Narrosw		21	31	24	21	3	29
Other Kup. & Kuiu Is.	3	25	28	16	19	9	32
Other Unit No. 3							
Total for Unit No. 3	1	21	30	23	20	5	117
Management Unit No. 4							
So. Admiralty Is.	8	11	30	8	28	5	39
No. Admiralty Is.	6	18	29	6	12	29	17
Other Unit No. 4		5	33	33	16	13	39
Total for Unit No. 4	4	10	36	18	20	12	95
Total for All Southeast	3	17	32	20	20	8	228

Table 4. Age groups by percent of female deer represented in the 1959 legal harvest.

	AGE IN YEARS						Sample
	Fawn	1-1/2	2-1/2	3-1/2	4-1/2	5-1/2	Size
Management Unit No. 1		40	20		40		5
Management Unit No. 3		44	12	22			18
Management Unit No. 4	7	14	27	21	28	3	29
Total for All Southeast	4	27	21	19	23	6	52

Figure 2. Age distribution of male deer harvested in Southeastern Alaska, 1953-1959.

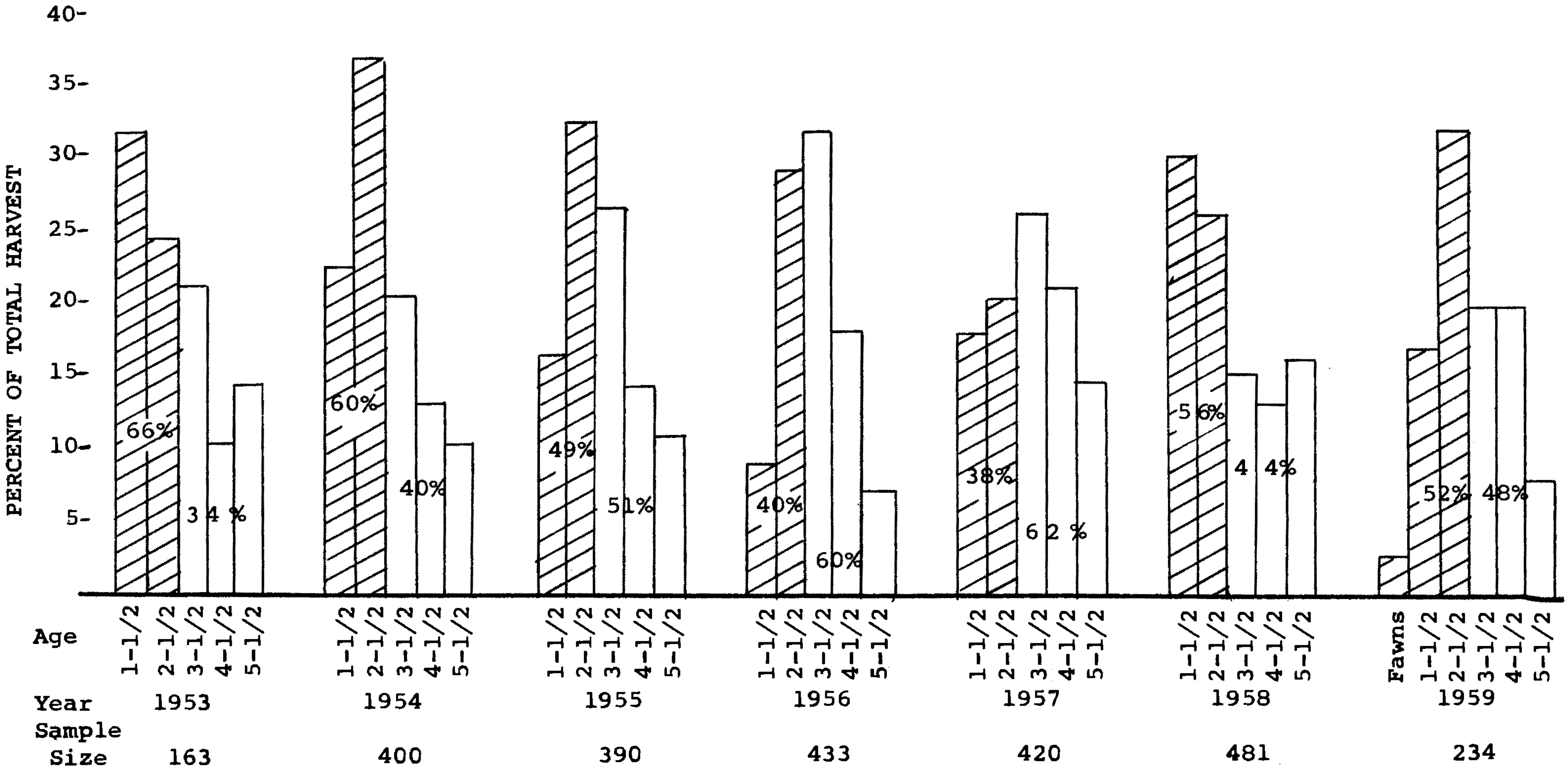


Figure 3. Trends in age classes of male deer harvest, Southeastern Alaska, 1953-1959.

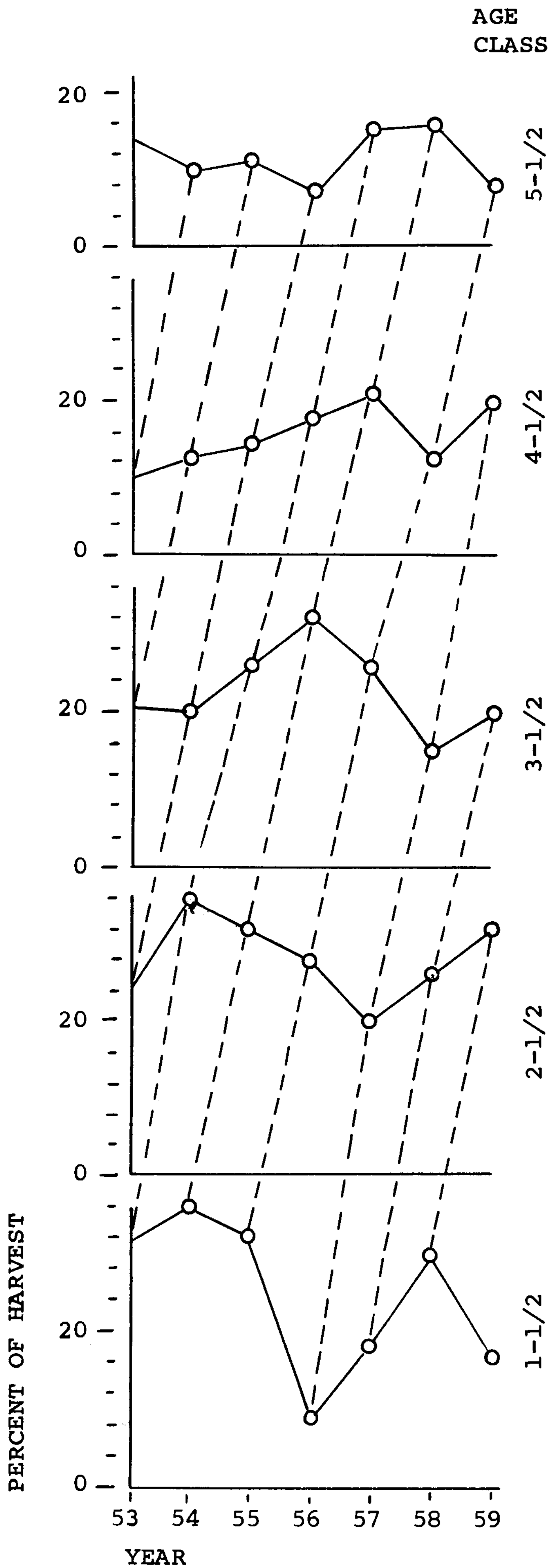
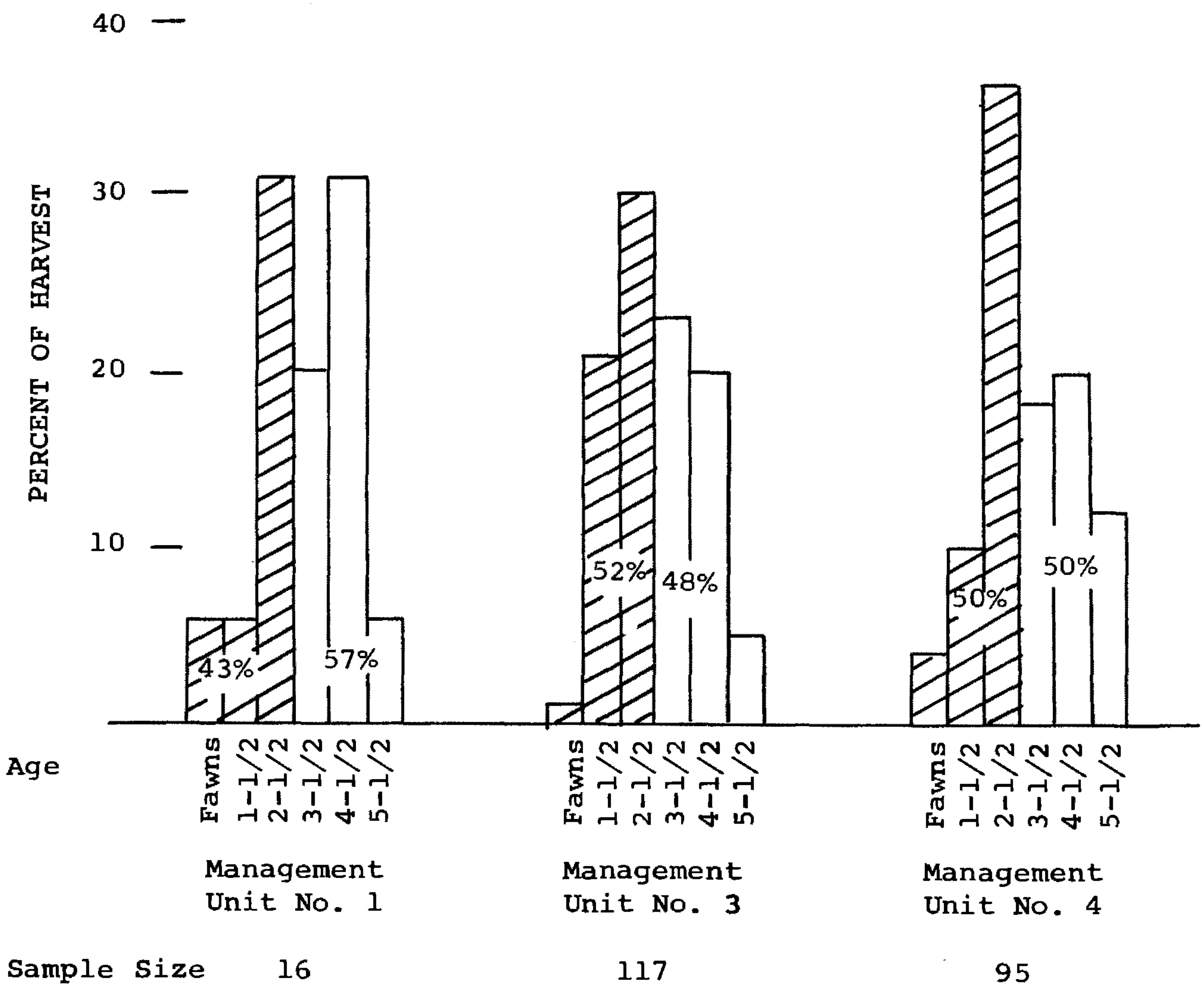


Figure 4. Age distribution of male deer in Management Units 1, 3, & 4 - Southeastern Alaska - 1959.

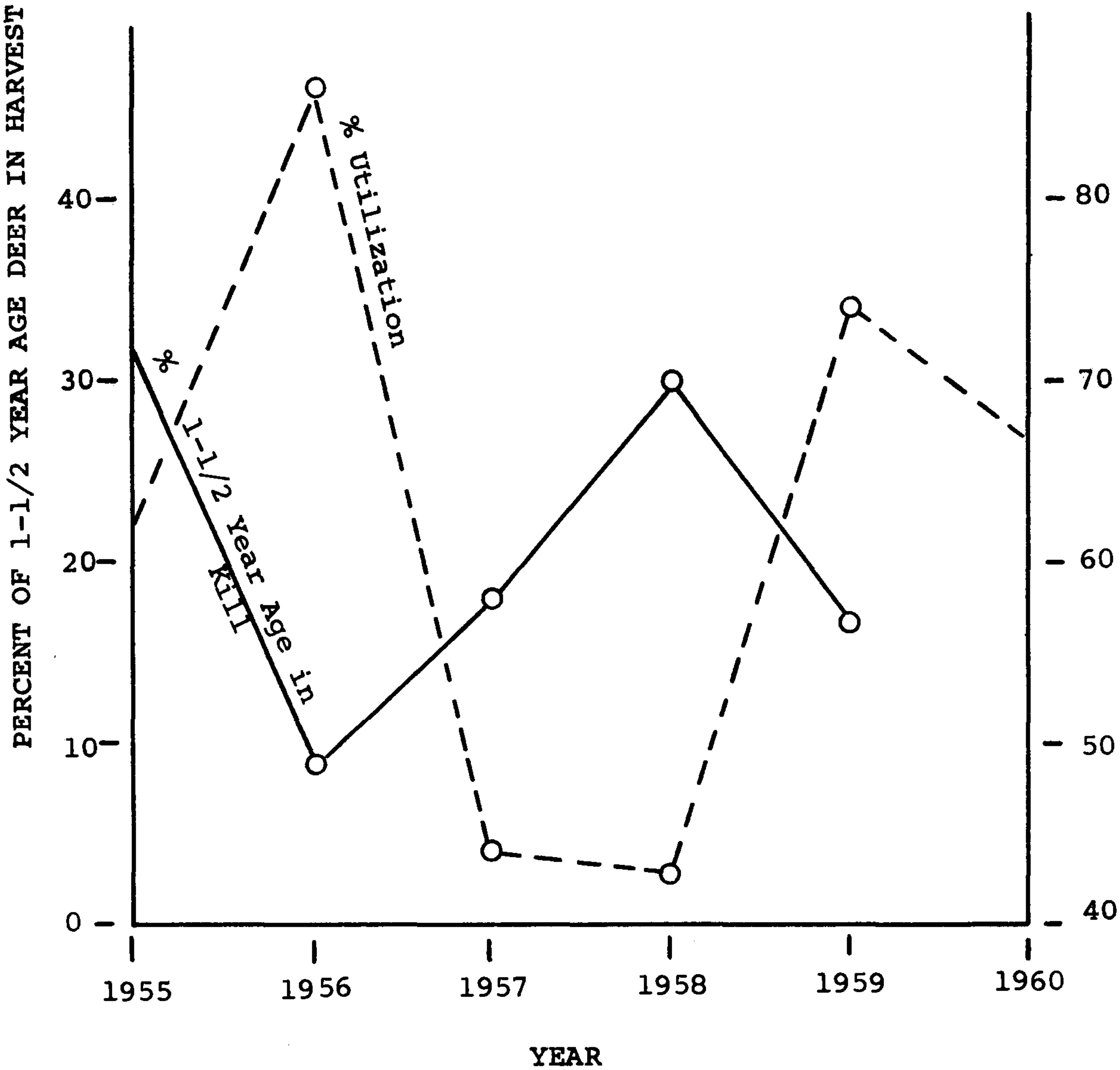


duration, it caused deer to concentrate on the beach and was reflected by heavier than normal browse utilization in the spring of 1959. Browse utilization figures are available since 1955, and as can be seen from Figure 5, spring utilization figures have been consistantly inversely proportional to the numbers of 1-1/2 year age animals in following fall harvest. It follows that if the spring utilization is greater than that of the previous year, the proportion of 1-1/2 year age animals in the fall harvest can be expected to be less than that of the preceding year. This shows the delicate position on which deer populations in Southeast Alaska balance. Most deer populations which are under-harvested, first show range deterioration, which is secondarily reflected in lowered productivity and by herd stabilization. This was thought to be the case in Southeast Alaska during the period from 1953 to 1956 when the 1-1/2 year age class was dropping at a constant rate each year. However, in 1958, at a time when the herd should be approaching a point of stabilization, there was a renewed vigor of younger age animals. It is doubtful that a completely stabilized herd will ever be a reality in Southeast Alaska. There is little danger of over-utilization on the range as a whole, but even a very short period of relatively light snow conditions is reflected by high browse utilization in the critical beach fringe area and secondarily in herd welfare as seen by the lowered 1-1/2 year age class in 1959.

The largest age class represented in the1959 hunter kill was the 2-1/2 year age group, comprising 32 percent of the total harvest. The large proportion of 2-1/2 year old animals in 1959 reflects the large 1-1/2 year age class of 1958. Enough data is now available to follow animals, which were 1-1/2 years of age in 1953, 54 and 55 respectively, through five years of their life. As can be seen from Figure 3, the lower percentage of 5-1/2 year age animals in the 1959 harvest than in 1958 can be traced back to 1955 when the 1-1/2 year age class showed a drop from that of 1954.

In 1959 the older age group, 3-1/2 years and older, comprised 48 percent of the harvest. This high proportion of older animals has been apparent since 1955 and is undoubtably a reflection of under-harvesting. In most areas where deer herds are heavily cropped, few animals reach the age of 3-1/2 years and older. There is little danger of over-harvesting deer in Southeast Alaska as long as the proportion of older animals in the kill remains high.

Figure 5. Comparison of winter browse utilization and the percent of 1-1/2 year age deer in the fall harvest - Southeastern Alaska, 1955-1960.



Female Age Distribution: The age distribution of female deer in the 1959 harvest was similar to that of male deer, with the exception that the 1-1/2 year age group, rather than the 2-1/2 year age group in males, represented the largest age class in the kill. This difference may be due to hunters by-passing some 1-1/2 year age bucks during the buck-only portion of the season because antlers were not yet visible as well as a differential mortality between male and female fawns. However, the small sample of 52 jaws collected to determine female age distribution is insufficient to draw any reliable conclusions. The age distribution of female deer in the 1959 harvest is shown in Table 4.

Chronological Age and Sex Distribution: The chronological age distribution of male deer harvested in the 1959 season is shown in Table 5. During the later part of August and the first half of September, the 1-1/2 and 4-1/2 year age groups represented the largest portion of the kill. After September 15, the 2-1/2 year age group increased and continued as one of the larger segments of the harvest throughout the remainder of the season. The percentage of older animals increased in the harvest toward the end of the season, and comprised the major portion of the kill during the final 2 weeks of the 14-week season. As shown in Table 6, the largest portion of the female kill was made during the first two weeks of November.

During the first few weeks of the hunting season, the kill is very high and is obtained primarily by two distinct types of hunters. One follows the beaches by boat looking for the easy animal. His kill is composed primarily of 1-1/2 and 2-1/2 year old bucks. The other type is the trophy hunter who climbs to alpine country where he can pick his buck from a choice of many. His deer fall in the older age classes. After this initial pressure, hunting slacks off until the deer move down from the higher elevations and become more available to the average hunter. This is usually about the middle of October. Mature bucks become more available as the season progresses and are a sizeable component of the late harvest.

Hind Foot, Chest Girth and Dressed Weights: The hind foot, chest girth and dressed weights for male and female deer taken in hte 1959 hunter harvest are shown in Tables 7, 8, 9, and 10. No significant changes were noted from values obtained in 1958. The average dressed weight was 100 pounds for male deer and 68 pounds for females. Table 9 also shows

Table 5. Chronological age distribution of male deer in the 1959 hunt - Southeastern Alaska.

Date of Kill	AGE IN YEARS												Total of	Percent of kill
	Fawn		1-1/2		2-1/2		3-1/2		4-1/2		5-1/2			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
8/20 - 9/3			2	29	1	14	1	14	2	29	1	14	7	3
9/4 - 9/18			2	33	1	17	1	17	2	33			6	2
9/19 - 10/3			1	25	2	50			1	25			4	2
10/4 - 10/18			2	33	2	33	1	17	1	17			6	2
10/19 - 11/2	1	3	10	33	9	30	3	10	4	14	3	10	30	13
11/3 - 11/16			14	14	39	38	29	28	14	14	6	6	102	44
11/17 - 11/30	5	6	8	10	22	28	12	15	23	29	9	12	79	34
Sample Size	6		39		76		47		47		19		234	100

Table 6. Chronological distribution of female deer in the 1959 hunter harvest - Southeastern Alaska.

	DATE OF KILL				
	10/4 - 10/18	10/19 - 11/2	11/3 - 11/16	11/17 - 11/30	Totals
Sample Size	2	5	25	20	52
Percent of Harvest	4	10	48	38	100

Table 7. Hind foot measurements of deer in the 1959 hunter harvest - Southeastern Alaska

	AGE IN YEARS											
	Fawn		1-1/2		2-1/2		3-1/2		4-1/2		5-1/2	
MALE DEER	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Management Unit No. 3	1	14.00	8	16.62	10	17.00	7	17.04	8	17.38	3	17.41
Management Unit No. 4	2	14.25	3	16.50	11	17.02	6	17.12	6	17.12	2	17.50
All Southeast Alaska	3	14.17	11	16.59	21	17.01	13	17.08	14	17.23	5	17.45
FEMALE DEER												
All Southeast Alaska	2	14.87	8	16.09	6	16.42	2	16.38	4	16.50	2	16.00

Table 8. Chest girth measurements of deer in the 1959 hunter harvest - Southeastern Alaska

	AGE IN YEARS											
	Fawn		1-1/2		2-1/2		3-1/2		4-1/2		5-1/2	
MALE DEER	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Management Unit No. 3	1	23.00	7	30.29	9	32.53	3	34.67	6	37.83	1	35.75
Management Unit No. 4	2	24.00	3	33.83	13	34.66	5	37.60	8	38.69	2	41.00
All Southeast Alaska	3	23.67	10	31.35	22	33.79	8	36.50	14	38.32	3	39.25
FEMALE DEER												
All Southeast Alaska	2	26.75	8	30.75	6	32.83	1	35.00	4	36.31	2	31.50

Table 9. Chronological dressed weights of male deer in the 1959 hunter harvest - Southeastern Alaska.

Date of Kill	AGE IN YEARS											
	Fawn		1-1/2		2-1/2		3-1/2		4-1/2		5-1/2	
	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
8/20 - 9/3			1	92					1	131	1	136
9/4 - 9/18												
9/19 - 10/3			1	61	1	108						
10/4 - 10/18					1	125			1	116		
10/19 - 11/2	1	33	3	69	4	84	1	92	2	165	1	137
11/3 - 11/16			2	80	8	94	13	106	4	108	2	126
11/17 - 11/30	2	28	2	61	6	102	2	94	7	120	1	106

Table 10. Dressed weights of deer from Management Units 3 & 4 in the 1959 harvest - Southeast Alaska.

	AGE IN YEARS											
	Fawn		1-1/2		2-1/2		3-1/2		4-1/2		5-1/2	
MALE DEER	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.	No.	Ave.
Management Unit No. 3	1	33	7	72	10	91	11	97	8	126	3	118
Management Unit No. 4	2	28	2	80	10	96	5	108	7	116	2	138
Weight Range	24-33		51-92		72-125		80-120		95-171		94-139	
Mean Weight	29		71		96		104		123		126	
FEMALE DEER												
Management Unit No. 3			6	64	1	75	1	60				
Management Unit No. 4	1	26	2	66	4	81	1	80	1	77	1	74
Weight Range	26		54-80		75-85		60-80		77		74	
Mean Weight	26		64		80		70		77		74	

Average Weight:
Male Deer - 100 Pounds
Female Deer - 68 Pounds

from hunter-killed deer. Dressed weights should be taken in preference to chest-girth measurements and the measurement of the hind foot should be augmented by removing and measuring the fused metacarpals from the foreleg.

APPENDIX: JANUARY SPECIAL DEER SEASON - 1960

On January 8, 1960, a special ten day deer season in Southeast Alaska was announced by Commissioner of Fish and Game, C. L. Anderson. This decision was reached after favorable recommendations were received from most of the Fish and Game Advisory Committees, as well as villages not represented by such committees. The special season included Game Management Units 2, 3, except on Mitkof Island, and 4, except on Admiralty Island north of a line drawn from the mouth of Admiralty Creek at the head of Admiralty Cove to the mouth of Greens Creek at the entrance of Hawk Inlet. All of Unit 1 remained closed. The season extended for ten days, from January 8 through January 17, inclusive. The bag limit was two deer of either sex, which were bonus animals, not to be counted against the bag limit for the regular fall season in 1960.

The 1959 estimated hunter harvest of 11,000 animals was considerably below that of 1958 when an estimated 13,000 animals were taken. With continued high productivity, there was no reason to believe that the total population had decreased, but rather had probably increased over that of 1958. The lower take in 1959 was most likely the result of mild weather conditions throughout the season which enabled the deer to remain at higher than normal elevations, above where most late season hunters prefer to hunt. With a continued under-harvest, reflected by high hunter success and the high proportion of older age animals in the kill, it was unlikely that an additional take would harm the deer herds in most areas. A special season would especially benefit trappers and other people living in remote areas throughout Southeast Alaska. Surveys conducted in 5 major towns of Southeast Alaska showed that 58 percent of the people were in favor of, 36 percent against, and 6 percent noncommittal in regards to the special season. An extension to the regular fall season which ended November 30, 1959, was suggested, but this was not approved by the U. S. Fish and Wildlife Service who still controlled the game resources of Alaska. During this period of transition from Federal to State control, Federal personnel were not available for the chronological distribution of dressed weights for each age class of male deer in the 1959 harvest. Deer from Management Unit 4 appear to be slightly larger than those taken in Unit 3.

Hind foot measurements are taken from the tip of the hoof to the proximal end of the calcaneus. The average hind foot measurements for male deer in 1959 ranged from 19.59 inches for the 1-1/2 year age class to 17.45 inches for the 5-1/2 year age class. The use of hind foot measurements of ungulates as inconsistencies in measuring techniques. A more reliable measurement could be obtained from the fused metacarpal bones of the foreleg which could be easily removed from hunter-killed deer.

Dressed weights appear to be more reliable than chest-girth measurements. Many field-dressed deer are split through the brisket, making an exact chest-girth measurement impossible. Error due to measuring techniques can be quite large, making this measurement unreliable. When dressed weights of deer are compared, age, sex and date taken must be considered. Young animals utilize most of the food energy obtained during the summer months for metabolic growth, little being stored as fat reserves until fall. Older deer develope fat reserves early in the summer, does continuing to gain weight as long as high quality food is available and bucks beginning to lose weight with the initiation of the rut in the fall.

Recommendations:

Under present conditions, an increased hunter harvest cannot harm the welfare of the deer population in Southeast Alaska. It is therefore recommended that deer be utilized to the fullest extent possible without decreasing its value as a game species.

No predator control is recommended with the exception of isolated cases where (1) range conditions and kill statistics indicate a thrifty deer herd, (2) hunting pressure is sufficiently heavy to harvest the annual increment of the local deer population, and (3) the need for predatory control can be demonstrated.

Increased emphasis should be placed on collecting jaws the additional work an extension to the regular season would involve. The State proposed the special season after taking control of the game on January 1, 1960.

Characteristics of the Harvest: The total hunter harvest in the special season was estimated at less than 300 animals. The total known kill was 134. Age distribution, weights, hind foot and chest-girth measurements are shown in Tables 11, 12 and 13. A sample of 34 jaws was obtained from Units 3 and 4. A high proportion of older animals, 26 percent were 5-1/2 years of age or older, was observed in the harvest. The proportion of does in the harvest was 44 percent, compared to 24 percent during the regular season. Many hunters indicated a preference for does, believing that they would be in better condition than bucks at this time of the year. About 50 percent of the bucks taken had shed their antlers and some of these bucks were shot believing they were does. Dressed weights of bucks, from the small sample available, showed a considerable drop from those taken during the regular season. The average weight of 5-1/2 year age bucks in the regular season was 126 pounds, while the same age class in the January special season averaged only 91 pounds. Dressed weights of does averaged slightly lower than those taken in the regular season, but the sample was too small to be significant.

Considerable opposition was voiced by some people who felt deer would be in extremely poor condition at this time of the year. For this reason, two deer, a buck and a doe, were collected from Lindenberg Peninsula near Petersburg, and arrangements made for a local butcher to cut and observe the condition of the meat. Both animals were at least 5-1/2 years of age, the buck weighing 90 pounds dressed, and the doe 72 pounds. The doe was carrying a 30 mm. embryo. The buck had no adipose tissue present on the exterior muscles and only a small amount of pinkish fat in mesenteries and around the kidneys. The meat had no strong odor and was more palatable than that of bucks taken toward the end of the rut in November. The doe was in excellent condition. The butcher stated that he had never cut a doe in better condition. From one to one and one-half inches of fat was present over the rump and saddle, extending as a white blanket over the rib cage. The meat was marbled to some extent, a condition seldom seen in deer, and was very palatable. All of the older bucks examined showed very little exterior fat while animals 1-1/2 to 2-1/2 years of age usually had about one-

Table 11. Age and sex distribution of deer killed during special January hunt in 1960 - Southeastern Alaska.

Sex	AGE IN YEARS						
	Fawn	1-1/2	2-1/2	3-1/2	4-1/2	5-1/2	Total
Male	2	5	2	3	2	5	19
Female	1	3	2	2	3	4	15
Total Sample	3	8	4	5	5	9	34
Percent of Harvest	9	23	12	15	15	26	100

Table 12. Hind foot and chest girth measurements and dressed weights of male deer killed during special January hunt in 1960 - Southeastern Alaska.

Age	Hind Foot	Chest Girth	Dressed Weight	Sample Size
Fawn	14.8	23.5	36	1
1-1/2	16.8	31.8		3
2-1/2				
3-1/2	17.1	32.5	70	3
4-1/2				
5-1/2	17.8	34.0	91	2

Table 13. Hind foot and chest girth measurements and dressed weights of female deer killed during special January hunt in 1960.

Age	Hind Foot	Chest Girth	Dressed Weight	Sample Size
Fawn	13.5	20.5	26	1
1-1/2		32.0		1
2-1/2	16.0	31.0	58	1
3-1/2	16.2	32.5	60	2
4-1/2	16.2	31.8		1
5-1/2	16.5	30.0	72	2

quarter inch of fat on the rump. All does checked were in good condition.

Summary: The 1960 special January deer season showed that deer are quite edible at that season of the year. Does were in excellent condition and bucks, though showing very little adipose tissue, were completely palatable. Hunting pressure was too light to have any significant effect on the deer population. Of special importance is the fact that a season can be held at this season of the year, under proper weather and population conditions, with no fear of an over-harvest. A late season undoubtably benefits many people living in remote areas who have no refrigeration facilities, however, a larger kill would probably be obtained by an extension of the regular hunting season.

Prepared by:

Harry Merriam
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30 June 1960

Approved by:

Sigurd T. Olson
P-R Coordinator

James W. Brooks, Director
Division of Game

Volume 1 Report No. A-le

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: le Title: Range Studies

Period Covered: July 15, 1959 - June 30, 1960

Abstract:

Browse utilization on deer winter ranges in Southeast Alaska for the winter of 1959-1960 averaged 66 percent, a drop of 8 percent below the utilization figure for 1958-1959. No significant change in density or vigor was observed. All browse transects visited were re-established.

Objectives:

To continue, without break in continuity, the browse studies initiated by the Fish and Wildlife Service (Federal Aid in Wildlife Restoration) which were aimed at determining winter utilization of browse, trends in range condition (i.e., changes in density and vigor of browse species) and area-wise quantitative and qualitative variations in browse conditions.

Techniques:

Browse inventory transects were walked during late March and early April, after the period of winter utilization. Eighteen transects throughout Southeast Alaska were checked, noting percent of utilization, density and vigor of the indicator species *Vaccinium ovalifolium* and *V. parvifolium*. All transects were re-established on their existing locations.

Transects were one-half mile in length, containing 20 stations, and were well blazed to facilitate following them. Stations were established at 2 chain intervals (132 feet) along each transect and marked by stakes, the tops of which were painted yellow. Each stake was marked with an aluminum tag denoting the number of the station. The closest *V. ovalifolium* or *V. parvifolium* plant to the station stake was marked with an orange flag and utilization was determined from this single marked plant. Plants were not marked if their size, too short or too tall, indicated they would be unavailable as a winter food species. If no plant was found within a radius of 25 feet of the station, no plant was marked. Utilization for the entire transect was determined by dividing the total utilization by the number of plants checked. Densities were taken within a ten foot square which had its central point at the station stake. Actual readings of utilization, vigor, and density were determined according to procedures outlined in Job Completion Report, Job No. 2, June 30, 1957. Assistance was received on browse utilization inventories from Research Biologist Paul Garceau in the Ketchikan and Petersburg districts and from Protection Officer Bob LeGuire in the Sitka district.

Findings:

Browse utilization for all of Southeast Alaska was slightly lower in 1960 than in 1959. Utilization for each area is summarized in Table 1. Even though no heavy snowfalls occurred throughout the winter, utilization was fairly high. This indicates that the wintering deer population is probably increasing, due to both relatively high productivity and a smaller hunter harvest in 1959 than in 1958. As shown in Figure 5, Job No. 1-d, winter utilization is inversely proportional to the percent of 1-1/2 year age animals in the fall harvest, reflecting winter fawn losses. As was shown by the heavy utilization recorded for the winter of 1958-59, slight differences in weather conditions have a pronounced effect on percent of utilization. There is little question that, under present population densities, a relatively severe winter will cause heavy winter losses, especially fawns and older age animals, in deer herds throughout Southeast Alaska.

Utilization, density and vigor factors are all subject to some error due to individual sampling techniques. It is

Table 1. Browse inventory of winter deer ranges in Southeast Alaska, March, April, 1960.

(Index species - _Vaccinium ovalifelium_ & _V. parvifolium_)

Area	Percent Utilization 1958	1959	1960	Density Plants Per 1,000 sq.ft.	Vigor Scale of 3
Ketchikan	35	56	67	48	2.2
George Inlet, Revilla Is.	40	87	90	58	2.6
Gravina Island	24	63	42	32	1.8
Helm Bay (east side)	27	12	40	46	1.5
Helm Bay (west side)	47	61	97	58	2.9
Petersburg-Wrangell	36	70	62	38	2.0
Onslew Island	16	92	84	18	2.6
Whale Pass, P. of W. Is.	21	8	7	50	1.7
Zarembo Island	75	86	97	4	2.7
Duncan Canal, Kupreanof Is.	41	84	60	22	2.2
Wrangell Narrows, "	38	96	80	76	2.2
Five Mile Creek, "	45	94	48	64	1.8
Big John Bay "	24	48	62	30	1.7
Juneau-Sitka	56	91	66	45	2.3
Pybus Bay, Admiralty Is.	51	94	76	52	2.8
Gambier Bay, "	69	96	60	62	2.1
Mole Harbor, "	94	96	90	61	2.7
Deadmans Reach, Baranof Is.	17	82	60	34	2.0
Nakwasina Passage, "	94	80	58	27	2.3
Rodgers Pt. Chichagof Is.	32	99	82	22	2.4
Point Hilda, Douglas Is.	33		54	55	1.8
Average For All Areas	43	74	66	43	2.2

therefore important that the system of reading browse transects be standardized as much as possible to obtain comparable results from year to year.

Recommendations:

Annual browse inventories should be continued as a method of determining deer population pressure on winter ranges.

Methods of reading transects should be further standardized for increased reliability.

Additional transects should be established to obtain better coverage throughout Southeast Alaska deer range.

Prepared by:

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30 June 1960

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Volume 1 Report No. A-1f

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 1f Title: Physiology of Growth and Maintenance

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

The study was initiated with the collection of deer, rumen samples, forage samples and soil samples on the Coronation and Woronkofski Island study areas. Nine point intercept transects have been located to sample the vegetative complex of the two islands.

Objectives:

To determine the physiological factors affecting growth and maintenance of deer in Alaska and the criteria of the relationship of these factors to range types and conditions.

Techniques:

Study areas were established on Coronation Island, an island of maritime climatic influence and Woronkofski Island, an area experiencing the influence of more continental climatic conditions. An additional study area at Horn Cliffs, on the mainland, was also established.

During June, July and August of 1959 and May and June of 1960 field studies were made in the three study areas.

Sample specimens of deer were collected for analysis. Qualitative and quantitative condition of the vegetative complex of the ranges on Coronation and Woronkofski Islands will be determined through the use of 30 line intercept transects on each area. The transects are 100 feet in length and with observation points at one foot intervals. Nine of these transects have been completed. An extensive plant collection has been made in conjunction with this phase of the work as a reference source. Four soil samples have been collected from the two islands.

Preliminary vegetative type maps of Coronation and Woronkofski Islands have been prepared from aerial photographs and these will be supplimented with data from the vegetative transects.

Twenty-nine forage samples have been collected for chemical analysis.

Findings:

Evaluation of data collected during the period of July 1, 1959 and June 30, 1960 will be done upon completion of the study in June of 1961. This report is of a preliminary nature to outline progress made and to present data collected in tabular form. Summaries of data collected from deer, rumen samples, forage samples and soil samples are included in Tables 1-4.

Recommendations:

This study should be continued to enable completion of data collection as outlined.

Table 1. Deer weights and measurements from Coronation and Woronkofski Islands.

Specimen No.	Date	Age (yrs)	Sex	Total Weight (lbs)	Dressed Weight (lbs)	Hind Foot (cm)
			C O R O N A T I O N I S L A N D			
58-1	3/12/58	5+	M	97	65	41.9
58-2	3/12/58	10mo.	F	56	36	38.1
58-3	3/12/58	4-1/2	M	80	58	40.6
58-4	3/12/58	10mo.	M	58	40	38.8
58-5	3/12/58	3-1/2	F	80	52	39.4
59-1	8/ 7/59	2	M	65	43	40.0
59-2	8/ 7/59	4	F	71	47	38.1
59-3	8/ 8/59	4	F	78	46	39.4
59-4	8/ 9/59	5	M	125	91	41.9
59-5	8/ 9/59	6+	F	90	58	40.0
59-6	8/ 9/59	2	M	86	59	41.3
59-7	8/ 9/59	2	M	92	62	41.3
60-1	5/19/60	2	M	89	62	42.0
60-2	5/20/60	3	M	64	44	40.3
60-3	5/21/60	1	M	37	26	35.7
			W O R O N K O F S K I I S L A N D			
60-4	5/26/60	1	M	53	37	38.4
60-5	5/26/60	2	F	76	55	41.5

Table 2. Chemical analyses of deer rumen contents, 1959. (All data on a dry weight basis)[1]

Specimen No. Date & Altitude	Crude Protein (% N x 6.25)	Crude Fat	Crude Fibre	Ash	Calcium	Phosphorus	Nitrogen Free Extract (by diff.)
	CORONATION ISLAND						
59-1,8/7 1100 ft.	20.99	6.03	23.97	12.44	1.53	1.83	36.56
59-2,8/7 1100 ft.	21.45	6.72	24.12	11.45	1.37	1.76	36.26
59-3,8/8 sea level	27.43	5.71	17.90	14.86	1.24	2.29	34.10
59-4,8/9 1900 ft.	29.81	7.48	18.97	15.25	1.87	2.43	28.50
59-5,8/9 1900 ft.	29.27	7.71	18.99	16.15	2.21	2.21	27.89
59-6,8/9 1800 ft.	29.04	10.26	18.60	14.47	1.58	2.54	27.63
59-7,8/9 1800 ft.	30.38	10.29	17.43	14.95	1.52	2.67	26.95
	KUPREANOF ISLAND						
59-8,8/20 2500 ft.	35.71	8.74	14.20	14.71	1.09	2.27	26.64

1) All analyses by A.O.A.C. methods.

Table 3. Percent composition of deer forage samples from Southeast Alaska, 1959. (All data on a dry weight basis)[1]

Species	Date	Location	Alt. (ft.)	(%Nx 6.25) %Pro.	Fat	Fibre	NFE	% Cal-cium	% Phos.	% Ash
Fauria crista-galli	6/3	Mitkof Is.	50	24.6	2.2	9.2	56.2	0.63	0.36	7.7
F. crista-galli	7/5	Mitkof Is.	50	15.7	2.7	8.3	64.2	0.75	0.17	9.1
F. crista-galli	6/6	Mainland	150	18.7	2.0	9.8	60.6	0.59	0.17	8.8
Carex sp. (beach)	6/6	Mainland	0	16.6	4.6	20.5	53.6	0.22	0.18	4.7
Elymus mollis	6/6	Mainland	0	24.7	4.3	28.8	34.7	0.24	0.47	7.5
Fauria crista-galli	7/16	Mainland	150	12.8	1.1	10.2	66.6	0.97	0.18	9.3
F. crista-galli	7/18	Mainland	1400	13.2	1.4	10.3	66.5	0.75	0.24	8.6
Carex sp. (beach)	7/16	Mainland	0	19.1	2.5	24.5	48.7	0.18	0.21	5.1
Artemesia sp.	6/10	Coronation Is.	1900	23.4	3.3	18.8	45.3	0.87	0.59	9.2
Polystichum munitum	6/10	Coronation Is.	100	17.6	2.7	23.7	49.4	0.23	0.31	6.7
Carex sp. (beach)	6/11	Coronation Is.	0	18.9	4.3	23.8	46.9	0.41	0.33	6.0
Polystichum munitum	8/6	Coronation Is.	100	7.7	0.9	37.7	49.9	0.34	0.20	3.8
Carex sp. (beach)	8/8	Coronation Is.	0	14.9	3.3	24.3	51.0	0.54	0.22	6.6
Artemesia sp.	8/9	Coronation Is.	1900	17.7	2.7	14.8	56.1	0.98	0.34	8.8
Heracleum lanatum	8/9	Coronation Is.	1700	20.6	3.8	14.1	50.9	2.23	0.41	10.5
Carex sp. (alpine)	8/9	Coronation Is.	1900	18.8	2.9	26.0	46.5	0.46	0.26	5.8
Caltha biflora	7/8	Woronkofski Is	2500	18.5	3.4	14.5	52.2	0.80	0.20	11.3
Fauria crista-galli	7/8	Woronkofski Is	2500	19.2	2.1	9.6	59.8	0.61	0.22	9.4
Plantago maritima	7/9	Woronkofski Is	0	10.4	2.8	14.0	48.6	0.38	0.21	24.2
Fauria crista-galli	8/11	Woronkofski Is	3000	20.1	1.8	10.4	57.0	0.61	0.38	10.7
Caltha biflora	8/11	Woronkofski Is	3000	21.8	2.8	14.6	47.9	0.81	0.62	12.9

1) All analyses by A.O.A.C. methods.

Table 4. Analyses of soils from Coronation & Woronkofski Islands[1], 1959.

	Coronation Is.		Woronkofski Is.	
	Forest	Muskeg	Forest	Alp.Meadow
pH (Acidity)	6.4	3.8	4.6	4.0
Organic Matter %	33.4	75.2	8.8	17.6
Phosphate (P), lbs/acre	20	40	10	15
Potash (K) " "	100	200	38	105
Calcium (Ca) " "	10,000	4,400	1,800	2,300
Magnesium (Mg) " "	620	1,240	160	320
Sulphur (S) " "	1,000	1,000	50	200
Iron (Fe) " "	5	10	225	200
Manganese (Mn) " "	5	5	25	25
Copper (Cu) " "	3	3	1	1
Boron (B) " "	10	8	1	3
Zinc (Zn) " "	0	0	0	0
Sodium (Na) " "	720	620	60	110
Nitrogen (N) %	1.01	1.44	0.33	0.53

1) All values are approximate, with the exception of pH, organic matter and nitrogen, and are based upon colorimetric and spectrographic analyses of extracted available constituents.

Approximate conversion factors:

$P \times 2.3 = P_2O_5$
$K \times 1.2 = K_2O$
$Ca \times 1.4 = CaO$
$Mg \times 1.7 = MgO$

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30 June 1960

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Division of Game

Volume 1 Report No: A-2a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 2-a Title: Determination of Population Levels, Structures and Trends, Kodiak - Prince William Sound

Period Covered: August 1, 1959 - June 30, 1960

Abstract:

Evaluation of data available indicates large and increasing deer herds throughout the study areas. Browse utilization was moderate, winter mortality light and hunter success high.

Objectives:

To determine current population levels, structures and trends of Kodiak - Prince William Sound deer herds.

Procedures:

Data collected under jobs 2-b through 2-e were evaluated to yield information of the current population dynamics of the deer herds studied. Major emphasis has been placed on the Prince William Sound deer populations partly as a result of their greater importance for hunting and more ready accessibility. However, general conclusions of herd welfare are in most cases applicable as well to the Kodiak area.

These studies represent the first year of state administration of investigations under the Federal Aid in Wildlife Restorations Act. Consequently, much effort was devoted by the project leader in gaining familiarization with the deer ranges and management problems. Findings have been necessarily curtailed.

Findings:

Limited information obtained on range conditions and utilization indicates increasing deer populations on both Kodiak Island and in the Prince William Sound area. Some deterioration of range conditions from over utilization has been noted, however, generally the mild winter allowed wide dispersal of deer lessening the pressure on the forage in usual winter concentration areas.

Associated with the mild winters has been good winter survival of deer as indicated by winter mortality surveys.

The hunter harvest data again yield evidence of large deer populations. The total kill was relatively high at 775 (Prince William Sound) and hunter success appeared to vary with the accessibility of the ranges to the various towns. Cordova, with best accessibility had extremely high hunter success of 84 per cent. The doe-kill of 33 per cent is consistent with the take in Southeast Alaska where herds are large and increasing,and hunting pressure relatively light.

Recommendations:

The job should be continued as described.

Prepared by:

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Volume 1 Report No: A-2b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1

Name: Game Investigations of Alaska

Work Plan: A

Sitka Black-Tailed Deer Studies

Job No: 2-b

Title: Abundance and Composition Surveys, Kodiak-Prince William Sound

Period Covered: July 15, 1959 - June 30, 1960

Abstract:

Transportation difficulties and an inadequate snowfall limited the collection of significant data for this investigation.

Objectives:

To determine population abundance and sex and age composition of Kodiak and Prince William Sound deer herds.

Procedures:

Approximately 20 hours of flying time were used for this study. Also, in coordination with other studies, ten days were spent traveling by boat and on foot. An annotated chart was kept of track and animal observations to provide an index to deer distribution.

Findings:

There was insufficient snowfall to make an estimate of the population. During the survey flights, 86 deer were counted on Montague Island after the only heavy snow of the year. Thirty-five deer were seen by foot at Patton Bay and MacLeod Harbor.

Light plane flights resulted in the collection of distribution information on deer concentrations in the Prince William Sound and Kodiak areas upon which future transects can be planned.

Recommendations:

The observer should have an aircraft at his immediate disposal to enable him to check after each heavy snowfall for possible concentrations of deer on the beach. In this way, he could better time his surveys.

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30 June 1960

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Volume 1 Report No: A-2c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 2-c Title: Natural Mortality Surveys, Kodiak - Prince William Sound

Period Covered: March 1, 1960 - June 30, 1960

Abstract:

No significant winter kill was noted in the sample areas of the Prince William Sound and Kodiak deer ranges.

Objectives:

To determine the sex and age composition, the extend and area-wise breakdown of the natural mortality as an index to the winter welfare of deer.

Procedures:

Kodiak Island - Five miles of beach fringe were examined on foot on Cape Chiniak and at Anton Larsen Bay of Kodiak Island. This was supplemented with an aerial examination of the beaches from Anton Larsen Bay to Womans Bay.

Prince William Sound - In the Prince William Sound area, 8 miles of beach fringe was searched for dead deer. This distance was about equally divided between Salmo Point and

Windy Bay on Hawkins Island, Johnstone Point on Hinchinbrook Island, and Zaikof Bay on Montague Island. Approximately 600 miles of beach was examined by air from an altitude of 500 feet. The foot survey was conducted in conjunction with the forage utilization estimates.

Findings:

Seven dead deer were found along approximately 5 miles of accessible beaches of Cape Chiniak on Kodiak Island in early April. These were found by ground surveys adjacent to the area between Mile 25 and Mile 33 of the Cape Chiniak Road. Three dead deer were found in the Prince William Sound area. This was considered trace mortality in both areas.

Recommendations:

This study should be continued.

Prepared by:

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Volume 1 Report No: A-2d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: A Sitka Black-Tailed Deer Studies

Job No: 2-d Title: Characteristics of Hunter Harvest, Kodiak - Prince William Sound

Period Covered: August 20, 1959 - March 31, 1960

Abstract:

A combination of field checks, hunter interviews and post card questionnaires was used to obtain deer harvest data in the Prince William Sound area. The estimated total kill was 775 which included 33 per cent does. Hunter success ranged from 23 per cent at Whittier to 84 per cent at Cordova. The average number of days hunted per deer killed was 2.5. Montague Island received the greatest concentration of hunting effort (38 per cent of the total).

Objectives:

To secure information relative to the total deer kill, area and chronological distribution of the kill, hunter success, and to determine and evaluate the sex and age composition and physical characteristics of the deer harvested.

Procedures:

Three techniques were employed to contact hunters for kill information, (1) patrolling during the season, (2) local post-season surveys in the towns of the surrounding areas, and (3) card questionnaires filled out by pilots who filed flight plans into the area. The following is a detailed description of these techniques:

1. Patrolling. This technique, if practicable, would obviously be the most efficient of the three. Actual physical data is collected in addition to hunter success information. However, this method proved to be extremely difficult to employ. The peak of the hunting pressure in Prince William Sound occurs on the islands during the month of November. Attempts to patrol these islands at this time with a small boat met with considerable difficulty. Nevertheless, limited information was collected in this manner.

2. Local Surveys. The local survey was conducted in two ways: (a) interviewing hunters by telephone and (b) by making house calls.

(a) Telephone interviews were conducted in Seward and Port of Whittier. This technique was possible only because subscription to telephone service is nearly complete in these areas. The selection of hunters was made in the following manner:

  (1) All license receipt books were arranged randomly.

  (2) A random starting point among the hunting licenses was selected.

  (3) An interval, restricted to between 3 and 6, was then used to select 60 hunters which constituted approximately a 10 per cent sample of the total licensed hunters.

  (4) The hunters selected were then contacted by telephone. Sampling was not necessary at Port of Whittier, since there were so few hunters that a complete enumeration was possible.

(b) The house visit technique was employed in Cordova and Valdez, where hunters cannot readily be contacted by telephone. Although the method of selection is the same used with the telephone survey, the people were actually visited.

3. Card Questionnaires. Card questionnaires were prepared and sent to 12 of the 21 pilots who had filed flight plans to the Prince William Sound area between August and December of 1959. The names of these pilots were found in the Master Flight Plan Log maintained at Merrill Field, Alaska. Their addresses were obtained from the files of the Office of Flight Safety of the Federal Aviation Agency, Anchorage, Alaska.

A review of the procedures used and findings for the Kodiak area can be found in the 1959 Refuge Narrative Report for the Kodiak Wildlife Refuge.

Findings:

The sampling techniques worked very well with the exception of the pilot card questionnaires. Only three of these were returned. In conjunction with the patrolling for kill information, the measurements of 19 deer were obtained. Also, 41 jaws were collected. When a larger sample is obtained of this type of data, it will be analyzed statistically and presented. The results of the Prince William Sound season are presented in Tables 1 and 2. Table 1 indicates a buck-doe kill ratio of 2:1.

Recommendations:

Some of the logistical and technical shortcomings in the collection of kill information could be remedied by initiating the following:

1. If the administrative and enforcement problems could be overcome, a tagging system, including a mandatory report card, would be desirable.

2. All meat processors should be supplied with a form on which to record the handling of big game.

3. A Biological Aide should be stationed centrally in the hunting area.

Table 1. Deer harvest for the 1959 Prince William Sound deer season.

Hunter Source	Male	Female	Fawns	Total	Charter Boat	Charter Plane	Handled by Mead Pro-cessors	Hunter Success (Per Cent)	Percent of Active Hunters Hunting Deer
Cordova	216	133	*	349	36	10	41	84[1]	98
Valdez	8	4	5	17	36	0	0	50	21
Whittier	3	2	2	7	7	0	0	23	100
Seward	52	*	*	52	48	24	2	75	11
Other Sources[2]				350					
TOTAL	279	139	7	775					

Average number of days hunter per deer killed 2.5

* Not enough data was collected to estimate the kill.

1. Based on hunters killing at least one deer.

2. Includes illegal kill through the year by local people as estimated from information provided by the Alaska State Department of Health.

Table 2. Estimated distribution of legal hunting pressure in Prince William Sound during the 1959 deer season by percent from all sources.

Area	Hunting Pressure (%)
Hawkins Island	27
Montague Island	38
Elenor Island	2
Hinchinbrook Island	29
Green Island	2
Mainland (Cordova)	2

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31 March 1960

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Volume 1 | Report No: A-2e

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 | Name: Game Investigations of Alaska

Work Plan: A | Sitka Black-Tailed Deer Studies

Job No: 2-e | Title: Range Studies, Kodiak - Prince William Sound

Period Covered: July 15, 1959 - June 30, 1960

Abstract:

Ocular estimates of percent utilization were made on the winter ranges of Prince William Sound, Afognak Island and Kodiak Island.

Utilization of blueberry (*Vaccinium ovalifolium*) in the Prince William Sound area was found to be moderate, ranging from 30 to 50 per cent. This was expected as the deer were concentrated for only short periods during the past winter due to mild weather.

The Kodiak and Afognak ranges show varying characteristics of use. The ranges on Cape Chiniak are composed of alder (*Alnus crispa sinuata*), willow (*Salix* sp.), elderberry (*Sambucus racemosa*), and rose (*Rosa nutkana*). The latter two species, although suffering excessive utilization in the creek bottoms, with some die-back of plants, have generally held up well during the past winter under heavy utilization. Alder is being utilized moderately in the Kodiak area in places where there has been heavy pressure on the elderberry and willow.

The Anton Larsen Bay area is marginal deer range. The principal available forage species are elderberry associated with alder. The elderberry has been heavily utilized by both deer and cattle to such an extend that both animals

must rely on the limited willow at the head of the bay during early spring.

Objectives:

To continue, without break in continuity, the browse studies initiated by the Fish and Wildlife Service (Federal Aid in Wildlife Restoration) which were aimed at determining winter utilization of browse, trends in range condition (i.e., changes in density and vigor of browse species) and area-wise quantitative and qualitative variations in browse conditions.

Procedures:

Estimates of browse utilization were developed and conducted on an ocular evaluation principal with special adaptations for different species. The following is a description of these techniques.

Hard-wood Browse - Willow, alder and rose plants were selected at a restricted random interval of between 5 and 10 yards along a predetermined transect. Each selected plant is then examined and an estimate of per cent utilization and dead material is made. The ratio of dead to live material provides an index of vigor.

Soft-wood Browse - Elderberry plants to be sampled are selected in the same manner as the hardwood species. The total number of stems are counted and the percent of viable stems determined. Utilization is estimated in percent removal of the current growth. Use of elderberry is manifested in two forms; removal of current growth and stripping. Impact from stripping is deserving of special consideration since the girdling of a stem contributes to loss of vigor, and if extensive enough, may cause death of the plant. In the case of elderberry, the vigor closely approximates utilization, since stripping constitutes most of the use it suffers.

Findings:

The study period was primarily devoted to reconnaissance surveys of the deer range to enable location of browse utilization surveys in representative sections of winter range, and development of survey techniques.

Results of the limited browse utilization surveys are presented in Table 1.

Recommendations:

Forage. The following studies should be made under this plan:

1. The pounds per acre produced, resistance to browsing pressure and methods of estimating use should be determined for elderberry.

2. The classification of the winter range should be continued along with this work.

Prepared by:

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30 June 1960

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Table 1. Mean per cent browse utilization of the winter ranges of Prince William Sound, Afognak Island and Kodiak Island during the winter of 1959-1960.

PRINCE WILLIAM SOUND

Range	*Vaccinium* sp.	*Alnus* sp.
Hawkins Island	30	--
Hinchinbrook Island	50	--
Montague Island	50	10

AFOGNAK ISLAND & KODIAK ISLAND

Range	*Vaccinium* sp.	*Alnus* sp.	*Sambucus* sp.	*Salix* sp.	*Rosa* sp.
Cape Chiniak		30	10		
Anton Larsen Bay			90	60	20
Little Afognak	20				

Volume 1 Report No. B-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 1 Title: Moose Investigations, Southeast Alaska

Period Covered: September 1, 1959 to June 30, 1960

Abstract:

The total known moose kill in Southeast Alaska during the 1959 regular season was 156 animals. Composition counts were flown on the Stikine River and between Yakutat and Dry Bay. A calf-cow ratio of 33 calves per 100 cows was observed in the Yakutat area and 37 calvers per 100 cows on the Stikine River. Eight moose, of the original plant of 15, were observed on the flats at the head of Berners Bay. No noticeable changes were observed in the Stikine River moose population in 1959.

Objectives:

To obtain an estimate of numbers and sex and age compositions of the Stikine, Taku, Berners Bay, Chilkat and Yakutat moose populations, and to collect and evaluate data from the hunter harvest.

Techniques:

Aerial composition counts were flown using a Piper Pacer aircraft in the Yakutat district and a Bell G helicopter on the Stikine River.

Hunter harvest data was obtained by collecting jaws from hunter kills and by conducting post-season hunter surveys in Wrangell and Petersburg. Age composition of the harvest was determined by tooth wear and replacement on collected jaws.

Kill statistics from Yakutat, the Chilkat and the Taku Rivers were obtained through the courtesy of Fred Robards, U. S. Game Management Agent, Fish and Wildlife Service.

Findings:

Distribution: Moose in Southeast Alaska are becoming increasingly important as a big game species. Moose are now known to occur near Yakutat and on the Chilkat, Taku and Stikine River systems. Smaller populations are located in Thomas Bay, Bradfield Canal and on the Unuk and Chickamin Rivers. In 1958, 16 moose calves were released near the confluence of the Lace and the Antler Rivers at the head of Berners Bay. One of these drowned during releasing operations. On January 11, 1960, Maurice Kelley, U. S. Fish and Wildlife Service, observed eight moose in this same area. At least some of these animals were sexually mature at 1-1/2 years of age, for in early June, 1960, Douglas Blanchard, Protection Officer, Alaska Department of Fish and Game, observed three cows, each with a single calf, in the Berners Bay area. In June, 1960, 11 additional calves were transplanted from Anchorage to Juneau where they are being held for a later transplant to Berners Bay.

In the Petersburg-Wrangell area, moose are apparently expanding their range but the degree of establishment is not yet known. During the 1959-60 project year, two bull moose have been reported near Blind River on Mitkof Island, one bull in Farragut Bay, and a cow on Cloverleaf Island in Duncan Canal. Another cow was observed swimming in Frederick Sound, north of Petersburg, and landing near Beacon Point on Kupreanof Island. It is quite probable that her point of origin was the mainland approximately four miles distant. Upon reaching the beach, the cow collapsed for a short time, then walked into the timber.

Composition Counts: Table 1 summarizes moose composition counts made in Southeast Alaska during 1959-60. On September 6, 1959, Sigurd T. Olson, Pittman-Robertson Coordinator, flew a moose composition count on the coastal flats between Yakutat and the south side of Dry Bay. In two and one-half hours of observation time, 178 moose were counted including 81 bulls (44 large), 73 cows, and 24 calves. The observed calf-cow ratio was 33 calves per 100 cows. The bull-cow ratio of 110 bulls per 100 cows indicates that present hunting pressure has little effect on the total population.

In April, 1960, the U. S. Forest Service conducted another survey of the same area covered previously by Olson. Arthur M. Sheets, Research Biologist, Alaska Department of Fish and Game, accompanied these flights as an observer. In 5 hours observation time, 345 moose were observed. A breakdown of age and sex composition was not possible. The average of 70 moose observed per hour of flying time during these flights is considerably less than the average figure of 126 moose per hour observed in the Susitna and Copper River Valleys in October and November of 1958.

On September 9, 1959, an aerial composition count was conducted in the Stikine River Valley, using a Bell G helicopter. In 1 hour of actual observation time 5 bulls, 16 cows, 6 calves and 1 unidentified animal were counted, giving a total count of 28 moose. Visibility was poor and many moose were undoubtedly missed. During a comparable count in 1958, 52 moose were tallied. The calf-cow ratio on the Stikine River was 37 calves per 100 cows, a productivity rate comparable to that of the moose herds of the Susitna and Matnauska Valleys.

On December 17, 1959, Paul Garceau, Research Biologist, Alaska Department of Fish and Game, made another moose count on the Stikine River. In 1 hour of observation time, 43 moose were observed. An accurate determination of sex composition could not be made.

Hunter Harvest: In 1959, the moose season in Southeast Alaska extended from September 15 to October 15, a total of 31 days. The total known kill during this period was 156 animals. The breakdown of the kill by area is shown in Table 2. In most areas hunting pressure is relatively heavy and the harvest consists mainly of young bulls, 1-1/2 to 3-1/2 years of age. The Yakutat herd, however, appears to be increasing rapidly in size and can withstand much heavier cropping than present hunting pressure supplies. As noted above, a composition count made in September, 1959, revealed a ratio of 110 bulls per 100 cows in the Yakutat area. The significance of this ratio is more apparent when compared to the Matanuska Valley herd where a ratio of 6 bulls per 100 cows was observed in 1958. There was no evidence that the low bull-cow ratio in the Matanuska area had lowered the annual calf crop.

The only area of Southeast Alaska for which consistent harvest data is available is the Stikine River. In 1959, the total known harvest for this area was 35 moose. Seven additional moose were taken in Thomas Bay and one from Jap Creek, a few miles north of the entrance to LeConte Bay. Table 3 shows the age composition of moose taken in the hunter harvest on the Stikine River from 1954 to 1959, (exclusive of 1956). As has been true in the past, the larger portion of the kill in 1959 consisted of 1-1/2-year-old animals. Seventy-seven percent of the total kill comprised of animals 3-1/2 years of age and younger. It might, on first appraisal, appear that this herd is being cropped too heavily, however, the kill has remained about the same for several years with no indication of detrimental effects. The proportion of older animals in the harvest increased in 1959 (31 percent) to the largest value since 1955 (33 percent), indicating that hunting pressure may have relaxed somewhat. The sample of jaws of older animals is too small (four jaws 3-1/2 years of age and older) to be significant.

Table 1. Moose Composition Counts - Southeast Alaska, 1959-60.

Date	Locality	Calves	Cows	Bulls	Unident.	Total
9/6/59	Yakutat	24	73	81		178
April, 1960	Yakutat				345	345
9/9/59	Stikine R.	6	16	5	1	28
11/17/59	Stikine R.				43	43
1/11/60	Berners Bay				8	8

Table 2. Known Moose Hunter Harvest - Southeast Alaska, 1959

Area	Harvest
Yakutat	55
Chilkat River	39
Taku River	19
Jap Creek	1
Thomas Bay	7
Stikine River	35
Total Harvest	156

Table 3. Age Composition of Moose Taken in the Hunter Harvest on the Stikine River, 1954-1959.

Age	1954		1955		1957		1958		1959	
(years)	%	No.	%	No.	%	No.	%	No.	%	No.
1-1/2	8	1	58	7	57	12	59	13	54	7
2-1/2	33	4	8	1	29	6	41	9	15	2
3-1/2 and older	58	7	33	4	14	3	0	0	31	4
Totals		12		12		21		22		13

Recommendations:

Aerial composition counts and collection of hunter harvest data should be continued. More complete data should be obtained from the Taku River and Chilkat River herds.

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Division of Game

Volume 1 | Report No. B-2a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 | Name: Game Investigations of Alaska

Work Plan: B | Moose Management Investigations

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

Period Covered: December 1, 1959 to June 30, 1960

Abstract:

1. The total estimated moose processed by commercial locker plants was 1,250; however, many additional moose were harvested and stored in home freezers by hunters in Southcentral Alaska.

2. Hunting pressure in the Matanuska Valley appears to be shifting from the Palmer to the Kashwitna-Willow areas along the Alaska Railroad. A road through this area will be partially completed by the 1961 hunting season and will increase the accessibility.

3. The lack of access prevents an adequate harvest of moose in the Copper River Valley, the Nelchina River Basin, and the Denali area.

4. Productivity is good despite the continuing ratio of 6 bulls per 100 cows in the lower Matanuska Valley. Productivity elsewhere in Southcentral Alaska as indicated by calf-cow ratios and rate of survival of calves to yearlings is generally satisfactory.

5. Conditions during the winter of 1959-60 were not severe, and there is little indication of winter kill in

Southcentral Alaska during this period.

Objectives:

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

Techniques:

The findings resulting from investigations of moose distribution, numbers, sex and age composition, productivity, harvest, etc., because of inter-relationships, must be synthesized before herd status can be adequately clarified to serve the needs of management. This job therefore entails bringing together all data bearing on present herd characteristics and trends, and assessing them according to past, present, and anticipated future environmental conditions and harvest demands. With this information for guidance, regulations may be directed more precisely and effectively toward improved resource management.

Findings:

Lower Susitna-Matanuska Valley Area

Productivity in the Matanuska Valley is good. Aerial counts made during the fall of 1959 reveal calf production is higher than in 1958. The calf-cow ratio in 1959 was 51/100 as compared to 47/100 in 1958. In the Kashwitna-Willow area, however, the calf-cow ratio dropped from 39/100 last year to 32/100 this year. This area should receive close attention in the future.

In the Matanuska Valley heavy hunting pressure has depressed the bull-cow ratio to 6/100. This ratio is comparable to last year's count and perhaps suggests that the bull segment of the population may be stabilizing at this low level. Information obtained from hunter contacts has revealed a shift in moose hunting emphasis to the Kashwitna-Willow area farther up the valley. A new road from Willow to Talkeetna will allow increased access during the 1961 season. The Alaska Railroad, also utilized by moose hunters, passes directly through the area. The shift in hunting emphasis may take some of the pressure off the bull moose present in the Palmer area now.

A special moose season during December 1960 will allow hunters to take antlerless moose in certain areas of the Matanuska Valley. Four hundred fifty permits will be issued to persons wishing to take part in this hunt. The area concerned also includes that section of the Alaska Railroad where the highest train-kill occurs. It is hoped this mortality factor can be decreased through an increased hunter kill prior to the period of deep snow which forces the moose into the rail area.

Little attention has been given to the Susitna-Beluga Mountains area, because of its inaccessibility. Here the bull-cow ratio is 97/100. A few hunters using airplanes have utilized the area for hunting up to this time. A new landing strip has been installed on Mt. Susitna and should result in a small harvest of moose in that area this coming season.

Hunting pressure is difficult to assess in the Lower Susitna and Matanuska Valleys. Locker plant data from the Anchorage and Palmer areas shows that approximately 1,250 moose were processed commercially in those two areas. This is the minimum calculated kill for all of Southcentral Alaska. It is known, however, that many additional moose are processed and stored by people in their own homes, thus the total hunter kill is actually much greater than indicated by the data from the locker plants.

Survival of the 1959 calf crop was difficult to evaluate because spring calf counts were not made in 1959. The only other index to survival was the ratio of bull calves to yearling bulls which indicated satisfactory survival of calves. A comparatively mild winter in 1959-60 did not affect the moose in the Lower Susitna-Matanuska Valley adversely. Other mortality factors in the Lower Susitna-Matanuska Valley are highway and railroad kills, and illegal kills. The mortality from these sources is not excessive.

Copper River Valley

The status of the moose populations of the Copper River Valley, including the Nelchina River Basin, and most of the tributaries of the Copper and Susitna Rivers remained similar to last year's. Extremely poor weather conditions encountered during herd composition counts in the Nelchina area, the Lake Louise area and the Alphabet Hills limited the collection of data. An increase in the calf/cow ratio was noted over the

1958 counts, however, which may indicate continued satisfactory productivity.

Hunting pressure is light to moderate in the Nelchina area primarily because of a lack of roads. A road system bounds two sides of the area; however, few persons are willing to hunt much beyond its fringes. With the exception of the 18 mile long Lake Louise road, few roads penetrate the interior of the Nelchina area to any distance.

A hunter check station, operated on the Denali Highway for eight days during the fall of 1959 revealed that only 48 moose were taken. Most of these animals were taken either close to the road, or by flying in to the back country. A small harvest such as this can be increased only by better accessibility coupled with a greater hunting pressure.

Survival of calves to the yearling age class in the Alphabet Hills area is better than in the Lake Louise area. Composition counts show that out of 18 bull calves per 100 cows in the fall of 1958, 10 young bulls per 100 cows remained in 1959. Similar data from the Lake Louise area shows a reduction from the 1958 fall calf population in excess of 50 percent. This is expected however, since the latter area is much more accessible to hunters as a result of the road penetrating its boundaries while the Alphabet Hills area can be reached only by air or swamp buggy.

Recommendations:

Special efforts should be made to obtain separate harvests of moose in those areas which, due to inaccessibility, are presently under harvested.

More intensive locker plant checks should be made to obtain more reliable kill data. In addition, a ratio of commercial locker-home locker processing should be established.

Periodic analysis of herd composition data from identifiable moose populations should continue to detect population trends which can be used advantageously in management.

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Volume 1 Report No. B-2b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 2b Title: Herd Composition and Abundance Surveys Southcentral Alaska

Period Covered: October 1, 1959 to December 15, 1959

Abstract:

Sex and age composition counts of moose populations occupying areas in the Lower Susitna-Matanuska and Copper River Valleys were conducted during the winter of 1959-1960 with the following results:

1. A total of 1,921 moose were tallied in 18 hours and 36 minutes flying time actually spent counting moose.

2. Calf production in both areas remains good (51 calves per 100 cows) even slightly above last year's count (47 calves per 100 cows).

3. Bull/cow ratios vary from 6/100 in a heavily hunted area (Matanuska Valley) to 97/100 in an inaccessible area (Mt. Susitna-Mt. Beluga).

Objectives:

1. To determine herd composition of identifiable moose populations as an index to productivity and survival.

2. To establish an index of relative moose abundance in these areas.

Techniques:

A Piper Super Cub was utilized to conduct all of the aerial surveys. Edward P. Keough, ADFG Research Biologist, piloted the aircraft and the writer acted as observer in all flights with one exception. A portion of the Matanuska Valley was flown with Albert W. Erickson, Management Biologist, as observer.

A total of 18 hours and 36 minutes was spent actually counting moose during the flights. No attempt was made to obtain total counts or to fly any of the areas using a systematic sampling technique.

The counts were initiated the second week in October, at which time the animals are believed to be more homogeneously distributed. Survey flights were flown at altitudes varying from 300 to 600 feet depending on terrain. No attempt was made to survey according to cover type.

Data Recorded.

Moose sex and age determination by aerial observers is limited. Listed below are five categories that were utilized for the counts.

1. Young bulls--bulls with spike or forked antlers, usually with little or no palm development. These animals are predominantly "yearlings",approximately 18 months old, but there is some overlap in ages.

2. Medium bulls--bulls having some palm development, but not massive appearing. Probably two and three year olds.

3. Adult bulls--all bulls having greater antler development than the preceding age category.

4. Cows--all antlerless animals other than calves, including yearlings.

5. Calves--young of the year, generally five to seven months old when the counts are made.

Methods of Analysis.

The data from the 1959 sex and age composition counts were analyzed to determine current productivity and survival. These indicators of population status were first described in Federal Aid Progress and Completion Reports. Among the reports are Federal Aid in Wildlife Restoration (Alaska) 10(3) 7-11, the indicators were restated and modified in 12(1) 3-6 and 13(1) 3-6. The indicators are again defined below. Evaluations are based on one or more indices provided by the appropriate sex or age ratios.

Productivity.

Productivity includes increment and survival of calves to the date of the count. The most significant productivity index used is the ratio of calves per 100 cows. Another productivity indicator is the ratio of twins per 100 cows with calves. Although the significance of the ratio is not fully understood at present, a high incidence of twin moose calves adds significantly to the total herd in certain areas.

Using descriptive terms rather than numerical ratios has proven popular in the past and the practice has been continued this year. The terms--poor, fair, good, and excellent--are used in the discussion of productivity contained in this report. The terms correspond to the following numerical values:

Poor............below 20 calves per 100 cows
Fair............20 to 35 calves per 100 cows
Good............36 to 50 calves per 100 cows
Excellent.......more than 50 calves per 100 cows

Necessarily, the categories above apply only to productivity at approximately six months of age as measured by the calf/cow ratio. Even though a population has poor productivity at the time the census is flown, it could have an excellent survival rate from that time on and thus be increasing. Of course, the converse is true if a population has excellent productivity and a poor survival rate.

Survival.

The survival of calves on a 12 month comparison basis i.e., survival approximately from 6 months of age to 18 months of age is one index used.

The ratio of young (presumed yearling) bulls per 100 bull calves is another index of survival. It is necessary to assume that calf production and survival remains constant from year to year and that the sex ratio at birth is 50 males for each 50 females. Examination of moose fetuses and calves indicate the presumption is essentially correct, according to Robert A. Rausch, Management Biologist, ADFG.

Findings:

Lower Susitna-Matanuska Valleys

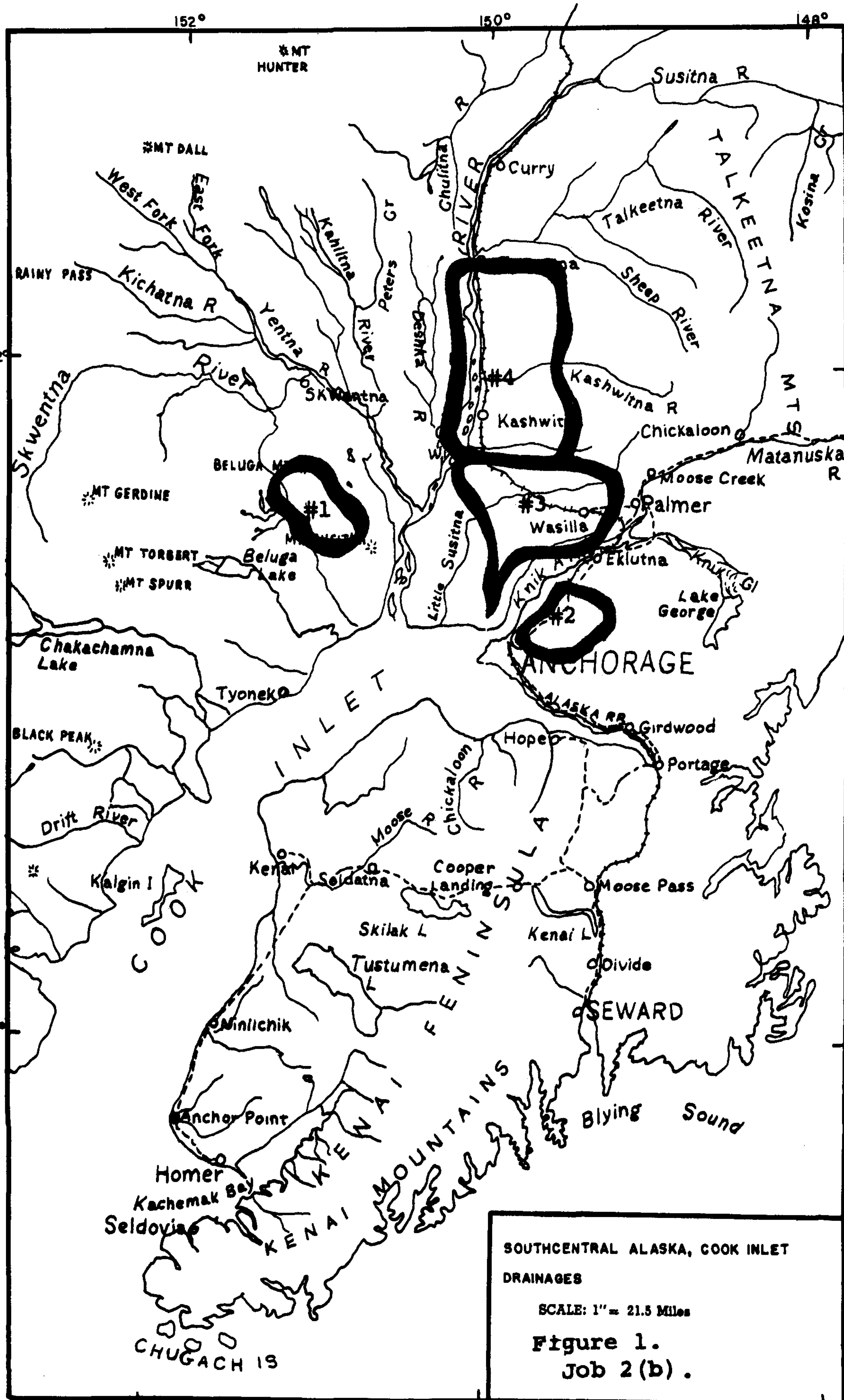
The general area of the Lower Susitna, Matanuska Valley and Anchorage region is illustrated in Figure 1. Counts were flown in these areas on October 13, 14, 15, 21, and November 8, 9, 11, and 14. In an attempt to follow previous work done in this field, aerial censuses were closely allied to areas covered in the past.

The Kashwitna-Willow areas were combined unintentionally when the pilot and observer failed to recognize the borders of each area. The area censused in the Matanuska Valley was increased somewhat this year in an effort to better realize the effects of hunting.

Productivity.

Productivity in the Lower Susitna and Matanuska Valleys is good again this year. Calf/cow ratios compared exactly with last year's count of 42 calves per 100 cows. Although the Kashwitna-Willow area (Figure 1) averaged 39 calves per 100 cows last year, the count this year dropped that category to 32 (Table 1). The Matanuska Valley on the other hand, shows a slight increase in the calves per 100 cows ratio indicating productivity is still good despite hunting pressure reducing the bull/cow ratio to 6/100.

In the Mt. Susitna and Beluga area (Area #1, Figure 1) located generally between the two mountains, a much lower calf/cow ratio is noted. This area dropped from a figure of



SOUTHCENTRAL ALASKA, COOK INLET DRAINAGES

SCALE: 1" = 21.5 Miles

Figure 1.
Job 2(b).

48 in 1958 to 27 this year (Table 1). The factors entering into the situation are not understood at this time. Winter browse conditions are not known and availability of browse may have been decreased due to an expanding moose population.

Twinning varies considerably within the Lower Susitna areas when compared to last year's count. The figures for the Anchorage area show an increase (14 twins/100 cows as opposed to 6 twins/100 cows in 1958) over the previous year's figures. This may be attributed to a small sample size in part, as the total count in that area in 1958 was 398 moose as opposed to 69 moose this year (Table 2). Also, the Anchorage area (Area #2, Figure 1) flown in 1958 covered the area from the railroad on the north to the Chugach Mountains on the southwest, with the Glenn Highway bisecting the area. This year (1959), the area surveyed extended from the Glenn Highway south and west along the Chugach Mountains and included the Ship Creek and Campbell Creek drainages. The number of twin calves per 100 cows with calf varied in one other place significantly. The Mt. Susitna-Mt. Beluga area dropped from a ratio of 26 twin calves per 100 cows with calf to 5 twin calves per 100 cows with calf (Table 1). As the sample size for 1959 (175) very closely approximated the 1958 count (189), we can assume twin production has decreased. The reasons for a decrease in twin production are not fully understood at present, but subsequent annual surveys by aircraft will determine if the trend will continue.

Survival.

Survival of young bulls to 18 months is considered fair. In the fall of 1958, the bull calf per 100 cows ratio was 22:100 (assuming a 50-50 sex ratio) for the Matanuska Valley. When that ratio is compared to the 1959 fall composition count of 3 young bulls (18 months approximately) to 100 cows (Table 1), we find it indicates nearly a 14 per cent survival.

An area such as the Mt. Susitna-Beluga expanse experienced good survival as indicated by the young bulls per 100 bull calves ratio of approximately 60 per cent (Table 1). Hunting is nonexistent in this area for all practical purposes. The young bull per 100 cows ratio in the same area suggests survival has not changed greatly since the 1958 composition count. In 1958, 9 young bulls per 100 cows were counted and this year (1959), 8 young bulls per 100 cows were tabulated.

Table 1. Sex and age ratios in the Susitna and Copper River drainages, winter 1959-1960.

Area	Total ♂/100♀	Young ♂/100♂ (adult)	Calves /100♀	Twin Calves /100♀	Calf % in Total Herd	Young ♂ % in Total Herd	Young ♂/100♂ Calves	Young ♂/100♀	Total Moose
Matanuska Valley	6	65	48	5	31	2	11	3	793
Kashwitna-Willow area combined	21	24	32	-	21	3	26	4	633
Mt. Susitna & Mt. Beluga	97	9	27	5	12	3	60	8	175
Anchorage area	13	67	60	14	35	3	17	5	69
Average, Lower Susitna Valley	34	41	42	8	25	3	29	5	1,670
Lake Louise area	40	35	57	3	29	5	37	10	132
Alphabet Hills	94	12	44	0	18	4	45	10	119
Average Nelchina area	67	24	51	2	24	5	41	10	251
Combined Average Nelchina area & Lower Susitna Valley	51	33	47	5	25	4	35	8	1,921

Table 2. Summary of moose population composition counts in the Susitna and Copper River drainages, winter 1959-1960.

Area	Young Males	Adult Males	Total Males	F & 0	F & 1	F & 2	Total Females	Total Calves	Total Moose
Matanuska Valley	13	20	33	280	222	12	514	246	793
Kashwitna-Willow area combined	17	71	88	-	-	-	414	131	633
Mt. Susitna & Mt. Beluga	6	70	76	58	19	1	78	21	175
Ft. Richardson area	2	3	5	19	18	3	40	24	69
Lake Louise area	7	20	27	30	36	1	67	38	132
Alphabet Ridge	5	42	47	28	22	0	50	22	119
Totals	50	226	276	415	317	17	1,163	482	1,921

Copper River Valley

As Figure 2 illustrates, the Copper River Valley includes the Nelchina River Basin, the Copper River and its tributaries (from the Tazlina River to the Sanford River), and most of the tributaries of the Susitna River above Deadman Creek.

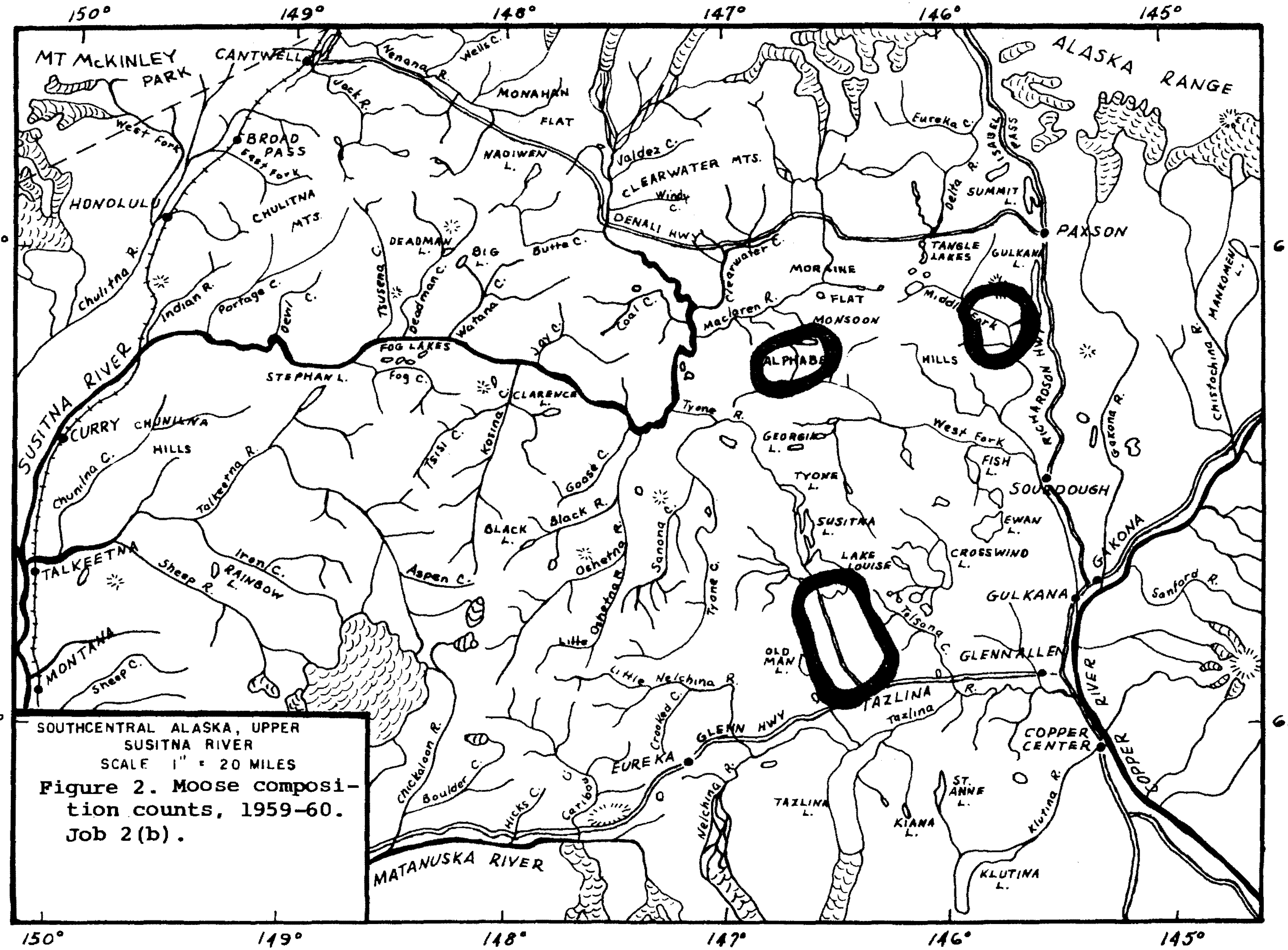
Due to extremely poor flying conditions during the period of the counts (October 28, 29, 30, November 22, and December 3), the pilot and observer sampled only two of the areas (one of which is split into two parts on Figure 2). The Lake Louise area (Area #1, Figure 2) was one of these and the other was the Alphabet Hills region (two parts). Although the observer intended to count the entire Alphabet Hills region (Area #2, Figure 2), weather would not permit it. Ice fog, high winds, and turbulence were the main contributors to the situation which kept us grounded. The remainder of this discussion will be confined to the areas flown. Table 1 summarizes the results of the counts.

Productivity.

The 1959 fall counts indicate a rise in the number of calves per 100 cows (Table 1) in both the Alphabet Hills and Lake Louise areas. In 1958, the fall count showed 35 calves per 100 cows in the Alphabet Ridge area while the 1959 count revealed 44 calves per 100 cows. The 1959 count in the Lake Louise area was 57 calves per 100 cows as opposed to 47 calves per 100 cows the year before. The count taken in the Lake Louise area closely approximates the count taken in that area in 1958. Calf production remains good to excellent as evidenced by the 1959 count. The 1959 Alphabet Hills count was very small when compared to the previous year's count and therefore may not be representative.

Survival.

The only criterion available at the present time is the survival of young bulls to 18 months. The 1958 bull calf per 100 cows ratio was 23 in the Lake Louise area. This year our count of young bulls per 100 cows totaled 10. The young bulls per 100 cows can be compared to last year's bull calves per 100 cows to establish mortality from bull calves to bulls 18 months of age. In the Lake Louise area, it appears that mortality factors have reduced the 1958 fall calf population



SOUTHCENTRAL ALASKA, UPPER SUSITNA RIVER
SCALE 1" = 20 MILES

Figure 2. Moose composition counts, 1959-60. Job 2(b).

by more than 50 per cent.

In the Alphabet Hills region, if we compare the 1958 bull calf per 100 cows ratio with the 1959 young bull per 100 cows ratio we find that 10 young bulls per 100 cows (Table 1) remain from the 1958 count of 18 bull calves per 100 cows. This indicates a higher survival rate than the Lake Louise area and it is to be expected. The Lake Louise area count produced 40 bulls per 100 cows this year as opposed to 62 bulls per 100 cows in 1958. The Alphabet Hills are less accessible by hunters than is the Lake Louise region, which has a road and waterway penetrating it.

The 1959 counts in the Alphabet Hills (Table 1) resulted in a small sample (119) compared to 1958 counts (1,154). This may account for the discrepancy in the following bulls per 100 cows analysis. In the 1959 counts, the Alphabet Hills area revealed 94 bulls per 100 cows. Last year's (1958) figures reveal that 68 bulls per 100 cows were counted. It is possible that the two areas of the Alphabet Hills counted in 1959 contained a higher percentage of bulls, but this writer believes the sample size was not large enough to compare with the 1958 count.

Recommendations:

Sex and age composition counts should be continued and an effort made to obtain an experienced observer and pilot. Knowledge of the areas involved appears to be a prerequisite to better counts. Utilizing inexperienced personnel is undesirable and should be avoided if possible.

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Volume 1 Report No. B-2c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 2c Title: Breeding Biology and Productivity Studies Southcentral Alaska

Period Covered: May 1, 1960 to June 15, 1960

Abstract:

1. Moose calving progressed from May 15, 1960 when calves were first sighted, to a peak on May 23 to May 25. The final calf:cow ratio was 105 calves per 100 cows.

2. Twins occurred in 21 per cent of the pregnancies.

3. Calf mortality cannot be computed for 1960 until the fall composition counts are flown to supply the remainder of the information relative to survival.

4. An experimental moose calf tagging program was initiated in the lower drainages of the Matanuska, Little Susitna, and Susitna Rivers using helicopters to capture the calves. Between May 24 and June 9, 1960, 206 moose calves and 1 adult female moose were tagged.

Objectives:

1. To determine areas utilized for calving, patterns and dates of parturition, initial productivity and survival of calves.

2. To tag as many calves as possible as an aid in the study of early mortality.

Techniques:

Aerial calf counts were made during May and June, 1960 with Piper Super Cubs. Piloting the aircraft were Edward P. Keough, Alaska Department of Fish and Game Research Biologist, James H. Branson, U. S. Fish and Wildlife Service, and Edward L. Williams, commercial pilot. Robert A. Rausch, Management Biologist and Jack C. Didrickson, Research Biologist, were observers on all flights.

Counting time totaled 55 hours and 18 minutes. The 12 counts were initiated on May 11, 1960 and continued through June 10, 1960. The first calves were seen on May 15, 1960. All counting took place at low altitudes, generally between 300 and 600 feet. Early morning (3:00 A.M. to 8:00 A.M.) was found to be the most advantageous time for counting.

The major problem involved in making accurate parturition/cow observations from the air is the tendency for some cows to hide calves. The problem became particularly noticeable during the last aerial counts. The female moose will leave the calf and move 100 to 200 yards away to browse. As the parturition counts move into June, vegetation becomes more luxuriant adding to the difficulty in locating moose calves. Often, during the latter portion of the parturition counts even aerial buzzing fails to make the female approach the calf. It is not until a diligent search is made of the area that one can locate the calf. It is believed that some calves are not located, especially during June, for these reasons.

Early morning counts, persistent circling of questionable cows, and learning the locations preferred by the female moose all aided in reducing the questionable cow category. There was, however, a steady increase in the questionable cow category for the latter part of May and the first 10 days in June. Early calf mortality, emerging vegetation, and the female moving away from the calves as the latter gain independence are some of the factors which enter into the problem.

The calf counts were conducted in the lower Susitna and Matanuska River Valleys. The specific areas utilized for this study are shown in Figure 1.

An experimental moose calf tagging program was undertaken as an aid in the study of early mortality. Calves were tagged on May 24, 25, 26, June 3 and 9 using donated Army and Air Force helicopters and chartered commercial UH-12E Hiller helicopter. Crew members of military helicopters were from the 80th Transportation Company (Light Helicopters), Fort Richardson (Army) and the 5040th Operations Squadron, Elmendorf Air Force Base. In addition to the author, tagging crews were made up primarily of Alaska Department of Fish and Game personnel: Robert A. Rausch, Albert W. Erickson, and Gerry Atwell, Management Biologists, and Melvan E. Morris, Biological Aide. A Fish and Wildlife Service pilot, James H. Branson, assisted helicopter crews by locating moose calves while they were engaged in the capture of other moose calves. It is believed this procedure reduced the capture time per calf substantially, resulting in greater operating efficiency for the tagging crews. Total helicopter flying time including time spent going to and from the tagging areas was 47.5 hours.

The areas where the tagging occurred were located in the lower Susitna and Matanuska valleys with the exception of the Eagle River Flats, near Anchorage on the south side of Cook Inlet and the Chickaloon River Flats on the Kenai Peninsula, Figure 1.a.

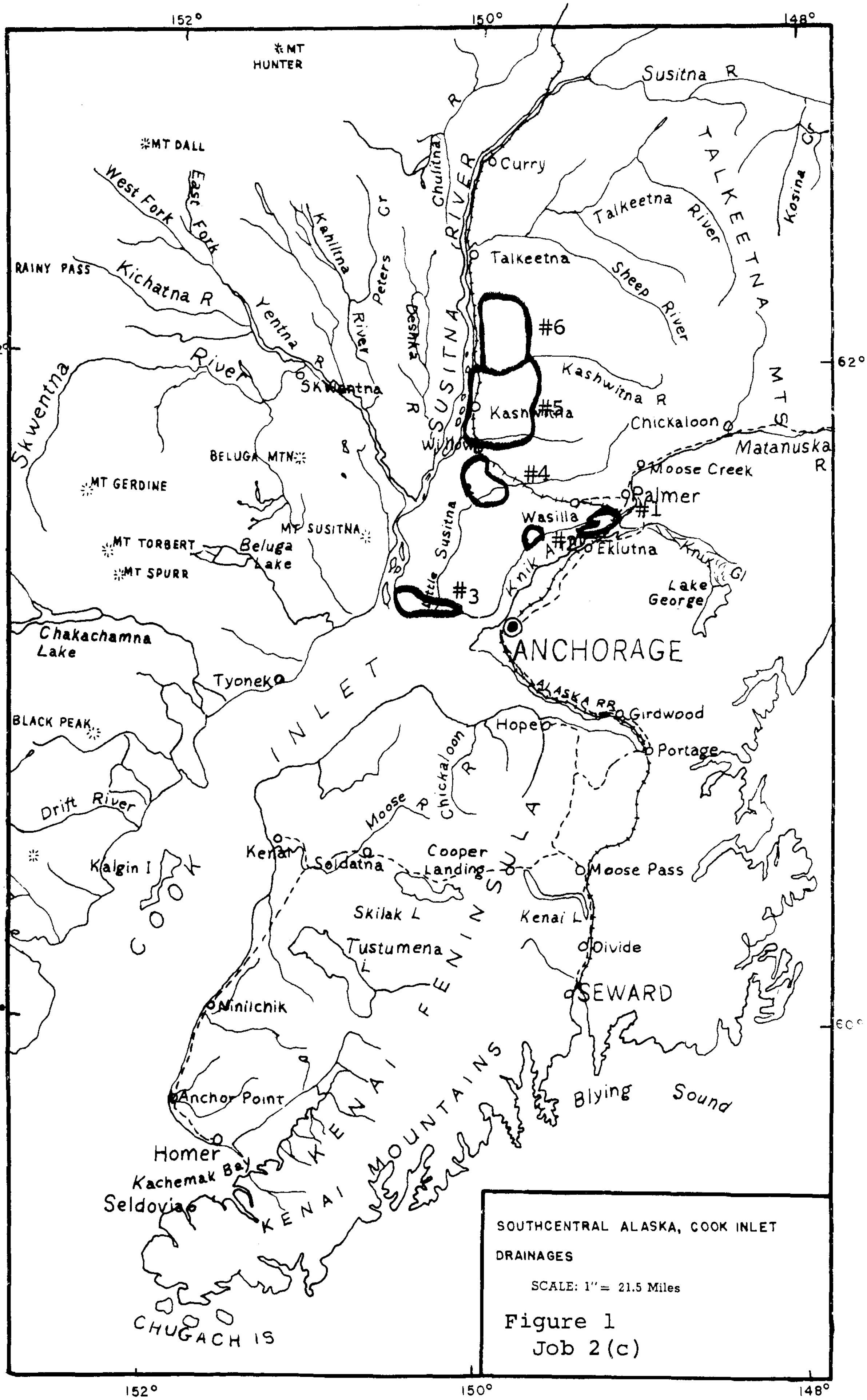
Problems that had previously been encountered while conducting aerial moose calf counts were also in evidence during the tagging operation. In some areas, such as Goose Bay the moose left the open marshy region during the late morning period and entered the heavily wooded surrounding area where they could not be found. Flying conditions were good in the early morning with only occasional patches of fog preventing the crews from tagging in areas that had previously been selected. Shifting the operation to another area until later in the day solved the problem. Early morning flights (3:00 A.M. to 9:00 A.M.) also resulted in finding greater numbers of moose calves.

One member of the tagging crew attempted to get the location of the calf spotted from the helicopter to facilitate its capture. That man led the crew to the calf. When it was seen on the ground, the crew attempted to catch it on foot. Capture of the calf was relatively simple if it was a

Figure 1. Moose calving concentration areas in the lower Susitna Valley, May-June, 1960.

Key:

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



SOUTHCENTRAL ALASKA, COOK INLET DRAINAGES

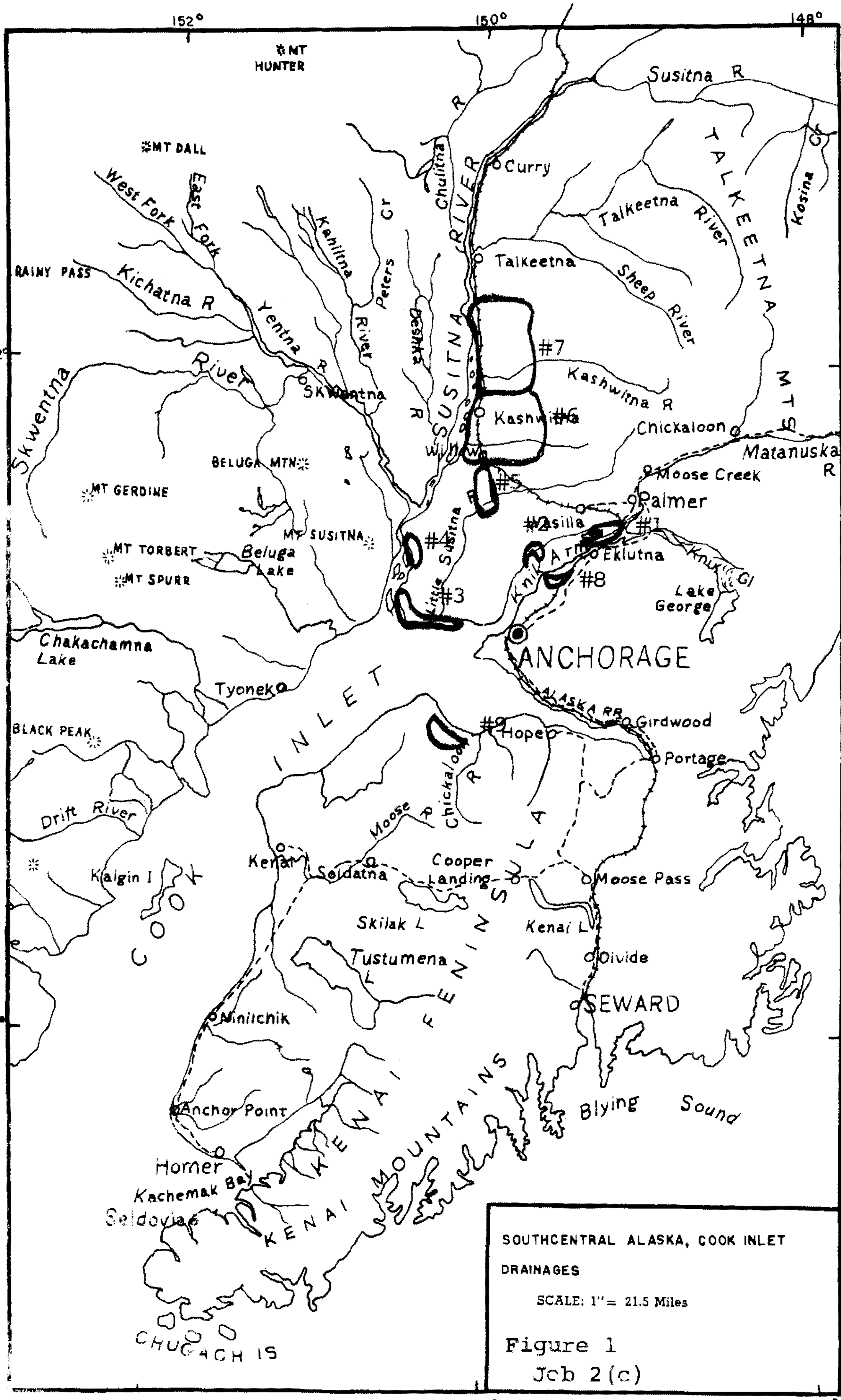
SCALE: 1" = 21.5 Miles

Figure 1
Job 2(c)

Figure 1a. Moose calf tagging area in Southcentral Alaska, May-June, 1960.

Key:

- #1 Palmer Hay Flats
- #2 Goose Bay
- #3 Susitna Salt Flats
- #4 Flathorn Lake
- #5 Lake Nancy
- #6 Willow
- #7 Kashwitna
- #8 Eagle River Flats
- #9 Chickaloon Flats



SOUTHCENTRAL ALASKA, COOK INLET DRAINAGES

SCALE: 1" = 21.5 Miles

Figure 1
Job 2(c)

week or less old. Older calves could usually outrun a man on the marshy terrain.

The downdraft from the helicopter rotor blades was used to drive the cow away from the calf. The noise and nearness of the aircraft also aided in this maneuver. This method usually worked; however, there were occasions when the cow would not leave the calf. To save time and in the interest of safety, these animals were by-passed.

The calves were easily spotted from the helicopters in flight, but on the ground it was extremely difficult to locate them. In several instances the helicopter pilot returned to the area to locate the calf for the tagging crew. The cow moose, which had then been released from harassment by the helicopter often returned to search for the calf, also. Because cows charge on occasion, tagging crews were especially alert during these situations.

After the calf was caught it was tagged with a numbered metal cattle tag in each ear. The entire operation took only a minute or two depending on the size of the calf. As soon as the calf was sexed and released, the helicopter was summoned by hand signal to pick up the tagging crew and the search for another moose was resumed.

An eight inch yellow streamer attached to the ear tags marked calves sufficiently enough to prevent recapture in all cases except one. In that instance, the tags and the tape were coated with dried mud and were difficult to see.

Utilizing the Super Cub to spot calves for the helicopter crew also worked well, as the men in the helicopters experienced little difficulty in locating the calves after the Super Cub crew had pointed out the general area.

The Hiller helicopter offers some distinct advantages. The centrally located pilot permits quick exit for the two men comprising the tagging crew. It also was an advantage in that the stability of the craft was maintained. In those three place helicopters where the pilot sits on one side, it is difficult for the pilot to correct for the 350 approximate pounds loss in weight when the crew suddenly departs from the craft. In early June the calves were quite large and could easily outrun a man in the muskeg type areas in which they were found. The Hiller helicopter is very maneuverable, and chasing the cow away from the calf was achieved quickly. Upon returning to the calf, the pilot utilized downdraft from the rotor blades to force the calf into an open area. Once this was accomplished one of the tagging crew could jump from a height of 3 or 4 feet, where the helicopter was hovering directly onto the calf in order to capture it. Occasionally if the calf was not caught immediately, the tagging crew would crouch low in the muskeg while the helicopter pilot herded the calf back to the men. Usually, however, the helicopter returned to the cow to keep her distracted while the tagging crew captured and tagged the calf.

Although the smaller helicopter was more maneuverable and catching calves was more quickly accomplished, one disadvantage was noted. The large H-21 helicopter's twin rotors clear the ground by 15 feet; however, the small Hiller's tail rotor is located at the rear of the fuselage and clears the ground by only three and one half feet, creating a safety hazard to the tagging crew and an obstacle when landing in muskeg.

Findings:

Progression of Calving.

Periodic aerial counts were utilized to determine the pattern of calving. Calves were first sighted on May 15, 1960 when a set of twins and a singleton were spotted. The progression of calving is presented in Table 1 which shows the daily increase in the number of calves seen per 100 cows during the survey period. Large samples were sought to increase the validity of the information; however, it was late in May before sample counts of 150 female moose were obtained.

A graphical interpretation of the data is presented in Figure 2, which illustrates the observed progression of calving. Figure 3 represents the estimated progression of calving, with "status unknown cows" included with the "cows with calves" segment. The peak of calving shown in Figure 4 was derived by plotting the daily parturition increment data from the curves in Figures 2 and 3. All curves are fitted visually and follow the technique described by Ronald O. Skoog, Research Biologist in the 1958 Federal Aid (Alaska) 12(3)56-70 report. These graphs were compared to calving information obtained by Robert A. Rausch and described in Federal Aid (Alaska) 13(2)27-41.

Table 1. Summation of aerial surveys on the progress of calving in the lower Susitna and Matanuska Valley moose populations, May and June, 1960.

	F w/o Calf	F Status Unknown & M's	F w/1 Calf	F w/2 Calves	F w/3 Calves	Total Females	Total Calves	Total Cows & Calves	Short Yearlings (11-12 mos.)	Total All Animals
5/11/60	37	0F & 6M	0	0	0	37	0	37	15	58
5/15/60	74	2F & 0M	1	1	0	78	3	81	47	128
5/17/60	53	2F & 0M	1	1	0	57	3	60	15	75
5/19/60	73	8F & 3M	9	2	0	92	13	105	42	150
5/20/60	55	11F & 2M	11	2	0	79	15	94	56	152
5/23/60	85	52F & 5M	52	16	0	205	84	289	25 (& 4 unidentified)	323
5/25/60	56	12F & 7M	42	9	0	119	60	179	26	212
5/27/60	95	18F & 13M	48	17	0	178	82	260	11	284
5/29/60	67	19F & 23M	52	11	0	149	74	223	7	253
5/31/60	42	20F & 15M	82	20	0	164	122	286	64	365
6/2/60	53	21F & 40M	67	17	0	158	101	259	20	319
6/10/60	42	28F & 47M	44	11	1*	126	69	195	15	257

* Probably female with a pair of twins and one adopted calf.

Figure 2. Actual parturition:cow observations made in May and June, 1960 of the lower Susitna and Matanuska Valley moose populations.

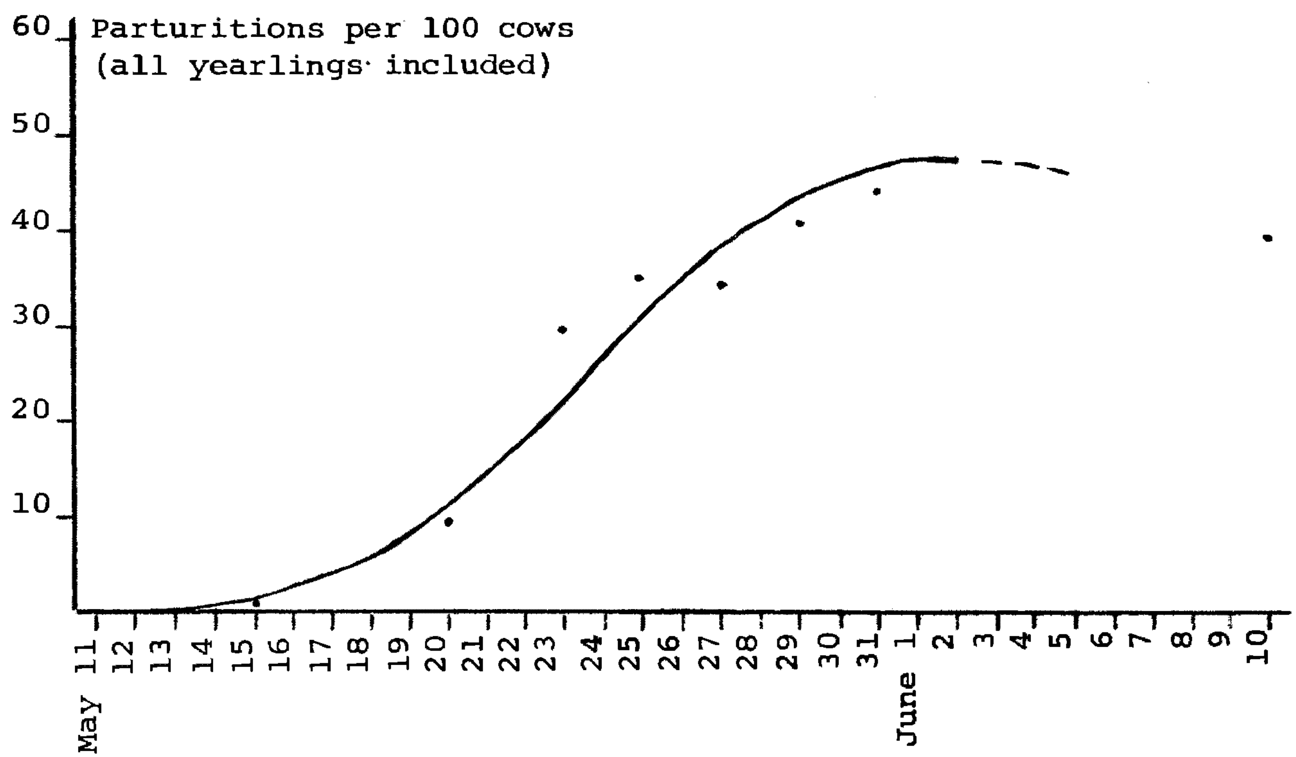


Figure 3. Estimated parturitions per 100 cows based on aerial surveys made of the lower Susitna and Matanuska Valley moose populations during May and June, 1960.

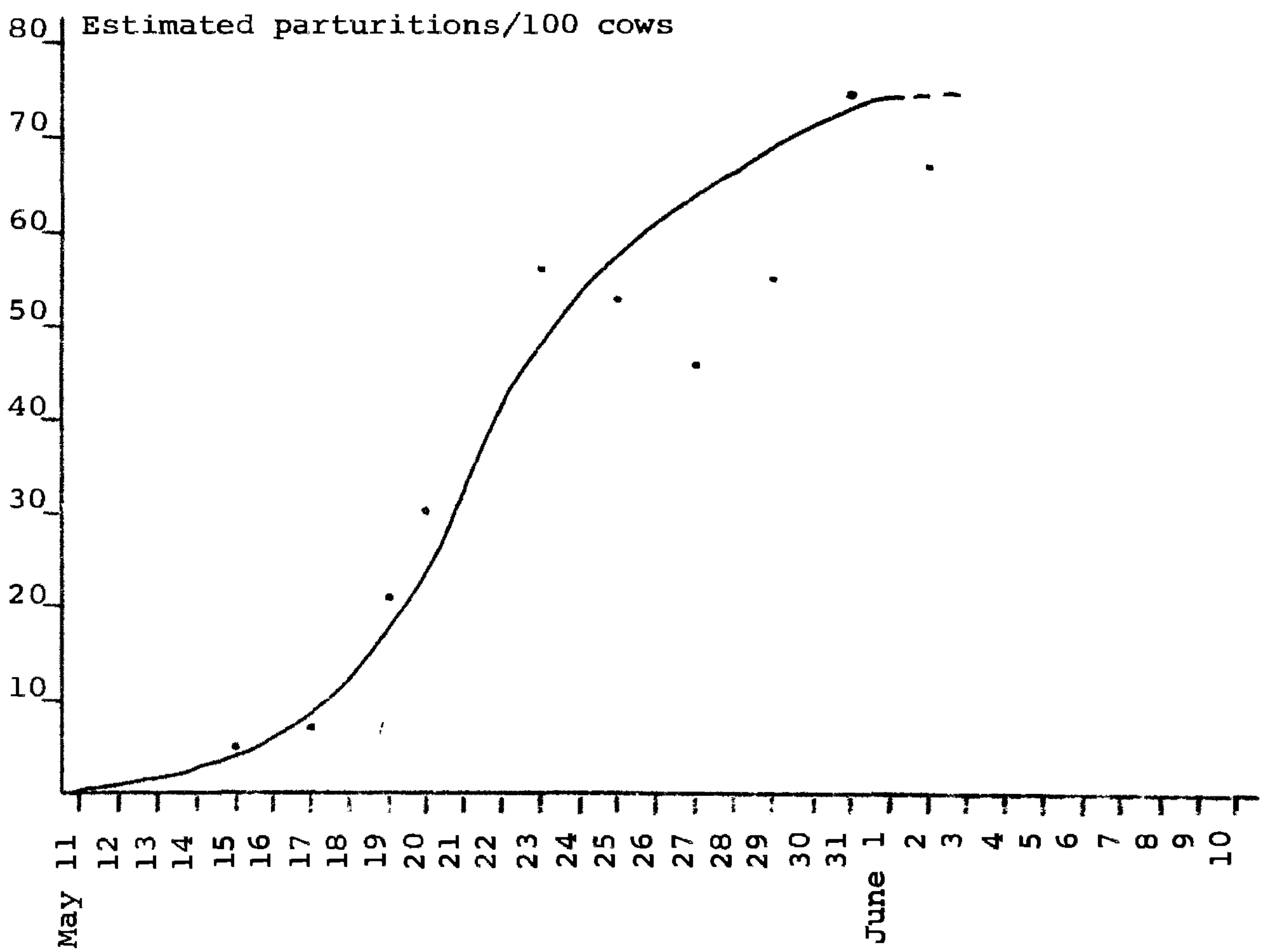
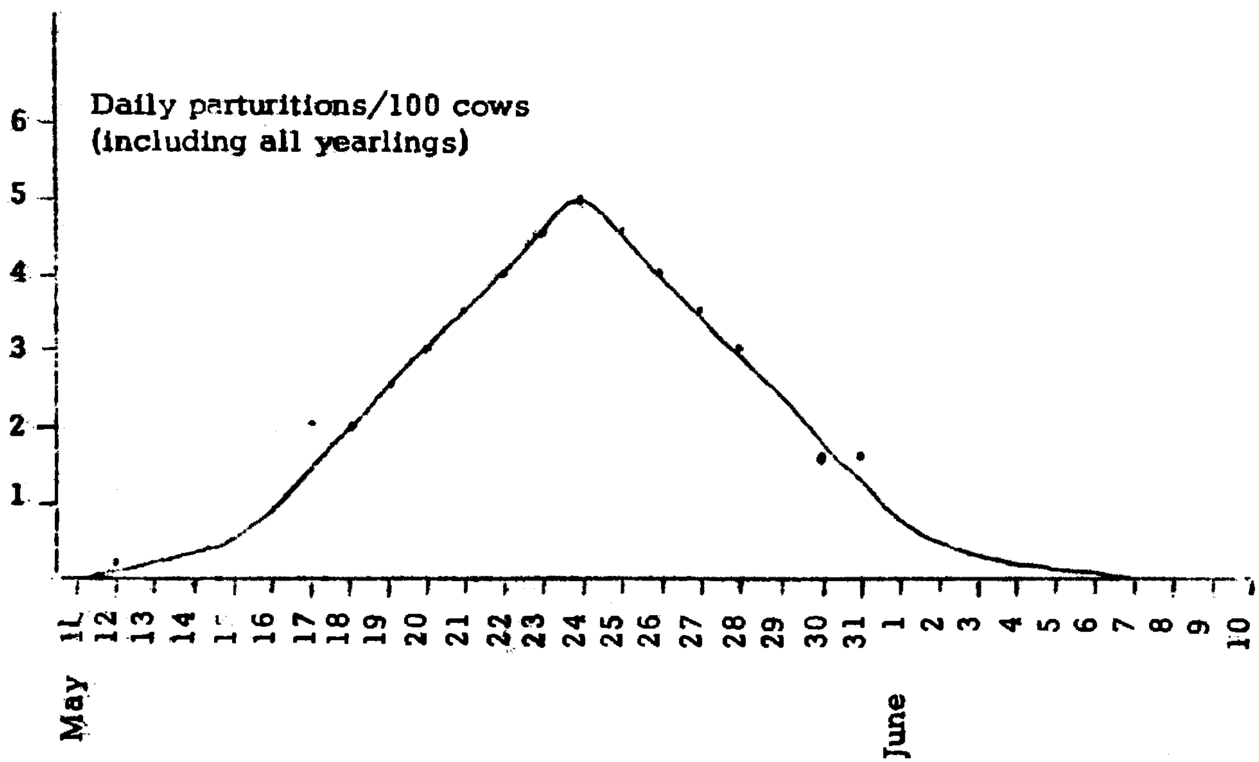


Figure 4. Progression and peak of moose calving in the lower Susitna Valley, May - June, 1960.



In 1958, Rausch found the peak of the calving occurring between the 24th and the 27th of May. Information derived from the 1960 aerial calf counts revealed the 23rd to the 25th of May to be the peak of calving. Yearlings were included with the cows this year when it was found that during counts made early in 1960 many cows were classified as yearlings by the observers.

Magnitude of Calving.

An estimate of the calf crop was made based on the early June parturition counts and on the *in utero* observations made on 100 cows collected in the study areas from 1956 to 1959. Approximately 65 to 75 parturitions per 100 cows on May 31 and June 2 is indicated in Table 2. The parturition/cow ratio refers to the number of cows that have given birth at the time of the aerial counts. The term is more exact than a calf/cow ratio, because moose frequently have twins. Aerial observations cannot separate non-reproducing Class 1 females (12-24 months) from older females, thus an estimate of this segment of the population is required. Rausch used an arbitrary value of 12 per cent in 1958, and since conditions have not changed appreciably, the value will be utilized again this year. Using this figure, 88 out of every 100 cows counted in 1960, could therefore, have been pregnant. The *in utero* examinations reveal 95 per cent of all females 24 months and older are pregnant. The average number of sets of twins per 100 parturitions between May 23, 1960 and June 2, 1960 was 21. The average number of singletons was 63 for a grand total of 105 calves per 100 cows derived as the estimated calf crop for 1960. This is actually the rate of calving rather than the size of the initial crop of calves and indicates a satisfactory rate of reproduction or calf crop.

Survival.

Aerial counts conducted this fall will enable the writer to complete this section. The calves will then be approximately six months old and survival to that age can be computed.

Calving Areas.

The areas utilized for calving in the lower Susitna-Matanuska valleys are primarily wet, marshy lowlands. In some instances, however, calving activity was observed in the

Table 2. Moose calving progression in the lower Susitna and Matanuska Valleys, spring, 1960.

Date	Observed Parturitions: 100 Cows	*Estimated Parturitions: 100 Cows	Calves 100 Cows	**Twins:100 Parturitions	Total Cows in Sample
5/11/60	0	0	0	0	37
5/15/60	2.5	5.0	3.8	50.0	78
5/17/60	3.5	7.0	5.3	50.0	57
5/19/60	12.0	20.7	14.1	18.2	92
5/20/60	16.5	30.4	19.0	15.4	79
5/23/60	33.2	58.5	41.0	23.5	205
5/25/60	42.9	52.9	50.4	17.7	119
5/27/60	36.5	46.6	46.1	26.2	178
5/29/60	42.3	55.0	49.7	17.5	149
5/31/60	62.2	74.4	74.4	19.6	164
6/2/60	53.2	66.5	63.9	20.2	158
6/10/60	44.4	66.7	54.7	21.4	126

* Computed by including unknown status females as having calves.
** Questionable triplet group included in twin:singleton ratio as twins.

adjacent foothills on drier sites. In the lowlands there were large marshy open areas or meadows interspersed with dense brushy stands of willow, aspen, birch and alder. Here and there clumps and islands of spruce were in evidence. Insufficient data have been collected to date, however, to accurately delineate calving areas in relation to the total habitat utilized by the moose populations in these areas.

Calf Tagging.

A total of 207 moose was tagged during this operation. Of these 206 were calves and 1 was an adult female. The latter became temporarily exhausted during harassment by the helicopter and was tagged before it recovered.

Areas utilized for moose calf tagging were very closely associated with the areas involved in the spring aerial moose calf counts. Areas such as the Palmer Hay Flats, Goose Bay, Susitna Salt Flats, Lake Nancy, Willow and Kashwitna were visited each day by the tagging crews. The Eagle River Flats were visited three times. The Chickaloon Flats were visited on June 9, 1960 to collect seven female moose calves for transplant to an area in Southeastern Alaska. The crew also tagged eight males in this area.

Table 3 gives a record of moose calves tagged in Southcentral Alaska in May and June of 1960. Of the 206 calves tagged, 62 were twins. In 84 per cent of the cases where twins were encountered, both calves were tagged. Sixteen per cent of the sets of twins encountered had only one of the twins tagged. The main reason both twins were not located was the diversion of attention to one calf. As the tagging crew chased one of the calves, the other ran out of sight or would lie down quietly and not move, making it extremely difficult to locate. Very little time could be spent looking for the second calf because it was much more profitable to seek another calf which was not hidden. Calves were generally captured as the helicopter crews located them but when a single cow with calf was spotted and at the same time a cow with twins was seen, the natural tendency to catch the pair of calves would bias a twin calf-cow ratio.

The sex ratio was nearly 50 males per 50 females (Table 3). The slight predominance of males (50.5 per cent) in a sample of this size would not, in all probability, have a great deal of significance.

Table 3. Moose calves tagged in Southcentral Alaska, 1960.

Date	Females	Males	Sets of Twins Encountered	Sets of Twins Both Tagged	One Twin Tagged	Total Calves
5/24/60	14	17	6	5	1	31
5/25/60	23	19	6	5	1	42
5/26/60	21	38	7	5	2	59
6/3/60	19	14	4	4	-	33
6/7/60	18	8	4	4*	-	26
6/9/60	7**	8	4	3*	1	15
Totals	102	104	31	26	5	206
Per cent:						
Of Total Calves	49.51%	50.49%	30.10%			
Of Twins Encountered				83.87%	16.13%	

* One female removed for transplant from each set of twins.
** All females were taken out of the area for transplant purposes.

Recommendations:

Aerial parturition counts should be made next spring to further evaluate productivity and survival. Counts should be initiated early in May but halted in June to eliminate variables such as calf independence and the new leaf growth concealing calves.

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Volume 1 Report No. B-2d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 2d Title: Characteristics of Hunter Harvest, South-central Alaska

Period Covered: August 15, 1959 to December 1, 1959

Abstract:

A summary of the characteristics of the hunter moose harvest for 1959 is presented below. Information was obtained from a checking station operated on the Denali Highway and from commercial locker plant data gathered in the Anchorage and Palmer areas.

1. A total of 1,159 hunters was checked through the Denali checking station. Of the 1,159, 613 were hunting moose and caribou, 41 were hunting moose only, and 505 were hunting caribou only.

2. Of the 41 hunters specifically hunting moose in the Denali area, 14 per cent were successful on a per hunt basis. Of the 613 hunting both moose and caribou, only 6 per cent were successful in bagging a moose per hunt.

3. Locker plant checks revealed a calculated 1,249 moose processed commercially in the Anchorage and Palmer areas.

Objectives:

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

Techniques:

A hunter checking station, located at Mile 1.5 on the Denali Highway was operated periodically during the first moose season. Moose seasons in Southcentral Alaska are as follows:

Unit 6, 7	West of 148°W long.	Aug. 20-Sept. 20
Unit 6	East of 148°W long.	Closed season
Unit 14	North of Little Susitna River	Aug. 20-Sept. 20
		Nov. 1-Dec. 10
Unit 14	Draining into Cook Inlet between Girdwood and Portage	Aug. 20-Sept. 20
Unit 14	Remainder of Unit 14	Aug. 20-Sept. 20
		Nov. 1-Nov. 30
Units 11 & 16	(Except Kalgin Island)	Aug. 20-Sept. 20
		Nov. 1-Nov. 30
Unit 13	(Except Denali and Paxson Reserves)	Aug. 20-Sept. 20
		Nov. 20-Nov. 30

One bull a year was the maximum allowable take for moose hunters in the units specified above. The remainder of the information on the total moose kill in Southcentral Alaska was gained from interviews with guides and outfitters, a guide questionnaire by mail, and locker plant data. The locker plants supplied information relative to the number of pounds of moose meat processed. To determine the weights of moose processed at establishments butchering these animals, the proprietors were interviewed. It was generally agreed that 400 pounds per animal was a reasonable figure for the per cent of each moose actually taken to the processing plant. The average moose will dress out in excess of this figure, but the entire animal is not usually taken to the commercial processing plant. To further verify these figures, weights of individual moose were recorded and weights of parts of moose were tallied. It was concluded that 400 pounds is the approximate average weight of moose meat per animal actually processed commercially. This figure was used in determining the number of moose processed when only total poundages of moose processed were available. The raw data obtained are filed at Anchorage in the P-R office, Alaska Department of Fish and Game.

Findings:

The Denali Highway checking station provided data on 48 known moose kills for the 1959 moose hunting season. The number of hunters checked through the Denali checking station totaled 1,159 during the 8 days it was operated (Table 1). Weekends were utilized primarily. Of the grand total of 1,159 hunters checked through the station during its operation, 406 hunters, or 35 per cent, were recorded during the Labor Day weekend (9/5/59-9/7/59).

The Maclaren River Valley, located between Mileposts 31 and 40, was shown to be one of the most popular hunting areas. The area between Milepost 51 and Milepost 60 yielded the same number of moose (9), however only 83 persons hunted there as compared to 148 persons hunting in the Maclaren River area.

A total of 1,159 hunters were contacted at the Denali checking station. Of these, 505 were interested in hunting caribou only. Of the 613 hunters hunting both moose and caribou, 6 per cent were successful in bagging a moose. The hunters hunting moose exclusively realized a much greater success ratio, 14 per cent of 41 hunters being successful per hunt. The difference is believed to be due to the manner in which the game was sought and the hunting effort put forth by the moose hunter. Those hunters who seek moose only generally engage equipment (track vehicles, airplanes) which avails them of otherwise inaccessible hunting areas and aids them in returning meat to the highway.

Guide questionnaire returns were tabulated by Edward P. Keough, Research Biologist for the Alaska Department of Fish and Game. The questionnaires were mailed to all guides registered on the last guide roster (1956) compiled by the U. S. Fish and Wildlife Service. The questionnaire mailed to guides in the Nelchina area revealed that 147 moose were taken by hunters employing these guides. Hunters were questioned closely to avoid duplication of information, especially if they had employed a guide. Exclusive of the checking station contacts, interviews with guides, outfitters, and hunters in the Denali portion of the Nelchina area were conducted by ADFG biologists, Ronald O. Skoog, Albert W. Erickson, Edward P. Keough, and Jack C. Didrickson. Information obtained from these interviews revealed that an estimated 159 moose were taken in the Denali area.

Table 1. Chronological distribution and location of moose kills by hunters on the Denali Highway, 1959.

Location Denali Hwy. Mileposts	8/20 H	8/20 M	8/21 H	8/21 M	8/22 H	8/22 M	8/23 H	8/23 M	9/5 H	9/5 M	9/6 H	9/6 M	9/7 H	9/7 M	9/17 H	9/17 M	Total H	Total M
1- 10	0	0	2	0	2	0	0	0	0	0	4	0	5	0	0	0	13	0
11- 20	1	0	6	0	6	0	8	0	3	0	2	0	12	0	0	0	38	0
21- 30	2	0	13	1	12	0	16	1	7	0	5	0	18	0	5	3	78	5
31- 40	16	1	27	2	25	1	27	3	7	1	7	1	37	0	2	0	148	9
41- 50	0	0	5	0	5	1	6	0	4	1	5	1	6	1	0	0	31	4
51- 60	2	1	15	0	10	0	15	1	11	3	1	0	24	3	5	1	83	9
61- 70	3	0	12	1	9	0	9	1	3	0	0	0	9	1	1	0	46	3
71- 80	2	0	24	0	16	1	19	2	4	1	9	2	5	0	4	0	83	6
81- 90	12	0	20	0	31	0	12	1	5	0	4	0	6	1	2	0	92	2
91-100	8	0	12	0	33	0	30	0	0	0	11	0	2	0	0	0	96	0
101-110	1	0	9	2	16	0	16	1	2	0	12	1	15	1	0	0	71	5
111-120	0	0	2	0	14	0	0	0	0	0	3	0	11	0	2	0	32	0
121-130	0	0	0	0	7	0	2	1	0	0	0	0	0	0	0	0	9	1
* Road	15	1	31	0	69	1	65	0	27	0	37	0	83	1	12	1	339	4
Totals	62	3	178	6	255	4	225	11	73	6	100	5	233	8	33	5	1159	48

Key: H = Hunters
M = Moose
* = Milepost unknown

The total estimated number of moose taken in the Nelchina area was 354. This figure was obtained by compiling the moose take figures obtained from the guide questionnaires (147 moose), the interviews (159 moose), and the checking station data (48 moose).

A calculated total of 1,137 moose was processed commercially in locker plants located in Anchorage. This figure was obtained by contacting personnel of each locker plant in the area and finding out how many pounds of moose meat were processed by each plant. In the Anchorage locker plants approximately 454,800 pounds of moose meat were processed during the 1959 season. Rupert E. Andrews, Research Biologist at Palmer, Alaska, reported 112 moose (44,800 pounds, approximately) processed commercially by the locker plants in the Palmer area. Thus the poundage figures obtained from locker plants in the Anchorage and Palmer areas give a calculated total of 1,249 moose processed.

No processed moose meat figures were obtained from the Kenai or Seward areas. U. S. Fish and Wildlife personnel stationed at Kenai, Alaska reported an estimate of 700 moose taken by hunters on the Kenai Peninsula. This figure includes 348 known moose kills. The estimated total of 1,249 moose could include some of the 348 known moose kills on the Kenai because hunters may have had their game processed at locker plants located either in Anchorage or Palmer.

Totals of known moose kills in Southcentral Alaska obtained from checking station operations, guide questionnaires, and interviews with guides, outfitters, and hunters in no way approach the figures supplied by commercial locker plant data. This situation suggests an intensive survey be conducted in locker plants following the 1960 moose hunting season in order to obtain a more accurate figure of the total number of moose kills.

An estimated total of 1,200-1,300 moose was processed in Southcentral Alaska during the 1959 hunting season. It is suggested by this writer that this total be used as a minimal kill figure for Southcentral Alaska.

Data concerning age composition of hunter killed moose (Table 2) was obtained from 11 moose jaws returned to the checking station. This data indicates that 36 per cent of the animals belonged to Age Class II and 27 per cent belonged

Table 2. Age class of hunter killed moose in the Denali area, 1959.

Age Class	Number of Jaws	Percentage of Total Jaws by Age Class
I	2	18
II	4	37
III	3	27
IV	2	18
V	0	0
VI	0	0
VII	0	0
VIII	0	0
IX	0	0
Total	11	100

to Age Class III. None of the animals aged was put in an age class higher than IV. Because the sample size is small, it precludes any analytical statements based on age composition.

Recommendations:

A sampling of the hunter harvest should be continued and the possibility of correlating locker plant data to harvest data should be investigated.

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Volume 1 Report No. B-2e

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

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

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

1. Moose mortalities from sources other than legal hunting numbered 269. Of that number, 150 were railroad kills, 44 were highway kills, 27 were illegal kills, and the remaining 48 kills from miscellaneous causes.

2. Of the 150 railroad mortalities, over one third or 55 were killed between Willow and Talkeetna on the railroad.

3. Parasitism occurred in 38 instances, including 4 cases of *Dictyocaulus* sp., believed to be the first reported in the Matanuska Valley.

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 or wolf predation.

Techniques:

All possible instances of mortality resulting from railroad and highway accidents, predation, pathological causes, parasitism, and winter kill were investigated. Carcasses were autopsied in an attempt to determine the cause of death and condition of the animal. When practical, reproductive data, weights and measurements were recorded. In addition, specimen material was collected and preserved. Carcasses in suitable condition were donated to charitable organizations after autopsy.

All enforcement agencies were contacted and supplied with information relative to location of Alaska Department of Fish and Game personnel on a 24 hour basis. Organizations or persons calling to report moose mortalities were cautioned against removal of the carcass prior to autopsy by Alaska Department of Fish and Game biologists.

Railroad officials agreed to continue submitting monthly reports of train kills as had been the policy with the U. S. Fish and Wildlife Service. A survey of railroad moose mortality was also conducted during April and May by Federal Aid biologists and aides who walked a total of 150 railroad miles gathering the information.

Findings:

Railroad Mortality

During the period of June 1959 through May 1960 a minimum of 150 moose were killed by trains of the Alaska Railroad. Foot surveys by the Alaska Department of Fish and Game located 122 kills and reports of the Alaska Railroad accounted for 40 kills for a grand total of 162 recorded kills. Since 12 of these were duplicate records, a minimum kill of 150 was established. The actual total kill no doubt is greater than this figure since on the 150 miles of track covered by foot, survey crews recorded 122 kills as opposed to only 25 recorded by the railroad reports. Had it been possible to cover the entire route by foot, the total recorded kill would have been somewhat greater. The report of moose mortality on the railroad as recorded by the Alaska Railroad and the Alaska Department of Fish and Game is shown by 10 mile segments in Table 1.

The most significant aspect of Table 1 is that it clearly indicates that the greatest kill occurs between Mile 1 and 70 (Seward to Portage) and Mile 141 and 220 (Anchorage to Talkeetna), 22 per cent and 72 per cent of the kill respectively. In the

Table 1. Moose mortalities by the Alaska Railroad, June 1959 to June 1960.

A.R.R. Milepost		Report Source A.R.R.	ADFG	
0-10		1	0	
11-20		3	5	
21-30		2	8	
31-40		1	7	
41-50		2	1	
51-60		0	5	
61-70		2	1	
	Subtotal	11	27	
71-80		0	0	
81-90		2	0	(not covered
91-100		0	0	on foot by
101-110		1	0	ADFG)
111-120		0	0	
121-130		1	1	
131-140		0	0	
	Subtotal	4	1	
141-150		2	4	
151-160		0	2	
161-170		0	4	
171-180		2	12	
181-190		1	11	
191-200		4	18	
201-210		2	19	
211-220		3	18	
	Subtotal	14	88	
221-230		0	0	(not covered
231-240		8	6	on foot by
241-250		0	0	ADFG)
above 250		3	0	
	Subtotal	11	6	
	Total	40	122	
	GRAND TOTAL			*162

* 162 includes 12 duplicate reports, thus the calculated total kill is 150 animals.

latter area, further inspection shows that 55 of the kills occurred between Mile 191 and 200 (Willow to Talkeetna) and indicates that this is a problem area.

In addition to checking the track on foot and by train, aerial counts were attempted during April 1960. Between Seward and Portage aerial counts showed five moose casualties as did a count made from the train. When the same segment of track was checked on foot, thirty kills were found. This indicates that to properly evaluate the rail kill of moose it must be done on foot. A possible alternative might be to calculate the ratio of kills observed by air to kills observed from the ground. Should this prove a relatively constant value under given circumstances, it might be possible to approximate the total kill by extrapolating the number of kills observed from an aerial check.

There are several reasons why the reports from the Alaska Railroad do not show the actual kill. Conductors and crew members of the railroad cited instances such as fog, rain, snow, and darkness when a train could strike a moose without their knowledge. Occasionally moose have approached a moving train from the side and such an encounter is not detected until inspection of the entire train upon arrival at the destination. The location of such encounters is seldom known.

During snow storms moose frequently remain near the tracks, probably to avoid walking in the deeper snow off the tracks. Engineers operate trains at slow speed during snow storms, but reduced visibility still causes moose-train accidents. The snow banks tend to confine the animal to the tracks, particularly in sections where the hills rise steeply on both sides.

The rate of salvage of moose carcasses by the Alaska Railroad is quite low. Checks during the foot surveys showed that only 27 percent of the moose killed were salvaged. Reasons for the low salvage percentage are not completely known at present. However, it appears that most moose are killed during snow storms during December, January and February. Moose hit by trains during snow storms can be thrown into the snow drifts along side of the tracks and covered with fresh snow before the next train passes by. If the snow is deep, trains with plows attached are sent to clear the tracks and consequently moose carcasses are hidden in this manner. Recovery is unlikely until the snow melts exposing the carcass too late to salvage.

Section crews located at strategic points along the railroad are responsible for salvage of train-killed moose. Table 1 indicates that salvage operations should be concentrated in the Seward-Portage and Willow-Talkeetna areas, particularly during periods of extreme snow accumulation in January, February and March.

Highway Mortality

During the period December 1, 1959 to June 30, 1960, a minimum of 44 moose were struck by automobiles. The areas primarily concerned were the Matanuska Valley (Palmer), Anchorage, and to some extent, Portage. Highway moose kills plotted on a map reveal a majority of the collisions occurring along main highways close to the outskirts of population centers. High speed and the difficulty in seeing moose at night cause most of the mortalities.

Of the 44 highway mortalities recorded 22 were adults and 22 were calves. Assuming that there are less calves than adults in a population the proportion of calves in the above data would suggest that they are more vulnerable to highway mortality than adults.

Illegal Kills and Other Causes of Mortality

During the period from December 1959 to June 1960, 27 illegal moose kills were examined. The figure is not believed to be indicative of the total illegal kill however, and should be considered minimal.

Forty-eight other mortalities included dispatch of wounded animals, possible winter kills, and animals found in various stages of decomposition where the cause of the death could not always be determined. These mortalities occurred during the same period as the illegal kills listed above.

Parasitism was recorded in 44 instances, although never directly assigned as the cause of death. Thirty-three livers were found to be infected with cysts of *Taenia hydatigenia*. All lungs were taken to the Arctic Health Research Center and examined there by members of its parasitology laboratory. They reported seven cases of *Echinococcus granulosis*, a hydatid cyst found in the lungs. Also reported were four cases of

Dictyocaulus sp., a lung nematode. This is believed to be the first incidence of *Dictyocaulus* sp. noted in moose in the Matanuska Valley. Of the animals infected, 2 were found near Wasilla, and the remaining 2 in Palmer and Jonesville.

There were no recorded instances of moose being killed by predators. It is known, however, that moose calves are subject to predation by bear, and adults are subject to predation by wolves from time to time under certain circumstances.

Discussion

Two hundred sixty-nine moose were killed from sources other than legal hunting. Of the 269, 150 were train mortalities, 44 were highway mortalities, 27 were illegal kills, and the remaining 48 were mortalities from miscellaneous causes.

Whenever possible, data on sex, lower jaws, reproductive tracts, measurements, and specimens of parasites and disease tissue were collected to add to the growing file of biological information on moose in Alaska which can be utilized in other investigations. This information is recorded in the Federal Aid in Wildlife Restoration files of the Alaska Department of Fish and Game at Anchorage, Alaska.

One important aspect of the investigation is the fact that all tallies of moose mortality from factors other than hunting in Southcentral Alaska are absolute minimum figures. Present information indicates the sources of mortality and their relative importance. Future investigations should be directed towards determining methods which will enable the investigator to evaluate the effect of the particular mortality cause on the moose population in question.

Recommendations:

1. The moose kill reporting system should be continued and expanded on the Alaska Railroad. Salvage operations between Willow and Talkeetna should be intensified by section crews in that area.

2. Foot surveys should cover the entire length of the Alaska Railroad between Milepost 0 (Seward) and Milepost 226.7 (Talkeetna) during the spring months

to accurately determine the winter moose mortality along this segment of the railroad.

3. All available biological data should be obtained from moose carcasses when practical. Special emphasis should be directed toward the collection of parasites.

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Volume 1 Report No. B-2f

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 2f Title: Range Studies, Southcentral Alaska

Period Covered: February 1, 1960 to April 30, 1960

Objectives:

1. To delineate primary winter moose ranges.

2. To determine key indicator browse species on these areas.

3. To establish browse utilization and condition indices to be used on selected key wintering areas to evaluate current range conditions.

Procedures:

1. Aerial reconnaissance will serve to locate primary moose wintering areas.

2. Each area will be checked by a ground crew to determine suitability for study.

3. Ground inventories will be designed to record occurrence, utilization and condition of key browse species on a sampling basis.

4. Key inventory wintering areas will be selected to serve as "indicators" of current winter range conditions.

Findings:

This project was inactive for the period, 1959-60.

Prepared by:

Jack C. Didrickson
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Approved by:

Sigurd T. Olson
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James W. Brooks, Director
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Volume 1 Report No. B-2g

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 2g Title: Moose-Black Bear Relationships

Period Covered: May, 1959 to June 30, 1960

Objectives:

To determine where, when and the degree to which black bear predation on moose calves occur, and to evaluate its importance to the welfare of the herds.

Procedure:

Studies will be conducted on representative moose calving areas in the Susitna River Valley and on the Kenai Peninsula. Moose calf production and survival within these areas will be determined during the course of other moose investigations or specifically in connection with this study. Relative numbers and age composition of bears on the calving areas prior to, during and following the calving period will be estimated from aerial surveys. Predational aspects will be evaluated by observation, searches for killed calves, stomach analysis of sacrificed bears, and comparisons of calf survival on areas of high and low bear densities.

Findings:

This project was inactive for the period, 1959-60.

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Volume 1 Report No. B-3a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 3a Title: Herd Status, Interior Alaska

Period Covered: December 1, 1959 to June 30, 1960

Abstract:

1. Although it is generally known that moose are widely distributed and comparatively numerous in the interior substantiating quantitative information is largely unavailable.

2. The harvest of moose in the interior is small in relation to the harvestable surplus. This is due in part to the "bulls only" hunting law in effect.

3. Intensive moose management practices will probably not be needed in the interior for some time to come, the interim period can be used to good advantage for future long range research studies.

Objectives:

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

Techniques:

The findings resulting from investigations of moose distribution, numbers, sex and age composition, productivity, harvest, etc., because of interrelationships, must be synthesized before herd status can be adequately clarified to serve the needs of management. This job therefore entails bringing together all data bearing on present herd characteristics and trends, and assessing them according to past, present, and anticipated future environmental conditions and harvest demands. With this information for guidance, regulations may be directed more precisely and effectively toward improved resource management.

Findings:

The main purpose of this report as stated above has been to bring together the available information concerning the status of the moose in the interior and to assess it in accordance to the needs of management. The question might also be raised, what are the needs of management as related to moose in the interior of Alaska?

Since an attempt has already been made to compile and analyze the findings of individual phases of the moose research work in job completion reports, this discussion will be limited to an attempt to condense the available information and then evaluate it. This discussion will not include a review of the published literature.

Moose Distribution and Numbers.

Moose are distributed throughout the interior of Alaska. Although comparatively large numbers of moose have been observed and recorded in specific areas from the Canadian border to the Kobuk River near the base of the Seward Peninsula the approximate size and extent of these herds are unknown. Sportsmen in this area generally consider moose plentiful and the residents in the smaller communities scattered throughout the interior have indicated that an adequate winter supply of moose meat is comparatively easy to obtain. In addition, residents who have lived in the interior for a number of years generally believe that moose are increasing in number in the interior.

The Moose Harvest and Its Relationship to the Harvestable Surplus of Moose.

One of the early attempts at gathering big game harvest information in Alaska included the technique of requesting this information for the past year from individuals applying for a new hunting license. This technique had some limitations and an attempt was made starting in 1954 to implement the information obtained with the use of big game checking stations. These stations were located along highways at key points. Because of the various methods used in reaching moose hunting areas including that of airplanes, and boats as well as cars, the comparatively small and scattered human population, and because of the large areas involved, the moose harvest information obtained via this method has been somewhat limited.

Some idea of the relationship of the moose harvest to the harvestable surplus can be obtained indirectly. In this regard perhaps one of the more important generalizations that can be drawn is that the bulk of the moose harvested (which game managers are directly concerned with) are taken around the fringes of the more heavily populated areas and along the limited highway system. Much of the interior is highly inaccessible and receives practically no hunting at all. In addition, moose hunting is limited to a male sex hunt only. Since the bull-cow sex ratios and productivity remain high, the only conclusion that can be reached is that hunting has little or no influence on the overall moose population in the interior of Alaska today.

Productivity and Survival.

The main moose research effort in the interior of Alaska to date has been that of determining productivity and survival. This information has been obtained during the fall and early winter months on selected areas by means of aerial observations.

The productivity information which in reality is productivity less mortality up to the age of about 6 months, has been obtained by computing calf-cow ratios from the field data. The survival information has been obtained by computing the ratio of yearling bulls (recognized on the basis of antler development) to bull calves. The difference being considered mortality. These data present some problems. In addition to the possibility that the two samples in the survival computations may not have been derived from the same statistical population, some difficulties have been encountered when attempting to obtain samples representative of the structure of the moose population as a whole. Specifically, it has been found that the adult bulls, young bulls, cows without calves, and cows with calves are not distributed randomly but are grouped in various combinations, as yet not completely understood.

During the 1960 spring moose calving season an attempt was made to obtain additional productivity information by making repeated aerial moose counts over a selected area during the parturition period. The information obtained indicated that rather high mortality takes place as soon as the calving season is well under way. This information conflicts with that obtained in the past during the fall counts in adjacent areas. Because of this, the disproportionate bull-cow ratio that was obtained (a larger number of bulls than cows), and because of the possibility that the pilot and observer simply failed to see the calves proportionately as the season progressed, no attempt was made to draw conclusions based on these data.

One additional facet of moose ecology was studied briefly during the 1959-60 winter period. During the fall and early winter months the moose were observed scattered throughout a number of vegetative types. During the late winter period that can be considered critical for most big game, these animals were found distributed along the foothills in a deciduous shrub belt area between the spruce forest valley floor and the tundra type vegetation at the higher elevations.

Recommendations:

1. Plans should be made to initiate an either sex moose hunt in the interior as soon as the general public can be convinced of its desirability.

2. The use of a big game tag and hunter report card system should be considered for resident as well as nonresident hunters.

Prepared by:	Approved by:
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	James W. Brooks, Director Division of Game

Volume 1 | Report No. B-3b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

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

Period Covered: October 1, 1959 to June 30, 1960

Abstract:

The areas, from which moose age composition and abundance information have been obtained in the past by means of aerial observation, were reflown during the fall of 1959. The same methods that were used in the past were used in this study so that the base from which the information was obtained would be as comparable as possible.

The number of moose seen per hour of flying time continues to vary from year to year. Some of the variations in 1959 were believed to be due to the change in personnel and the intensity with which the area was covered. Other variables of climate, weather and animal movements will always affect the data obtained.

The productivity information obtained suggests that productivity and survival to the age of about six months was high in all of the areas covered. Some variables other than changes in productivity and survival to the age of six months that may influence the data obtained were recognized, but were believed relatively unimportant.

The indicated survival of bulls to the yearling age was comparable to the survival data obtained in the past. A

number of variables, however, appear to affect these data.

Objectives:

The objectives of this study as stated in the Plans, Specifications and Estimates were:

1. To determine the sex and age composition of identifiable moose populations subject to either significant hunting pressure or wolf predations.

2. To establish an index to relative moose abundance in the areas where herd composition counts are conducted.

Techniques:

Moose sex and age composition counts have been made yearly in the interior of Alaska since 1954. In order that the data obtained be as comparable as possible, the procedure used during the fall of 1959 was similar to that followed in the past. Sex and age composition counts were made in three general areas of the Tanana Valley, Fortymile River drainage and Koyukuk River drainage. The specific areas from which the data were obtained within these drainages are listed in Table 1.

All of the information was obtained by means of aerial observations. During the course of the counts three different types of aircraft were used. These were: a 140 horsepower Champion, a 150 horsepower Super Cub, and a Cessna 170. The observations were made from elevations averaging 500-700 feet. No specific flight pattern was followed for all areas. However, the general procedure followed once the count area had been reached was that of making parallel flights about one fourth to one half miles apart. No attempt was made to obtain tctal numbers of animals for any area.

Five categories of animals were recorded. These categories, the same as those used in the past, were:

1. Young bulls--antlers spiked or forked with little or no palmation. These animals were considered yearlings; however, there is probably some overlap between this class and the adult class.

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

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

4. Calves--young of the year.

5. Unidentified.

The sex and age composition counts in the Tanana Valley were made during the first 22 days in November. The counts in the Fortymile River drainage were made on December 5, 10, and 20. Those in the Koyukuk River drainage were made on December 13 and 15.

Findings:

The moose sex and age ratio data that were obtained during the fall of 1959 in the Tanana, Fortymile, and Koyukuk river drainages are listed in Table 1. A total of 890 moose was observed and recorded during this period. Two hundred sixty-four of these were found in the Tanana Valley area, 256 in the Fortymile River area and 370 in the Koyukuk River area. In addition to following the same procedure in obtaining these data, all of the findings have been compiled in the same manner as that used in the past by the Department of the Interior, Fish and Wildlife Service so that direct comparisons could be made. A total of 43 hours and 4 minutes were flown during the counting operation. This included ferry time, counting time, and lost time for various reasons.

Moose Seen Per Hour of Flying Time

In an attempt to obtain an index to moose abundance in the past, the number of moose seen per hour of flying time have been recorded. These data are compared with that obtained during the fall of 1959 in Table 2. About one and one half times as many hours were flown during the fall of 1959 as during the two previous seasons. There may be several reasons for this difference. One of the main reasons perhaps is that new personnel were making the counts. Also, during the 1959 fall season an attempt was made to obtain an adequate sample even if additional time had to be expended in obtaining that data.

Table 1. Moose sex and age trend counts, 1959.

Area	MALE			FEMALE				Calves Without Cows	Total Calves	Total Ident. Moose	Total Unid. Moose	Total Moose
	Lg.	Sm.	Total	W/O	W/1	W/2	Total					
Tanana Valley												
Chena R.	2	0	2	4	2	1	7	2	6	15	0	15
Chatanika R.	1	0	1	4	4	1	9	0	6	16	0	16
Salcha R.	1	0	1	1	0	0	1	0	0	2	0	2
Goodpaster R.	0	0	0	1	1	1	3	0	3	6	2	8
Shaw Creek	7	4	11	10	10	0	20	2	12	43	0	43
Total above areas	11	4	15	20	17	3	40	4	27	82	2	84
Salchaket Slough area	45	12	57	51	23	8	82	1	40	179	1	180
SUB TOTAL	56	16	72	71	40	11	122	5	67	261	3	264
Fortymile												
West Fork	20	11	31	12	4	0	16	0	4	51	4	55
Mosquito Fork	41	32	73	38	36	6	80	0	48	201	0	201
Total above areas	61	43	104	50	40	6	96	0	52	252	4	256
Koyukuk												
Koyukuk to Huslia	85	26	111	61	44	12	117	1	69	297	10	307
Huslia to Hughes	23	4	27	15	6	1	22	0	8	57	6	63
Total above areas	108	30	138	76	50	13	139	1	77	354	16	370
GRAND TOTAL	225	89	314	197	130	30	357	6	196	867	23	890

Table 2. Comparison of moose seen per hour in the Tanana, Fortymile and Koyukuk Valleys during 1957, 1958 and 1959.

Area	Total No. Moose Seen			No. Hours Flown			No. Moose Seen Per Hour		
	1957	1958	1959	1957	1958	1959	1957	1958	1959
Tanana	242	427	264	9.8	11.8	12.7	24.7	36.0	20.8
Fortymile	141	129	256	3.5	3.3	9.0	40.0	39.1	28.3
Koyukuk	226	553	370	6.5	4.2	7.3	34.6	131.6	50.6
Totals	609	1,109	890	19.8	19.3	29.0	30.7	57.4	30.7

The number of moose seen per hour of flying time in both the Tanana River and Fortymile River drainages was less than that observed during either of the other two years. The number seen per hour in the Koyukuk River area was larger than the number seen in 1957, but much smaller than the number seen in 1958 (Table 2). A number of variables, however, affect these data. As stated previously, the main objective of this work was to obtain an adequate sample for the sex and age ratio information that was being collected. Thus, the number of hours flown obtaining these data was of secondary importance. In addition, the number of hours flown from year to year may vary greatly because of the large variation in weather conditions, snow cover, animal groupings and their movements, and because of the difference in intensity with which different workers may cover an area from year to year. If data indicating the number of moose seen per hour is to be significant however, the total number of hours flown, the speed at which the aircraft is flown, the path followed and weather conditions should be comparable. Thus, the procedure used in obtaining data to meet the requirements of the one objective tends to minimize the value of these data in meeting the requirements of the other objective.

Productivity

Tanana Valley.

Moose productivity during the 1959 spring calving season in the Tanana Valley areas sampled appears to have been high. The number of calves varied from 68 per 100 cows in the drainage areas north of Fairbanks to 49 per 100 cows in the Salchaket Slough area (Table 3). The percentage of twin calves per 100 cows averaged 15 and 26 per cent respectively for these two areas.

When the combined areas for the Tanana Valley are compared with the data obtained during the preceding three years (Table 4) moose productivity during the 1959 spring calving season appears to have been excellent. The number of calves increased from 42 and 43 per 100 cows in 1957 and 1958 respectively to 55 calves per 100 cows in 1959. Similarly, the sets of twin calf ratio increased from 5, 2, and 9 per 100 cows in the preceding three years to 22 sets of twins per 100 cows with calves in 1959. Increased productivity is also suggested when the number of calves observed are expressed as a percentage of the total herd (Table 4). A four to six per

Table 3. Sex and age ratios in moose populations, Tanana Valley, Fortymile, and Koyukuk Valley, 1959.

Area	Bulls /100 Cows	Young Bulls /100 Adult Bulls	Calves /100 Cows	Sets of Twin Calves/ 100 Cows w/Calves	Calf % of Total Herd	Young Bulls % of Total Herd	Young Bulls /100 Bull Calves	Young Bulls /100 Cows	Total Identi-fiable Moose
Tanana									
Chena, Chatanika, Goodpaster R.s & Salcha, Shaw Cr.s	38	36	68	15	33	5	29	10	82
Salchaket Slough area	70	28	49	26	22	7	60	15	179
Above areas combined	60	29	55	22	26	6	47	13	261
Fortymile									
West Fork of Fortymile	194	55	25	0	8	22	550	69	51
Mosquito Fork of Fortymile	91	78	60	14	24	16	133	40	201
Above areas combined	108	70	54	13	21	17	165	45	252
Koyukuk									
Koyukuk to Huslia	95	31	60	21	23	9	74	22	297
Huslia to Hughes	123	17	36	14	14	7	100	18	57
Above areas combined	100	28	55	21	22	8	79	22	354

Table 4. Comparison of sex and age ratios in moose populations in interior Alaska.

Area	Year	Total Bulls /100 Cows	Young Bulls /100 Adult Bulls	Calves /100 Cows	Sets of Twin Calves/ 100 Cows w/Calves	Calf % of Total Herd	Young Bulls % of Total Herd	Young Bulls /100 Bull Calves	Young Bulls /100 Cows	Total Moose in Sample
Tanana Valley	1959	60	29	55	22	26	6	47	13	261
	1958	53	49	43	9	22	9	80	17	419
	1957	60	32	42	2	20	7	69	15	236
	1956	83	25	47	5	20	7	71	16	405
Fortymile	1959	108	70	54	13	21	17	165	45	252
	1958	63	56	45	8	22	11	100	23	129
	1957	91	29	46	8	19	8	89	20	140
	1956	66	30	53	0	24	7	60	15	129
Koyukuk	1959	100	28	55	21	22	8	79	22	354
	1958	44	44	55	19	28	7	49	13	520
	1957	80	25	66	23	28	6	48	16	216
	1956	(no data available)								

cent increase is indicated for the year 1959.

Fortymile.

Two areas were sampled in the Fortymile River drainage system. These were the West Fork of the Fortymile and the Mosquito Fork tributaries. The data obtained in the West Fork of the Fortymile appears to be biased and indicates that the animals recorded probably represent only a portion of the population structure in that area. This will be discussed in greater detail later. Because of this possible variable, however, no attempt will be made to discuss the two areas separately. When the data for the two areas are combined, it appears more realistic. In the combined area a total of 54 calves per 100 cows was recorded. This figure compares favorably with the one obtained in the Tanana Valley area and is consistently larger than the figures obtained during the three preceding years (Table 4). A total of 13 sets of twin calves per 100 cows was recorded in this area. This figure is also higher than that obtained in previous years. The value obtained for calves as a percentage of the total herd, however, is about the same as for the preceding three years.

Koyukuk.

Moose productivity in the Koyukuk River drainage continues to be high (Table 3). When the data for the individual areas recorded are examined, it again appears that only a portion of the moose population structure was recorded for the area from Huslia to Hughes, in particular. For this reason, only the data for the combined areas will be discussed. An average of 55 calves per 100 cows was recorded in the Koyukuk River drainage. This figure compares favorably with those obtained during the previous two years (Table 4). A total of 21 sets of twins per 100 cows with calves was also recorded in this area. This figure also compares favorably with those obtained in previous years. When the calves are expressed as a percentage of the total herd, a value of 22 per cent is obtained. This figure is slightly lower than that obtained during the two previous years.

Survival

In the past some indication of survival of young animals to the yearling stage has been obtained by comparing the "young bulls per 100 cows" for a given year with the "bull calves per 100 cows" data for the previous year. This information has also been computed for the data obtained during the fall of 1959 (Table 5). The indicated survival is comparable to that obtained during the two previous years.

Effect of Hunting

At the present time moose hunting in the interior of Alaska is limited to bulls only. The number of bulls per 100 cows in all of the areas sampled is high and since moose are considered to be polygamous, it must be concluded that moose hunting in the interior has little or no influence on the moose populations in that area. It is also interesting to note that approximately a fifty-fifty sex ratio was recorded in areas that have been subjected to light hunting pressure.

Discussion

Moose sex and age composition counts have been carried on for a number of years in various parts of the interior. The data obtained from these counts have been condensed to productivity and survival values. During this time, although fluctuations have been noted, the productivity figures obtained have remained comparatively high and within a rather narrow range. Specifically, the calf-cow ratios obtained have only varied from a low of 42 to 100 to a high of 66 to 100. One variable that could consistently be affecting these data is the extent to which young bulls may be classified as cows each year. Classifying young bulls as cows would tend to lower the calf-cow ratios. Another variable that may affect these data to some degree is the extent to which cows without calves tend to remain with portions of the herd other than the cows with calves when the herds break up in the fall. These variables, however, appear to have only a minor effect on the productivity values obtained. This is also suggested by the rather stable values obtained when the calves as a percentage of the total herd is computed (Table 4).

The problem of determining the survival of the young animals to yearling age seems to be more complicated. In order to obtain survival information, data concerning young bulls as a percentage of the total herd, young bulls per 100 bull calves, and young bulls per 100 cows have been computed. All of these values are influenced by the possibility that representative samples from the various moose populations are

Table 5. Index to the survival of bull calves to 18 months.

Area	Bull Calves/ 100 Cows 1958	Young Bulls/ 100 Cows 1959	Indicated % Survival
Tanana			
Chena, Chatanika, Salcha, Shaw Goodpaster	22	10	45
Salchaket	22	15	70
Above areas combined	22	13	60
Fortymile	22	45	100+
Koyukuk	27	22	81

not obtained. Also, the values indicating the number of yearlings in the populations are being compared with values that change from year to year.

Recommendations:

Moose sex and age ratio counts form a part of the 1960-61 P-R work plans and will lend continuity to future research efforts. Plans should be formulated to incorporate these activities into other work plans which may result in added information being obtained.

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Volume 1 Report No. B-3c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 3c Title: Breeding Biology and Productivity Studies, Interior Alaska

Period Covered: May 1, 1960 to June 30, 1960

Abstract:

During the 1960 spring period, moose breeding biology information was obtained by means of aerial observations in the Tanana Valley Flats south of Fairbanks, Alaska. In this area the moose calving period began about May 20. The maximum number of cows with calves were observed on May 27 about one week after the first calves were seen.

A decrease in the number of cows with calves and in the calf-cow ratio was observed shortly after the peak of the calving period. The question that these data raise is whether actual mortality took place or if moose cows with calves simply became more difficult to observe. Comparisons with past calf-cow ratio information obtained from adjacent areas do not answer the question.

The bull-cow ratios that were obtained during each of the flights were also computed. These data indicate that the bulls out number the cows in the area sampled. Since these data conflict with the bull-cow ratios obtained in adjacent areas in the past, the question as to which set of data or either is correct must be raised.

Objectives:

The objectives of this study as stated in the job descriptions were:

1. To determine the location of calving areas.

2. To determine patterns of calving, to include dates, initial productivity, and calf survival.

Techniques:

Location of the Study Area

The study area that was selected for the moose breeding biology and productivity study is located between the Tanana River and the foothills of the Alaska Range, a distance of about 25 to 35 miles. It extends from the Bonnifield trail, directly south of Fairbanks downstream to the Tatlanika River. This area was chosen because of its proximity to Fairbanks and the comparatively large number of moose that were known to be present.

Although the basic information needed in order to obtain productivity data was calf-cow ratios, all moose observed were recorded. Five classifications were used; bulls, cows without calves, cows with one calf, cows with two calves, and unidentified moose. No attempt was made to record the specific location of the individual animals observed. In addition to recording the moose observed, miscellaneous species observed, such as caribou, black bear and swan, were also recorded.

Equipment and Method Used

All of the productivity information recorded in this report was obtained by means of aerial observation. Specifically, a 150 horsepower Super Cub airplane was used. A department biologist did most of the piloting; however, a commercial pilot and airplane was also employed.

Reconnaissance.

During the critical winter period the general area now under discussion was flown and the moose wintering areas were recorded. At that time the bulk of the moose population was located along the foothill areas at elevations well above the Tanana Valley Flats. On May 11, 1960, following the spring breakup, the area was reflown. No moose were found in the foothills area; however, large numbers were observed in the Tanana Valley Flats. Since moose reportedly inhabit areas such as this during the calving season in southcentral Alaska, and because of the nearness of this season, it was believed that a movement out of the area was unlikely and that an adequate sample would be obtained.

Aerial Counts.

In addition to the reconnaissance flights, a total of five flights were made to obtain moose parturition information during the calving season (Table 1). No specific flight plan had been prepared prior to the initiation of the study. However, a system of strip flying evolved as the work progressed. Specifically, this system of obtaining information included flying the area in parallel strips about one half to one mile apart. When groups of animals were located, all of the animals in the general vicinity were recorded before the regular flying pattern was resumed. Thus, the method of covering the study area departed somewhat from the standard strip flying techniques but preserved enough of it so that a representative coverage was obtained. Most of the flying was done at elevations averaging 500-700 feet. At this general elevation moose can be observed at distances up to one mile and occasionally at even greater distances in the type areas under consideration.

Although adult bull moose are easily identified by their antler growth at this season of the year, sex and age identification of other groups within the population structure was often difficult. Sex and age determination was often made at elevations considerably less than that normally flown. Cows with calves were easily identified. Often, however, several passes over these animals were necessary before both pilot and observer were satisfied that a second calf was or was not present. The yearlings or young bulls were the hardest animals to identify. In this group the antlers were often represented simply as a round darkish protrusion about an inch and one half in size. Aerial passes extremely close to the animals were often needed in order to determine sex. Adult cows without calves were more easily identified by conformation characteristics.

Table 1. Breeding biology data obtained during the spring of 1960 in the Wood River, Tatlanika River drainage areas.

Date	Bulls	Cows W/O Calves	Cows W/1 Calf	Cows W/2 Calves	Total Cows	Unidentified	Total
May 11	Aerial reconnaissance, no calves observed.						
May 20	66	48	7	1	56	7	129
May 25	55	38	17	5	60	5	120
May 27	60	26	17	4	47	11	118
June 7	80	19	11	2	32	17	129
June 28	57	34	12	1	47	7	111

Findings:

The sample size that was obtained during each of the five flights and the specific sex and age ratios obtained are recorded in Table 1. The flight time averaged about three hours per trip. The sample size obtained during each of these trips was quite constant and it is believed that rather extended and intensive flying would have had to have been conducted in order to increase the sample size on the study area. A disproportionate sex ratio was obtained on June 7, 1960 (Table 1). During this flight, flying conditions were marginal and the study area was not covered as uniformly as during the other flights. It is believed, however, that the productivity data obtained was not materially affected even though the calf-cow sample size was somewhat smaller than during the other flights.

Calf-Cow Ratios.

The calf-cow ratios and the percentages of cows with calves that were obtained as the calving season progressed are shown in Table 2. On May 20, only eight cows representing 14 per cent of the cows observed were with calves. The field notes for this period indicate that in two or three instances parturition probably had taken place shortly prior to the time that the observations were made. The data in Table 2 also indicates that the bulk of the calving takes place during a comparatively short period of time and that the peak was reached near May 27 during the 1959 spring calving season. Following this date, the percentage of cows with calves and the percentage of cows with twins decreased rather rapidly. It is also interesting to note that a bull-cow ratio favoring the bulls was obtained (Table 2).

Discussion

The change in the calf-cow ratios from a high of 53 per 100 to 30 per 100 following the indicated peak of the period of parturition and the change in number from a high of 9 sets of twins per 100 cows to a low of 2 per 100 cows may indicate comparatively high early mortality. The other possibility that must be considered is that these data simply reflect an increasing difficulty to observe calves with time, or that cows with calves seek areas of denser cover with time and therefore become harder to detect. Also these data may simply reflect a lack of an adequate number of samples. When

Table 2. Changes in calf-cow percentages with the progression of the calving period.

Date	Bulls/ 100 Cows	% Cows W/1 Calf	% Cows W/2 Calves	% Cows W/Calves
May 11	No moose calves observed.			
May 20	118	12	2	14
May 25	92	28	8	37
May 27	128	36	9	45
June 7	250	34	6	40
June 28	121	25	2	28

Table 3. Comparison of fall calf-cow ratio information obtained during a six year period in a portion of the Tanana Valley adjacent to the breeding biology study area with the calf-cow ratios obtained during the breeding biology study.

Date	Calf-Cow Ratio	Year	Calves/ 100 Cows	Sets of Twin Calves/100 Cows
May 11	0	1954	77	5
May 20	17	1955	53	13
May 25	45	1956	47	5
May 27	53	1957	42	2
June 7	47	1958	43	9
June 28	30	1959	55	22

the fall calf-cow ratios that have been obtained during the past six years in the general areas near the study area are compared with the calf-cow ratios obtained and the change that took place during this study, little additional information seems to be forthcoming (Table 3). The fall calf-cow ratios for the various years involved vary almost as much as those obtained during this study.

The bull-cow ratios obtained are especially interesting (Table 2). Discounting the values obtained on June 7, the bull-cow ratio varied from 92 per 100 cows in one instance to 118, 128, and 121 bulls per 100 cows in three instances. The fall bull-cow ratios obtained in the general area adjacent to the study area during the past six years is considerably less than 100 bulls per 100 cows (Table 4). There are a number of possible answers and if the correct one is to be found more critical research is needed.

Recommendations:

The breeding biology study is scheduled to be continued during the coming year. Plans should be made to incorportate this study into a long range program designed to obtain the information needed to form the basis for continuing management work.

Prepared by:	Approved by:
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Table 4. Fall bull-cow ratios obtained during a six year period in a portion of the Tanana Valley adjacent to the breeding biology study area.

Year	Bulls per 100 Cows
1954	85
1955	123
1956	83
1957	60
1958	53
1959	60

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

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

Period Covered: August 15, 1959 to March 31, 1960

Abstract:

Harvest information for moose in the interior of Alaska is limited. The available information does suggest that in general the hunting pressure on this species in the interior is slight. Because of the size of the area, the limited highway systems, and the diverse methods of hunting used in the interior of Alaska, the harvest information obtained via checking stations and direct hunter contacts may only be valid for specific areas.

Objectives:

The objectives of this study as stated in the job descriptions were: to obtain information indicative of the total hunter kill, area hunted, age composition of the kill, hunter success, and the chronological distribution of the kill.

Techniques:

The main techniques used in obtaining information for this report included highway patrol, and hunter interview in the field. In addition, information was obtained from individuals and files of the U. S. Fish and Wildlife Service.

Information on past harvest information was obtained from a review of the pertinent literature.

Findings:

A search of the records related to harvest of moose in Alaska indicates that this type information was first obtained by requiring hunting license applicants to record game they had harvested in the previous year. This type information which was recorded on a statewide basis only, appears in Annual Reports of the Alaska Game Commission from 1948 through 1954.

Starting in 1954 the harvest of moose by specific areas in the interior of Alaska was recorded. Most of this information was obtained from the Steese-Elliott Highway system and from the Taylor Highway area in east-central Alaska. The data recorded for these areas was divided into "known kill" and "estimated kill" categories. The known kill was obtained at checking stations and from hunter contacts. The estimated kill was apparently the result of all information obtained by U. S. Fish and Wildlife Service personnel in the field.

During the 1959 fall hunting season the changeover from Federal to State control was being completed and as a result the total information obtained was somewhat limited. No checking stations were operated; however, both U. S. Fish and Wildlife Service and Alaska Department of Fish and Game personnel did obtain information via hunter contacts. The information obtained and its relationship to the information recorded during the 1954, 1955, and 1956 hunting seasons for the Taylor Highway area is recorded in Table 1. Note that the total moose harvest for this area for 1959, known and estimated, equals 100 animals. The estimated portion of the harvest figure may be a more general figure than that for previous years. Since the known kill, which was obtained largely from U. S. Fish and Wildlife Service information, compares favorably with that of previous years, the assumption can be made that the harvest in 1959 for this area was generally the same as for previous years.

Some additional information concerning hunting success is available for the interior. Local inquiry in the Fairbanks area suggests that the hunting success for the residents in that area was comparable to that of previous years. In the villages of Minchumina and Koyukuk the residents apparently obtained all of the moose meat that they wanted with little difficulty.

No attempt has been made to determine the age composition of the kill because of the limited specimen material obtained. Also, no attempt was made to determine hunter success, general areas hunted or the chronological distribution of the kill because of the limited amount of data obtained and the fact that it was limited to the portions of the harvest that results from road hunting only.

Table 1. Moose kill, Taylor Highway.

		1st. Season	2nd. Season	Total
1954	Known Kill	17	0	17
	Est. Kill*	53	5	58
Total				75
1955	Known Kill	37	4	41
	Est. Kill	13	1	14
Total				55
1956	Known Kill	57	3	60
	Est. Kill	3	4	7
Total				67
1959	Known Kill	51	0	51
	Est. Kill	0	0	49**
Total				100

* Includes known kill based on estimates by FWS personnel in the field during the hunting season.

** Estimated kill for both first and second seasons.

Recommendations:

A system of tagging big game kill combined with a hunter report card may be an approach worthy of serious consideration. Such a system could start with one or two species such as caribou and moose and then later be expanded.

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Volume 1 Report No. B-3e

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 3e Title: Mortality Studies, Interior Alaska

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

Winter moose mortality was light. Ten instances of mortality were recorded including deaths by poaching and highway kills.

Objectives:

The objective of this study as stated in the Job Descriptions was to determine the incidence of mortality from various factors, other than hunting, which operate against moose populations subject to significant hunting pressure or wolf predation.

Techniques:

No specific attempt was made to locate moose carcasses during the period under consideration. However, all instances of moose mortality observed while conducting other work in the interior and the reported moose kills from all sources other than hunting in the general area around Fairbanks were investigated and recorded. All edible meat was salvaged and given to the various charitable institutions in the area.

Findings:

Ten instances of moose mortality were recorded during the winter period, 1959-60. Two of these were observed from the air, three were the result of poaching activities, one was caused by an accidental injury indirectly related to automobile traffic, and the other four cases of mortality were directly related to highway traffic. In each of the last four instances, the accidents took place along straight stretches of the highway where the moose must have been plainly visible to the driver. Thus speed, and carelessness on the part of the driver must have been partly responsible for these accidents.

Whenever possible, the carcasses of these animals were examined. The information recorded included the condition of these animals, the cause of death, and whether or not they were parasitized. All of the animals observed were in reasonably good flesh and only two possible cases of parasitism were observed.

Recommendations:

The mortality studies in this project segment are being continued. At the present time, because of the limited data obtained, no conclusions can be drawn. An increased effort to inform the public of the danger involved in moose-car accidents may cut down on the number of accidents of this kind.

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Volume 1 Report No. B-3f

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 3f Title: Range Studies, Interior Alaska

Period Covered: February 1, 1960 to June 30, 1960

Abstract:

Major winter concentrations of moose in Interior Alaska were in foothills among deciduous shrub between the spruce forests adjacent to the rivers and the alpine tundra zone.

Objectives:

1. To delineate primary winter moose range.

2. To determine key indicator browse species on these areas.

3. To establish browse utilization and condition indices to be used on selected key wintering areas to evaluate current range conditions.

Techniques:

During the course of the winter period aerial flights were made over various portions of the Tanana River drainage. These flights were taken in order to record the general wintering location of moose.

Findings:

During the fall and early winter months when the moose composition and abundance surveys were being made, these animals were found scattered throughout rather diverse areas ranging from the extensive valley bottoms to the high mountain slopes in the Tanana drainage north of the river. During the period that could be considered the critical winter period, selected areas in the Tanana River drainage south of the river were flown. These included the areas between Tetlin Lake and the Canadian border, the Gerstle River area, and the area between the Nenana River and Wood River. The majority of the moose observed in these areas were found along the foothills in the deciduous shrub belt between the spruce type forest on the river flats and the tundra type areas at the higher elevations. No attempt was made to delineate the specific areas occupied by these animals.

Discussion

Although the total effort expended on this work was small, the information obtained indicates the direction in which one of our main work efforts may want to be directed. It is perfectly possible that once the type of wintering areas used by moose during the critical winter period are identified on the ground, that it would be possible to delineate these areas using aerial photographs. A statistically valid sampling technique could be used to determine if the areas are being correctly delineated. This type information could form part of the base that is needed and from which sound research efforts could emerge.

Recommendations:

Plans should be made to continue and expand this work effort as part of a long range, correlated, statewide program.

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Volume 1 Report No. B-4

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: B Moose Management Investigations

Job No: 4 Title: Moose Investigations, Western Alaska

Period Covered: August 15, 1959 to April 1, 1960

Abstract:

The moose habitat in northwestern Alaska is largely restricted to willow and poplar stands adjacent to rivers. In many instances, the habitat extends more than twenty-five miles in length, but only one-half mile in width.

Moose occur in most valleys of western Alaska, but the populations are localized, discontiguous and of low density. Moose have been recorded from nearly all sections of the Seward Peninsula, but only in two or three valleys do resident populations exist. Indiscriminate hunting probably influences both distribution and density.

The hunting effort is not confined to legal seasons, legal methods nor permissible animals. In some areas, the illegal harvest probably outweighs the legal take, and effectively curtails any population spread.

Objectives:

To determine the distribution and numbers, and the magnitude of harvest of moose on the Seward Peninsula and valleys of rivers flowing into Kotzebue and Norton Sounds.

Techniques:

The assessment and evaluation of the distribution and numbers, and the magnitude of harvest of moose in northwestern Alaska was accomplished by Samuel J. Harbo.

Aerial surveys conducted during the winter of 1959-60 revealed the distribution and abundance of moose. The surveys were attempted in November, but insufficient snow cover caused a postponement of the flights. In some areas unsuitable conditions persisted until late January, at which time accurate composition counts are impossible due to the antlerless condition of most bulls. Additional current distribution and abundance data, plus pertinent observations recorded during the last two decades were obtained by conversing with guides, bush pilots and other individuals possessing local knowledge.

Harvest data was obtained through several different means. Hunters, guides and other interested individuals furnished some data, harvest report forms contributed additional information and correspondence with native store managers and village schoolteachers aided in ascertaining the harvest in some areas.

Findings:

Extent of Moose Habitat.

Most moose habitat in northwestern Alaska forms narrow, winding strips, often only one-half mile wide but more than twenty-five miles in length. Perhaps the very narrowness of the willow and poplar patches is "unattractive" to moose, making some of the seemingly suitable communities actually unsuitable. Seasonal differences in suitability probably occur also, for "suitable" habitat in summer may be so changed by ice and snow conditions during winter as to make it "unsuitable." However, not enough is known of moose ecology to enable us to evaluate many of the environmental and climatic facets.

Seward Peninsula.--The only moose habitat of any extent on the Seward Peninsula exists in the Koyuk valley. Along a 40-mile stretch of the Koyuk River grow willow thickets ranging from one-half to over three miles in width, but the heaviest concentrations of willows borders the river. Many of the willows are 6 to 12 feet tall and probably afford more browse than is required by the present moose population. The area is one of relatively light snowfall, although heavy winds in the surrounding uplands blow the hills clear, distributing the snow in the valley; on March 23, 1960, snow depths of two feet were encountered in the willow thickets. The willow is interspersed with sedge flats and small ponds, and is displaced with black spruce or open tundra on the valley edges and slopes.

Two other drainages, the Niukluk-Fish and Kuzitrine drainages, have willow stands that extend more than one-half mile from the river's edge. Along the Niukluk River, the willow is interspersed with black spruce and some of the willow patches exceed 10 feet in height. Only about a 20-mile stretch of the river has such stands, however. In the Kuzitrine system only along the lower 10 miles of the river does the willow grow more than 1/2 mile from the river. A few very restricted stands of _Populus_ sp., some 25 feet high, grow in both drainages.

Willows grow along most of the other streams on the Seward Peninsula, but often they do not exceed more than 6 feet in height, nor extend more than 100 feet from the river. In some areas, willows grow only along the bends of the river.

The southeastern one-fourth of the Seward Peninsula has extensive stands of black spruce, plus a few stands of white spruce in restricted locations. Often the stands are mixed with alders, but seldom with willows. It is doubtful if such areas could support moose.

Areas Other Than the Seward Peninsula.--A short distance south of the Seward Peninsula are four rivers that empty into Norton Sound. Three of these, the Inglutalik, Ungalik and Shaktolik Rivers, are bordered by narrow bands of willows, seldom extending more than 100 yards from the river's edge except along the downstream portions of the river. In many localities along those three rivers, willows grow only at the bends in the rivers, with infrequent patches of 4-6 foot tall willows growing on the slopes above the streams. The three rivers support small moose populations.

The fourth river, the Unalakleet, supports a larger moose population and has much more extensive stands of willow, plus some birch and _Populus_ sp. In places the valley is seven miles wide; it extends back more than 50 miles from the coast.

Willows occur along most sections of the river, and grow nearly to the divide between the Unalakleet and Yukon drainages.

North of the Seward Peninsula the Kobuk and Noatak drainages possess the most extensive moose habitat, which reflects the size of the drainages more so than any other factor. Not all of both drainages have been surveyed so the comments will be restricted to just those areas covered.

The Kobuk valley was surveyed from the mouth to approximately five miles upstream from the village of Kobuk. In the section between Kiana and Kobuk willow grows profusely along the river, oxbow lakes, and some ponds, often growing to heights of 10 feet or more. Guides and bush pilots in Kotzebue state that the same situation exists above the village of Kobuk and in the large streams emptying into the Kobuk River.

The Noatak valley was surveyed from the mouth to the confluence of the Nimiuktuk and Noatak Rivers; that section of the valley is nearly devoid of willow and alder. Only along the streams emptying into the Noatak River were any extensive willow growths evident. The Nimiuktuk valley serves as an example. That valley was nearly covered with a dense growth of 5 to 10 foot high willow. Reports from people familiar with the Noatak drainage indicate that many of the other large drainages into the Noatak River also have abundant willow growth.

The Buckland and Selawik drainages have not been surveyed, but persistent reports of moose in those areas indicate that some habitat is available. Wildlife harvest records from Selawik for December, 1959, and January, 1960, substantiate those reports, for the forms listed 10 moose killed by Selawik hunters presumably in the Selawik drainage.

None of the streams north of the Noatak River or south of the Unalakleet River have been surveyed.

Moose Distribution.

Survey flights, interviews with bush pilots and hunters, and harvest reports have aided in delimiting the moose distribution in northwest Alaska. The distribution pattern resembles sinuous threads reaching toward the coast, for only along the willow-bordered streams are moose present. In general, the populations are localized, discontiguous and of low density. The results of the survey flights are shown in Table 1.

Seward Peninsula.--Moose have been recorded from nearly all sections of the Seward Peninsula, but in most areas only wandering animals infrequently appear. Only at the base of the peninsula do resident populations occur.

The Koyuk valley supports the largest moose population, but when compared with populations in other parts of Alaska the herd appears insignificant. The moose occur throughout the valley with the main concentration residing in the willow patches along that section of the Koyuk River lying between the mouths of the Salmon and Alameda Rivers. During a flight down the valley on 23 March, only 13 moose were sighted, but numerous tracks attested to a larger population. The flight occurred during mid-day when most of the moose were bedded down in the thick willow thickets, and spotting the animals proved difficult. In one instance, only after repeated passes over a bedded-down animal did we sight a neighboring animal 25 feet away. On the basis of survey data and harvest information, an estimated 50-100 animals inhabit the valley.

A small moose population reportedly over-winters in the Fish-Niukluk drainage, but no animals or tracks were sighted during a survey flight of the area on March 23. Native hunters from White Mountain sighted a few sets of tracks throughout the winter, however, so a small over-wintering population, probably not exceeding 5 animals, exists.

Moose frequently are reported along the Kuzitrine, Kwiniuk, Kougarok, Kiwalik, and Tubutulik Rivers, but it is doubtful if any populations can sustain themselves in face of the heavy and indiscriminate hunting pressures. One bush pilot reported seeing seven animals along the headwaters of the Tubutulik River during winter of 1958-59, but he stated that native hunters from a nearby village killed them all before spring. During a survey flight down the valley on November 10, 1959, only one moose track was sighted during 55 minutes of flying.

Areas Other Than the Seward Peninsula.--Only a few of the drainages bordering the Seward Peninsula have been surveyed. Those south of the peninsula receiving attention were the Inglutalik and Ungalik systems, and those to the north

Table 1. Results of moose survey flights made during winter, 1959-60 in northwestern Alaska.

Drainage	Date	Survey Time (hrs.)	Sighting Conditions	Animals Sighted F	M	Calves	Unknown	Total	Tracks
SEWARD PEN.									
Kuzitrine R.	10 Nov.	0:25	Poor	0	0	0	0	0	None
" "	23 Mar.	0:47	Good	0	0	0	0	0	1
Fish-Niukluk	23 Mar.	0:18	Good	0	0	0	0	0	None
Tubutulik R.	10 Nov.	0:25	Poor	0	0	0	0	0	1
Koyuk Valley									
Koyuk R.	23 Mar.	1:14	Good	2	1	3	5	11	Many
Peace R.	23 Mar.	0:18	Good	1	0	1	0	2	Many
OTHER THAN SEWARD PEN.									
Inglutalik R.	3 Dec.	0:29	Poor	0	0	0	0	0	None
Ungalik R.	3 Dec.	0:43	Poor	0	0	0	0	0	2
Kobuk Valley									
Noorvik to Ambler	17 Nov.	1:40	Poor	0	0	0	0	0	Few
Kiana to Kobuk	9 Dec.	1:35	Fair	2	0	1	0	3	Many
Squirrel R. to Pah R.	13 Mar.*	3:30	Good	7	5	13	69	94	Abundant
Noatak Valley									
Noatak R.	10 Dec.	1:25	Poor	0	0	0	0	0	None
Nimiuktuk R.	10 Dec.	0:25	Fair	7	3	5	0	15	Many
TOTALS		13:14		19	9	23	74	125	

* R. Rausch and S. Olson observers

were the Kobuk and Noatak drainages. Table 1 contains the results.

Of the four drainages a short distance south of the Seward Peninsula, the Unalakleet system, which was not surveyed due to poor snow conditions, reportedly has the largest moose population; the other three drainages, the Inglutalik, Ungalik and Shaktolik, have smaller populations. During survey flights of the Inglutalik and Ungalik valleys, no moose or moose tracks were seen along the former, and only 2 sets of tracks were noted along the latter. The flights were made during poor snow cover, yet much more sign would have been evident if large populations existed. The native hunters of Elim claim they shot five moose on the Inglutalik during fall, 1959, however, so a small population existed there, at least prior to the hunts. Bush pilots and native hunters indicate that the conditions in the Shaktoolik valley are similar to those in the Inglutalik and Ungalik areas.

North of the Seward Peninsula moose have been reported from the Buckland, Selawik, Kobuk and Noatak drainages, with the largest populations reportedly present in the largest systems, the Noatak and Kobuk.

Surveys were flown in the Kobuk valley during 17 November and 9 December 1959 with Harbo as observer, and during 13 March 1960 with Olson and Rausch as observers. During the first two flights, poor snow cover and severe cold hampered operations and only three moose were seen (Table 1). Better conditions prevailed for the March 13 flight, however, and 94 moose were counted. Classifying the animals as to sex and age proved difficult, however, for the new antler growth of many bulls was of insufficient size to be discernible from the air. The flight path crossed the Squirrel, Salmon, Pah and Pick drainages, as well as the main river, and moose or moose tracks were noted in all drainages.

A few small moose populations exist in the Noatak drainage. Guides and bush pilots in Kotzebue state that the valleys of the feeder streams contain most of the moose; one guide reportedly counted 27 in the Nimiuktuk valley during late winter 1959, and another counted about 20 in a section of the Kugururok River valley during March, 1960. A survey flight during December 10, 1959, substantiates the above observations. During an 85-minute flight along the Noatak from the mouth of the Kelly River to the mouth of the Nimiuktuk River, no moose or moose tracks were noted, but during a 25-minute flight up the Nimiuktuk, 15 moose were censused. Peter Lent, a biologist associated with the Atomic Energy Commission's Project Chariot, has flown extensively in the Noatak drainage during winter, 1959-60, and he has sighted only six moose during the trips. He also reports that no moose or moose sign has been noted in the drainage east of the confluence of the Nimiuktuk and Noatak Rivers.

Hunting Intensity.

In areas that are hunted by native peoples living in scattered, remote villages, ascertaining the man-hours or man-days of hunting pressure is virtually impossible. Only by diligent and repeated effort could any semblance of accuracy be assured, and the large expenditures undoubtedly would outweigh the returns. Such a situation applies in northwestern Alaska; hence the hunting intensity can only be generalized.

Seward Peninsula.--The hunting effort in this area, as in most of northwestern Alaska, is not confined to the legal season. In many cases whenever a native is afield, be it for fishing or berry picking, he is in effect hunting, for if the opportunity presents itself he will shoot game. Inasmuch as many natives spend the fishing season camped along streams in moose country, the hunting effort is fairly steady and widespread.

Another consideration is the fact that much of the effort is directed at specific animals. For instance, if a bush pilot reports seeing a moose at a certain location hunters will undoubtedly proceed to the area in search of that animal. Although such a practice is followed regardless of the hunter's mode of transportation, it is most obvious when the hunters use aircraft. One bush pilot in Nome is very adept at spotting moose from the air, and he has a waiting list of hunters willing to charter his aircraft for a chance at the moose he sights. During the 1959 season at least two moose were taken by this method. The hunt lasted only about five hours. If the moose is not near a landing spot when initially sighted, the pilot will try to keep track of the animal, and when it nears a suitable location the hunters are flown to the scene.

Areas Other Than the Seward Peninsula.--South of the Seward Peninsula the residents of Shaktolik and Unalakleet exert considerable pressures on the moose populations in the

Ungalik, Shaktolik and Unalakleet River valleys. The pressures are probably greatest in the Unalakleet valley, inasmuch as the village of Unalakleet is fairly large, and a few hunters from Nome also hunt in the valley. The same conditions as exists on the Seward Peninsula, i.e. the steady, widespread hunting pressure throughout the year, exists in this area, but it is probably not as marked in the Unalakleet area as elsewhere, for the evidence indicates the effort is restricted mainly to the hunting season.

North of the Seward Peninsula the moose season has been closed for the last few years, but the closure has not curtailed the hunting effort. Harvest reports from Selawik indicate that the effort must be fairly substantial, for during December and January, 10 moose were taken by Selawik hunters. The taking of these moose cannot be justified as an emergency measure due to food shortage, for during the same period the hunters reported taking 235 caribou.

Pilots and guides in Kotzebue unanimously state that few moose exist around any of the villages in the Noatak or Kobuk valleys because of the heavy hunting pressures exerted by the natives. Judging from the Selawik harvest reports, perhaps the pilots and guides are correct in their evaluation of the hunting pressures.

Moose Harvest.

The size of the annual moose kill in Northwest Coastal Alaska is not easily ascertained. Determining only the legal kill is not sufficient, for in some localities the illegal harvest probably is largest. Although the total harvest is small in terms of numbers, if considered in terms of percent of population it undoubtedly would assume more importance.

Legal Harvest.--The few small moose populations present on the Seward Peninsula receive fairly heavy hunting pressure. The Koyuk valley at the base of the peninsula undoubtedly contains the largest population and receives much of the hunters attentions. Natives from Elim and Koyuk, and airborne hunters from Moses Point and Nome hunt in the valley, but the native hunters account for most of the hunting pressure, and moose.

On August 17, 1959, three days before opening of the moose season, I visited Koyuk. Late that night one boat, and the next day two boats, arrived from Elim and headed up the

Koyuk River; the crews were getting an early start on the season. About four boats were being readied at Koyuk for the trip upriver, but they did not leave until August 19. Other boat owners planned to go upriver about September 1. On opening day of the season more than 20 hunters were in the small valley.

During the late season (November 20-30) natives go upriver by dog sled, effectively traversing much of the suitable moose habitat. Various bush pilots in Nome state that during such times individual moose sometimes are trailed for two or three days until capture. Often the hunters are indiscriminate as to sex or age.

The Bureau of Indian Affairs school teacher at Koyuk tallied 12 moose taken during the fall and early winter, 1958, by the hunters of Koyuk; all were taken from the Koyuk River drainage. Through conversations with many of the village hunters, I determined that the total for the fall and early winter, 1959, also was 12. Elim hunters took about seven moose, but nearly all were from the Inglutalik River area.

Sport hunters from Nome took four moose from the Seward Peninsula during the season. Of these, three were from the Kuzitrine drainage and one from the Koyuk valley. Two of the three taken from the Kuzitrine drainage were taken with the aid of an aircraft. A local bush pilot flies extensively over the peninsula on charter work, and during those routine flights he spots moose. His flights are very frequent, permitting him to ascertain the movements of individual animals. When such an animal wanders near a suitable landing area, the pilot lands hunters in the area. The success of his hunters is sufficiently high so that he has, during the open season, a waiting list of hunters for such flights. The third moose taken from the Kuzitrine drainage also would have fallen to an airborne hunter's gun if a hunter in an airboat had not reached the animal shortly before the plane arrived.

White Mountain hunters took three moose from the Niukluk-Fish drainage during the season. Those were the only moose reported taken from that area.

Considering the entire Seward Peninsula, about 18 moose were taken during the hunting season.

The Unalakleet River, just south of the Seward Peninsula, supports a small moose population. Based on interviews with Unalakleet hunters, about 10 moose were taken during the 1959 hunting season; one of them was taken by a Nome hunter. The hunters stated that the same number were taken during the 1958 season. A few of the Unalakleet sport hunters cross over to the Yukon drainage for their hunts.

Unit 23, the Kotzebue Sound area, was not open to moose hunting.

Illegal Harvest.--Undoubtedly many residents of the Seward Peninsula take moose whenever the opportunity presents. In some localities the legal plus illegal harvest is of sufficient magnitude to control the moose population. For example, at least four bull moose and a cow with calf were sighted in the Kuzitrine drainage by pilots during the summer, when sightings are difficult due to the heavy growth of vegetation. Three bulls were taken during the season and the cow and calf reportedly were killed by a native family camped along the river. During the winter only one set of moose tracks was sighted, although bush pilots flew over the valley frequently. With indiscriminate killing of cows and calves, it is not surprising that small populations aren't established in some of the suitable small drainages.

Another instance of an illegal cow kill occurred at Koyuk. The school teacher's son reported that just before the first season closed, two bulls and a cow wandered out of the timber near the village; all were shot within minutes. If such things occur within sight of a village, imagining what must occur in more remote sections is not difficult.

The total known illegal kill from the Seward Peninsula is five animals. Others probably were taken of which I was unaware.

Effect of Harvest on Moose Populations.--Work conducted by Rausch (unpublished) in southcentral Alaska indicates that only killing bulls does not control a moose population. The conclusion is drawn from studies made on dense moose populations, but there is no evidence to suggest the findings can't be applied to thin, scattered populations such as are characteristic of the Seward Peninsula. However, the harvest on the Seward Peninsula is not restricted to bulls.

Reports from local guides, miners and bush pilots indicate that nearly all of the moose sighted west of the Fish-Niukluk drainage are bulls. One pilot who has operated in this area for 20 years states that the cow and calf he sighted in the Kuzitrine valley this summer were the first he had seen west of Council on the Niukluk River. He has sighted many bulls, however, and for some he has movement records revealing a great deal of wandering. During one month in summer, 1958, the pilot traced one bull from the Kuzitrine valley to Cape Douglas, a distance of 50 miles, thence 16 miles down coast to Feather River, and then back to the Kuzitrine River where it was killed by hunters. During the 1940's, a bull was killed at Wales and two years ago a bull was killed near Nome. Persistent reports of a bull killed near Shishmaref this past fall apparently are based on fact.

Heavily cropping the bulls that move into unoccupied habitat should not adversely affect the chances of a population becoming established. It seems reasonable that any cows venturing into new range would be serviced by the few bulls present, even though the animals are widely dispersed, for the bulls apparently range widely.

Shooting the few cows that appear in new habitat seriously hinders the establishment of new populations. Some of the numerous rumors of illegal moose kills assuredly are factual, and the small size of the Niukluk herds and others no doubt reflect such kills. Until such time as the illegal harvest can be curtailed, the immigrant animals will provide the base for the hunting effort for most of the Seward Peninsula.

Recommendations:

An effective enforcement program must be instituted in northwestern Alaska to protect the low density, isolated moose populations. The indiscriminate killing of cow and calf moose undoubtedly is a limiting factor in many areas; only through frequent aerial and ground surveillance can the practice be curtailed.

In order to maintain adequate plane patrols throughout the area, aircraft other than chartered craft must be available to the enforcement personnel. Commercial and charter airlines are adverse to transporting enforcement personnel on their assigned missions for unfavorable public sentiment toward the airlines arises. In addition, the use of chartered aircraft permits negligible flexibility in a patrol program. To be effective, enforcement personnel should use unencumbered, readily accessible aircraft.

The low density moose populations and inadequate snow cover in fall and early winter are of negative value when conducting moose composition surveys from aircraft for they contribute toward insignificant counts. Unfortunately, those conditions exist in northwestern Alaska and virtually destroy the usefulness of aerial surveys. Perhaps in the Kobuk valley aerial composition surveys of moose are practicable, but elsewhere they are not. Using aircraft to determine moose distribution and abundance are feasible, however, for they can be conducted during late winter and early spring when adequate snow covers exist. Until such time as the game regulations are enforced, however, the management recommendations, based on data gained through surveys, will be unapplicable and of no avail.

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Volume 1 Report No. C-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 1 Title: Statewide Caribou Distribution

Period Covered: July 15, 1959, to April 30, 1960

Abstract:

Two reconnaissance trips were made during the year to provide basic information needed for more intensive work later. The areas covered were the Lake Minchumina region and the Kuskokwim Mountains, the main purpose of the trips being to get acquainted with these areas and to note the general distribution of caribou.

A minimum of 5,000 caribou from the McKinley-Minchumina herd spent the November period in the Sischu Mountains, west of Lake Minchumina. This herd is estimated to contain at least 10,000 animals. Other groups of caribou were widely scattered throughout much of the Kuskokwim Mountains and adjacent area, but no estimate of numbers was attempted. The whole region between the Yukon River and the Alaska Range has a big potential for caribou increase, because of good range conditions and low hunting pressures.

Objectives:

To determine the distribution and relative abundance of caribou on a statewide basis.

Techniques:

This job attempts to inventory the caribou herds in Alaska as to location, numbers, and status. The magnitude of this task necessarily will require that several years of effort be expended.

Caribou are present throughout much of Alaska north of the southeastern "Panhandle". One or possibly two herds are present in the Alaska Peninsula area south of Naknek Lake and River. To the north of the Peninsula, the Mulchatna herd occupies the region lying north and west of Iliamna Lake. Scattered groups of caribou are found throughout the Kusko-kwim Mountains and Alaska Range to the Mt. McKinley Park area which is occupied by the McKinley-Minchumina herd. Eastward along the Alaska Range to the Alaska-Canada border are scattered groups of caribou, with the Nelchina herd and the Wrangell Mountain group to the south and the Steese-Fortymile herd to the north. Farther north, the Porcupine herd straddles the border, ranging both in Alaska and the Yukon Territory; westward from there to the Chukchi Sea lies the vast Brooks Range "herd".

Generally speaking that is the distribution of caribou in Alaska. Most of the work on this study will be done by aerial reconnaissance, covering the areas chronologically in approximately the same order as the caribou distribution is described above. Reports from pilots, long-time residents, U. S. Fish and Wildlife personnel, and members of the Alaska Department of Fish and Game will be used to supplement the reconnaissance work.

All raw data are filed at the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

The past year marked the start of the P-R game research under the Alaska Department of Fish and Game, and the change-over from Federal to State administration was accompanied by more than one problem. Lack of airplanes, pilots, and personnel, plus a heavy work schedule, prevented a great deal of time being spent on this study, other projects being of more immediate importance. Work through April consisted of brief reconnaissance flights in some areas and in laying plans for future work. A rather thorough coverage was made of the Alaska Peninsula, but the results of this trip will appear in next year's report.

The limited data gathered last year resulted from two reconnaissance trips. Frank Jones, during the latter half of November, 1959, examined the Lake Minchumina area, where a large portion of the McKinley-Minchumina herd was wintering. On the second trip, during late January, Jones and Skoog covered the major portion of the Kuskokwim Mountains. A brief discussion of each trip follows.

Lake Minchumina

During October the McKinley-Minchumina caribou moved northwestward from McKinley Park along the McKinley and Foraker Rivers across the flats to the southwest of Lake Minchumina and into the Sischu Mountains. This movement continued through the end of October.

During the latter half of November Frank Jones reconnoitered the area and found the animals widely dispersed in the Sischu Mountains and along the Sulukna River and the North Fork of the Kuskokwim River. He estimated at least 5,000 caribou to be present, and probably many more. These caribou were not encountered in that area during a flight on January 29, 1960, so apparently the animals had moved elsewhere by then, probably to the east.

Fred Dean and Lou Schene of the Department of Wildlife Management at the University of Alaska tallied over 8,000 caribou in McKinley Park during the summer of 1959. On the basis of this count and on his own reconnaissance work, Jones estimates that the McKinley-Minchumina herd numbers at least 10,000 animals.

Kuskokwim Mountains

This reconnaissance was made January 29 to February 3, 1960, with Ray Tremblay, Game Management Agent of the U. S. Fish and Wildlife Service at McGrath. The purpose of this trip by Jones and Skoog was to acquaint themselves with the area and with the distribution of caribou (utilizing Tremblay's extensive knowledge of that region), in order that they could do more intensive work at a later date.

The Kuskokwim Mountains and adjacent areas encompass about 50,000 square miles of rolling hills from 1,000 to 4,000 feet in elevation, with vast spruce-covered lowlands interspersed between. Groups of caribou are scattered thinly here and there throughout the region and it is difficult to say now whether each constitutes a small herd in itself or whether some groups actually are parts of a larger herd. All groups encountered appeared to have both sexes represented fully, however, and most were so widely separated that it seems logical to assume they may be distinct groups.

The largest group encountered was the Beaver Mountains "herd", located about 50 miles west of McGrath. We sighted only about 500 caribou there, but there could easily have been a few thousand, judging from the sign present. This group is the main source of caribou hunting for the McGrath residents.

The region as a whole has considerable potential for the future expansion of both moose and caribou. Food for both species is abundant and the hunting pressure light. According to Tremblay there are great quantities of lichen throughout most of the area.

Discussion:

These two trips were important in that they provided the basic information needed for more intensive work in the future. Both areas have a potential for increased caribou populations, because of good range and low hunting pressures. As Alaska continues to grow these animals may prove to be the reservoir needed to provide continued hunting for the sportsmen.

Recommendations:

This project hinges upon the availability of aircraft, for these extensive areas can be reconnoitered in no other way. There is a definite need for a moderately fast, long-range airplane, similar in type to the Cessna 180. Such a plane would cut the time needed for this study at least in half, especially in isolated areas such as the Brooks Range. Emphasis for the next year should be placed upon the areas partially examined this past year, with some reconnaissance of areas to be covered the following year. In this manner the inventory will have a continuity that should facilitate its completion.

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30 June 1960

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Volume 1 Report No. C-2a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2a Title: Assessment of Herd Status--Nelchina Herd

Period Covered: May 1, 1959, to April 30, 1960

Abstract:

The Nelchina caribou herd, as determined by the data on hand, is increasing steadily under high calf crops and low mortality. Both the range and the animals appear to be in good condition; winter forage is abundant and diseased animals are few. Continued increase may result in a major portion of the herd leaving the range, and it is recommended that the herd be reduced if possible. An August 1 opening of the hunting season is recommended.

The following herd statistics for the period May 1, 1959, to April 30, 1960, are summarized below:

1) No known egress nor ingress of caribou took place.

2) The herd composition was estimated at 19 per cent yearlings, 46 per cent cows, and 35 per cent bulls, as of May 1, 1960.

3) A minimum of 6,500 calves survived to the yearling age.

4) Mortality of adults (older than calves) was estimated at 5,500 animals.

5) The annual increment to the herd on May 1, 1960, was estimated to be a minimum of 1,000 animals.

6) The herd is estimated at about 55,000 animals, as of May 1, 1960.

Objectives:

To compile and analyze all pertinent data resulting from field investigations of the Nelchina caribou herd in accordance with the needs of management.

Techniques:

This job attempts to synthesize all the data available concerning the Nelchina caribou into a concise report that will establish the current status of the herd. In essence much of the data is simply a summary of that presented in the reports that follow, but here the information is related directly to such management needs as range condition, carrying capacity, annual increment, herd size, condition of the herd, and the effects of hunting, with recommendations for future management practices.

Findings:

The status of a caribou herd hinges upon a number of factors. Among these are availability and condition of the food plants, movements on or off the range, annual reproduction, extent of predation, hunters' kill, prevalence of disease, population structure, general condition of animals, and herd size. These factors are discussed below under appropriate headings.

Range

The Nelchina caribou occupy an area approximating 18,000 square miles, the main portion of their range being outlined in Figure 1 of the "Hunter Harvest" report, Job 2(h). Much of the area lies above timber line, but an extensive wooded plateau occupies the southeast quadrant (Lake Louise Flats). Work on the range vegetation has been in progress for three years, with the ultimate goal being an evaluation of carrying capacity, but too few data exist as yet for any conclusions on this aspect.

Much of the range has been examined, however, both quantitatively and superficially, and forage plants for caribou generally are abundant and in good condition.

Good growths of the forage lichens (Cladonia alpestris, C. rangiferina, C. sylvatica, C. uncialis, and other) occur throughout the western and northern sections, and sedges, the other major winter food items, are abundant throughout. Summer range is practically unlimited.

Some portions of the range show signs of heavy use, notably the Lake Louise Flats (Range Unit 13) which were the main wintering grounds during the eleven year period, 1945-1955. There the lichen mat generally has been rather flattened (less than 1-1/2" for the most part), and is badly cracked; sedge is present throughout the Unit, but extensive stands normally do not occur amidst the spruce. Range Unit 12, encompassing the drainages of the Oshetna River and Kosina Creek, and the southeast portion of Unit 5, the upper Coal Creek-Jay Creek drainage, show signs of heavy use also, with heavy trails cutting to mineral earth throughout; but these are principally summering areas and they produce abundant food at that season. The remaining portion of Unit 5, that in the Deadman-Nadiwen Lake area, has suffered somewhat under recent heavy use, but still contains much winter forage. As a whole, the range seems to be in excellent shape and apparently adequate for the estimated 55,000 animals present.

Movements

Movements of the Nelchina caribou during the past year continued to reflect the westward shift in range-use during the winter. Also evident again was the splitting of the herd into several wintering groups, as has been typical of their behavior in recent years. These facets have been described in the "Movements" report, Job 2(b), and need no elaboration here. The only emphasis needed here is to stress that the westward shift and extensive movements have become somewhat characteristic of this herd, which in the past seemed somewhat more sedentary. Supposedly the great increase in population has been the main factor in this change.

The caribou wintering in the Cantwell area last winter--over 10,000 animals--were at the extreme northwest edge of the range, adjacent to the Mt. McKinley herd and near to those groups present on the north side of the Alaska Range. As far as known, there was no interchange of animals, and all the calving groups returned southward in the spring.

A southeastward movement in late October past Paxson Lake resulted in some of the Nelchina herd moving as far eastward as the Chistochina River, adjacent to the Mentasta Pass-Mt. Sanford caribou. Some of the latter commonly winter near Mankomen Lake, just east of the Chistochina. Again as far as known the Nelchina caribou returned to the westward.

Extensive aerial reconnaissance along the peripheries of the Nelchina range during the year revealed no major egress nor ingress of caribou, although small groups would not have been detected. Essentially the Nelchina herd has remained on its range.

Herd Composition

No data were gathered during the past year that would indicate a change in the composition of the Nelchina herd. Ground counts taken in mid-October were too few to be significant, although the 58 bulls:100 cows ratio obtained may be indicative of the effect of the selective kill by hunters, which for the past eight years has averaged over 70 per cent bulls. The bull:cow ratio obtained in October, 1956, was 76:100, but also from a small sample. Still using the 1956 data, in lieu of better data, the writer estimates the composition of the Nelchina herd to be 19 per cent yearlings, 46 per cent cows, and 35 per cent bulls, as of May 1, 1960.

Productivity

Once again the calf crop was high, with an estimated calf:cow ratio of 60:100 on July 1, 1959 (approximately 14,500 calves). The July-November mortality of 23 per cent compared closely with that obtained in previous years, but the November-April mortality of 43 per cent was unusually high. The resultant mortality computed for the July 1-April 1 period was 56 per cent. Mortality for similar periods in past years has ranged from 30 to 40 per cent.

The low survival this past year is difficult to explain considering the mild winter, lack of disease, abundance of food, and low wolf population. The writer feels that the calf:cow ratio of 20:100 obtained in April, 1960, probably resulted from a non-representative sample and probably is a minimum. These data reveal that a minimum of 6,500 calves lived through the winter to the yearling age-class.

Mortality

Hunters had a reasonably successful season last year, but the take totaled only about 3,500 animals (excluding calves) and again about 70 per cent were bulls. Further details concerning the take appear in the "Hunter Harvest" report, Job 2(h).

Natural mortality probably was at a minimum, as indicated in the "Mortality" report, Job 2(g). Most of the animals examined were in excellent condition after the winter, including pregnant cows, and the incidence of disease and crippling seemed low. The number of adults (older than calves) dying between May 1, 1959, and April 30, 1960, of predation, disease, and accidents was estimated at 4 per cent of the total herd figure for May 1, 1959 (51,800), or about 2,000 animals. Total mortality for the year was estimated at 5,500 caribou.

Annual Increment

During the period May 1, 1959, to April 30, 1960, a minimum of 6,500 calves survived to the yearling age. At the same time an estimated 5,500 adults (older than calves) succumbed to hunters, predation, disease, and accidents. Thus the annual herd increment on May 1, 1960, is estimated to be a minimum of 1,000 animals.

Herd Size

On May 1, 1959, the Nelchina herd was estimated at 51,800 (about 50,000), based upon the census figures of 1955 and subsequent data on reproduction and mortality. Last year's annual increment was a minimum of 1,000 animals, so the present herd size on May 1, 1960, is estimated at 52,800, or approximately 55,000 animals.

Evaluation of Herd Status

The Nelchina herd has continued to increase steadily during the past fifteen years for which we have data, as a result of high calf crops and low mortality. Diseased animals are scarce and the general body condition of most animals is excellent. The range is beginning to show the effects of heavy use in some areas, but as a whole remains in good condition. This steady increase in numbers possibly has caused the herd to move more extensively than before and frequently to separate into widely separated groups, although the calving segment continues to use the ancestral grounds. Continued increase in the herd probably will result in a major portion of the herd moving elsewhere.

Recommendations:

An effort should be made to reduce the size of the herd in order to insure its remaining on the Nelchina range. As long as calf crops remain high and mortality low, however, there is little chance of reduction, barring some catastrophe, such as severe calf-killing weather during the spring for several years. Although wolves are protected now, they still are not increasing rapidly; a higher wolf population would aid our efforts. The hunting season presently is quite long and the limit of three quite liberal; the main drawback seems to be a lack of hunters. It is suggested that some consideration be directed toward opening the caribou season on August 1. This opening date would tend perhaps to direct attention to the caribou, especially for the nonresident tourist, and thereby provide a kill at a time when no other big-game animal is hunted. Extending the closing date of the season or liberalizing the present bag limit probably would not increase the kill.

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30 June 1960

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Volume 1 Report No. C-2b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2b Title: Movements, Distribution and Numbers--Nelchina Herd

Period Covered: April 1, 1959, to March 31, 1960

Abstract:

Movements of the Nelchina caribou during the past year continued in the pattern of a gradual western shift in range-use. The historical calving grounds were again utilized. Scant information was obtained concerning summer movements as a result of change over of personnel and the initial functioning of a new organization.

The major portion of the rut took place in the Sheep Mountain-Crooked Creek-Caribou Creek area. Following major extensive movements, over 20,000 caribou settled for the winter in the Talkeetna River Basin and the mountain slopes westward as far as Iron Creek. Another group of 10,000-12,000 caribou wintered on the hills and broad valley to the east of Cantwell. A part of this segment wintered a short distance west of the Alaska Railroad. As far as is known, there was no egress of caribou from the Nelchina range.

On March 31 a definite shifting of the caribou from the Talkeetna River Basin to the northeastward signified the commencement of the pre-calving migration. Calving groups in the Cantwell area also began moving southwestward in early April as did those in the Nadiwen Lake area.

A census was not attempted due to the mountainous terrain of the range utilized this past winter and the wide distribution of the caribou on this range. Considering the magnitude of the hunter harvest, and the data obtained on productivity and natural mortality, it is believed safe to assume an annual herd increment of 9 per cent. On the basis of this information in correlation with past censuses conducted by the U. S. Fish and Wildlife Service, the present Nelchina herd is estimated to number 55,000 caribou.

Objectives:

To determine the distribution, seasonal movements, and gains or losses in numbers resulting from ingress and egress of caribou to or from the Nelchina range.

Techniques:

Periodic aerial surveys were utilized to trace the movements and distribution of the caribou throughout the year. Additional data were obtained from U. S. Fish and Wildlife Service personnel, guides, outfitters, and hunters.

Plans were formulated for an extensive winter census of the herd but this did not prove feasible due to geographical distribution of the caribou.

Although the department began functioning on July 1, 1959, this report includes information gathered and assembled prior to this listed date to provide continuity in the data recorded concerning the Nelchina caribou.

Rather than breaking the movements up by seasons in this report the emphasis will be placed on the type, size, speed, and possible reasons for the movements as they occurred, in the yearly cycle, with seasonal notations where possible.

Appreciation is extended to the U. S. Fish and Wildlife Service Aircraft Division for use of their aircraft and to the pilots, Gordon Watson, James Branson, Neil Argy, and Robert Burkholder for their excellent cooperation on this project.

All the raw data are filed in the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

Movements and Distribution

Pre-Calving Movements--Calving

Movements from the wintering grounds began in early April, 1959, with a gradual drift of animals into the lower Kosina Creek and Clarence Lake areas. This phase was typical of past years' observations. Then, instead of moving southeastward in long files as expected, the calving segment continued its gradual drift to the eastward along a wide front to the lower Goose Creek and lower Oshetna River areas, and in early May swung southward up the Oshetna River and Sanona Creek. Observations in late May and early June indicated that the animals had spread out over the traditional calving grounds, which comprise some 1,000 square miles of rolling foothills between Kosina Creek and the Little Nelchina River.

Figure 1 depicts the main calving grounds utilized by the Nelchina caribou. During the April-June period, of course, non-calving animals are found throughout the range with most concentrations remaining near the wintering grounds. Calving progressed normally, reaching a peak during the last week of May.

Post-Calving or Summer Movements

No observations were made between early June and late August, but it is presumed that the caribou probably moved as they have in the past. Normally the calving segment concentrates in mid-June somewhere south of the Black River, and is joined by many of the bulls and non-calving animals. In July a northward movement brings the main herd into the Clarence Lake-Deadman Lake-Coal Creek region where it remains through August. Many adult bulls, however, and others will be found to the south in the Caribou Creek drainage system, and a few animals will be scattered throughout the range. Data obtained in late August indicate that many caribou were in the Deadman Lake-Nadiwen Lake-Coal Creek area on August 20.

Pre-rut, Rut Movements

Early in September the caribou began to bunch and move from the summer range, which was predominantly the

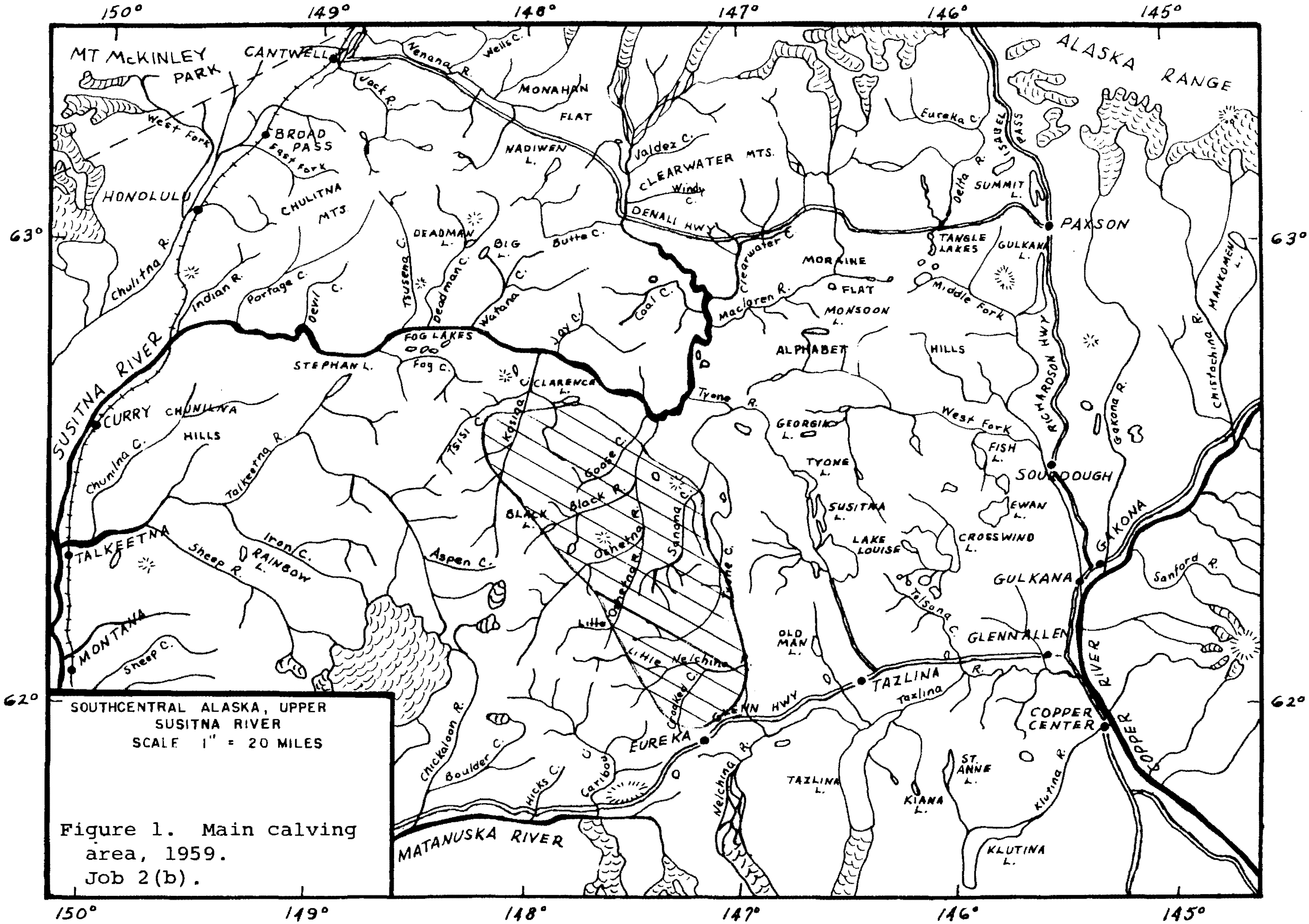

Figure 1. Main calving area, 1959. Job 2(b).

area lying north and west of the middle and upper portions of the Susitna River. About mid-September a reported 10,000 caribou moved across Stephan Lake from the Devil Creek area in an easterly direction. By September 25 these animals had moved about 10 miles east of Stephan Lake and were ranging above tree line in that area. Another large group from the Clarence Lake area had drifted southward to the region of Black Lake. These caribou began moving northward down Tyone Creek and several of them were sighted along the west shore of Susitna Lake on September 27. On September 29 two bands of 2,000± caribou were sighted--one band moving southward along the Tyone River approaching Tyone Lake, the other moving up the Susitna River. This latter band later returned down the Susitna River and joined the mass movement which converged in the region of Tyone Lake and progressed eastward toward the Lake Louise system then swung southward. Thousands of caribou were reported swarming around Sheep Mountain on the afternoon of October 7. A reconnaissance flight was flown on October 8, and at that time 10,000 to 15,000 caribou were located north of Sheep Mountain. The forerunners of the movement were traveling slowly up Caribou Creek followed by other caribou massed along Crooked Creek, the Little Nelchina River, and eastward to Old Man Lake. On this same date another group numbering 2,000± was located in the Betty Ann-Tyone Lake region moving southward in bands of 50 to 250 animals. These were probably stragglers of the general movement. Other small bands of caribou were moving up the Maclaren River and 1,000+ caribou were moving southward along the west bank of the Susitna River, just above the mouth of the Maclaren River. During these movements the rut had commenced. On October 9 the general movement northwest of Sheep Mountain had reversed direction and the caribou were moving slowly east and northward. By October 18 all the caribou had departed the Sheep Mountain area and the peak of the rut had passed. Figure 2 shows the movements described above.

Post-rut, Winter Range Movements

As the caribou departed the Sheep Mountain region, the pace of the movement increased. On October 28 the main portion of the herd had progressed to the south side of Maclaren Summit on the Denali Highway. Several thousand caribou were reported there this date by Milstad Zahn, FWS Game Management Agent. By October 31 the main segment of the movement had progressed down the Middle Fork of the Gulkana River, across Paxson Lake and some were crossing the Richardson Highway at

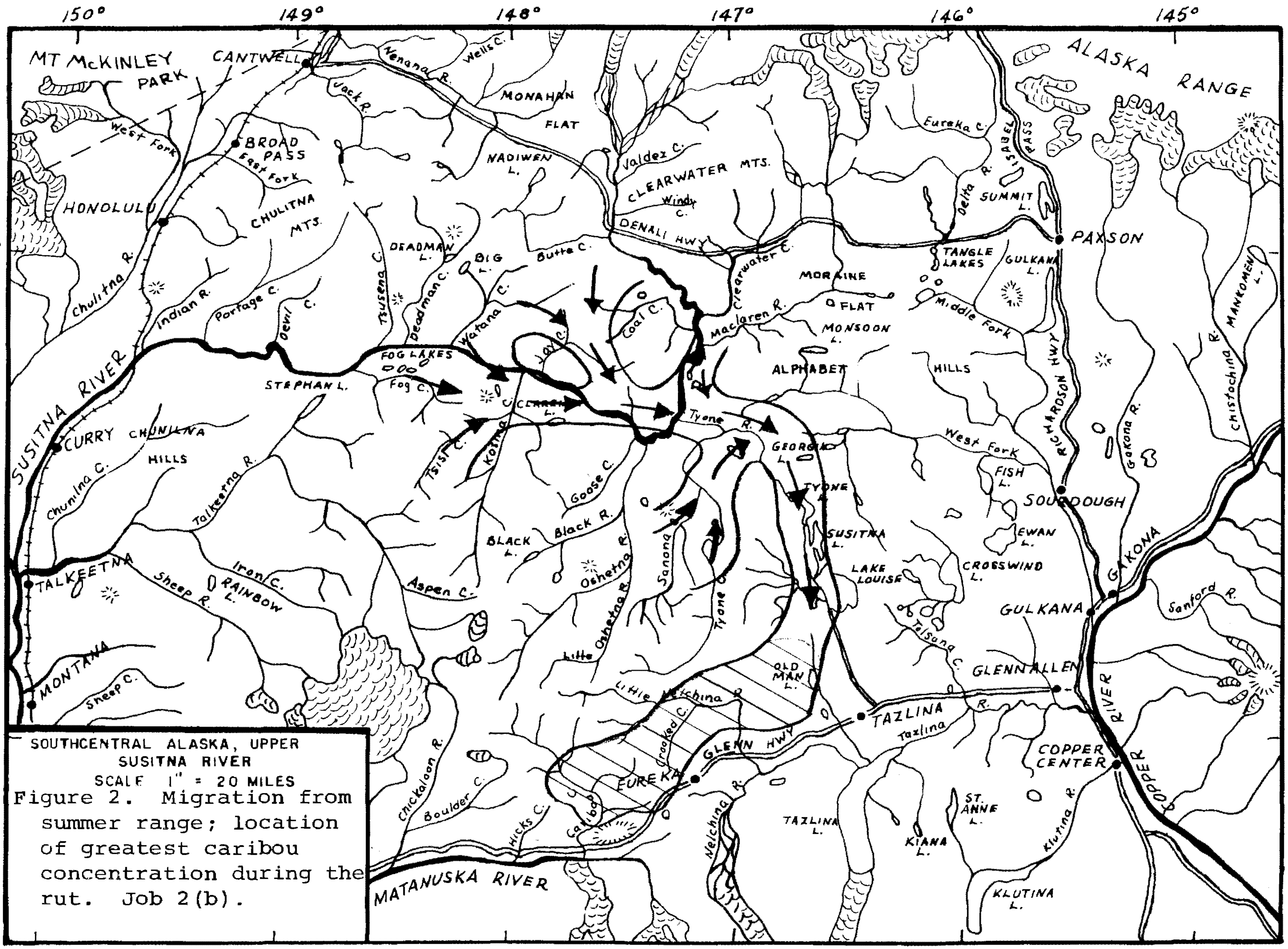

Figure 2. Migration from summer range; location of greatest caribou concentration during the rut. Job 2(b).

Meiers Lodge. The main segment of the herd turned southward near Paxson Lake and by November 1 had reached the Fish Lake area, as reported by Robert Burkholder, FWS Predator Control Agent. At this time the movement began to fan out, part of the caribou continued southward with segments breaking off and proceeding westward between Fish Lake and Glennallen. The southernmost travelers crossed the Glenn Highway east of Glennallen then returned northward and westward. By November 11 only stragglers remained in the vicinity of Tolsona Lake. By November 14 the rear guard had crossed the Lake Louise Road and progressed to the area northwest of Old Man Lake. On November 17 the major portion of the movement had progressed along Butte Creek to the Deadman Lake-Devil Creek area and was proceeding farther westward. On November 19 the movement had stagnated in the Devil Creek area. Estimates of the number of caribou involved in this movement vary, but the number was in the vicinity of 25,000 to 30,000. Of these, some 5,000+ caribou remained in scattered groups on the Lake Louise Flats. This extensive movement beginning in the Sheep Mountain area on October 18 progressed north to the Denali Highway, east to the Richardson Highway, south to the Glenn Highway, then west crossing the Lake Louise Road to the Devil Creek area. Here the greater part of the movement stagnated on November 19 after covering approximately 250 miles in a period of thirty days. Figure 3 illustrates this movement.

Unfavorable flying weather and other projects interferred at this time and the next observations were made on December 30. At this time an estimated 15,000 caribou (5,538 actually counted for estimation purposes) were located in the Nadiwen Lake area. One file of trotting caribou about 5 miles long was observed at the Denali Highway bridge on the Susitna River. These caribou were moving northwestward on a well-beaten trail in the snow. They would not move off this trail although visibly frightened by the aircraft. When next observed on January 12, 1960, approximately 1,000 caribou remained in the Devil Creek area and those in the Nadiwen Lake area had split, some moved northwestward toward Cantwell and others moved southward to Butte Creek. Some 3,000+ of these animals had located on one knoll along Butte Creek.

During early January the first wintering concentrations of caribou were observed. The northwestward movement from the Nadiwen Lake area terminated in the mountain slopes east of Cantwell. This herd segment contained roughly 10,000 to 12,000 caribou by early February. On January 13, a group numbering 8,000 to 9,000 caribou was sighted moving up the Talkeetna River. This movement which had stemmed from the

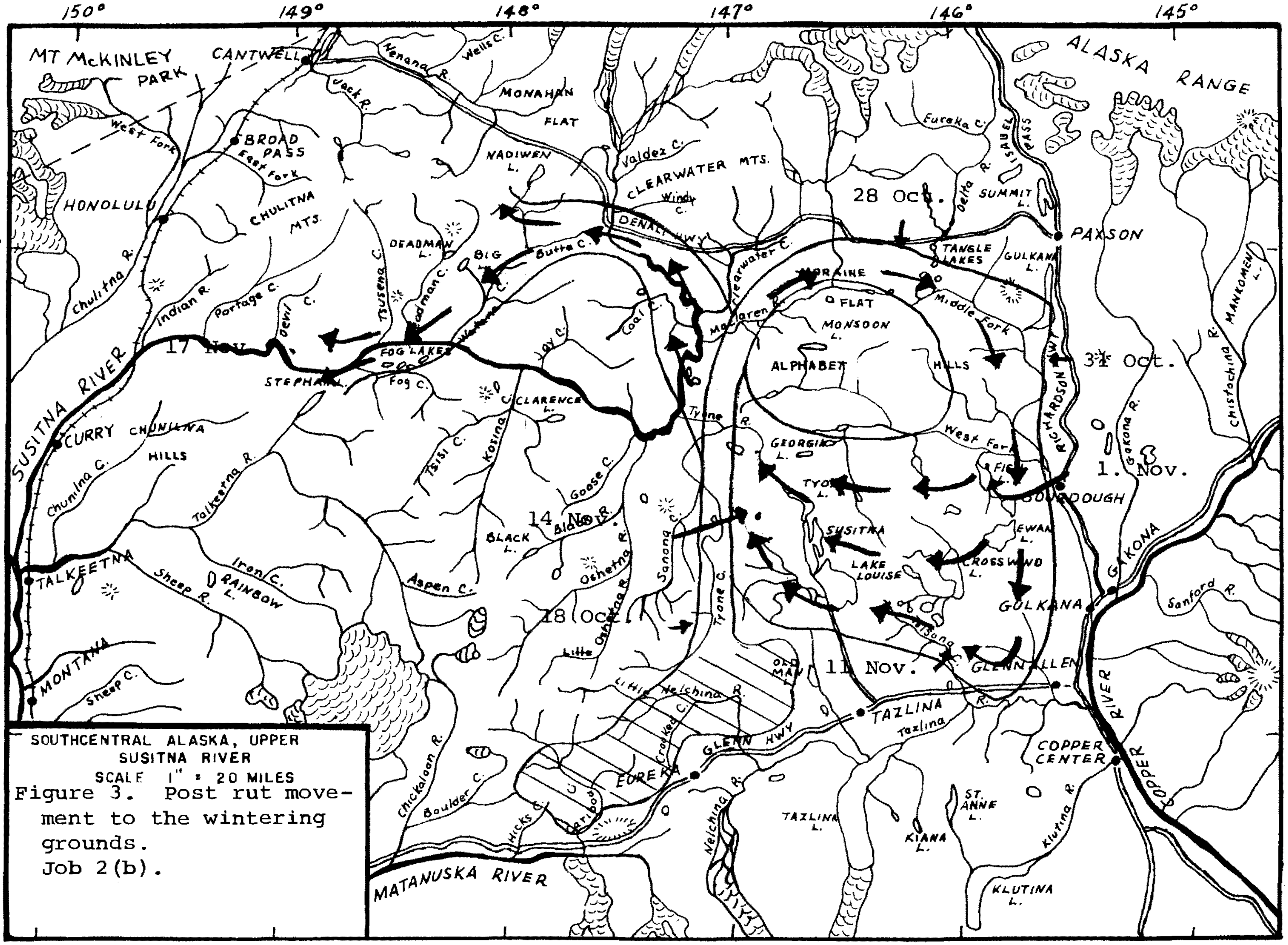

Figure 3. Post rut movement to the wintering grounds. Job 2(b).

Butte Creek-Fog Lakes-Devil Creek area concentrated on the headwaters of the Talkeetna River. By February over 20,000 caribou had moved into this area to remain here until the end of March. These two areas provided the main winter concentrations of the Nelchina caribou herd. One group of 5,000+ caribou wintered in the Lake Louise Flats and another group of 5,000 animals remained in the Nadiwen Lake region. Other smaller groups wintered generally between Cantwell and the Talkeetna River. Figure 4 depicts the locations of these main wintering concentrations. Once the caribou had settled for the winter, during early February, they remained stationary with the exception of local movements until early April.

Numbers

Because of the vast area utilized by the Nelchina caribou herd, censusing must be attempted during periods of caribou concentrations. Although most major movements involve several thousand caribou, the nature of the movement itself makes censusing very nearly impossible. The movement may consist of a concentration of 5,000-10,000 animals in a group moving as a unit while the remainder of the movement may be equal in number to this unit, but moving in very small bands over the same route days or weeks later. Very often the herd movements are more a shifting of location rather than a noticeable movement. While on the winter range caribou are most densely congregated, and other conditions are most favorable for censusing. Plans were formulated for a census of the wintering caribou concentrations, but due to the rugged mountainous terrain of the range utilized this winter and the wide distribution of the caribou on this range an aerial census was not attempted. Estimates of the numbers of caribou on the wintering areas were made as noted under "Movements and Distribution". Counts of other groups were made throughout the year when possible, but the size of the range and the ability of these animals to seemingly disappear by the thousands makes the task of estimating the present size of the Nelchina herd a very difficult one. Considering the magnitude of the hunter harvest and the data obtained on productivity and natural mortality it is believed safe to assume an annual herd increment of 9 per cent. On the basis of this information in correlation with past censuses conducted by the U. S. Fish and Wildlife Service, the present Nelchina herd is estimated to number 55,000 caribou.

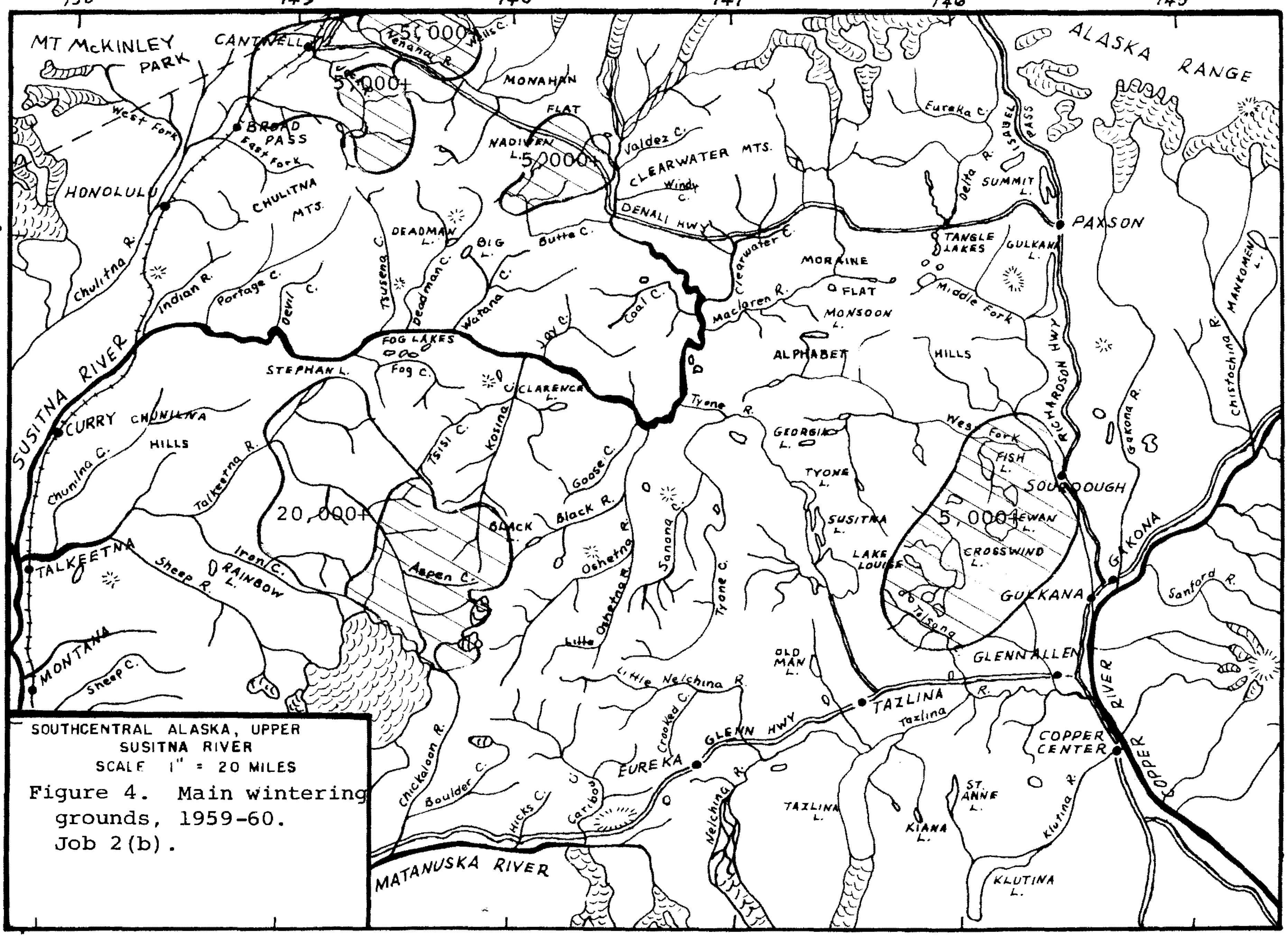

Figure 4. Main wintering grounds, 1959-60. Job 2(b).

Discussion:

The general impression obtained as a result of the observations made in recent years is that with the increasing numbers of caribou on the Nelchina range the large scale movements have increased in speed and area covered and the herd is becoming more widely dispersed. The caribou are behaving more as separate bands within a herd rather than as one distinct herd. This is most pronounced on the winter range. In the past the main herd has wintered in one area with scattered small bands widely dispersed. This past winter, as in recent winters, there were three main caribou wintering concentrations--these were located in the Talkeetna River Basin, the Nadiwen Lake area, and the Cantwell-Nenana River area, besides the usual scattered bands in the Talkeetna Mountains and on the Lake Louise Flats.

It will be interesting to see if this trend is followed as the caribou population continues to increase and to see if these large scale movements will result in an emigration of the herd from the Nelchina range.

It is probably a coincidence, but the wintering areas this past season were those receiving the lightest snow coverage of the entire range. These are, however, areas of normally heavy snow fall. How the caribou knew where these areas of light snow-fall would be or when to settle on their wintering ground requires further investigation. Although their movements took them to the periphery of the range in several instances, no ingress or egress of caribou to the Nelchina range was noted.

Recommendations:

Investigations of movements and distribution should be followed closely during this period of obvious herd expansion to determine the effects of increased population. It is now becoming increasingly important to keep very close watch on all movements near the periphery of the present range to observe any egress of caribou from the Nelchina country.

The last major census of this herd was conducted in 1956. It is therefore very important that a similarly conducted census be completed as soon as practical to verify data obtained since 1956. A conclusive census is a necessity for formulating the scope and intensity of future investigations necessary to intelligently manage this particular big game herd.

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30 June 1960

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Volume 1 Report No. C-2c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2c Title: Herd Composition--Nelchina Herd

Period Covered: May 1, 1959, to April 30, 1960.

Abstract:

Aerial and ground counts were obtained from the Nelchina herd during early and late winter, primarily to trace calf survival, but also to note composition changes. These counts provided no data that would significantly alter past years' work. The Nelchina herd remains young, typical of an expanding population, and, as of May 1, 1960, consists of approximately 19 per cent yearlings, 46 per cent cows, and 35 per cent bulls, with a bull:cow ratio of about 76:100.

Objectives:

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current population status of the herd.

Techniques:

Aerial segregation counts taken periodically from the main portions of the Nelchina herd provided information on calf survival through the year and on composition of major concentrations during early and late winter. All counts attempted to classify the animals as completely as possible. Segregation from the air, however, is limited largely to calves, adult bulls (over three years old) and "others".

Two ground counts were made during the year, one in early October and one in early April. All animals tallied were classified as calves, cows, young bulls, or adult bulls.

Lower jaws from hunter kills provided some information regarding the sex and age structure of the herd.

All the raw data are filed in the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

A June calf-count was not obtained in 1959 due to the work gap existing at that time between the cessation of caribou studies by the U. S. Fish and Wildlife Service in late May and the resumption of those studies by the Alaska Department of Fish and Game in late July. Field work during May by the author, however, and by other members of the ADFG and of the FWS indicated that calving progressed normally, with good weather, and the calf crop seemed to be high once again.

In early October a large segment of the herd moved into the Eureka area, and thus enabled the writer to obtain a few ground composition counts. Unfortunately he misjudged the movement of the caribou and was able to reach only the periphery of this group during a five-day hike along Caribou and Alfred Creeks. Thus the ratios obtained probably are not characteristic of the main herd; bulls did not seem to be represented fully in the groups observed.

Aerial counts were taken in early November, primarily to obtain figures relating to calf survival. At that time a major portion of the herd was moving southward and westward across the Lake Louise Flats. By then many of the large bulls (over three years old) had dropped out of the movement, and many had already shed their antlers. Most of the young bulls probably remained.

In early April both aerial and ground counts were obtained from a major portion of the herd wintering along the upper Talkeetna River, just after the start of the spring movement. Adult bulls (over three years old) were relatively scarce and frequently alone or in small groups by themselves, but large numbers of the younger bulls still were present. About half of this wintering segment had left the Talkeetna River basin just prior to the counts, so it is possible that those obtained are not representative of that segment and even less so of the herd as a whole. About half of the herd wintered in other portions of the range.

The figures obtained from these various counts are shown in the accompanying tables. Table 1 lists the results of the aerial counts and Table 2,of the ground counts.

That data pertaining to calf survival will be analyzed more completely in the report on "Productivity" (Job 2d) and in that on "Herd Status" (Job 2a). Suffice it here to say that the relatively heavy calf mortality indicated by the counts probably is not an accurate measurement of last winter's toll.

The figures pertaining to seasonal herd composition are interesting in that they illustrate the disassociation of the adult bulls from the others during the winter. The October ground counts showed that 16 per cent of the adults (those older than calves) in that portion of the herd observed consisted of bulls over three years old. By early November, the aerial counts showed a drop in this figure to 12 per cent. Finally, in early April, these bulls made up only about 6 per cent of the total adults. This segregation appears to be a normal phenomenon, and the bulls generally remain apart until the rut the following fall, although occasionally fair numbers are present with the others during the fly season in July.

Table 2 shows that the younger bulls (under four years old) tend to remain with the main portions of the herd. The ground counts revealed that this bull segment comprised about 20 per cent of the total adults tallied, both in October and in April. This percentage, however, is apt to vary considerably from season to season and from year to year. This variance presents one of the main problems confronted in obtaining accurate composition counts, for these bulls generally closely resemble the cows and one must observe them at close hand from the ground for identification.

The ground counts taken in April revealed further that about 2 per cent of the cows had shed their antlers by April 1. These represent the non-pregnant adult segment of the cows, but perhaps not all of them. Yearlings and two-year-old cows (sub-adults) usually are not pregnant, but will carry the hard antlers into May.

Table 1. Aerial composition counts taken from Nelchina caribou herd during Fiscal 1960--W-6-R-1.

CATEGORY/RATIOS	Lake Louise Flats 11/2-5/59			Talkeetna River 4/1-5/60		
	No. Tallied	Per cent of Total Animals	Per cent of Total Adults	No. Tallied	Per cent of Total Animals	Per cent of Total Adults
TOTAL ANIMALS:	1,792	-	-	2,129	-	-
CALVES	421	23	31	346	16	19
ADULTS	1,371	77	-	1,783	84	-
Cows & Young Bulls	1,203	67	88	1,671	78	94
Adult Bulls (over three years)	168	10	12	112	6	6
RATIOS:						
Calf:Total Animal	23:100			16:100		
Calf:Adult	31:100			19:100		
Calf:Cows & Young Bulls	35:100			21:100		

Table 2. Ground composition counts taken from Nelchina caribou herd during Fiscal 1960--W-6-R-1.

CATEGORY/RATIOS	Eureka 10/10-13/59 No. Tallied	Eureka Per cent of Total Animals	Eureka Per cent of Total Adults	Talkeetna River 4/1/60 No. Tallied	Talkeetna River Per cent of Total Animals	Talkeetna River Per cent of Total Adults
TOTAL ANIMALS:	299	-	-	241	-	-
CALVES	78	26	35	19	8	9
ADULTS	221	74	-	222	92	-
Cows	140	47	63	170	71	77
with antlers	-	-	-	166	69	75
without antlers	-	-	-	4	2	2
	(All cows w/antlers)			(2% of cows w/o antlers)		
Bulls	81	27	37	52	21	23
Young (1-3)	47	16	21	43	18	19
Adult (4+)	34	11	16	9	3	4
RATIOS:						
Calf:Total Animal	26:100			8:100		
Calf:Adult	35:100			9:100		
Calf:Cow	56:100			11:100		
Bull:Cow	58:100			31:100		

Data regarding the sex and age ratios remain insufficent to make definite statements. Ground counts in mid-October, as indicated in Table 2, provided a bull:cow ratio of 58:100 as compared with 76:100 obtained in 1956, but the sample of 221 adults is too small to be conclusive. It was noted that the bulls did not seem to be represented fully in the groups observed, although it is possible that hunting selectivity has begun to exert an effect on the sex ratio. For the past eight years, including 1959, about 70 per cent of the caribou taken by hunters have been males. Such a bias in the kill probably tends to lower the relative numbers of bulls in the older age classes, for hunters definitely seem to pick the largest animals from any group encountered. Such selectivity also tends to bias the age-ratio data obtained from examining caribou lower-jaws. See the "Characteristics of Hunter Harvest" report, Job 2(h), for last year's harvest data.

Sex and age ratios for the Nelchina herd were reviewed in the Job Completion Reports W-3-R-12 and W-3-R-13, for Fiscal 1958 and 1959, respectively. No new data have been gathered that would add or detract from those presentations, hence, as far as known, the population remains a young one and, as of May 1, 1960, continues to be composed of approximately 19 per cent yearlings, 46 per cent cows, and 35 per cent bulls.

Recommendations:

Calf/adult counts should be continued in order to trace the survival of calves from mid-June through March. These are necessary to assess the annual increment. More complete composition counts are needed periodically and in conjunction with the calf counts, in order to properly evaluate the "adult" segment used as a base for computing calf survival and to detect changes in composition occurring with major movements.

Reliable sex and age ratios are still lacking for this herd and the effort to obtain significant data should be continued. Ground counts during the rut are very important, as is the obtainment of age data from all caribou carcasses.

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30 June 1960

Approved by:

Sigurd T. Olson
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James W. Brooks, Director
Division of Game

Volume 1 Report No. C-2d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2d Title: Breeding Biology and Productivity Studies--Nelchina Herd

Period Covered: September 1, 1958, to April 30, 1960

Abstract:

The changeover from Federal to State administration interfered with the productivity studies to some extent and complete data were not obtained on some phases. Limited aerial observations between September, 1958, and July, 1959, indicated that breeding probably had progressed normally, with high fertility among cows, resulting in a relatively high calf crop. It was estimated that about 60 per cent of all cows were accompanied by calves at the end of June. The calf increment as of July 1, 1959, after the effect of "infant" mortality, was estimated at 14,500 animals.

Calf survival from July to November was similar to past years, with about 77 per cent of the calves surviving the summer and fall periods. April counts, however, indicated a 43 per cent calf mortality during the November-April period; it was thought that this high figure possibly resulted from a nonrepresentative sample, and hence the figure expressed is considered a maximum. A minimum of 44 per cent of the calves alive on July 1, 1959, survived to April 1, 1960, and thus adding a minimum of 6,500 yearlings to the herd.

The annual herd increment for the period May 1, 1959, to April 30, 1960, was estimated at 1,000 animals.

Objectives:

To obtain quantitative data regarding breeding, fertility rates, parturition, and survival of calves to yearling age.

To determine the factors affecting these elements of productivity.

Techniques:

This project attempts to determine the elements of productivity as reflected by one calf segment of the population during the period from conception, through parturition, to the yearling age-class. Thus, data collected during this twenty-month period would encompass breeding behavior, sexual cycles, fertility and natality rates, progression and magnitude of calving, and the survival of calves through their first winter.

Ground surveys were planned for early October, 1958, to obtain information on breeding behavior. Testes and ovaries were collected from all carcasses examined for ultimate analysis to obtain information regarding the sexual cycles of caribou; these carcasses also were to provide data regarding fertility of the cows.

No attempt was made to duplicate past years' intensive work on the calving grounds. Periodic aerial counts were planned to ascertain the relative size of the calf crop and the survival of calves through the winter.

All raw data obtained are filed at the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

Caribou distribution during the rut in late September and early October, 1958, was such that the writer was unable to reach the breeding groups to observe breeding behavior and to obtain composition counts. Generally the animals must be accessible by foot, for airplane landings at this time are extremely hazardous due to the light snow cover on the ground and the weak, newly formed ice on the lakes. The main portion of the herd was located in the Talkeetna River-Clarence Lake area with a strong movement to the east. A smaller group, containing about 5,000 animals, was moving northward from the Little Nelchina River.

All groups observed from the air, however, seemed to contain animals of both sexes and all age classes, so it is presumed that breeding progressed normally.

Curtailment of field work because of the pending cessation of Federal Aid work by the U. S. Fish and Wildlife Service prevented the gathering of fertility and natality data during the period November, 1958, to June, 1959. Brief reconnaissance work during May and June indicated that the caribou used their ancestral calving grounds once again and that the calf crop was high.

Normally a calf/adult count is made in late June to assess the magnitude of the calf crop after "infant" mortality, and calf survival as determined from future counts then is related to that ratio, considered as being effective on July 1. No field work was done then, because of the gap existing in the caribou work due to the changeover from Federal to State administration. If the calf crop compared with former years, as inferred from aerial observations during the calving period, then the calf increment as of July 1 probably approximated 28 per cent of the total herd and the calf/cow ratio approximated 60:100.

Aerial and ground counts were taken in early and late winter. The results of these have been presented previously, in the report "Herd Composition", Job 2c, Tables 1 and 2 of that report presenting the figures obtained. These figures serve as a base for computing calf survival.

The early winter (November 2-5,1959) counts indicated a high calf/adult ratio of 35:100 (421 calves:1,371 adults) somewhat higher than the 32 per cent average for the past four years of November counts. Of the 1,371 adults tallied, 168 or 12 per cent were designated as bulls over three years old. Ground counts taken October 10-13, 1959, indicated that 21 per cent of the adults tallied were bulls under four years of age. It is thought that these bulls probably were present in about the same proportion among the adults tallied in November, thus both age groups of bulls comprised a total of about 33 per cent of the total adults. Eliminating this percentage of bulls from the 1,371 adult figure results in an estimated total of 919 cows, which compared with the calf tally gives a calf:cow ratio of 46:100 (421 calves:919 cows). This ratio reveals a calf mortality of 23 per cent since July 1 (14/60 = .23).

Unfortunately the calf/adult figures obtained in early April, 1960, perhaps are not representative of the herd as a whole. The counts were taken from a major portion of the Nelchina herd that wintered along the Talkeetna River, but were taken from the latter half of this group as it moved out of that area, and the rear of any movement tends to have a lower percentage of cows with calves. At any rate, of 2,129 animals tallied, 346 were calves and 1,783, adults, giving a calf:adult ratio of 19:100--quite low when compared with past years' April ratios, which have ranged from 26 to 34. Of the 1,783 adults tallied, 112 or 6 per cent were bulls over three years of age. Ground counts at that time revealed that the adults consisted of 19 per cent young bulls (less than four years old). Eliminating the 25 per cent bulls present from the adult figure leaves a total of 1,337 cows, which together with the 346 calves tallied results in a calf:cow ratio of 26:100. This ratio indicates a calf mortality of 43 per cent since November 1, 1959 (20/46 = .43).

Tables 1 and 2 of the "Herd Composition" report (Job 2c) list the figures used above. Table 1 of this report shows the computation of calf survival from July 1, 1959, to April 1, 1960.

Table 1. Computation of calf survival in Nelchina caribou herd from July 1, 1959, to April 1, 1960, as determined from periodic calf:cow ratios.

Date	Calf:Cow Ratio		Per Cent Calf Mortality	Per Cent Calves Surviving
7/1/59	(estimated)	.60	-	100
11/2-5/59	421:919	= .46	23	77
4/1-5/60	346:1,337	= .26	43	44

Total Mortality, July 1 - April 1 = 56 per cent

According to the data obtained, about 56 per cent of the calves alive on July 1, 1959, died before April 1, 1960--the lowest calf survival yet computed for this herd. No exact information is available to dispute this high mortality figure other than the possibility of a nonrepresentative sample. The mild winter, general lack of wolves, low calf-kill by hunters, and lack of disease should have provided for a high calf survival. Also, observations in May and June, 1960, seemed to indicate an abundance of yearlings. The figures expressed above are the only ones available, however, but it is thought that the high calf mortality computed probably is not valid; at best the figure probably is a maximum one.

At the end of June, 1959, after the effect of "infant" mortality, the writer estimated that about 14,500 calves had been added to the herd. A minimum of 44 per cent of these survived to April 1, 1960, and thus the Nelchina caribou received a minimum increment of about 6,500 yearlings (.44 x 14,500 = 6,500). Hunters took an estimated 3,500 animals (excluding calves) and natural mortality (disease, accidents, predators) accounted for an estimated maximum of 2,000 animals (excluding calves) during the period May 1, 1959, to April 30, 1960; thus the minimum annual herd increment for that period is estimated at 1,000 animals.

Recommendations:

Information on both the breeding behavior and sexual cycles of caribou remains inadequate. An attempt should be made to close this gap in our knowledge. In addition more data concerning fertility rates would serve to round out this phase of the productivity study. A larger collection of testes, ovaries, and fetuses could supply much of the information presently lacking.

Calf counts should be taken at various times of the year in order to determine the calf crop and the survival of calves to the yearling age-class. Mortality data concerning the other animals in the herd are needed to assess the annual herd increment.

Prepared by:

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30 June 1960

Approved by:

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James W. Brooks, Director
Division of Game

Volume 1 Report No. C-2e

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2e Title: Analysis of Range--Nelchina Herd

Period Covered: August 1, 1959, to September 30, 1959

Abstract:

Last summer was almost over before field work commenced, due to the change-over from Federal to State administration. Lack of equipment and personnel further restricted the range project, so that the results of the study were meager at best.

Some of the Range Stations and Quadrats established in past years were checked. A few were in need of repair and two had been destroyed--one (Quadrat 31) by humans and the other (Station 3) by a caribou migration.

Extensive field notes were taken in portions of Range Units 5, 6, 13, and 15. These will be used in the final analysis of the Nelchina Range.

Objectives:

To further examine the patterns of plant succession and the factors affecting succession, maintenance, and occurrence of the plant communities comprising the Nelchina Range, with particular reference to lichens.

Techniques:

The purpose of this project was to continue the work on the Nelchina Range that has been initiated in recent years.

The range has been divided into fifteen units, as described in Job Completion Report W-3-R-13, Job 4, based upon topography, drainage, vegetation types, and caribou usage, and the present plan seeks to analyze each of these units to obtain an assessment as to its vegetation makeup and relative condition as related to present and future caribou usage.

Work was extremely limited last year due to the administrative change from Federal to State. Lack of time, equipment, and personnel restricted the scope of this study to general observations made in portions of the range not yet examined thoroughly and to maintenance checks of some of the range stations established in the past.

The field notes and data obtained are filed at the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

As inferred from the previous paragraph, the results of last summer's brief work were meager and far from conclusive. Perhaps the best way to present the limited information obtained is in a narrative form, and as such, the observations considered of importance enough to express in writing appear below.

A ground check was made of the Eureka area, lying in the eastern portion of Range Unit 15, where a large portion of the Nelchina herd had spent a major part of the winter of 1958-59. This portion of the Unit consists mostly of the Dwarf Birch vegetation type, and contains good growths of lichen (about 3 inches high with a ground cover of 50-75 per cent), the principal species being Cladonia alpestris, C. rangiferina, C. uncialis, and Stereocaulon spp. This area of about 500 square miles was the wintering grounds for about 10,000 caribou during the period November-March, inclusive, and could be considered as having received relatively heavy use. Quantitative data were not obtained, but aerial checks that winter revealed the snow-cover to be thoroughly pock-marked with feeding craters, tracks, and trails. The writer examined the area by foot in early August, 1959, and the appearance of the vegetation then gave him the impression that the area had received light to moderate usage. Broken branches of Vaccinium uliginosum and Betula glandulosa were common, tuffs of the lichen and moss mat were lying loose on the ground here and there, small spots of bared ground occurred sporadically, and caribou droppings were common. Yet most of the lichen mat appeared untouched and excellent forage remained, due no doubt to the cursory feeding habits of caribou. This observation was interesting to the writer, because it gave him a good impression of the limited damage done by a winter concentration of caribou in an area which had been used little previously and contained excellent growths of lichens.

Three days were spent along the Lake Louise water system checking the five Range Stations established there in 1955. A major caribou movement had passed through the area in the fall of 1958, and two of the exclosures had suffered. Station 3 had been eliminated, with one heavy caribou trail passing through the fenced-off plot (Plot A) and another through the control plot (Plot B). Needless to say, the fence was sagging badly. Apparently a few caribou were imprisoned within Plot A for awhile, for all the vegetation within the fenced portion had been flattened to the mineral earth. This station was crossed from our records. The fencing of Station 4 was sagging a bit, also, but apparently no animals had entered the plot; this was repaired. A caribou movement passing through one of the exclosures hadn't really been considered by the writer as being much of a problem, but the possibility of such an occurrence has become a reality now. Perhaps the caribou could be diverted if the fences were brightly marked in some way. At any rate, some consideration of the problem will be necessary before more exclosures are established.

Much of August and September was spent in the northwest portion of the range during the hunting season. Vegetation checks were made along the Richardson Highway every five miles from Mile 130 to Mile 225, approximately Gakona to Black Rapids Roadhouse, respectively. At each site a ground reconnaissance was made and a general description was written of the area, including the major vegetation types and species present, abundance and distribution of lichens, and notes on succession, fire, and caribou usage. Brief descriptions were written concerning the vegetation between these sites along the highway also. These notes are filed at the Anchorage office and will be analyzed later together with the range data as a whole for the final completion report concerning the Nelchina caribou range.

Along the Denali Highway, permanent Range Quadrats 31-33 were checked. Quadrat 31 had been destroyed by persons unknown. Quadrats 32 and 33, located in climax Cladonia alpestris stands near Cantwell, were intact and these were marked with steel fence posts and metal signs.

A ground reconnaissance was made into the northwestern portion of Range Unit 6, to the West Fork of the Maclaren River from about Mile 45 on the Denali Highway. The Dwarf Birch vegetation type dominates the rolling terrain there, with Fescue-Willow stands interspersed. Lichen growth is excellent, consisting of 3"-5" stands of Cladonia alpestris, C. sylvatica, and C. rangiferina, with a ground cover of about 75 per cent. This section has been used little in winter, however, possibly because of the relatively deep snow-cover usually present.

Another ground reconnaissance covered the area lying in Range Unit 5 just to the northwest of Nadiwen Lake, southward from about Mile 102 on the Denali Highway. There the rolling terrain lies above timberline and as a whole is poorly drained, consisting predominately of Sedge Meadow, with Dwarf Heath Shrub on the better drained sites. Lichen growth is poor and many species are present, thinly scattered. This section has been most important in the past as summer range, rather than winter.

A third reconnaissance traversed a portion of Range Unit 15 along the Hicks Creek drainage, northward from Mile 100 on the Glenn Highway. The major vegetation type present is the Dwarf Birch, with much Sedge Meadow on the poorly drained sites, and interspersed with Dwarf Heath Shrub on wind-swept places and on sites above about 4,000 feet. Lichen growth is scarce for the most part, but occasional excellent growths (3"-5" high) of Cladonia sylvatica are found amidst the Dwarf Birch. That area is primarily summer range, but many caribou spent the winter of 1958-59 there.

As mentioned earlier, the meager information obtained was mostly of a general nature, and hence conclusions would be presumptuous. Many of the extensive notes taken, however, will be used in the future evaluation of the range.

Recommendations:

This range work is of the utmost importance to the management of the Nelchina caribou herd and, by extrapolation, to all the herds of Alaska. Recommendations for future studies remain the same as outlined in Job Completion Report W-3-R-13, Job 4, and several more years of research will be needed to complete the project.

Prepared by:	Approved by:
Ronald O. Skoog Research Biologist 30 June 1960	Sigurd T. Olson P-R Coordinator
	James W.Brooks, Director Division of Game

Volume 1 Report No. C-2f

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2f Title: Range Utilization Studies--Nelchina Herd

Period Covered: November 1, 1959, to April 30, 1960

Abstract:

Portions of Range Units 1, 2, 4, 5, 9, 11, and 13 were utilized by the Nelchina caribou last winter (1959-1960). Most of the various wintering groups remained in their areas throughout the January-March period with but minor movements. The bulk (over 20,000 animals) of the herd wintered throughout Range Unit 11, concentrated most heavily in the Talkeetna River basin. There the snow-cover became so hard that in some places the caribou literally were having to chop their way through to the food. Yet the seven animals from that area killed and examined were in excellent condition, with much visceral fat in evidence.

Quantitative data were obtained from an area of heavy use located on the upper Talkeetna River. The 5,000 square meters of surface area examined contained 681 feeding craters--one for every seven square meters of surface. These craters totaled about 306 square meters, or 6 per cent of the total area examined, and averaged 0.45 square meters in size. In this area of heavy feeding use, the caribou did not seem to cause much damage to the total vegetation cover.

Objectives:

To determine quantitatively the plant associations utilized most by caribou during this winter feeding.

To determine the food plants most frequently sought and eaten by caribou during the winter months.

Techniques:

Aerial reconnaissance flights were made periodically to determine the areas used by caribou during the winter. Ground work was planned to obtain quantitative data concerning the major wintering grounds. In the areas examined transects composed of ten-meter-square quadrats spaced twenty meters apart were run across the main portions of the feeding areas. Within these quadrats, the area of each pawed-out plot made by a feeding caribou was recorded in square meters, and if feasible the plants occurring in each plot were listed by species. Meters were used for measurement to facilitate a direct comparison between these data and that obtained from past range work. In addition the following information was recorded for each quadrat or transect, as necessary: vegetation type, elevation, and snow depth and condition. Also, at each site visited a number of caribou were killed for stomach samples to gain further information on the vegetation utilized.

The raw data obtained are filed at the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

Once again this job was relegated to the background as more important ones took precedence. Having but one airplane and one pilot for both the moose and caribou studies combined proved a serious limitation to both projects, and required a reduction in the plans for extensive field work.

The Nelchina caribou used a variety of wintering grounds this past year in widely scattered portions of the range. During November the major part of the herd moved through the Lake Louise Flat (Range Unit 13) to the northwestward, with a split occurring near Deadman Lake and resultant movements northward and southward. By mid-December, however, the caribou had pretty well settled for the winter, with concentrations noted as follows: Range Units 1 and 4--over 10,000 animals in the Cantwell area along the upper Jack and Nenana Rivers; Range Unit 2--scattered groups, mostly on the south end of Monahan Flat;

Range Unit 5--over 5,000 animals in the Deadman-Nadiwen Lake area; Range Unit 9--about 2,000 in the Alphabet Hills; Range Unit 11--over 20,000 in the upper Talkeetna River basin; and Range Unit 13--over 5,000 animals scattered on the Lake Louise Flats, mostly in the eastern half. These concentrations remained throughout the January-March period, with minor movements taking place within the areas outlined.

The snow-cover in the Talkeetna River basin became thorougly pock-marked with feeding craters, tracks and trails, from the tops of the mountains to the main streambed and into many of the adjacent valleys. On the divide between the Talkeetna and Chickaloon Rivers, where repeated heavy concentrations of caribou occurred, the two to four foot snow-cover became hard enough for a man to walk on top in many places and by early April some caribou were literally chopping their way through the snow to the food, as indicated by the large (some 6" x 6") chunks of snow excavated. The area can be considered as having received heavy use, probably as heavy as can be exerted by a group of caribou. Some time will be spent this summer along the Talkeetna River to obtain quantitative measurements of the vegetation there and perhaps it will be possible to assess the effect of the caribou usage.

A trip to the upper Talkeetna River in early April provided some quantitative data concerning winter range utilization by the Nelchina caribou. The area examined lay near the divide between the Chickaloon and Talkeetna Rivers, specifically a long, gently sloping (about 10^{o}) ridge between Clear Creek and the main stem of the Talkeetna River. There the main vegetation types present were Sedge Meadow and Dwarf Heath Shrub, with perhaps the latter being more dominant; lichens appeared to be scarce. The snow-cover ranged from 16 to 30 inches and was rather dense--a 200 pound man (me) sinking in only about 3"-4". The surface had been quite disrupted by the caribou during their three-month stay in that area; many of the first feeding craters were covered with snow. About 2,000 animals remained on the ridge and in the near vicinity, the bulk of the wintering group having moved down the Talkeetna River during the past week.

One transect, 10 meters wide by 1,500 meters long, composed of 50 ten-meter-square quadrats spaced 20 meters apart, was run on April 2 across a section of the aforementioned ridge in the midst of a major feeding area. The area of each feeding crater (greatest area disturbed by pawing action) within the 50 quadrats was measured in square meters; plant species occurring within each crater were not listed due to the greatly disturbed snow-cover and the "old age" of many of the craters. Vascular plants noted were Arctostaphylus alpina, Betula glandulosa, Empetrum nigrum, Ledum decumbens, Salix, spp., Vaccinium uliginosum, V. vitis-idaea, plus unidentified sedges and some grasses; the lichens present included Cetraria cucullata, C. islandica, C. nivalis, C. richardsonii, Cladonia rangiferina, C. sylvatica, and C. uncialis, all of poor growth (scattered distribution and generally less than one inch high). The main food items seemed to be sedge. Seven caribou were killed for reproductive and food habits data. All were in excellent condition (much visceral fat) and the stomachs contained predominately sedges and lichens; the stomach samples will be analyzed at a later date.

A total of 681 feeding craters occurred within the 50 quadrats, an average of about 14/quadrat or one for every seven square meters of surface area. The craters ranged in area from 0.05 to 5.00 square meters, averaging 0.45 and totaling 306 square meters. Total area of the quadrats was 5,000 square meters (100 x 50), so the caribou had disturbed in their feeding activity about 6 per cent of the area examined. Table 1 compares the above data with that obtained during the winter of 1957-58.

These data serve to illustrate the limited area of the range affected by the feeding activity of caribou. Their cursory feeding habits probably tend to preclude the possibility of the utilization percentage ever exceeding 10 in any one section of range, even under extended heavy use, such as in last winter's sample area. The writer is beginning to wonder whether the caribou are a major factor in range deterioration as supposed; perhaps natural phenomena, such as fire, plant succession, frost action, etc. are the chief factors.

Recommendations:

The problems confronting this study were described well in Job Completion Report W-3-R-12, Job 7, and need not be repeated here. The writer believes the potential value of this project to be great, providing that sufficient time were available and conditions such that significant data could be obtained. Little is known at present regarding the effort of caribou upon the range, and certainly that information is of utmost value in attempting to manage caribou herds. Greater emphasis should be placed upon this job in the future.

Table 1. Comparison of the three winter feeding-areas quantitatively examined thusfar on the Nelchina caribou range.

Items Tabulated	Talkeetna River	Fog Lakes	Talkeetna River
Dates Examined	2/15/58	3/22-24/58	4/2/60
Snow Cover	4"-12", Old	10"-15", Old	16"-30", Old
Slope	15^{o}-20^{o}	3^{o}-5^{o}	10^{o}-15^{o}
Vegetation Type	Lichen-Heath	Sedge-Heath	Sedge-Heath
Total Quadrats	0	100	50
Total Area Examined	3,400 sq. m.	10,000 sq. m.	5,000 sq. m.
Total Feeding Craters	86	914	681
Crater Density: One for every	40 sq. m.	11 sq. m.	7 sq. m.
Average No. Craters/Quadrat	-	9	14
Area of Craters: Total	24.14 sq. m.	218.85 sq. m.	305.96 sq. m.
Average	0.29 sq. m.	0.24 sq. m.	0.45 sq. m.
Per cent of Total area Disturbed by Craters	0.7	2.2	6.1
Degree of Use (Impression gained from aerial view)	Moderate	Heavy	Heavy

Prepared by:

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30 June 1960

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Volume 1 Report No. C-2g

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 2g Title: Mortality--Nelchina Herd

Period Covered: May 1, 1959, to April 30, 1960

Abstract:

Three caribou were examined last year in which disease had, or would probably have, caused death. One animal succumbed as a result of breaking a femur bone after falling on the ice of a lake. Eight others were killed by wolves. Fourteen cripples were noted among approximately 15,000 caribou observed closely.

No attempt was made to evaluate this limited data in terms of the whole herd, but natural mortality probably is at a minimum. The Nelchina caribou generally seem to be in excellent condition.

Objectives:

To determine the incidence of mortality from various factors, other than hunting, which operate against the Nelchina caribou herd.

Techniques:

Carcasses of caribou were examined whenever possible to check for evidence of parasites, disease, crippling, predation, and other possible factors influencing mortality. Weights, measurements, and specimens were taken as the opportunity arose. Field observations of live animals that seemed to be diseased or crippled were recorded also.

Findings:

The main purpose of this job is to record all instances of natural mortality (other than that due to man) and to note all possible mortality factors affecting the caribou, in order that these eventually can be evaluated in terms of an annual herd loss. At present this job has been relegated to the background, and data is obtained only in conjunction with other studies.

During the past year 49 caribou carcasses were examined in the field. Of these, 4 were natural deaths and the remaining 45 were killed by man. All of the 45 were in good condition. The other four died as follows: one apparently of disease--not definite because the viscera and most of the meat were gone, but the animal was only three years old and had no fat; one had fallen on the ice of a lake and had broken the right femur; and the other two had been killed by wolves. In addition, six other wolf kills (believed such, judging from wolf sign nearby) were sighted from the air. Two animals killed by hunters were diseased: one, an old bull killed in late August, had infected lungs (pus and lung worms) and very little fat; and the other, an adult bull, had pus pockets between layers of muscles and next to the hide. The latter malady usually is found in at least one animal each year, but its cause remains unknown. Cripples are not abundant in this herd, and of approximately 15,000 animals observed closely during the past year only 14 were noted to limp.

The wolf population continues to be rather low with a maximum of 50 estimated for the entire 18,000-square-mile range. Extensive field work along the Talkeetna River in late March and early April revealed the tracks of but two wolves, and no kills were sighted, in spite of the abundance of caribou, nor were any "other" deaths noted. If wolves or disease were common, one would expect to find carcasses with some regularity in an area used by over 20,000 caribou for three months.

The herd seems to be in excellent condition, with little evidence of disease. Natural mortality, including predation, probably is at a minimum. No attempt will be made to evaluate this mortality until more data become available.

Recommendations:

Knowledge of natural mortality is necessary to caribou management in order to properly assess the annual herd increment. Data are lacking at present, and the difficulties of this project are such that several years will be needed before proper assessment is possible.

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Volume 1 Report No. C-2h

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Studies

Job No: 2h Title: Characteristics of Hunter Harvest--Nelchina Herd

Period Covered: August 20, 1959, to March 30, 1960

Abstract:

During the 1959 hunting season, August 20, 1959, to December 31, 1959, an estimated 4,000 caribou were harvested from the Nelchina herd. Thirty-five per cent of the hunters in this area were successful. The greater part of the kill was obtained during the first two months of the season. The data may be summarized as follows:

1. The total hunter harvest was estimated at 4,000 caribou.

2. 70 per cent of the animals taken were males.

3. 34 per cent of the animals taken were calves and yearlings.

4. 56 per cent of the animals taken were less than 4 years old.

5. 88 per cent of the animals taken were less than 6 years old.

6. 35 per cent of the hunters were successful.

7. 55 per cent of the caribou taken along the Denali Highway were obtained with the aid of vehicles.

8. 62 per cent of those caribou taken with the aid of vehicles were taken with commercial vehicles.

9. 94 per cent of the hunters along the Denali Highway were Alaskan residents.

Objectives:

To determine the temporal and areal distribution, the magnitude, and composition of the harvest.

To determine hunter success.

Techniques:

Several methods were employed during the hunting season to gain information on the magnitude and characteristics of the kill. A hunter check-station located on the Denali Highway, one and one-half miles west of Paxson, provided much of the information for that area during the early part of the season. Operation of the station on a sampling basis was conducted from August 20 to August 23, September 5 to September 7, September 17, and September 30, 1959. The following data were recorded for each party: date, area hunted, total hunters in the party, animal species hunted, days hunted (to the nearest 1/3 day), number of nonresident hunters in the party, method of hunting (divided into the following categories: foot, horse, plane, tractor, and boat), species of game taken per hunter, and sex and age of the animals killed. The method of hunting categories were designated as private or commercial.

Interviews with guides, outfitters, and roadhouse proprietors operating in Game Management Units 13 and 14 provided additional information on their kills and on other animals brought out at their establishments. A questionnaire mailed to guides conducting hunts in Units 13 and 14 supplemented the above interviews and furnished data on dates, locations, numbers, and sex of caribou taken by their clients.

Locker and meat processing plants in Anchorage and Palmer were contacted for data as an additional indicator of hunter success. At the time of contact only estimates of numbers and poundages of meat processed were available.

Lower jaws were collected whenever possible and those obtained were used to determine the age structure of the harvest. All available ovaries and testes were preserved for reproduction data. Estimates of additional kill evolved from interviews with hunters, U. S. Fish and Wildlife Service personnel, and the correlation of reports from operators on the Denali Highway with Denali check-station data. The raw data obtained are filed in the Anchorage office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

Conditions Affecting the Harvest

Distribution of and accessibility to the caribou this season, as in the past, were major factors in limiting the magnitude of the harvest. A brief description of the Nelchina caribou range is given below to acquaint the reader with the range in general and to give him some insight as to how the above factors can affect the harvest. Figure 1 shows the main boundaries and important land features.

Access to this range on the north is provided by the Denali Highway, a gravel road running east-west close to the northern border of the Nelchina range, the natural border being the Alaska Range. Eastern access is provided by the north-south paved Richardson Highway between Paxson and Junction, where it is joined by the Glenn Highway. The Glenn Highway, an east-west paved road, is located very near the southern border of the Nelchina range, paralleling the Denali Highway at an average distance of 60 miles to the south. The gravel Lake Louise Road extends 20 miles to the north from the Glenn Highway to Lake Louise and affords access to this water system to boat hunters. The west slopes of the Talkeetna Mountains constitute the western border of the range, these mountains comprising the major summering and wintering range of the Nelchina caribou.

Numerous lakes throughout the area furnish access for airplane hunters throughout the season. The hunters utilizing this aid, however, constitute only a small percentage of the total hunters. The Richardson Highway lies roughly 120 miles to the east of the western slopes of the Talkeetna Mountains.

Thus, of the total area of the caribou range (approximately 15,000 square miles), about 10,000 square miles, or two-thirds, are inaccessible to hunters by road travel. It is therefore quite obvious that should the caribou avoid the above-mentioned roads in their migrations during the open hunting season, the kill will remain low.

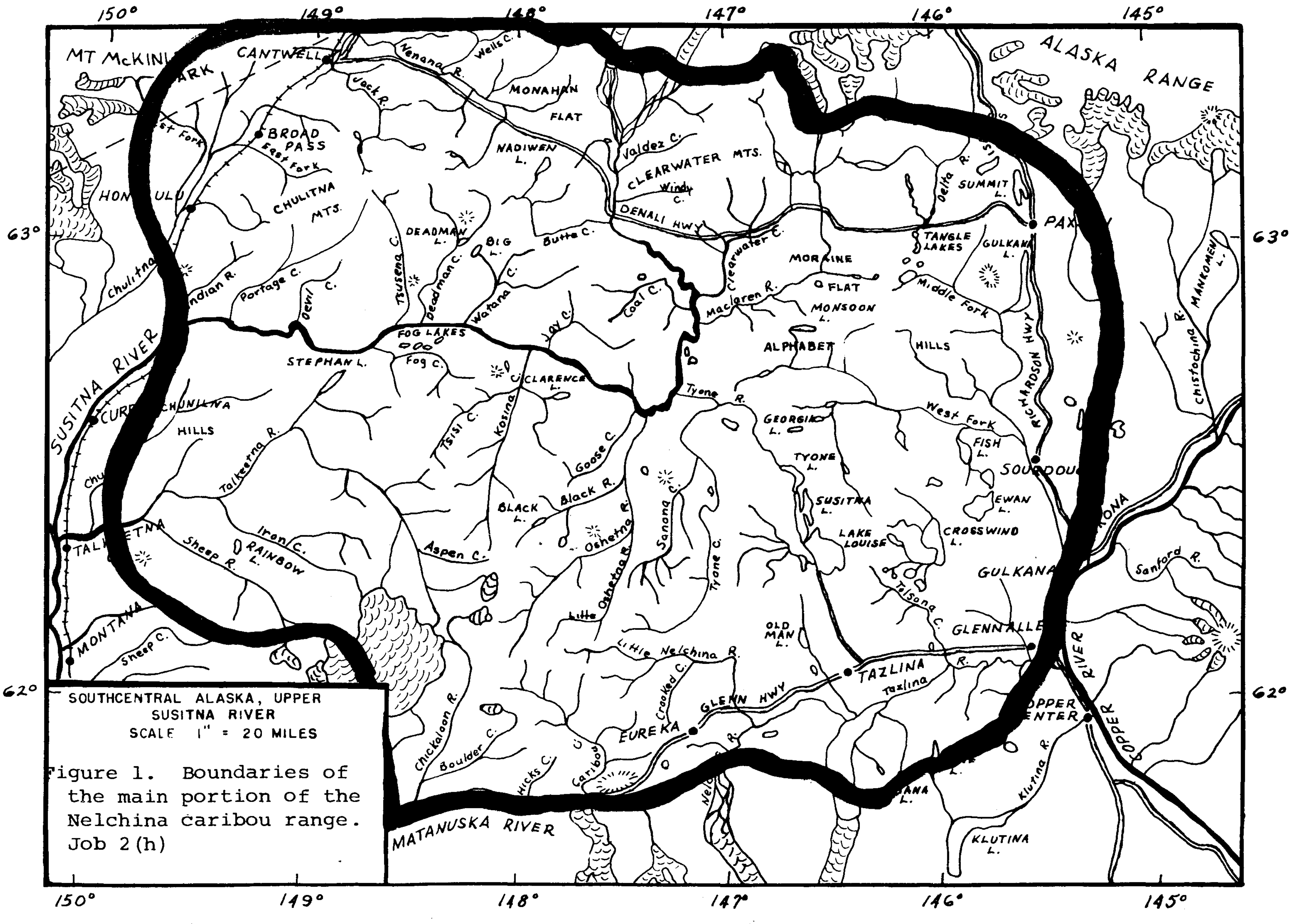

Figure 1. Boundaries of the main portion of the Nelchina caribou range. Job 2(h)

Distribution During the Season

The opening of the season found the bulk of the caribou herd in the Clarence-Deadman-Fog Lakes region. These were available to aircraft hunters and hunters with guides having field camps in that area. One segment of the herd had moved southwestwardly across the Denali Highway just north of Nadiwen Lake on August 19, 1959, and provided game for foot hunters during the early part of the season. This herd was composed largely of cows, calves, and young bulls which had been summering on the Monahan Flats. Other scattered groups of caribou were located on the Lake Louise Flats, foothills to the west, and southeast portion of the Talkeetna Mountains, but few were accessible from the Glenn Highway by foot.

As the season progressed, the following movements occurred. On August 29 two bands of 2,000+ caribou each were seen, one along the Tyone River approaching the Tyone Lake region and the other moving northeasterly along the Susitna River just above the mouth of the Maclaren River. At this time boat hunters on the Maclaren and Susitna Rivers and those on the Tyone-Susitna-Louise Lake system began taking their toll. During this early part of the season, also, some caribou were located in the area between the headwaters of the Oshetna River and Tyone Creek, but abnormally heavy rainfall had rendered this country impassable by land vehicle and dozens of swamp buggies operating from the Eureka area of the Glenn Highway were reported stuck. By the second week of the season the herd north of the Nadiwen Lake region had moved 8 to 12 miles southward and were available only to hunters employing the use of weasels, swamp buggies, or aircraft.

Those hunters remaining close to and patrolling the Denali Highway were able to get some shooting at caribou crossing this road from the north. These were predominantly bulls in bands of three to six moving from the slopes of the Alaska Range. The few hunters along this highway during the latter part of September and early October were generally unsuccessful in obtaining caribou. The road was closed by snow after October 15, 1959.

On October 6, 1959, caribou were reported crossing the Glenn Highway in the vicinity of Sheep Mountain. A reconnaissance flight was flown to the area on October 8. Ten to fifteen thousand caribou had moved from the north into the Caribou Creek area, behind Sheep Mountain, and onto the drainage system of the Little Nelchina River. They remained here until about October 14 when they reversed their direction of migration and moved down Crooked Creek and up the Little Nelchina River thus returning to the north. Many foot hunters took advantage of this accessibility and killed an estimated 1,000 caribou in the Sheep Mountain-Crooked Creek areas from October 6 to October 18. Swamp buggies and weasels also were utilized extensively. One operator alone hauled out 145 caribou during this period.

On the October 8 flight, a few scattered caribou were sighted on the Lake Louise Flats and about 2,000 animals in groups of 25-100 were located to the north and west of Tyone Lake, with other herds extending up the Susitna and Maclaren Rivers. No animals were seen along the Denali Highway and few caribou were taken from this area after September 30, 1959.

The migration from the Sheep Mountain area continued to the north but swung eastward before reaching the Denali Highway. The leaders of the movement reached the Richardson Highway in the Paxson Lake area early in November. As the animals moved southward and then westward a few miles to the north of the Glenn Highway, they became available to hunters along the Richardson and Glenn Highways and the Lake Louise Road. Hunting pressure during this entire period was slight with the greatest number of hunters out on weekends.

From Wednesday, November 11, until Sunday, November 21, scattered bands of caribou were still crossing the Lake Louise Road moving westward. The greatest hunting pressure continued to be on the weekends, and hunters killed an estimated 250 animals during this period. Although scattered bands of caribou (an estimated total of 5,000+) remained on the Lake Louise Flats until the end of the hunting season, December 31, the overflow condition of the lakes and persistent frost fogs in the area greatly retarded the take of caribou by airplane hunters.

The largest portion of the Nelchina herd had migrated into the Talkeetna Mountains by the first of December, so the kill during the final month of the season was very slight.

Magnitude of the Kill

The 1959 caribou harvest by hunters was estimated at a maximum of 4,000 animals. The caribou movements and distribution in relation to avenues of accessibility to hunters were the main limiting factors. Weather was also a major deterrent to hunting success. Low clouds and steady rain during the first three weeks of the season probably dampened much enthusiasm and reduced the caribou kill.

Table 1 lists the data on total kill as obtained from hunter check-station, field checks of hunters, interviews with guides and outfitters, returns from questionnaires sent to guides, and locker plant surveys.

An actual tally of 1,400 caribou was recorded taken. This figure is a minimum count, however, as all sources of possible duplication were believed eliminated in the course of working up the data. The "estimated additional" figure in each instance is based on second hand reports, on estimates in correlation with actual tallies, and on knowledge of additional sources of information which were untapped during the period involved due to a shortage of man power. The guide questionnaires furnished data on an estimated 75 per cent of the guides providing hunter services in the Nelchina caribou country, Game Management Units 13 and 14. These questionnaires were sent only to guides operating in these units as listed on the 1956 guide register. The total estimate of 4,000 caribou harvested is believed to be accurate within 10 per cent. The additional estimate of harvest on the Denali Highway is based on the availability of the caribou, number of hunters, and ratios of caribou taken with guide services versus those taken by hunters without guide services checked through the Denali hunter check-station.

The Denali hunter check-station operation provided information on the areal distribution of the caribou harvest along the Denali Highway. Table 2 shows by milepost on this highway the areas receiving the greatest hunting pressure and the areas producing the greatest caribou kill. The large kill indicated for the area between Mileposts 81 and 100 was due mainly to accessibility of a moderate size herd of caribou during the early days of the season. The greatest number of caribou taken the first four days of the season were from this area. The fact that this particular herd was available to foot hunters for approximately the first 10 days of the season was utilized in estimating additional kill along the Denali Highway. The second major area of hunter success was that between Mileposts 71 and 80, this success in part being explained by circumstances rather than by caribou availability. One aircraft operator was flying out of a lake located near Mile 78, and caribou obtained with his aid constituted a major portion of the animals reported taken from this area. This

Table 1. Nelchina Caribou Harvest, 1959.

Source	Dates Covered	Number of Caribou Killed: Actual Tally	Estimated Additional	Total Estimate
Denali check-station	8/20-23 9/5,6,7 17,30	543	1,022	1,565
Guides & outfitters - Denali Highway	8/20- 9/30	(475)*	-	-
Guide questionnaire returns	10/22- 12/31	483	157	640
Guides & outfitters interviewed along Glenn & Richardson Highways	9/16- 12/20	81	19	100
Reports & estimates from outfitters & hunters in Sheep Mt., Caribou, & Crooked Creek areas	10/7- 10/18	149	851	1,000+
Reported & estimated take from Eureka, Lake Louise Road, & Lake Louise water system	8/20- 10/18	88	312	400
Reported, observed & estimated take along Glenn & Richardson Highways & Lake Louise Road	10/18- 12/31	47	248	295
		1,400	2,600	4,000

*This figure was not included in the actual tally total to prevent duplication in connection with check-station data. It was used, however, in arriving at the "Estimated Additional" figure for this station.

Table 2. Chronological Distribution of Caribou Harvest by Mileposts on the Denali Highway.

Denali Hwy.	8/20		8/21		8/22		8/23		9/5		9/6		9/7		9/17		Totals	
Mileposts	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C	H	C
1-10	0	0	2	1	2	2	0	0	0	0	4	2	5	5	0	0	13	10
11-20	1	2	6	5	6	2	8	3	3	0	2	0	12	4	0	0	38	16
21-30	2	0	15	12	12	9	16	7	7	2	5	2	18	5	5	2	78	39
31-40	16	6	23	14	25	14	27	18	7	5	7	1	37	14	2	1	148	73
41-50	0	0	5	3	5	2	6	4	4	3	5	5	6	6	0	0	31	23
51-60	2	0	15	6	10	7	15	7	11	1	1	3	24	12	5	5	83	41
61-70	5	0	12	0	9	3	9	1	3	0	0	0	9	1	1	1	46	6
71-80	4	0	19	16	16	20	19	20	4	7	9	14	5	4	4	3	83	84
81-90	10	4	23	27	31	34	12	7	5	0	4	4	6	2	2	0	92	78
91-100	8	7	12	10	33	46	30	43	0	0	11	11	2	0	0	0	96	117
101-110	1	0	9	1	16	1	16	7	2	0	12	15	15	3	0	0	71	27
111-120	1	1	2	0	14	4	0	0	0	0	3	3	11	6	2	3	32	17
121-130	0	0	0	0	7	3	2	0	0	0	0	0	0	0	0	0	9	3
*Road	13	0	34	2	69	1	65	2	27	0	36	0	83	3	12	1	338	9
Totals	63	20	178	97	255	148	225	119	73	18	99	60	233	65	33	16	1,158	543
Hunting Parties	34		81		123		99		36		45		106		16		539	

Key: H - Hunters
C - Caribou

*Road - Hunters patrolling the highway; milepost of kill unknown.

operator alone reported transporting 350 caribou. His report is substantiated by ratios worked out from additional check-station data.

It is also interesting to note the relative increase in hunters and numbers of animals taken on weekends. September 5 is a good example of the weekday average pressure during the early season. Those figures for September 6 and 7 show the influx of weekend hunters.

September 17 indicated the hunting pressure and success of a typical weekday during the end of the first month of hunting. On September 31, 1959, the station was operated for one-half day with no information obtained. There were not sufficient hunters along the highway to warrant further operation of the check-station.

Table 3 shows the chronological take of caribou by vehicle, commercial versus private, and of those taken by foot hunters. It is quite interesting to note that the successful foot hunters are in the minority, and unsuccessful foot hunters far outnumber the unsuccessful hunter using vehicles. The main reason for this being that the present day caribou hunter is extremely adverse to work and many caribou no farther than one-half mile from the highway were bypassed because "they were too far to pack out", if shot in their present location.

Three hundred-five (305), or 56 per cent of the caribou checked through the station were obtained with vehicular aid. This included all vehicles: varieties of tractors, boats, and aircraft. One hundred ninety-two, or 35 per cent, of the caribou were taken with the aid of commercial vehicles. A summary of additional information obtained from the Denali hunter check-station is shown in Table 4 and Table 5.

A survey of locker plants and commercial meat processing plants was made primarily to determine information on the moose harvest. This survey, however, provided enough caribou data to warrant future investigations of these plants as a method of determining hunter success by evaluating the poundages of caribou processed yearly. It is believed trends in hunting success may be obtained through this medium. The results of the survey may be seen in Table 6.

Records of 50 caribou indicated 117 pounds to be the average weight for caribou processed. These figures as listed are as reported and estimated by the processor. No effort was

Table 3. Caribou Hunter Success in Relation to Method of Hunting.

Date	Taken with Commercial Vehicular Aid (plane, boat, tractor)		Taken with Private Vehicular Aid (plane, boat, tractor)		Taken by Foot Hunters		Totals
	No.	%	No.	%	No.	%	
20 Aug. 1959	0	0	0	0	20	100	20
21 Aug. 1959	27	28	12	12	58	59	97
22 Aug. 1959	44	29	34	23	70	48	148
23 Aug. 1959	48	40	33	28	38	31	119
5 Sept. 1959	10	56	8	44	0	0	18
6 Sept. 1959	33	55	5	8	22	36	60
7 Sept. 1959	28	43	20	31	17	26	65
17 Sept. 1959	2	13	1	6	13	81	16
Total	192	35	113	21	238	44	543

Summary:

1. 56 per cent (56%), 305, of the caribou taken on the Denali Highway were obtained with the aid of vehicles (airplanes, boats, and tractors).

2. 35 per cent (35%), 192, of the total caribou, or 62% of those taken with vehicular aid, were taken with the aid of commercial vehicles (airplanes, boats, tractors).

3. 44 per cent (44%), 245, of the caribou taken along the Denali Highway were taken by foot hunters.

Table 4 Summary of data concerning caribou hunting as obtained at the Denali Highway hunter check-station, August 20-23; September 5-7, 17, 30, 1959.

Hunting parties	539
Caribou hunters	1,118
Hunters per party	2.12 (ave.)
Days hunted per party	2.10 (ave.)
Days per hunter	2.12 (ave.)
Total man-days hunting	2,370

No. in party	No. parties	No. hunters	Average days hunted per party
1 person	127	127	1.63
2 "	274	548	2.14
3 "	99	297	2.30
4 "	31	124	2.90
5 "	8	40	2.37
6 "	3	18	2.66

	Total No.	Per Cent
Caribou taken	543	
Male	333	63
Female	198	37
Sex Unknown	12	-
Successful hunters	393	35
Caribou taken with vehicles	305	56
Caribou taken with commercial vehicles	192	35
Caribou taken with private vehicles	113	22
Caribou taken by foot hunters	247	44

Table 5. Summary of check-station data concerning nonresident caribou hunters on the Denali Highway.

	Type Party		
	Resident & Nonresident	Nonresident	Totals
Parties	(44) & 36	14	50
Hunters	41	22	63
Hunters hunting caribou only	-	3*	-
Hunters hunting caribou and other game	-	18	-
Hunters killing caribou	25	9	34
Caribou taken	25	12	37
Hunters with 1 caribou	25	7	32
Hunters with 2 caribou	-	1	1
Hunters with 3 caribou	-	1	1
Parties using vehicles	-	5 (7 hunters)	-
Parties using commercial vehicles	-	4 (5 hunters)	-
Parties on foot	-	9 (15 hunters)	-
Caribou taken by hunters with vehicles	-	5 (41%)	-
Caribou taken by hunters on foot	-	7 (59%)	-

Summary: 1. 6 per cent (6%), 63, of the total hunters checked on the Denali Highway were nonresidents.

2. 7 per cent (7%), 37, of the total caribou kill checked on the Denali Highway were killed by nonresidents.

*These three hunters killed three caribou (100% successful).

Table 6. Caribou Processing Record.

Establishment	Location	Caribou Processed Number *Rep.	**Est.	Weight Rep.	Est.
Locker Plants	Anchorage	272	400	45,000	35,640
Grocery Stores	Anchorage	19	-	-	2,280
Meat Markets	Anchorage	-	250	30,000	-
Grocery Stores	Palmer	25	-	-	2,825
Meat Markets	Palmer	15	-	-	1,755
Sub-Total		331	650	75,000	42,500*
Total		981		117,000	

*These reported figures for both numbers and weights were obtained from personnel at the establishments contacted.

**The estimates for numbers were made by the writer when weights were reported and estimates for weight made when numbers were reported.

made to adjust the reports to coincide with the average caribou weight of 117 pounds due to the size of the sample used. This information was obtained late in the season and no previous arrangements had been made to correlate the percentage of hunters having their caribou processed commercially with those doing their own butchering. More emphasis will be placed on these meat processor surveys next season in connection with the hunter check-station, as it appears that total weights of caribou processed will be a reliable indicator of the caribou kill in the future, as noted from the high percentage (roughly one-fourth of the total kill) reported processed commercially.

Composition of the Harvest

Sex and age data were obtained from caribou carcasses whenever possible, and the samples later used to determine the composition of the kill. Table 7 summarizes the data on sex composition, and Table 8, that on age.

As in past years, bulls made up the bulk of the caribou harvest: 70 per cent of the 922 animals sexed. Guide reports indicated that nearly 100 per cent of their clients shot bulls. The combination of guide reports and guide aircraft operators accounted for the 87 per cent bull figure listed in Table 7. The cow caribou listed in this bracket were all reported by guides offering one-day aircraft hunts. Hunters using commercial transportation for hunting are thus indicated to be more interested in obtaining an animal rather than one large in body or antler size, in contrast to those employing guides.

The age structure of the harvest, as shown in Table 8, resulted from 232 lower-jaws aged by Ronald O. Skoog, Research Biologist, Alaska Department of Fish and Game, and the writer. The aging technique used is based on tooth eruption and relative wear, and has been described in previous Federal Aid Wildlife Restoration job completion reports. Age to 3-year-olds is considered accurate while the older animals are classed as prime (4-6 years), mature (7-9 years), and old (10+ years). The harvest again indicates the population to be a young one, as only 12 per cent of the animals were seven years or older. Thirty-four per cent (34%) of the animals were calves and yearlings. Fifty-six per cent (56%) of the animals were less than four years old, and eighty-eight per cent (88%) of the animals were less than 6 years old. These data were obtained from the Denali area largely and thus do not reflect the age of the harvest taken with the aid of

Table 7. Sex composition of 1959 caribou harvest as obtained from examination of hunters' kills.

	Denali Check-Station		Guide Reports		Field Checks		Total	
Sex	No.	%	No.	%	No.	%	No.	%
Male	333	63	172	87	137	70	642	70
Female	198	37	24	13	58	30	280	30
Totals	531	100	196	100	195	100	922	100

Table 8. Age composition of 1959 caribou harvest, as obtained from examination of hunters' kills.

	Male		Female		Unknown		Total	
Age	No.	%	No.	%	No.	%	No.	%
Calf (3-7 Mos.)	15	9	8	11	0	0	23	10
Yearling (15-19 Mos.)	37	23	18	25	0	0	55	24
2 Years	34	22	3	4	0	0	37	16
3 Years	11	7	5	7	0	0	16	7
Prime (4-6 Years)	45	28	26	36	1	100	72	31
Mature (7-9 Years)	11	7	11	16	0	0	22	9
Old (10+ Years)	6	4	1	1	0	0	7	3
Totals	159	100	72	100	1	100	232	100

guides. However, when compared with similar data of previous years there is a substantial increase in the number of calves and yearlings killed. The high survival of last year's calves may account for the large kill of yearlings, and the limit of 3 caribou could influence the taking of calves.

Recommendations:

The hunting season should be opened at an earlier date for a more adequate harvest of the annual surplus to be obtained. A recent increase in the bag limit to three caribou has not resulted in increasing the hunter harvest appreciably. Most hunters, as determined in previous surveys, do not desire to kill the present limit of three caribou. The extension of the season through December has added a minimal amount to the annual harvest, mainly due to the lack of hunters. An earlier opening of the season, possibly August 1, would permit hunters to kill their caribou while the bulls, which constitute the majority of the kill (70% this past season) are at their peak of primeness, and the milder weather is more conducive to hunting. Guides as indicated by interviews, would welcome an earlier opening of caribou season because they could fill their client's bag and then concentrate on the other species of big game on the later opening date.

An adequate sampling technique for determining the annual caribou harvest should be continued and data available from commercial meat processing plants should be more fully exploited to this end.

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30 June 1960

Approved by:

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James W. Brooks, Director
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Volume 1 Report No. C-3a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 3a Title: Assessment of Herd Status, Steese-Fortymile

Period Covered: December 1, 1959 to June 30, 1960

Abstract:

Sex and age ratios are not at present available to give us a complete picture of the herd composition and present status of the herd; but productivity compares favorably with previous years and survival for the year ending June, 1960 was well up. The movements and distribution during the year were of an erratic nature but there is little reason to believe this is anything but a healthy herd numbering in the neighborhood of 40,000 animals. Hunting pressure and the yearly kill is light primarily due to inaccessibility of the herd during the hunting season and little can be done to alter this situation.

Objectives:

To compile and analyse all pertinent data resulting from field investigations of the Steese-Fortymile caribou herd in accordance with the needs of management.

Procedure:

The findings resulting from investigations of caribou distribution, numbers, sex and age composition, productivity, harvest, etc., because of inter-relationships, must be synthesized before herd status can be adequately clarified to serve the needs of management. This job therefore entails bringing together all data bearing on present herd characteristics and trends, and assessing them according to past, present, and anticipated future environmental conditions and harvest demands. With this information for guidance, regulations may be directed more precisely and effectively toward improved resource management.

Findings and Discussion:

The purpose of this report as stated above is to bring together the available information relating to the status of caribou in the Steese-Fortymile area and to assess it in accordance to management needs.

In the other Job Completion Reports on the individual phases of research performed, an attempt was made to analyze the findings in each case; therefore, this discussion will attempt to condense and evaluate these assorted findings.

Movements, Distribution, and Numbers

Herd movements and distribution this past year, from May 1, 1959 to April 30, 1960, were erratic as compared to previous years since but a small portion of the total group that had wintered in the Tanana Hills returned to the calving ground in the White Mountains. The largest portion remained in Canada wintering in the Hungry Lakes area of the Peel River and but part of these returned to Alaska in August and, accompanied by the calving group from the White Mountains, crossed the Taylor Highway during October and then wintered in the Forty-mile country. Two to three thousand of these animals crossed into the upper Tanana Valley and proceeded into Canada via Border City and Scottie Creek late in the winter; something that has not occurred in the past several years. Those animals wintering in the Fortymile started their migration to the calving grounds in early April.

No opportunity was found to ascertain the total number of caribou comprising the Steese-Fortymile herd during the year, but in past years the population has been estimated at 40,000; and at present, there is little reason to change this estimate.

Herd Composition

Calf:adult ratios were obtained during the year but the nature of the migration prevented obtaining sex and age ratios and herd composition data (see Completion Report W-6-R-1, C-3c for this information); information sorely needed to determine present status of the herd.

Productivity and Mortality

Studies carried out during 1959 and 1960 on productivity and survival provided data for comparison with that obtained in previous years. No data was obtained on initial productivity due to weather conditions but composition counts were obtained as the calving groups crossed Eagle Summit on the Steese Highway. These data indicate calves comprised 33 per cent of this portion of the herd. For the past five years the percentage of calves has been between 26 per cent in 1957 to 37 per cent in 1954, therefore, compares favorably with previous productivity.

Survival for this year was much better than for the previous three years as shown by the following table.

Calf Survival During 1959-1960 as Shown by Calf Counts Taken in April 1960. (1957, 1958, and 1959 included for comparison) Steese-Fortymile Caribou Herd.

Date Count Taken	Calf:Adult Ratio
April 10, 1960	37:100
March 29, 1959	19:100
February, 1958	3:100
February, 1957	3:100

Conclusions:

The available data on the Steese-Fortymile caribou herd indicates a healthy productive group that are not being utilized to their full potential. All available information indicates that the total hunting pressure is light in most of the area and non-existent in the rest as the animals are not accessible to hunters during a great part of the time, the exception being when they are crossing either the Steese or the Taylor Highways, or are adjacent thereto.

Recommendations:

The harvest of caribou from the Steese-Fortymile herd is small compared to the harvestable surplus. This is primarily due to inaccessibility.

Increasing the length of the hunting season and the size of the bag limit could be resorted to but in my opinion would not materially affect the harvest.

Intensive management practices can not be utilized on this herd primarily due to the migratory nature of the beasts.

Hunter check stations should be utilized to ascertain information presently not available through other means, at least until a game tag and hunter report card system can be instituted.

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30 June 1960

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Volume 1 Report No. C-3b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 3b Title: Movements, Distribution, and Numbers--Steese-Fortymile Herd

Period Covered: May 1, 1959, to April 30, 1960

Abstract:

Herd movements and distribution for this year were of an erratic nature as compared to previous years. Most of the herd remained in Canada during the calving season. Only a small portion that had wintered in the Tanana Hills migrated to the usual calving grounds in the Spring. A portion of the herd that had remained in Canada returned to Alaska in August and crossed the Taylor Highway during October and then wintered in the Fortymile country. Two to three thousand of these animals crossed into the upper Tanana Valley and proceeded into Canada via Border City and Scottie Creek, something that has not occurred in the past several years. The animals that wintered in the Fortymile started their northwesterly migration to the calving grounds in early April. Many caribou wintered in the Hungry Lakes area of the Peel River and the Canadian people feel that these are part of the Steese-Fortymile herd.

Objectives:

To determine the distribution, seasonal movements, and gains or losses in numbers resulting from ingress or egress of caribou to or from the Tanana Hills.

Procedure:

Periodic aerial surveys were conducted during the year in an attempt to discover and trace caribou movements and to determine the distribution of animals. Flights were conducted into the Yukon Territory to determine the wintering grounds in Canada of this herd. Reports of co-operating personnel from the Bureau of Sport Fisheries and Wildlife, the Canadian Wildlife Service, private and commercial pilots and residents of the area supplemented these aerial observations. The observations made by Joe Miner, W. B. Stewart, and Robert A. Rausch were particularly helpful.

Findings:

The general patterns of movement and distribution from May 1, 1959 to April 30, 1960, were of an erratic nature as compared to previous years. Most of the herd remained in Canada during the Spring and Summer, and only a small number that wintered in the Tanana Hills moved to the calving grounds in the White Mountains. These animals numbered but three to four thousand. In late August reports of considerable numbers of caribou moving northwest through Seela Pass, Yukon toward Alaska resulted in a migration across the Taylor Highway during October. A good portion of these animals wintered in the Fortymile area. The years movements and distribution are discussed in detail beginning with the spring.

Spring - (April-June, 1959)

The Steese-Fortymile caribou herd remained in Canada during this period with the exception of an estimated 2,000 head that had wintered in the Tanana Hills. These few animals moved northwest during April and May to the calving grounds in the White Mountains. The nature of this movement could not be followed due to bad weather which restricted aerial activities until May 21 when the animals were already on the calving grounds. The main concentration of animals on the calving grounds were in the head of Preacher Creek with caribou scattered all the way from Mt. Ryan to Preacher Creek.

The movement out of the calving grounds started a few days later than usual and the first animals started crossing at Eagle Summit on the Steese Highway on June 13, ten days later than the previous year. However, all animals had crossed by the 17th of June. A total of 3,088 caribou was counted crossing the highway in the vicinity of Eagle Summit, and a few more crossed in the vicinity of 95-97 mile on the Steese Highway that were not tallied. These animals gradually dispersed into the area between the Chena River and Birch Creek.

Summer - (June-August, 1959)

During the summer the few animals of the herd remaining in Alaska were widely dispersed throughout the Tanana Hills. Small bands were in the vicinity of Birch Creek, Far Mountain, and Chena Hot Springs. In addition, a few animals were along the headwaters of the Salcha and Charlie Rivers.

The first of August Mr. Bedlake of the Canadian Wildlife Service reported an estimated 20,000 caribou fifty miles northeast of Dawson in the Seela Pass area heading north-northwest. These animals are believed to be part of the Steese-Fortymile herd.

Fall - (September-November, 1959)

Little change in movements and distribution occurred in September in most of the Tanana Hills, but the animals as reported in the Seela Pass area must have crossed into Alaska in the vicinity of the Seventymile country, dispersed over the Fortymile River area, picking up the animals that had summered there and began a migration southeast across the Taylor Highway. The first week in October the herd began crossing on a wide front extending from mile 11 on the Taylor Highway to Jack Wade Creek with the main numbers crossing between Mt. Fairplay and Chicken. By the 16th of October most of the animals had crossed but a few scattered groups continued to cross for the rest of the month. No actual counts were made since the animals stayed to the timber areas and it was impossible to follow the migration due to no snow conditions.

During November these animals moved into the area along the Alaska-Canadian border along the Sixtymile and the Ladue Rivers, being dispersed along both sides of the border.

Winter - (December, 1959-April, 1960)

During the winter months a few caribou were scattered over the Tanana Hills and a good part of the fall migration stagnated and backed up to winter all through the Fortymile River and its tributaries. Groups were along the Sixtymile and the Ladue. Also a few animals wintered along the Seventymile River.

It was determined that a large group of caribou, estimated to number between thirty and forty thousand animals, wintered around the Hungry Lakes along the Peel River in Yukon Territory, Canada. The Canadian Wildlife Service believed these to be part of the Steese-Fortymile herd.

During the first of February some of the caribou wintering along the Ladue and Dennison Fork crossed into the Tanana Valley in the vicinity of Gardner Creek and proceeded up along the flats and crossed into Canada in the vicinity of Border City and Scottie Creek. The residents of this area stated they had seen no caribou in this vicinity for the past twelve years.

By the middle of April the animals wintering in the Fortymile Country and along the Seventymile River were beginning the migration toward the calving grounds in the White Mountains.

The migrations, local movements, and seasonal distribution during the period May 1959 through April 1960 are shown in Figures 1, 2, 3, and 4.

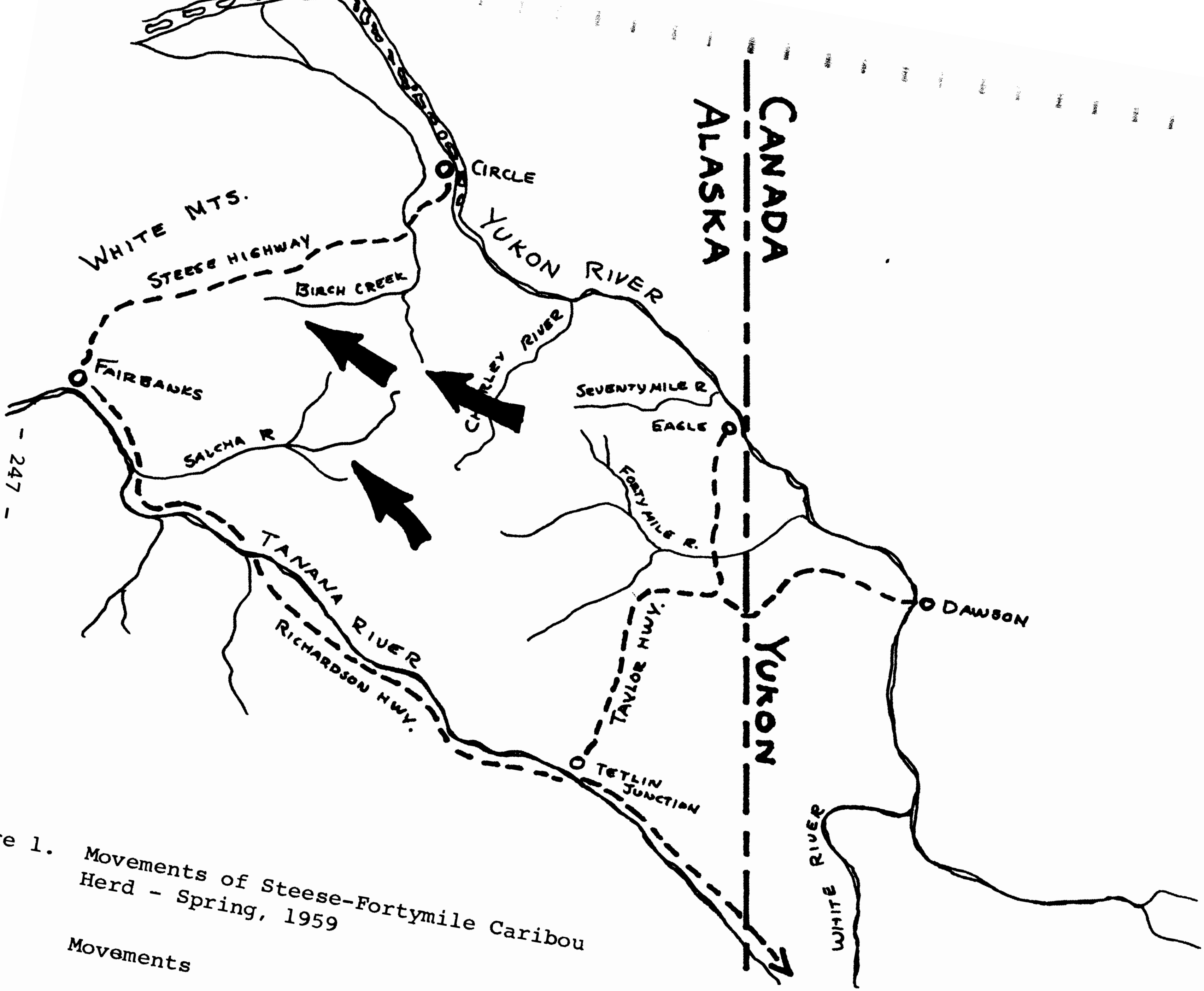
<u>Numbers</u>

No opportunity was found to determine the total number of caribou comprising the Steese-Fortymile herd during the year. The calving counts, which totaled but 3,088 animals, was but a small portion of the herd. The fall migration was not a major one although an estimated 20,000 animals did cross the Taylor Highway. These animals I believe to be but a portion of the total herd, the rest of the herd having remained in Canada for the past year. Since we must have gotten a portion of the herd back from Canada this past fall it is conceivable that a larger portion of the Steese-Fortymile herd may migrate back to Alaska in the near future, in which case, we may be able to determine the population level.

Recommendations:

Movements of the Steese-Fortymile herd should be followed closely in order to determine the seasonal movement patterns and to note any ingress or egress of animals. Particular emphasis must be placed on locating the migration routes and location and extent of the wintering areas in Canada's Yukon Territory and the effects of contact with Canadian caribou.

Every opportunity should be utilized to make a total census when feasible to determine the present size of the herd.



igure 1. Movements of Steese-Fortymile Caribou Herd - Spring, 1959

Movements

Calving Grounds

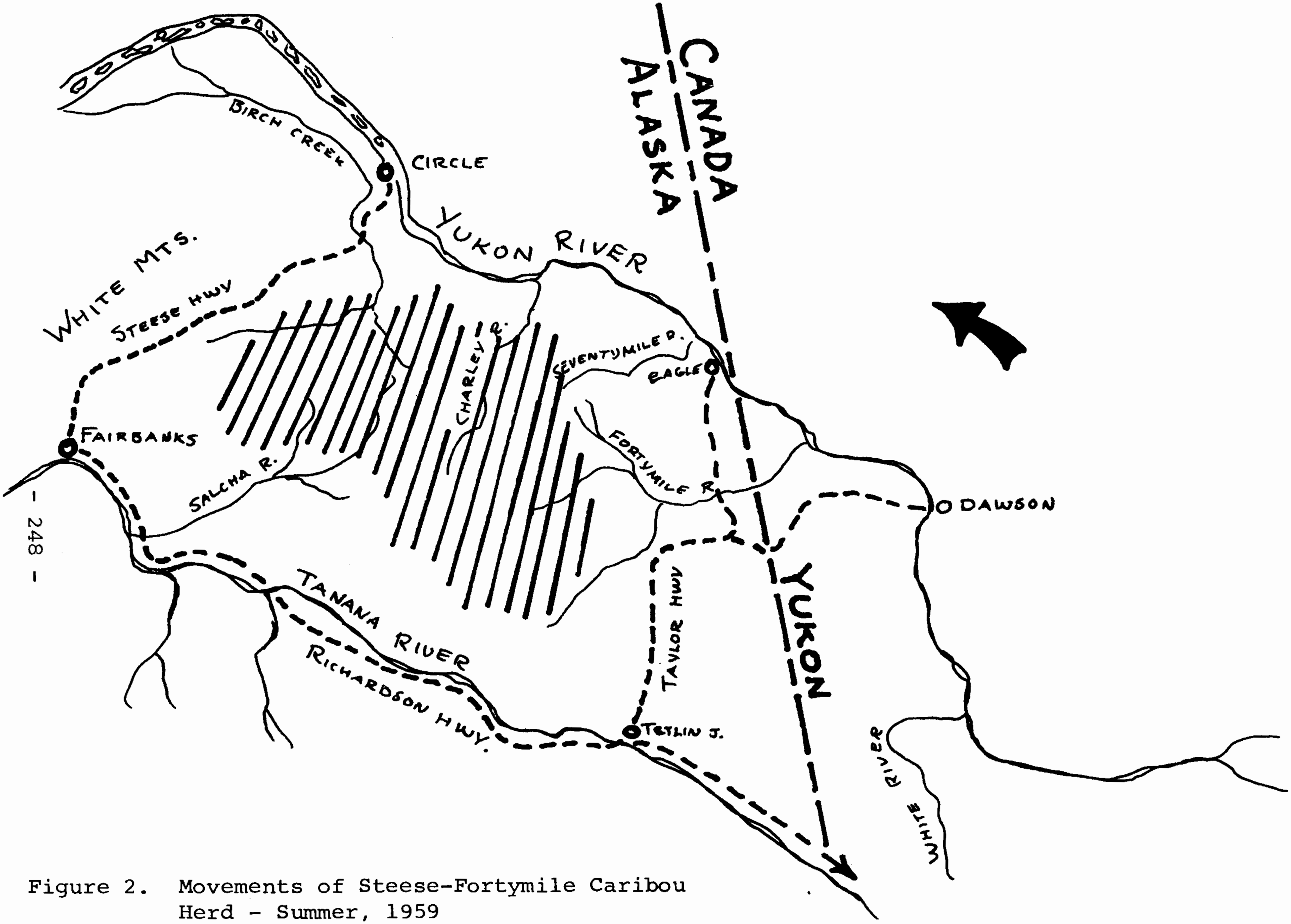


Figure 2. Movements of Steese-Fortymile Caribou Herd - Summer, 1959

Movements

Summering Area

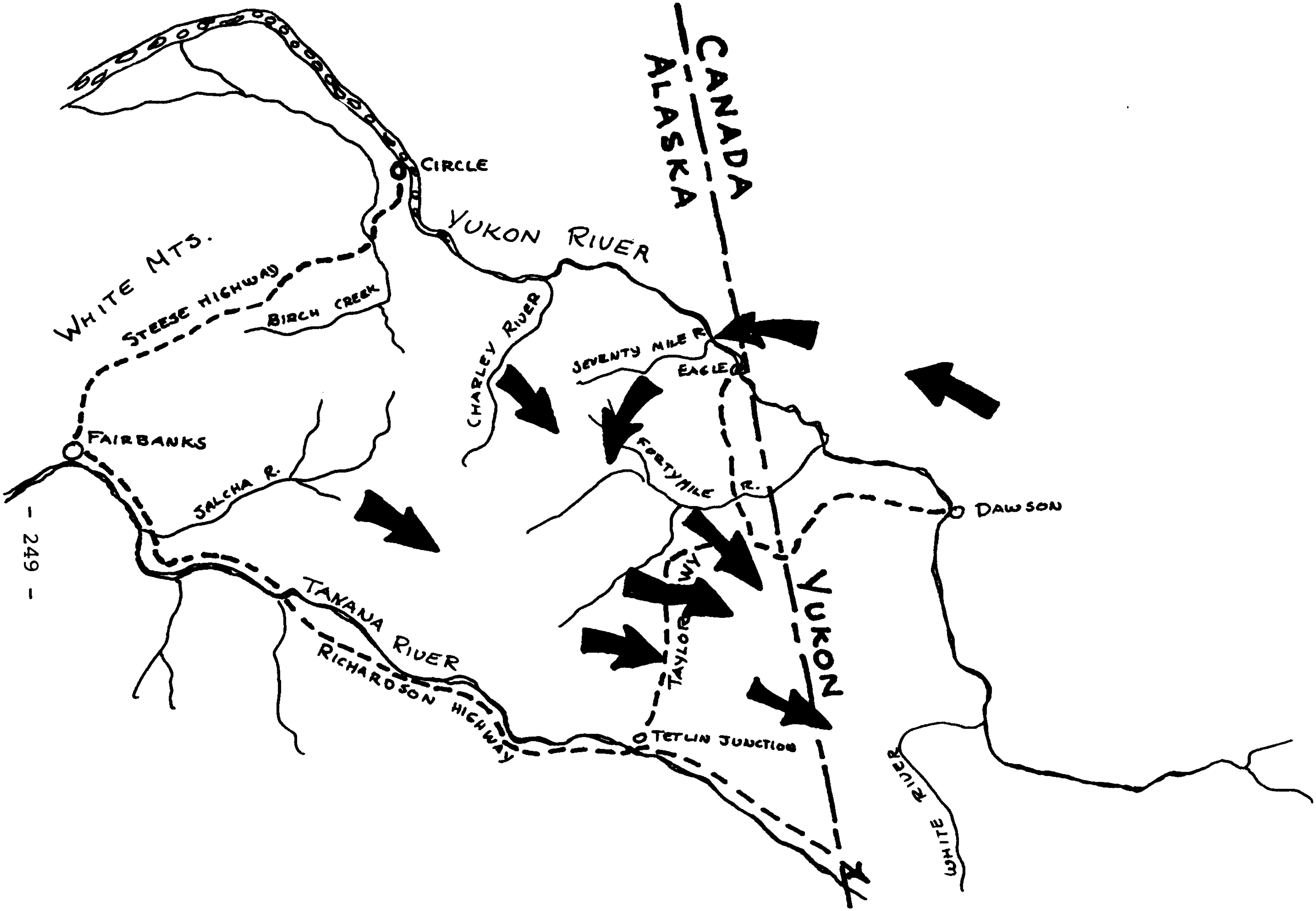


Figure 3. Movements of Steese-Fortymile Caribou Herd - Fall, 1959

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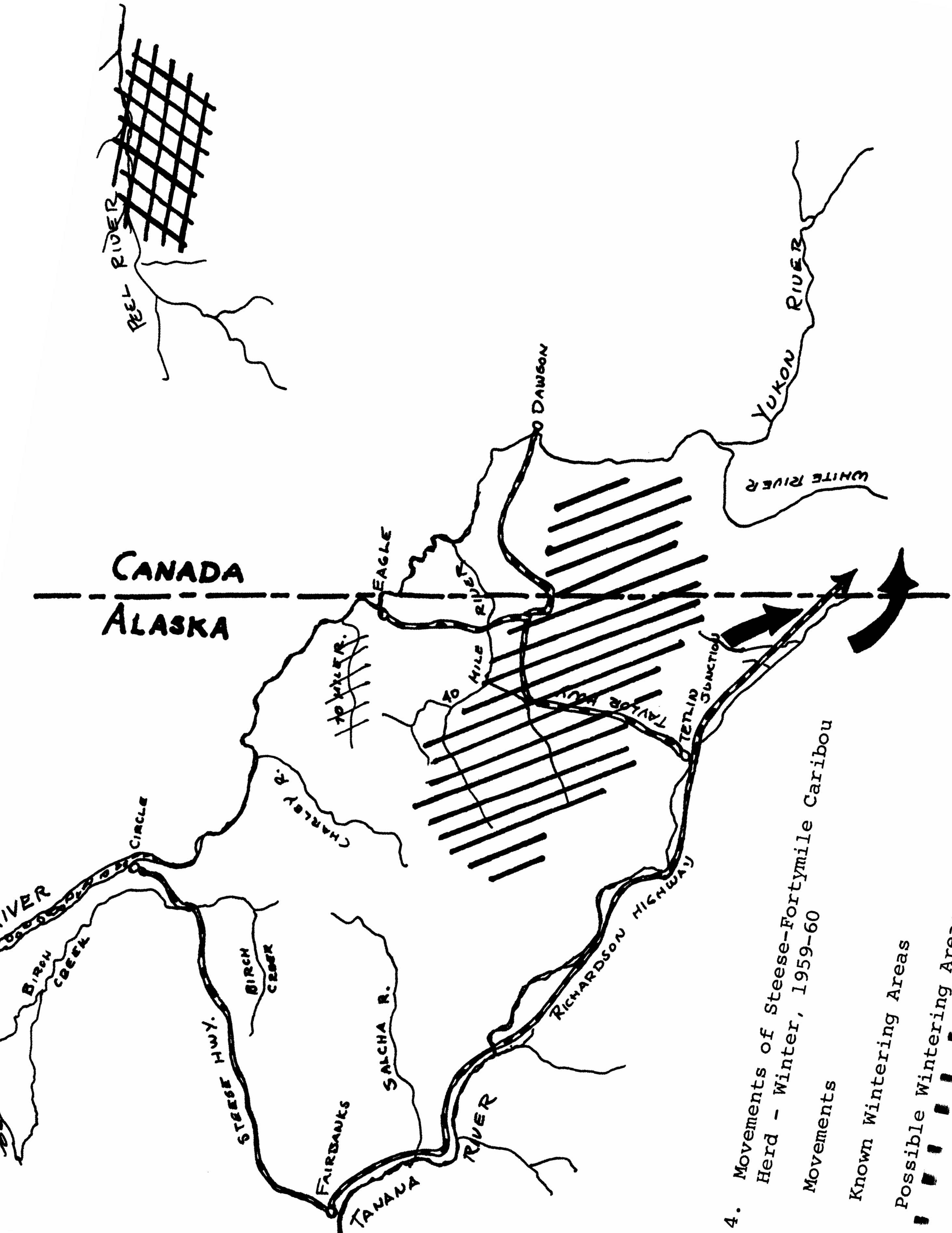

Figure 4. Movements of Steese-Fortymile Caribou Herd - Winter, 1959-60

Movements

Known Wintering Areas

Possible Wintering Areas

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30 June 1960

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Volume 1 Report No. C-3c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 3c Title: Herd Composition Surveys, Steese-Fortymile Herd

Period Covered: May 1, 1959, to April 30, 1960

Abstract:

Calf:adult ratios were obtained during the year but sex and age ratios were not obtained. The nature of the migration prevented the obtaining of herd composition data.

Objectives:

To determine sex and age ratios in order to ascertain calf survival and herd composition as an index to the current status of the herd.

Techniques:

Periodic counts made during the year provided information on calf survival and composition of the Steese-Fortymile herd. Ground counts were made during the post-calving migration, June 5 through June 16, 1959, at Eagle Summit on the Steese Highway. Aerial counts were conducted on October 9 and 10, 1959, along the Taylor Highway and on April 10 and 12, 1960, along the West Fork of the Fortymile River.

Findings:

Adult-calf ratios were obtained from ground and aerial counts made during June and again in October. To obtain a larger sample and to augment the early counts additional counts were made during early April, just prior to the migration to the calving grounds.

Detailed composition counts scheduled for late September, when all components of the herd are together, did not materialize due to the nature of the migration and weather conditions (early snow and unseasonal cold); therefore, the counts were made from the air. Segregation from the air was limited to calves, adult bulls (over four years), and "others" including the cows and young bulls.

There was no opportunity to collect jaws during the hunting season because there were very few animals along the Steese Highway and the crossing on the Taylor Highway was accompanied by adverse weather that limited hunting pressure.

Calf:adult ratios obtained this year indicate good survival over previous years, if the samples are large enough to be significant, but the sex and age structure of the herd is not known at this time. Table 1 and Table 2 give a comparison of this year's data to past years. Mortality is covered in Breeding Biology and Productivity, Job No. 3d.

Table 1. Summary of Steese-Fortymile Caribou Counts, 1959-60.

Date	Method	Total	Adults	Calves	% Calves to Total	Calf:Adult Ratio
1959						
June 5-16	ground	2297	1537	760	33.2	41:100
October 9	aerial	306	222	84	27.4	38:100
October 10	aerial	308	228	80	25.3	35:100
1960						
April 10	aerial	444	324	120	27.1	37:100
April 12	aerial	208	152	56	26.9	37:100

Table 2. Calf:Adult Ratio for 1959-60 as Compared to 1958-59.

Date Count Taken	Calf:Adult Ratio
June 16, 1959	41:100
October 9, 1959	38:100
April 10, 1960	37:100
June 15, 1958	57:100
August 19, 1958	33:100
March 29, 1959	19:100

Recommendations:

We have practically no information on actual herd composition and the sex and age structure. Therefore, every effort should be made to obtain this needed data during September and October of this year when all components of the herd are together. Collections of jaws should be secured from hunter check stations and ground composition counts should be conducted.

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30 June 1960

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Volume 1 Report No. C-3d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 3d Title: Breeding Biology and Productivity Studies, Steese-Fortymile Herd

Period Covered: May 1, 1959, to April 30, 1960

Abstract:

Studies carried out during 1959 and 1960 on productivity and survival provided the following information: Calving took place in the White Mountains but the largest segment of the calving herd remained in Canada. No data was obtained on the initial calving due to weather but composition counts were conducted at Eagle Summit where 3,088 caribou (including calves) crossed the highway. These counts indicated 56.9 per cent were cows, 33.2 per cent were calves, 9.8 per cent were yearlings, and .5 per cent bulls. Survival of calves to the yearling age was better than in the previous two years.

Objectives:

To obtain quantitative data regarding breeding, fertility rates, parturition, and survival to yearling age; also to determine the factors affecting these elements of productivity.

Techniques:

Aerial and ground surveys were conducted to accomplish the objectives. The aerial surveys were flown during May by Wilbur Libby as observer and the writer as pilot. The ground surveys were conducted by Wilbur Libby, Research Biologist and Biological Aid Thomas O'Farrell, and the writer.

Detailed aerial calf counts were planned to determine the pattern of calving and the initial calf crop. This phase was unsuccessful due to poor flying conditions over the White Mountains-Tanana Hills area. The migration to the calving grounds was missed and the calving ground studies did not materialize. The migration from the calving ground was intercepted and data obtained on productivity and composition of the calving segment of the herd. Survival to the yearling class was determined by early spring counts.

Findings:

Bad weather in the Tanana Hills restricted aerial activities until the latter part of May when the northwesterly movement to the calving grounds had been completed, and calving was almost completed.

On May 27, 1959, a reconnaissance flight was made in the White Mountains area. A few widely scattered groups of calving caribou were observed and composition counts obtained on a total of 128 adults and 31 calves. From this flight it was determined that a relatively small portion of the Steese-Fortymile caribou herd had retuned to the White Mountains calving grounds. Therefore, on June 1, 2, and 3, reconnaissance flights were made over the Tanana Hills to the southeast side of the Steese Highway where very few calving caribou were present although a few scattered animals were observed. On the June 3rd flight, a composition count was obtained on a minor concentration in the Preacher Creek area. A total of 149 adults and 58 calves was tallied, giving a ratio of 38.9 calves to 100 adults. Approximately 15 per cent of the adults were determined to be yearlings.

The period between June 5 and June 16 was spent on the Steese Highway in the vicinity of Eagle Summit obtaining composition counts as the caribou crossed the highway. A total of 3,088 animals was counted crossing in the vicinity of Eagle Summit, and a few more crossed between Milepost 95 and 97 that were not tallied. Complete composition counts were obtained on 2,297 animals. These data are broken down in Table 1.

Herd Composition

Calves comprised 33.2 per cent of the total number of caribou counted on the crossing and compares very well with the percentages of calves obtained in previous years. These data are presented in Table 2.

Table 1. Composition of Calving Herd in White Mountains, June, 1959.

Class	Number	Per Cent
Cows	1301	56.6
Calves	760	33.1
Yearlings	224	9.8
Bulls	12	.5
Total Animals	2297	100.0
Calf:adult ratio	49:100	
Calf:cow ratio	58:100	
Yearling:cow ratio	17:100	

Table 2. Per Cent Composition of Caribou Herds Calving in the White Mountains 1954 through 1959.

	Per Cent Composition					
Class	1954	1955	1956	1957	1958	1959
Calves	37	30	32	26	36	33
Yearlings	11	7	11	3	4	9
Cows	51	63	59	70	60	57
Bulls	1	T	T	1	T	T
Calf:cow ratio	73:100	55:100	54:100	38:100	62:100	58:100
Yrlg:cow ratio	21:100	12:100	16:100	4:100	9:100	17:100

While the segment of the Steese-Fortymile herd calving in the White Mountains this year was very small, it will be noted from Table 2 that the composition of the groups as they crossed the Steese Highway compares favorably with that obtained in previous years.

As mentioned earlier, few animals were found calving southeast of the highway and it is the writer's opinion that the largest number of cows calved in the Yukon Territory of Canada.

The increase in the per cent of yearlings this year over the past two years reflects an improved survival rate to the yearling age. Since the overall composition of the calving group is known and if the current data is applicable to that portion of the herd which calved in Canada, the annual increment to the herd is good.

Calf Mortality

As information was not obtained this year as to the initial calf:cow ratio on the calving grounds, the calf:cow ratio obtained as the herd crossed Eagle Summit must be utilized as a basis for comparison with ratios observed at later dates.

The weather during the calving period was cold, accompanied by fog and cloudiness and on two occasions snow fell in the high country and could have caused early calf mortality. However, the weather during the period June 4 to 17 was good and should not have contributed greatly to mortality.

Predation took its toll. A wolf was observed attempting to take a calf on one occasion but was scared off and, on another, a grizzly caught a calf out of a group of 200 animals. On three occasions eagles were observed in attacks on calves but in each instance they were unsuccessful.

One calf was abandoned by its mother when the accompanying band crossed the highway, but,four hours later it was picked up by the cow who returned for it.

Calf Survival to the Yearling Stage

Adult counts were conducted in October 1959, and April 1960, to ascertain calf survival during the first year of life. These counts were of relatively small samples as the herds were widely scattered. In the October counts, bulls were interspersed within the herd. The April counts contained very few bulls and the counts are comparable to the June counts in that respect. Both the October and April counts were aerial.

The October counts were conducted along the Taylor Highway late in the rutting period as the animals were crossing the highway. Composition on 614 animals included 164 calves; the calf:adult ratio was therefore 36:100.

The composition counts in April on 623 animals were obtained along the Fortymile River. Of these animals almost no bulls were observed. Calves numbered 167 of these animals; a calf:adult ratio of 36:100.

Calf mortality based on the above ratios from June 16, to October 10, was but 13 per cent. By the following April it was still the same; in short, no loss between October and April. The total mortality for the entire period was only 13 per cent.

This low mortality rate, if these data are significant, could be influenced by two main factors: First, the weather over the winter was extremely mild with little snow and second, few predators. Intensive predator control resulted in few wolves in the area. No wolf killed caribou were found in the Steese-Fortymile country this past winter.

In addition to the above, the caribou that wintered in the Fortymile country were most likely those that calved in Canada and could well have had a much higher productivity in the past calving season.

Recommendations:

Investigations of productivity of the Steese-Fortymile caribou should be continued with emphasis on the following: Breeding behavior during the rut; the study of fertility rates and factors affecting them; evaluation of initial productivity; and particularly the factors affecting mortality of calves during the first year of life.

Prepared by:

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30 June 1960

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Volume 1 Report No. C-3e

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: C Caribou Management Investigations

Job No: 3e Title: Analysis of Range-- Steese-Fortymile Herd

Period Covered: August 1, 1959, to August 30, 1960

Abstract:

A foot reconnaissance was made in areas along the Steese and Taylor Highways to assess the general condition of the caribou range. Most of the areas examined have suffered from fires and are still in the early stages of recovery. Lichen growth generally is poor, consisting of many species and poor growth (less than one inch high with a ground cover of less than 10 per cent). Compared with the Nelchina caribou range the Steese-Fortymile area is in poor condition, unless the abundance of sedges compensates for the lack of lichens.

It is recommended that a more thorough reconnaissance be made of the range to ascertain if this poor condition is widespread. Exclosures should be established for future study, but intensive work should be delayed until completion of the Nelchina range study to avoid duplication of effort.

Objectives:

To determine the qualitative nature of vegetation, patterns of succession, and factors influencing them in the Steese-Fortymile caribou range.

To assess the effects of caribou upon the vegetation and develop an estimate of carrying capacity.

Techniques:

No extensive work was planned for this summer due to the limited time available. The writer made a reconnaissance trip along the Steese and Taylor Highways to examine the range vegetation and compare it with that of the Nelchina caribou range on which he has been working in recent years.

Trips by foot were made into the region encompassing Eagle Summit on the Steese Highway, and ground checks were made every five miles between Circle and Sourdough Creek, approximately Miles 65-160 on the Steese. Notes were taken concerning the vegetation types present and the abundance and condition of the lichens, as well as information on succession, fire, and caribou usage.

Similar notes were taken along the Taylor Highway. Ground checks were made every five miles as far as Eagle, approximately Miles 5-160.

The field notes obtained are filed at the Fairbanks office of the P-R Section of the Alaska Department of Fish and Game.

Findings:

The Steese Highway area, between Miles 65-160 along the road, contains poor growths of lichen generally, and probably would be a poor wintering ground for caribou. The flat lying north of Eagle Summit, about Mile 120 to 160, has been burned-over and the vegetation has not returned to the climax White Spruce type yet. Black Spruce and Aspen stands seem to predominate, with a heavy moss cover in the former and a lack of lichens in both. The lichen succession seems to be at an early stage with scattered clumps of the forage lichens (chiefly *Cladonia sylvatica* and *C. uncialis*) just beginning to invade.

Eagle Summit and adjacent areas also contain few lichens except for a few of the valleys, notably along Porcupine and Golddust Creeks, where fair growths (2-3" high, ground cover of about 40 per cent) of forage lichens occur (*Cladonia rangiferina*, *C. sylvatica*, *C. uncialis*, *Certraria cucullata*, *C. delissei*, and *C. islandica*). Sedge Meadow occurs extensively above timberline and provides abundant summer forage, and possibly would provide an adequate winter food supply also.

South of Eagle Summit the highway winds along the valley of upper Birch and Twelvemile Creeks, climbs to Twelvemile Summit briefly, and then follows along the valley of the upper Chatanika River. Most of the vegetation along the road is recovering from burns and again Spruce (both black and white) and Aspen stands predominate. The moss cover frequently is heavy, but the lichens are scarce for the most part, except for isolated stands located in small White Spruce stands that apparently escaped the fire; there, good growths (3-4") of Cladonia rangiferina and C. sylvatica occur.

The surrounding mountains contain much Sedge Meadow, similar to Eagle Summit. The area as a whole seems better suited to summer range.

The Taylor Highway area is more typical of winter range, but also has suffered greatly from fire, and the lichens have not yet recovered. Black Spruce has been the chief invader after the fire and is the dominant type present, with Aspen stands interspersed and Dwarf Birch becoming dominant near timberline. Sedge Meadows and Black Spruce-Sedge bogs are common.

The lichens are scattered thinly throughout the areas examined, but consist of many species and are of poor growth (less than one inch), typical of the early stages of lichen succession. The chief forage species noted included Cladonia gracilis, C. rangiferina, C. sylvatica, C. uncialis, Cetraria cucullata, C. delisei, C. islandica, C. nivalis, and Stereocaulon spp., but few stands contained lichens higher than one inch nor with more than five per cent ground covered.

Caribou usage in both the Steese and Taylor Highway areas has been extensive and heavy in the past, judging from the heavy trails in existence. Fire, however, probably has been the major factor in the lack of lichens present, succession being still far removed from the climax stage. If the areas examined are typical of the Steese-Fortymile range as a whole, then the range could be considered as being in poor condition when compared with the Nelchina range, unless sedge is able to compensate for the lack of lichens.

Recommendations:

The Steese-Fortymile caribou range should be examined more extensively in the near future to see if the lack of lichens observed in last year's survey is typical of the whole area. Plans should be made to establish permanent exclosures in various portions of the range for future study. No intensive range work should be done until conclusive results have been obtained from the Nelchina study, in order to avoid duplication of effort.

Prepared by:

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30 June 1960

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Volume 1 Report No.D-1a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: D Elk Management Investigations, Afognak and Adjacent Islands

Job No: 1a Title: Herd Distribution, Abundance and Composition Studies

Period Covered:

Abstract:

Aerial surveys were flown in the spring of 1960 to determine distribution of elk on Afognak Island. Seven distinct herds were seen. A Piper Super Cub was used for most of the work.

Objectives:

To determine the distinctness, size and seasonal distribution of recognizable herds of elk, and to ascertain the age and sex composition of each herd. This information should indicate present herd status and serve as a basis for harvest regulations.

Procedure:

The entire island of Afognak was searched with a Piper Super Cub from an altitude of approximately 500 feet above the terrain. When a herd was spotted, an attempt was made to enumerate and classify the animals. The plane was equipped with floats which permitted landings to examine the animals closely.

Findings:

Seven distinct herds were seen during the survey. For reference purposes, they have been named the Buti Point, Malina Bay-Afognak Lake, Raspberry Slough, Duck Bay, Saposa Bay, Pillar Cape, and the First Bight (Tonki Cape) herds. (Figure 1). Although it was hoped a confident sex and age classification and total population estimate could be obtained, the weather was such that many of the animals were in the timber and a total of only 294 elk were seen. The survey did accomplish the delineation of the winter ranges, however, and provided information on potential range. Studies in the fall of 1959 indicated there was an abundance of potential winter range in the interior and at the northern end of the island. The recent winter observations do not support this impression. North of a line drawn from the head of Malina Bay to Tonki Cape the snow persisted for long periods in depths of three to four feet to the shoreline. In the interior plain, the snow was much deeper. One herd possibly exists in the northeast part of the island at Perenosa Bay which has less snow accumulation.

Deer and elk ranges overlap at Afognak Village and Duck Bay during the calving season. However, the limited forage utilization surveys conducted thus far indicate there is no noticeable competition between the two species for winter range.

Recommendations:

1. This investigation should be continued.

2. A temporary employee could be of great value in collecting this information if he were stationed in Kodiak. He could then take advantage of optimum weather conditions for distribution and snow depth determinations.

3. Snow-depth measurements should be taken as criteria for estimating the potential habitable winter ranges. This should be conducted in the standard manner outlined in Section 4200, Circular N, Manual of Surface Observations, (Weather Bureau Army Navy), Change No. 5.

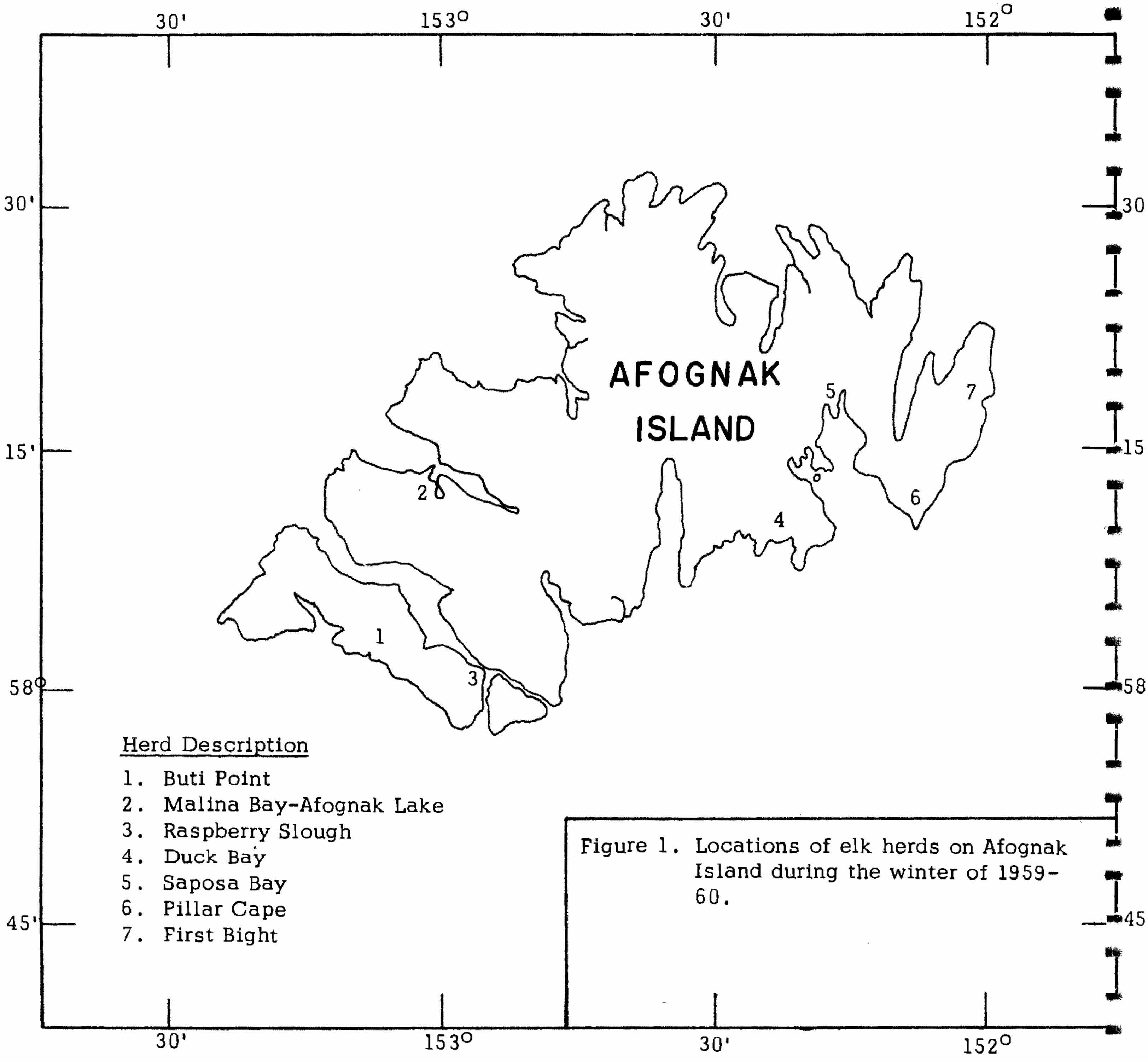

Figure 1. Locations of elk herds on Afognak Island during the winter of 1959-60.

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30 June 1960

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Volume 1 Report No. D-1b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: D Elk Management Investigations, Afognak and Adjacent Islands

Job No: 1b Title: Elk Range Studies

Period Covered:

Abstract:

1. Range condition and trend. Two elk exclosures were erected on Afognak Island. They were located on predetermined sites within the Afognak Lake and Litnik Lake winter ranges. Line transects inside and outside the exclosures were established to compare differences in range condition and trend between the protected and unprotected plants. Line transects were also established at 2nd Bight on Tonki Cape.

2. Vegetation typing. Aerial survey techniques were developed.

3. Utilization. Forage utilization estimates on Afognak Island during the spring showed heavy utilization of willow (*Salix sp.*) and elderberry (*Sambucus racemosa*) while the blueberry (*Vaccinium ovalifolium*), alder (*Alnus crispa sinuata*) and rose (*Rosa nutkana*) were only lightly utilized.

Objectives:

To delineate seasonal elk ranges, and determine their vegetative composition. To determine forage and browse production in relation to availability, utilization and preference.

Procedure:

1. Range condition and trend. Locations of the elk exclosures were determined by observation of winter distribution of the elk herds.

Each exclosure was selected to include all of the important winter browse species. This proved to be difficult in the Afognak Lake area as the principal browse species there were not associated closely enough to be included easily within 1/10th acre plots. The actual construction of exclosures involved building a seven foot fence around a 1/10th acre-square plot.

The Parker 3-Step Method was used to indicate plant composition inside and outside the exclosures. Two protected and two unprotected transects were made for this comparison on each site. Each of these transects was located in a random manner with the restriction that their starting points could not be within 5 feet of fence to avoid the edge effect. Aside from this modification, the Parker 3-Step Method was followed.

2. Vegetation typing. Two aerial survey techniques were employed. (a) Aerial Photo-Typing. Colored aerial photographs were made of several of the known winter ranges to obtain an estimate of the general vegetative composition of these ranges. This survey was conducted in the fall after the forage had matured and each species had attained a distinctive color. When there was some doubt as to what the various colors represented, a surface check was made to calibrate the photographs.

A flight plan was drawn that would most expeditiously cover the areas. Two observers and a pilot then flew this predetermined course at approximately 500 feet above the terrain. As a change was noticed in the composition, one observer would photograph the area while the other recorded the number of the photograph. These photographs were then processed and filed with a chart for later comparison with high altitude photographs of Afognak Island made by the U. S. Forest Service.

(b) Aerial Distribution Surveys. It would be unrealistic to suppose that wherever adequate forage was found potential winter range existed. No less important than the type of forage is its availability. To provide for this factor, an aerial survey was conducted of the entire island in March of this year. A systematic examination of each section of the island for snow depth and possible isolation of ranges resulting from deep snow was made. After the two projects are completed, an overlay of one upon the other will provide a fair estimate of the available range. An estimate of carrying capacity will require extensive range studies on the ground.

3. Utilization. The techniques used are the same as those outlined in Work Plan A-2e, since this sampling dealt with similar plant species.

Findings:

1. Range condition and trend. The construction of 1/10th-acre exclosures proved to be both economical and expedient. This is especially important, since 1/10th acre is considered the minimum representative plot size for composition studies on the Afognak Island ranges. Smaller plots do not include all the major plant species.

Two 1/10th-acre exclosures were constructed in cooperation with the U. S. Forest Service and the U. S. Fish and Wildlife Service. One was located near the Afognak Lake Naval Rest Camp, while the other was located on the east side of Litnik Bay. The experience gained from constructing these two exclosures indicates that the actual construction can be accomplished for approximately $250.00 each including labor. A recent inspection of the Afognak Lake exclosure showed that it effectively resisted damage by the elk through the winter.

The Parker 3-Step Method was not sensitive enough for sampling the frequency of this type of vegetation. This was especially evident in the case of large open-growing shrubs such as salmonberry (*Rubus spectabilis*) and elderberry. Many associated species of lower density were missed using this technique. Although the alternative of using the plot density technique (Stoddort, L. A. and Arthur D. Smith 1955, Range Management, McGraw-Hill, New York.) is slightly more tedious, the composition indicated was more representative.

The results of this sampling cannot be presented at this time, pending collection of a reference series of plants during the summer to enable positive identification of plants observed on the transects.

2. Vegetation typing. This work is still incomplete. Much of the aerial phototyping and the high altitude photographs taken by the U. S. Forest Service in May of 1960, are

still unavailable for comparison. Snowfall, although quite heavy for several weeks during the past winter, was inadequate to provide a basis for any but general statements about the limits of the elk range on Afognak.

3. Utilization. Willow and elderberry are the principal species supporting the elk herd at the present time. Some species of willow and elderberry are so palatable that the elk have relied almost entirely upon them for winter forage. This has led to overuse of these two species. In some areas on Tonki Cape, the willow has been subjected to such heavy utilization that many plants are beyond recovery. This loss of willow is not unusual nor is it necessarily indicative of excessive browsing pressure on the range as a whole.

As stated before, willow is a highly palatable browse. It is likely to be overutilized before the elk turn to other less palatable species such as rose, blueberry and alder. The latter is, and has been, one of the principal browse species on the Olympic range in Washington, where rose, elderberry, and willow have been much reduced.

Use of alder and blueberry is becoming evident on these ranges where elderberry and willow are much depleted, from heavy use and possibly disease. Table 1 shows the gradual change in diet occurring under different browsing intensities.

Extensive damage to the blueberry resulting from hare utilization was observed on the Tonki Cape, Saposa Bay and Afognak Lake areas. This does not constitute competition at the present time; however, when elk and deer turn to this source of forage, as they likely will, much of it may have been destroyed.

Table 1. Browse Utilization of the Afognak Island Elk Winter Ranges During the Winter of 1959-1960. (Per Cent Utilization)

Range	Salix sp.	Vaccinium sp.	Alnus sp.	Sambucus sp.
King Cove	90	20	5	
Afognak Lake	50	5	trace	25
Muskomee Bay			5	30
Raspberry Lake	20			40

Recommendations:

1. Range condition and trend.

   a). The study should be continued by constructing more exclosures as significantly different range areas are found.

   b). A plant collection should be made to more accurately identify the plants being studied.

2. Vegetation typing should be continued for one more year.

Prepared by:

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30 June 1960

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Volume 1 Report No. D-1c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: D Elk Management Investigations, Afognak and Adjacent Islands

Job No: 1c Title: Productivity Analysis

Period Covered:

Abstract:

No work of a specific nature was accomplished except for observations of prepartural cows at the Afognak Village calving area.

Objectives:

To obtain data concerning elk breeding, fertility and parturition; to determine factors affecting these elements of productivity; and to apply this information to proper herd management.

Procedure:

Eight cow elk were observed for three hours near Afognak Village.

Findings:

The only work accomplished on this job was done in spring in conjunction with browse utilization surveys. Eight pregnant cows were observed near Afognak Village. Two of them were off by themselves, and appeared ready to calf on May 28.

Recommendations:

Additional studies are required to more accurately ascertain dates of calving and location of calving areas.

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30 June 1960

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Volume 1 Report No. D-1d

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: D Elk Management Investigations, Afognak and Adjacent Islands

Job No: 1d Title: Mortality Studies

Period Covered:

Abstract:

No evidence of significant winter mortality was found.

Objectives:

To obtain data relating to annual mortality sustained by Raspberry and Afognak Island elk herds; to identify and evaluate the degree to which individual mortality factors are acting; and to apply this information to proper herd management.

Procedure:

Field studies were of a preliminary nature to gain familiarity with the area and the elk population. All of the elk winter ranges were examined between March 26 and 28, by air from an altitude of 500 feet above the terrain. Fifteen hours of flying time were expended on this survey. During this period the King Cove, Afognak Lake, Muskomee Bay, Raspberry Lake and Saposa Bay ranges were examined on foot. A minimum of one linear mile of each of these ranges was examined in conjunction with browse utilization estimates.

Findings:

A single kill from unknown causes was reported near Afognak Village by a native.

Brown bear were noted to be active throughout the winter. This could result in possible predation of elk during times of stress.

Recommendations:

This study should be continued, since the mild winter weather and abundant forage condition experienced at present will probably change.

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30 June 1960

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Volume 1 Report No. E-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: E Sheep and Goat Investigations

Job No: 1 Title: Sheep Distribution & Abundance Surveys

Period Covered: July 15, 1959 to June 30, 1960.

Abstract:

1. Two thousand, two hundred and thirty-three sheep were seen in 17.25 hours flying time.

2. A total of 162 rams per 100 ewes was observed in the Tazlina-Klutina Lakes area. It is believed that the sex ratio count obtained was influenced by the intermittent snow cover in the area when the counts were conducted.

3. The Sheep Mountain reserve is an unhunted area and can be utilized as a comparison base. There are 46 legal rams per 100 ewes in that area.

Objectives:

To determine the distribution and abundance of sheep, with special attention to accessible and/or heavily hunted ranges. To determine sex and age composition on key sites which will serve as indices to sheep welfare on broader geographic areas.

Techniques:

Contacting local guides and outfitters as well as pilots and sheep hunters revealed the areas of accessibility and hunting pressure. These areas were given priority when aerial counts were conducted.

A Piper Super Cub was utilized to conduct all of the aerial surveys. Robert L. Burkholder, U.S. Fish and Wildlife Service, piloted the aircraft and Jack C. Didrickson, Alaska Department of Fish and Game research biologist acted as observer on all flights. Total flying time on this project was 17.25 hours.

The aerial counts were conducted on August 3, 5, 6 and 7, 1959 in four areas. Aside from the Eklutna Reserve which will be open during the 1960 hunting season to all game animals, there are the Sheep Mountain Reserve which is closed to the taking of mountain sheep and mountain goat, the Tazlina-Klutina Lakes area, and the Horn-Syncline-Fortress Mountains area which includes the following streams: Little Nelchina River, Caribou Creek, Boulder Creek, and Hicks Creek.

All sheep seen were assigned to a sex and age category. It is extremely difficult to separate female sheep from young rams due to the similar outward appearance of the horns and general body configuration. Sheep located on ridges were sexed by flying at lower altitudes than the animals were positioned and observing the scrotal sac on the males. Generally speaking however, the size of the horns was the criteria used to distinguish males from females.

The non-legal rams column (Table 1) represents those rams which have not achieved the three-quarter curl to the horns required by law before a hunter can take the animal.

Findings:

Areas such as the Eklutna Reserve (Area #1, Figure 1) and Sheep Mountain (Area #3, Figure 1) were flown to supply a comparison base as they were closed areas.

The Eklutna Reserve in which 62 legal rams were observed is close to a highly populated area and could afford

Table 1. Sheep composition in four areas of southcentral Alaska, 1960.

Area	Ewes*	Unid.	Lambs	Legal Rams	Non-Legal Rams	Sheep Totals	Dates Counts Were Made
1. Eklutna Reserve	287		67	62	58	474	8/3/59
2. Sheep Mountain	112		35	52	28	227	8/5/59
3. Horn, Syncline, Fortress Mts., & Little Nelchina Caribou, Boulder, & Hicks Cr. Areas	866	3	269+ 3 dead	117	152	1,410	8/5/59-8/6/59
4. Tazlina-Klutina Lks.	32		12	52	26	122	8/7/59
Totals	1,297	3	386	283	264	2,233	

* It must be understood that young rams and ewes can be confused when censusing from an airplane.

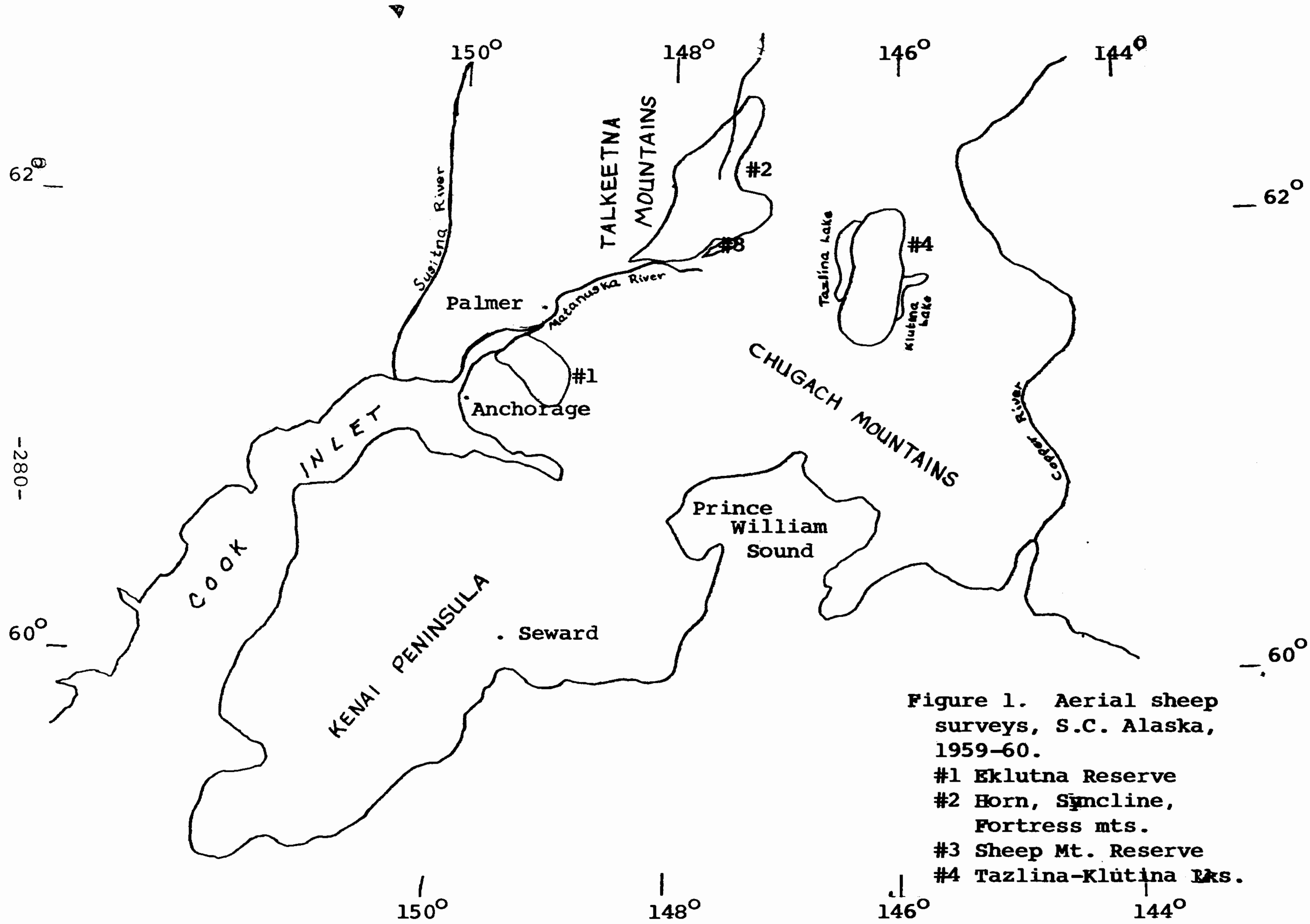

Figure 1. Aerial sheep surveys, S.C. Alaska, 1959-60.
#1 Eklutna Reserve
#2 Horn, Syncline, Fortress mts.
#3 Sheep Mt. Reserve
#4 Tazlina-Klutina Lks.

sheep and goat hunting to many persons who find it unavailable now due to the distances which have to be traveled to a hunting location. This area will be opened to hunting game animals (including sheep and goat) during the 1960 hunting season.

The Sheep Mountain Reserve (Area #3, Figure 1) flight revealed a total of 227 sheep and 52 legal rams counted (Table 1). This area is not hunted and can be utilized as a comparison area. Observed lamb producting in this area was 31 lambs per 100 ewes. There were 46 legal rams per 100 ewes observed when the count was conducted.

In the Horn, Syncline and Fortress Mountains (Area #2, Figure 1), the drainages are hunted heavily for sheep. Sheep counted in this area totaled 1,410 (Table 1) with 14 legal rams per 100 ewes. Lamb production remains the same as the Sheep Mountain reserve however, with 31 lambs per 100 ewes counted.

The Tazlina-Klutina Lakes (Area #4, Figure 1) is a very difficult area to hunt, both from the standpoint of accessibility and terrain. However, it is hunted to some extent, primarily by local guides and their hunters. This area was counted while small patches of snow were present on the peaks of the mountains, causing the writer much difficulty in locating sheep. A total of 122 sheep was counted (Table 1) and a ratio of 162 legal rams per 100 ewes was derived from information taken in this area. It is believed many animals were not located due to snow conditions and the sex ratios may be biased because the rams are easier to spot due to the massiveness of the horns. Lamb production is also high in this area with 38 lambs per 100 ewes observed, but again the snow variable enters the picture and must be taken into consideration.

Of the total 2,233 sheep counted, there were 42 rams per 100 ewes out of which 22 legal rams per 100 ewes were observed. Lamb production stands at 30 lambs per 100 ewes.

Recommendations:

Future aerial sheep counts should be initiated when snow cover is minimal in the areas flown. Helicopter usage should improve the reliability of the sex ratio as well as increasing the maneuverability required for sheep counts.

Prepared by:

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30 June 1960

Approved by:

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Volume 1 Report No. E-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: E Sheep and Goat Investigations

Job No: 2 Title: Sheep Productivity Studies, Tanana Hills

Period Covered: August 1, 1959 to June 30, 1960

Abstract:

A limited amount of field work was accomplished on this project but, it did provide us with the locations of the various, more or less isolated, bands of Dall sheep living in the Tanana Hills. Seven bands were located by aerial reconnaissance and two locations were pointed out by Mr. Robert F. Scott of the Cooperative Wildlife Research Unit, University of Alaska.

Objectives:

To determine the dispersement, numbers, and composition of sheep bands in the Tanana Hills.

Techniques:

During the course of the year, sheep observations were made from aerial flights in conjunction with reconnaissance for caribou. These observations were made in order to record the location and abundance of the different bands of sheep in the Tanana Hills.

Findings:

Work on this project was limited because of the transition of the Pittman-Robertson Program from the Federal Fish and Wildlife Service to the Alaska Department of Fish and Game and the press of field work on other game species. Therefore, rather than attempt to complete the project as outlined, which could not have been accomplished, a general reconnaissance was performed in conjunction with the caribou work in order to locate some of the rather isolated bands of sheep in the Tanana Hills.

Flights were conducted at odd intervals, as permitted by time and weather, and seven more or less distinct groups of sheep were located and recorded. Two additional groups were reported by Mr. Robert Scott, Unit Leader of the Cooperative Wildlife Research Unit, University of Alaska. Composition counts were made on these sheep when located if possible. However, on three occasions air turbulance or the location of the sheep in relation to the terrain precluded this. The data collected is presented in Table 1 and the location in the Tanana Hills is shown on the map accompanying this report (Figure 1). These data in no way present an estimation or total numbers of sheep in the Tanana Hills.

Recommendations:

1. More extensive reconnaissance should be conducted in the future to ascertain if all groups have been located.

2. Composition counts should be conducted in the Spring just after the lambing season to determine productivity and again late in the winter to ascertain survival during the first year.

3. Complete counts should be attempted to determine total numbers of animals existing in the Tanana Hills.

Table 1. Sheep Observations from August 13, 1959 to May 23, 1960.

Date	Location	Rams	Ewes & Yearlings	Lambs	Unid.
August 13, 1959	Charlie River*				16
October 21, 1959	Cache Mountain	3	9	4	
October 21, 1959	Lion Peak	2	11	9	
March 22, 1960	Seventymile River*				15
March 22, 1960	Glacier Mountain*				19
May 6, 1960	Big Windy Creek	18	19		
May 23, 1960	Brigham Creek	2	11	7	
	Totals	25	50	20	50

* Composition counts unobtainable due to air turbulance or the location of animals.

Prepared by:

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2 August 1960

Approved by:

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Volume 1 Report No: E - 3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: E Sheep and Goat Investigations

Job No: 3 (Part I) Title: Goat Distribution & Population Status

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Mountain goat investigations were conducted in Southcentral Alaska by Research Biologist Edward P. Keough and in Southeast Alaska by Research Biologist Harry Merriam. A total of 252 goats were counted by aerial surveys. Kid-adult ratios obtained from aerial counts were 17 kids per 100 adults in Southcentral Alaska and 34 kids per 100 adults in Southeast Alaska.

Objectives:

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

Techniques:

Goat investigations were conducted on a limited basis, often in conjunction with other projects. Information was obtained by use of aerial surveys, guide questionnaires, locker plant surveys and by personal contacts. Aerial surveys in Southcentral Alaska were flown in a PA-18 Piper Super Cub, while in Southeast Alaska a Cessna 180 was used. Flights were conducted during clear weather when the higher ranges were not obscured by cloud formations. Counts were made during the early morning and late evening hours when glare from the sun was at a minimum. At this time of the day goats were feeding and were easily observed against the green background of the mountain slopes. During the middle of the day most goats would retire to the shade of rock formations or snowbanks and were difficult to spot. Flights were made along each side of the major ridges about 500 feet out from the slope. When goats were spotted, a closer pass was made to determine the age structure of the animals.

Findings:

Southcentral Alaska

Distribution: The range of the mountain goat in Southcentral Alaska basically coincides with the coastal mountains, however, in recent years there has been an expansion northward into the interior regions. Distribution in newly occupied range is spotty, but some populations appear to have become fairly well established. The present distribution of mountain goats in Southcentral Alaska, based on past knowledge and recent sight reports, is shown in Figure 1.

Composition Counts: Aerial counts were flown during the month of August by Research Biologist Jack C. Didrickson incidental to a mountain sheep survey. A total of 56 goats were counted, 8 of which were kids, giving a kid-adult ratio of 17 kids per 100 adults. The relative abundance of goats in the localities counted is shown in Table 1. Figure 1 shows the extent of aerial surveys made in 1959 in relation to the entire goat range in Southcentral Alaska. The size of the present sample is too small to place any significance on the much lower kid-adult ratio obtained for Southcentral Alaska than for Southeast Alaska.

Hunter Harvest: Records of hunter kills were obtained from guide reports, meat processing plants, personal contacts and cooperating biologists. The known hunter kill for Southcentral Alaska is 116. Information on 31 goats was obtained from meat processing plants in the Anchorage-Palmer area and the locality of the kills is unknown. Table 2 shows the location and sex of hunter harvested goats during the 1959 legal season. Results indicate a male preference by hunters; of 46 animals of known sex taken, 37 were males and only 9 were females. Insufficient data is available on

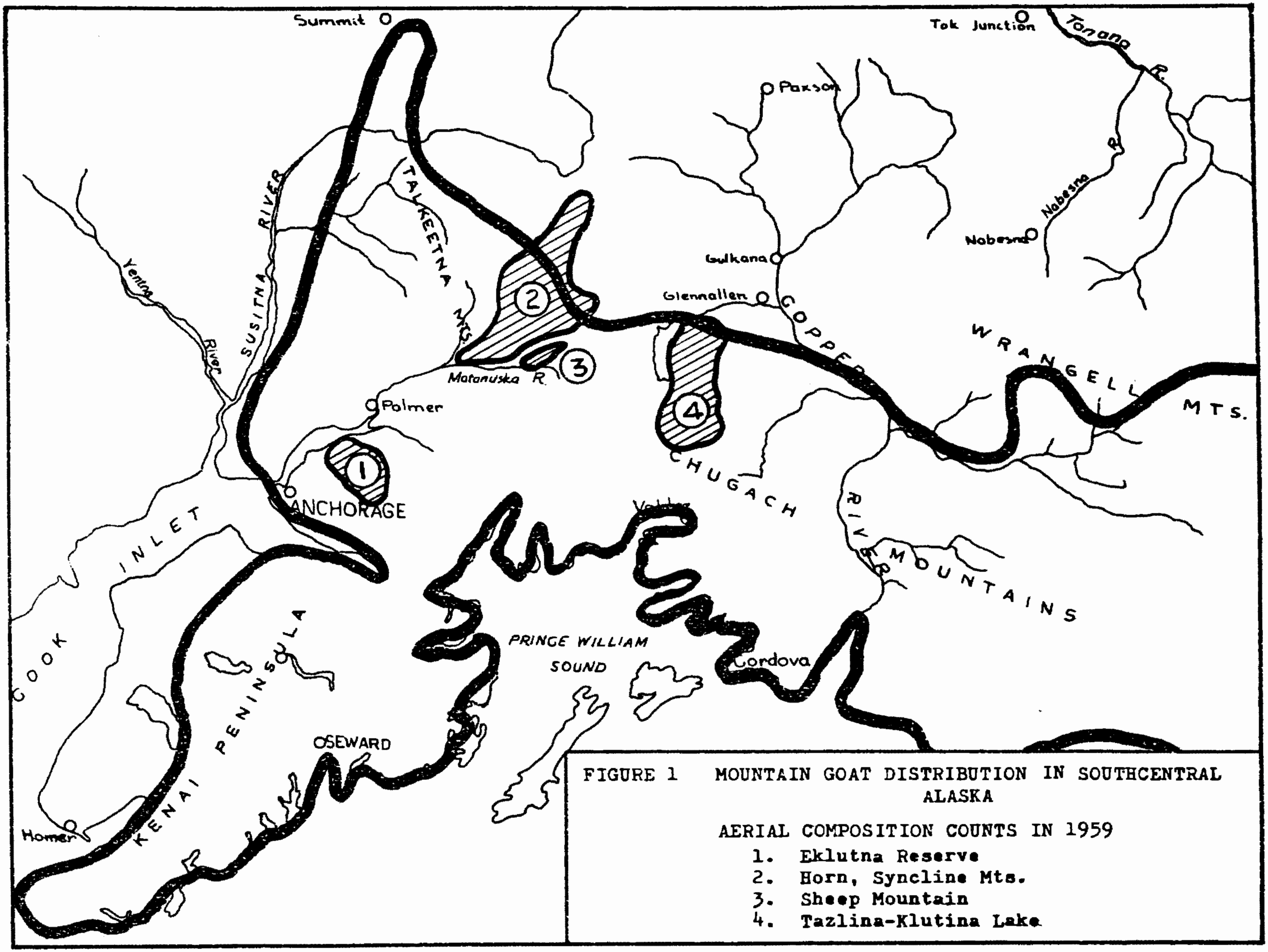

FIGURE 1 MOUNTAIN GOAT DISTRIBUTION IN SOUTHCENTRAL ALASKA

AERIAL COMPOSITION COUNTS IN 1959

1. Eklutna Reserve
2. Horn, Syncline Mts.
3. Sheep Mountain
4. Tazlina-Klutina Lake

Table 1. Mountain goat composition counts in Southcentral Alaska, 1959.

Date	Location	No. Kids	No. Adults	Kid-Adult Ratio	Total Count
8/3/59	Eklutna Reserve	7	34	21:100	41
8/5/59	Horn, Syncline & Fortress Mts., Little Nelchina Rv. Caribou Cr., Boulder & Hicks Cr.	0	0	0:0	0
8/5/59	Sheep Mountain	0	0	0:0	0
8/7/59	Tazlina-Klutina Lk.	1	14	7:100	15
	Totals	8	48	17:100	56

Table 2. Sex and location of mountain goat kills represented in the hunter harvest - Southcentral Alaska, 1959.

Location of Kill	Sex: Male	Female	Unknown	Totals
Chugach Mountains	23	5	0	28
Tazlina Lake	3	0	0	3
Knik River	1	0	0	1
Matanuska River	0	1	0	1
Valdez Area	2	4	0	6
Cordova Area	9	0	0	9
Other Areas	8	0	0	8
Wrangell Mountains	3	2	0	5
Chitna Area	1	2	0	3
Other Areas	2	0	0	2
Kenai Mountains	4	1	39	44
Day Harbo	1	0	0	1
Prince William Sound	1	0	0	1
Fox River	1	0	0	1
Kenai Moose Range	0	1	8	9
Seward Area	0	0	18	18
Other Areas	1	0	13	14
Talkeetna Mountains	7	1	0	8
Chickaloon River	4	1	0	5
Iron Creek	3	0	0	3
Anchorage-Palmer Area	0	0	31	31
Total Known Kill	37	9	70	116

total population and kill figures in Southcentral Alaska to determine the significance of present hunting pressure.

Southeast Alaska

Due to the limited time available for mountain goat studies, efforts were concentrated within a relatively small portion of their range where fairly complete coverage was obtained.

Distribution: Mountain goat range in Southeast Alaska includes all of the coastal mountain region from Portland Canal on the south, north along the entire mainland throughout the Coast and St. Elias Mountains. They do not occur naturally on the islands of the Alexander Archipelego, but introductions were made on Baranof Island in 1923 and on Chichagof Island Between 1953 and 1956. Goats transplanted on Baranof Island have increased steadily while the status of those on Chichagof Island is uncertain at the present time.

Composition Counts: Two aerial counts were made during the months of August and September covering the mainland area east of Petersburg; bounded on the north by the North Baird Glacier, on the south by the Stikine River and on the east by the International Boundary. A total of 197 goats were counted of which 50 were kids, giving a kid-adult ratio of 34 kids per 100 adults for the area covered. Actual observation time was 3.4 hours, with a sight rate of 1 goat per 1.04 minutes of observation time. Approximately 1,090 square miles were included in the aerial surveys which gives an average population density of 1 goat per 5.5 square miles for the area flown. Much of the area covered by the flights is rugged glacial terrain not utilized as goat habitat. The greatest concentration of goats was in the lower alpine areas 2,000 to 3,000 feet in elevation. Few goats were observed above an elevation of 3,500 feet. The results of the composition counts are shown in Table 3. Figure 2 shows the coverage of the aerial surveys in the Petersburg district of Southeast Alaska.

On September 17, 1959, Federal Aid Coordinator Sigurd T. Olson, accompanied by Jack Swartz, U.S. Forest Service, conducted an aerial survey to determine the status of mountain goats on Chichagof Island. The initial transplant of

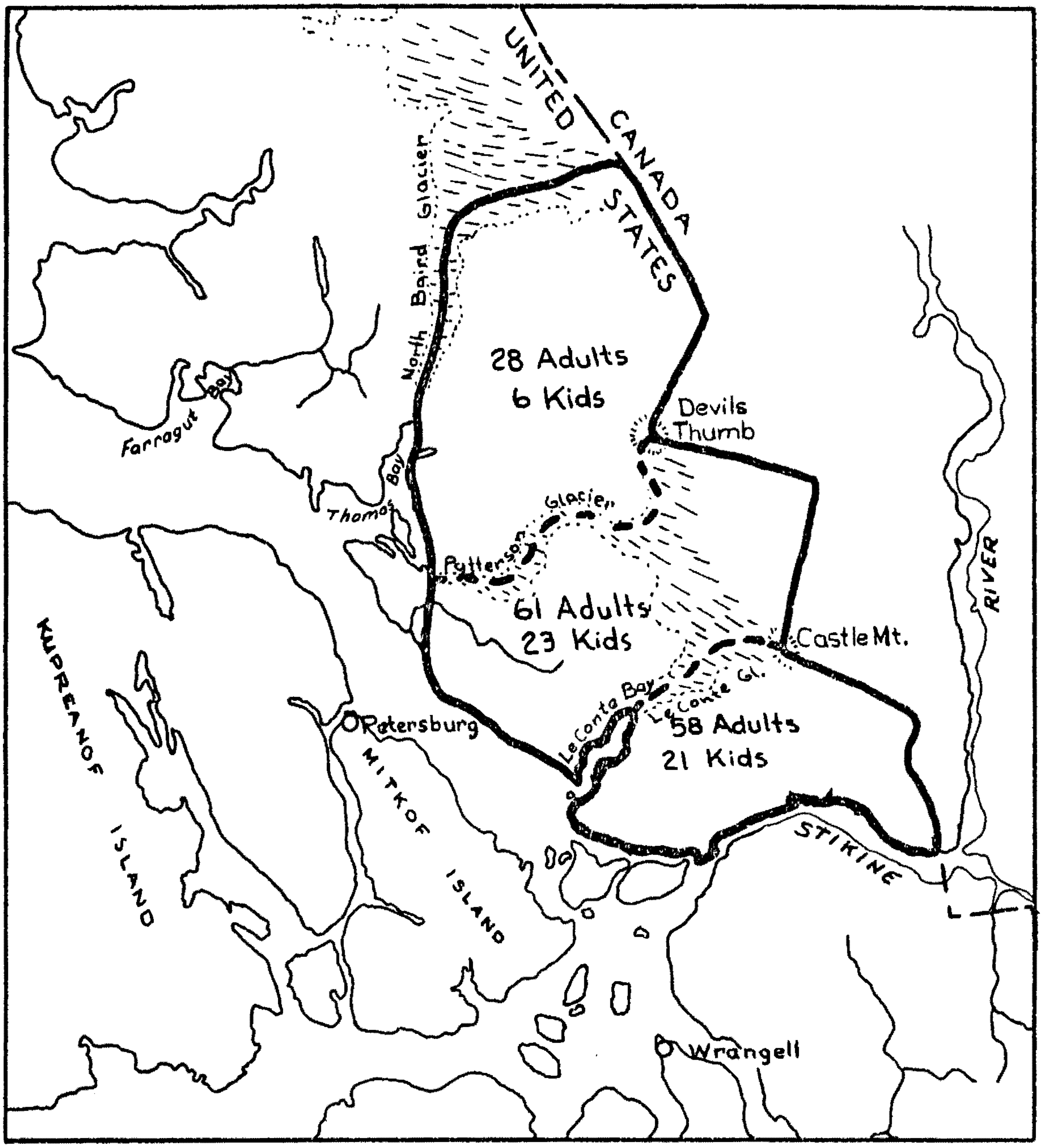

FIGURE 2 MOUNTAIN GOAT AERIAL COMPOSITION COUNTS CONDUCTED IN THE PETERSBURG DISTRICT OF SOUTHEAST ALASKA IN 1959, SHOWING THE NUMBER OF ADULTS AND KIDS COUNTED IN EACH AREA

Table 3. Mountain goat composition counts in Southeast Alaska, 1959.

Date	Location	No. Kids	No. Adults	Kid-Adult Ratio	Total Count
8/18/59	North Baird Gl. to Patterson Gl.	6	28	21:100	34
8/18/59	Patterson Gl. to LeConte Bay	23	61	38:100	84
9/17/59	Chichagof Is. (east of a north-south line drawn between Kadasham Bay, Tenakee Inlet Bay, Tenakee Inlet & False Is., Hoonah Sound)	0	0	0:0	0
9/21/59	LeConte Bay to Stikine River	21	58	36:100	79
	Totals	50	147	34:100	197

11 female and 6 male goats was made by the U.S. Fish and Wildlife Service on the beach at Basket Bay between 1953 and 1956. The island was not previously occupied by goats. In spite of excellent observation conditions, no goats were observed in 1.2 hours observation time during which all alpine areas, east of a north-south line drawn between Kadasham Bay in Tenakee Inlet and False Island in Hoonah Sound, were thoroughly covered. It is possible that the goats have moved from the area flown, however there have been no previous reports of goats on Chichagof Island outside of the area covered by the survey. The last report of goats seen on Chichagof Island was by an Alaska Coastal Airlines pilot, who claimed to have seen two near the head of Sitkoh Bay in August, 1958.

Hunter Harvest: The total known mountain goat kill from the area covered by the composition counts in the Petersburg district was seven animals. The total actual kill would probably not exceed 10 to 15 goats, a low harvest for the area considered. Mountain goats, in this portion of Southeast Alaska, are usually taken incidental to other activities, often after being sighted from tidewater. Few people are willing to undertake the strenuous task of hunting goats in the higher country. Increased lumbering activities on Baranof Island have recently caused an influx of people to this locality. Goat populations should be watched carefully in this area to prevent a possible over-harvest.

Recommendations:

Investigations should be continued. Efforts should be concentrated on areas where the hunter harvest is heaviest, as near Seward on the Kenai Peninsula and on Baranof Island in Southeast Alaska.

Aerial surveys should be utilized to obtain data on age composition, distribution and population trends.

The collection of hunter harvest data should be continued to obtain information on sex and age distribution of the kill, the amount of hunting pressure and its effect on goat populations.

Prepared by:

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30 June 1960

Approved by:

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James W. Brooks, Director
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Volume 1 Report No. E-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: E Sheep and Goat Investigations

Job No: 3 (Part II) Title: Goat Distribution & Population Status (Prince William Sound - Yakutat Area)

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Reconnaissance surveys were flown in the mountains between Cordova and Bering Lake. Eight adult goats and two kids were counted in the mountains adjacent to the Copper River Delta area. Heavy snows in the goat ranges precluded further counts.

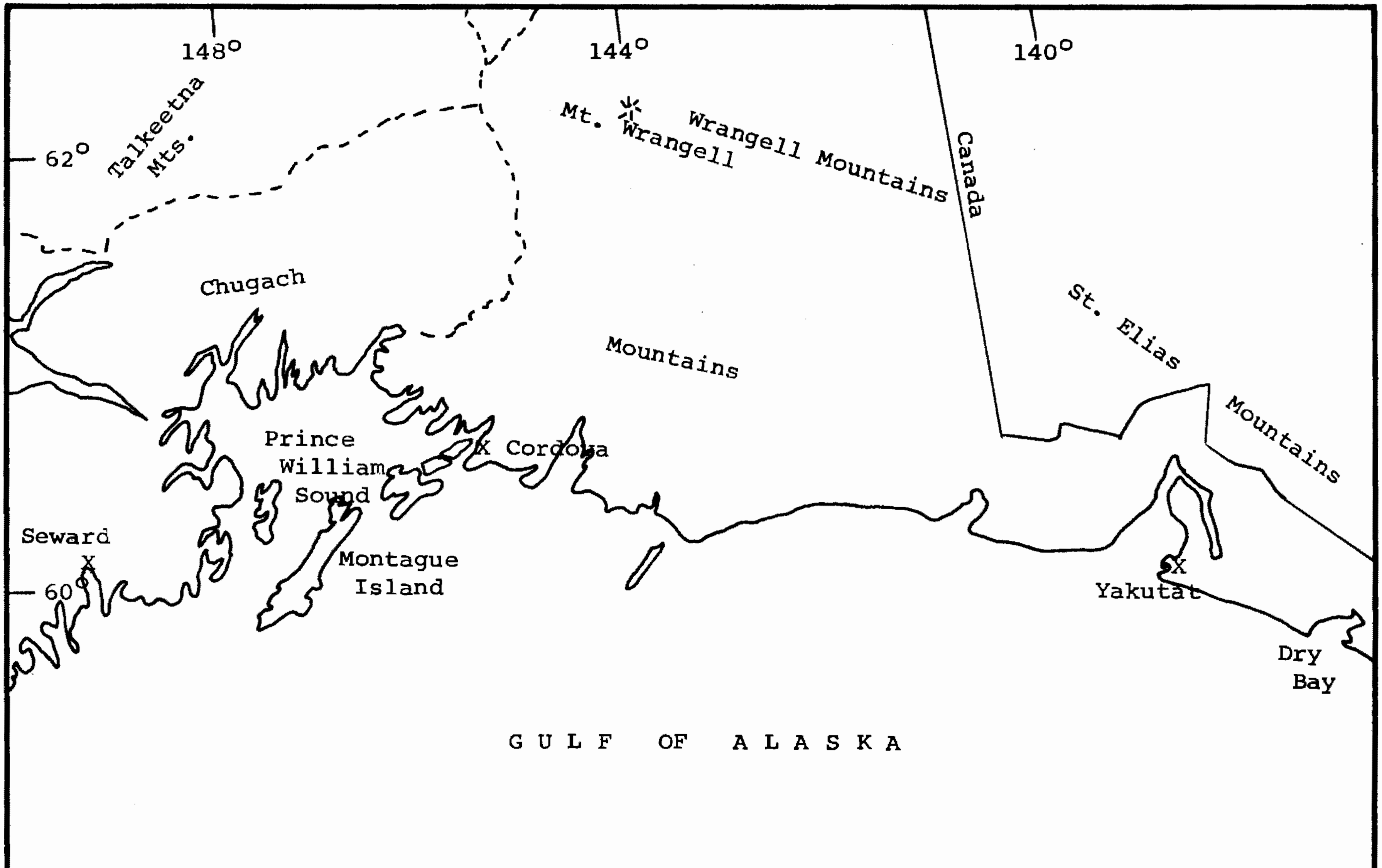
Objectives:

To determine the distribution, abundance, and sex and age composition of mountain goat populations in the Prince William Sound - Yakutat area.

Techniques:

An aerial reconnaissance was conducted with a Cessna 180 of the Chugach Mountain Range between Cordova and Bering Lake to gain familiarity with the extent and characteristics of the mountain goat range.

A distribution map was prepared to record goat observations of reputable informants. This map will facilitate the planning of future surveys and investigations.



----- Highway
Scale: 1" = 47.35 miles

Figure 1. Area referred to in report.

Findings:

Work on this investigation did not begin until October 14, 1959. As a consequence, heavy snows in the mountains limited operations for this season. Nevertheless, the following information was collected which will greatly simplify subsequent work on this study.

Aerial Survey: An aerial survey of goat range in mountains of the Copper River Delta area was conducted before snowfall on October 14, 1959. The results of the survey are as follows:

Adults	8
Kids	2
Total	10

The Cessna 180 used for the survey did not permit approaching the animals closely enough to consistently differentiate age classes. Further surveys were suspended for the winter due to excessive snowfall.

Distribution: Sightings of goat populations by local airlines pilots and other reputable observers indicate that goats are distributed from Bering River Lake on the southeastern edge of the Copper River Delta to Columbia Glacier on the northern shore of Prince William Sound.

Recommendations:

1. The study should be continued.
2. All aerial population and distribution surveys should be completed by September of each year.
3. Aerial surveys should be made in a Piper Super Cub or similar plane rather than a Cessna 180, since the latter cannot be flown slowly enough to allow accurate differentiation of kids from adults.

Prepared by:

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30 June 1960

Sigurd T. Olson
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Volume 1 Report No: F-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: F Bear Investigations

Job No: 1 Title: Brown Bear Studies, Alaska Peninsula

Period Covered: July 10, 1959 - August 30, 1959

Abstract:

Data obtained in the 1959 aerial census of Alaska Peninsula brown bear populations indicate a population makeup consisting of 27 per cent cubs, 10 per cent yearlings, 13 per cent sows with cubs, 6 per cent sows with yearlings, and 44 per cent other bears.

The large proportion of cubs in the 1959 census slightly exceeds that developed under P-R, W-3-R-13, in 1958 and indicates excellent recruitment. However, survival of cubs between 5-9 and 17-21 months of age was indicated at less than 40 per cent. This value is much less than the 69 per cent survival determined for the 1958 season. Heavy mortality for the 1959 season was indicated both for entire litters and within litters.

Population density indices on three study areas on the peninsula were 15.3, 7.7, and 20.9 bears seen per hour of aerial census. Similar values developed under the 1958 census were 38.9, 7.3, and 17.1. Comparison of census results on representative bear concentration areas indicated similar populations of bears for the two years with greater counts being obtained for those surveys conducted toward the later dates of census.

Objectives:

To determine numbers, age composition, characteristics of harvest, and population trends of brown bears on the Alaska Peninsula. Results of the studies will be used to evaluate present status, for future comparisons, for comparison with other areas, and to formulate management procedures.

Techniques:

Aerial composition surveys of Alaska Peninsula brown bear populations were flown between July 22 and August 8, 1959. Results of a foot census conducted on the McNeil River on July 25, 1959, are also included. Bering Sea drainages surveyed include Becharof Lake, and the Savonaski, Meshik, Ugashik, King Salmon, and Dog Salmon Rivers. Pacific Coast drainages surveyed were the McNeil and Kamishak Rivers, Black and Chignik Lakes, Wide Bay and associated streams, and Aniakchak River (Figure 1).

The surveys were made using 135 h.p. Piper Pacer on loan to the Alaska Department of Fish and Game from the U.S. Fish and Wildlife Service. The pilot was P-R Biologist, Frank Jones. The project leader served as observer. Observations were made from altitudes ranging from 400 to 700 feet, as terrain and flying conditions permitted. A total of 51 hours flying time was expended on the project, of which 19 hours were spent in actual survey.

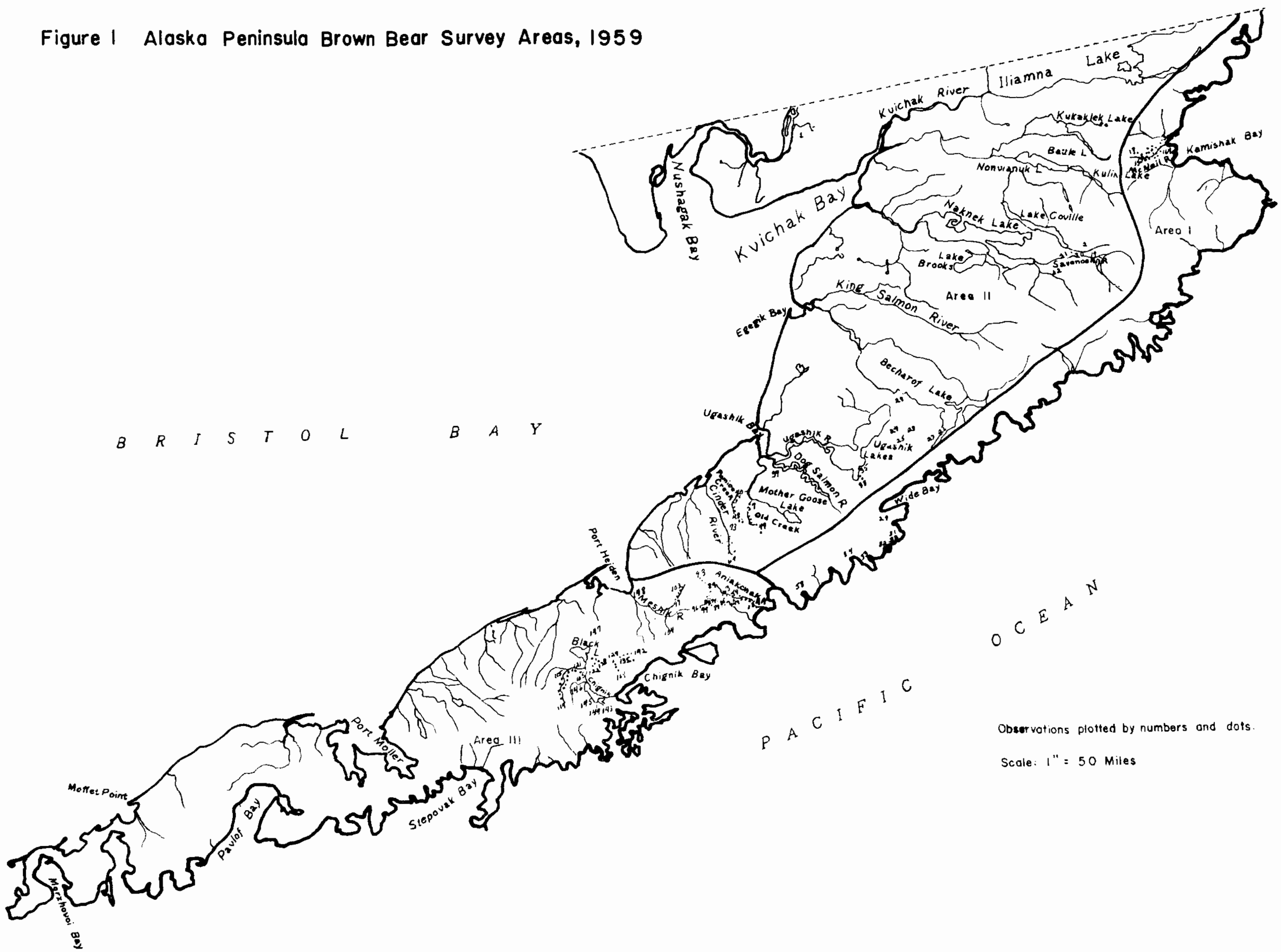
Data Recorded.

Data recorded during the surveys included classification of bears into three categories: 1) sows with cubs of the year, 2) sows with yearling cubs, and 3) other bears. Family groups were recorded as to total number of bears, and all observations were recorded as to date, time, and location. The time spent in actual census over each drainage was recorded for comparative bear density studies.

Method of Analysis.

Data obtained in this report are analyzed to show Alaska

Figure I Alaska Peninsula Brown Bear Survey Areas, 1959



Peninsula brown bear population structures, productivity, survival, population densities, and related management considerations.

Population structure refers to identifiable or calculable population segments.

Productivity refers to the general well-being of the population as measured by the following indices:

1. Per cent cubs in the total population.

2. Per cent yearlings in the total population.

3. Per cent of females two years (30 months) and older producing and rearing cubs or yearlings to the time of the survey.

4. Frequency of the various litter sizes, and average litter size.

5. By comparison of productivity data developed under P-R project W-3-R-13 with that developed under the present study.

The female segment of the population is determined by assuming an evenly divided sex-ratio for bears older than yearlings. The total numbers of females with cubs and yearlings is then added to the total of the "other bears" category and the sum divided by two to derive the calculated total female population segment. The "per cent productive females" is obtained by dividing the "total sows with cubs or yearlings" figure by the "total females" figure. It is to be understood that this method of analysis presupposes that all family groups remain intact through two summer seasons. If this assumption proves invalid, a lesser degree of productivity will be indicated than has actually been achieved since the separated group members would be tabulated as "other bears", widening the ratio between sows with young and other bears.

Survival as discussed here refers to survival of cubs of the year (5-9 months) to yearlings (17-21 months). It is measured by the ratio of total yearlings to total cubs in the 1959 census and by comparison of cub data developed under P-R project W-3-R-13 with that of yearling data developed under the present study. The former ratio assumes that total cub production and survival to the time of the count is constant.

Population Density is determined by analyzing the total time spent surveying peninsula brown bear populations. The bears-per-hour-of-aerial-survey-time figure is derived by dividing the total bear observations by the total hours of observation time expended.

Findings:

Productivity.

Productivity and population data as obtained from this year's survey are presented in Tables 1 and 2. A comparison of this data with that developed under P-R project W-3-R-13 in 1958 is presented in Table 3.

The results of the two surveys cannot be considered directly comparable, however, because 1) the 1959 census was less extensive than that of 1958, 2) the aircraft used in making the surveys were of different types and capabilities, and 3) the 1958 survey crew possessed a greater knowledge of the Alaska Peninsula.

Despite these differences a comparison of the two surveys appears warranted. Such a comparison (Table 3) indicates substantial productivity for both years with perhaps slightly greater productivity being indicated for 1959. This was reflected in increased percentages of cubs, sows with cubs, sows with cubs and yearlings combined, and productive females (Table 3). However, a reduced proportion of yearlings, sows with yearlings, and smaller litter sizes of cubs and yearlings and litter size frequencies (Figure 2) served to partially offset this indicated increase. It would thus appear that if the indicated increase in productivity was real for 1959, it resulted from an increase in litter numbers rather than from increased litter sizes.

Survival.

Survival of cubs to the yearling class, as measured by aerial counts for 1959 and by comparison with the 1958 survey

Table 1. Summary of 1959 Alaska Peninsular Brown Bear Composition Counts.

Area	Sow w/1 Cub	Sow w/2 Cubs	Sow w/3 Cubs	Sow w/4 Cubs	Sow w/1 Yrl.	Sow w/2 Yrl.	Sow w/3 Yrl.	Other Bear	Total Bear
I	3	4	3	0	1	3	0	24	65
II	3	6	1	0	0	1	0	32	63
III	3	6	5	1	5	3	2	63	139
Total	9	16	9	1	6	7	2	119	267

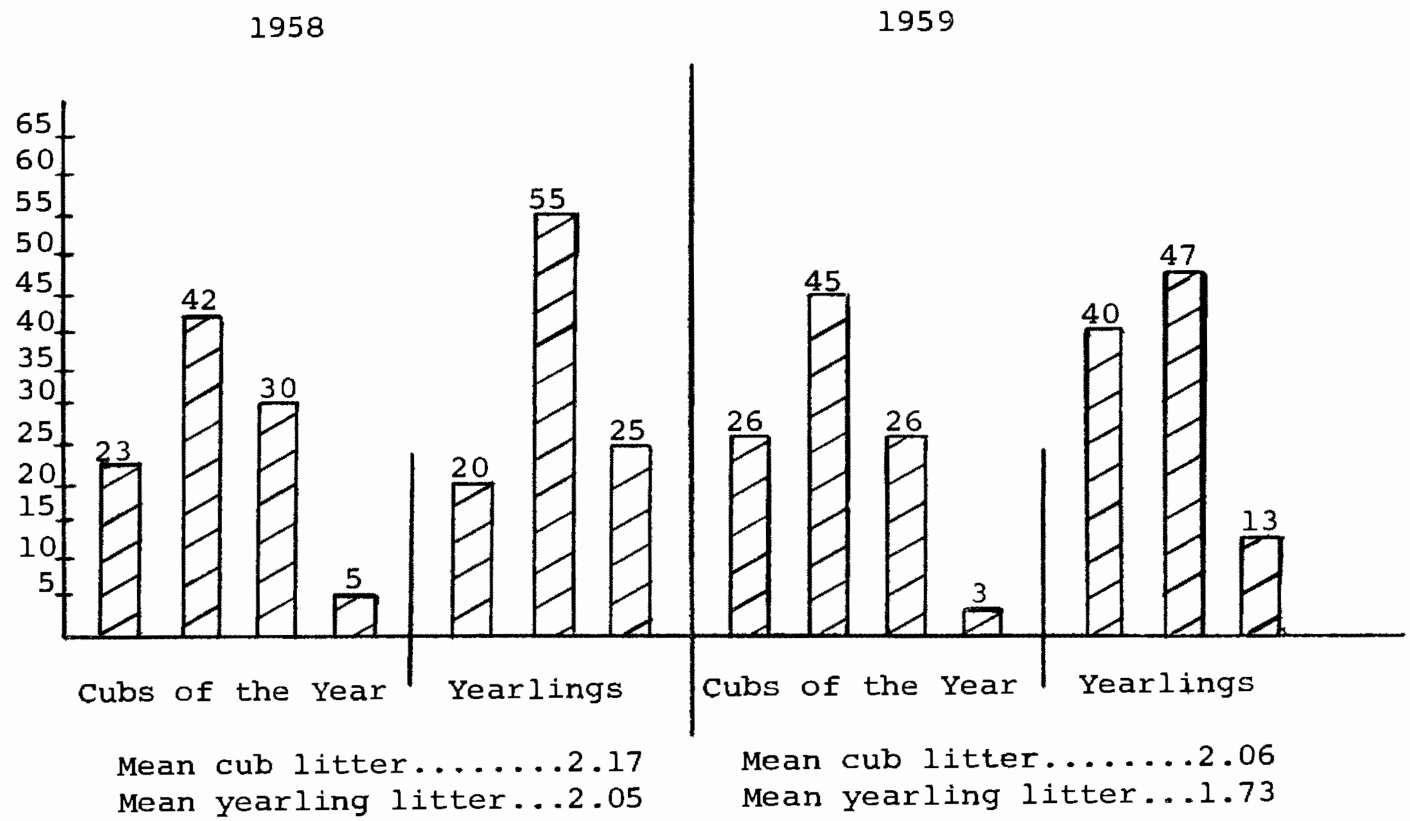
Table 2. Per cent composition of various Alaska Peninsula brown bear population elements, 1959.

Area	Cubs in Total Pop.	Yrls. in Total Pop.	Yrls. & Cubs in Total Population	Sows w/Cubs in Total Population	Sows w/Yrls. in Total Population	Sows w/Cubs or Yrls. in Total Population	Sows w/Cubs or Yrls. Estimated Female Segment of Pop.	Other Bear in Total Population	Average Litter Size --Cubs	Average Litter Size --Yearlings	Total Bear Observations
I											
Number	20	7	27	10	4	14	-	24	2.00	1.75	65
Per cent	30.8	10.8	41.6	15.4	6.1	21.5	73.7	36.9	-	-	-
II											
Number	18	2	20	10	1	11	-	32	1.80	2.00	63
Per cent	28.6	3.2	31.7	15.9	1.6	17.5	51.2	50.8	-	-	-
III											
Number	34	17	51	15	10	25	-	63	2.27	1.70	139
Per cent	24.5	12.2	36.7	10.8	7.2	18.0	56.8	45.3	-	-	-
Totals											
Number	72	26	98	35	15	50	-	119	2.06	1.73	267
Per cent	27.0	9.7	36.7	13.1	5.6	18.7	59.2	-	-	-	-

Table 3. A comparison of Alaska Peninsula brown bear population data, 1958 and 1959.

	1958	1959
Sample Size	779	267
Per Cent Cubs	21.40	27.00
Per Cent Yearlings	14.80	9.70
Per Cent Cubs & Yearlings	36.20	36.70
Per Cent Sows with Cubs	9.90	13.10
Per Cent Sows with Yearlings	7.20	5.60
Per Cent Sows with Cubs or Yrls.	17.10	18.70
Per Cent Productive Females	53.50	59.20
Per Cent Other Bear	46.70	44.60
Mean Cub Litter Size	2.17	2.06
Mean Yearling Litter Size	2.05	1.73
Bear Per Hour of Aerial Census		
Unit I	38.90	15.30
Unit II	7.30	7.70
Unit III	17.10	20.90

Figure 2. Per cent/Frequency of Brown Bear Litter Sizes, Alaska Peninsula, 1958 and 1959.



data, indicates that substantial mortality has ensued. If productivity for the two seasons can be considered equal, the 1959 survey indicates a 57 per cent (35 cub litters to 15 yearling litters) reduction in litters and a 62 per cent (72 cubs to 26 yearlings) cub mortality. A similar (55%) mortality value is indicated by the proportion of cubs (21.4%) in the 1958 population as compared with the same age class determined to be yearlings (9.7%) in the 1959 census. A further indicator of cub survival is provided by comparison of the 1959 mean-yearling-per-litter figure (1.73). A comparison of the two indicates that a 20 per cent mortality has resulted within surviving litters.

These percentages vary markedly from those determined for the 1958 season. Mortality as measured by the 1958 survey was 29 per cent, with mortality apparently affecting entire litters and with little or no mortality indicated within litters. The divergent mortality findings for the two seasons suggest sampling errors and invalid basic assumptions from which mortality was calculated for either or both seasons.

Population Densities.

Population density data as compiled for the 1959 season are presented in Tables 2 and 3. Fourteen bears were tallied per hour of actual census. Greatest density was noted for Unit III and lowest for Unit II (Figure 1). Data for Units II and III compare favorably with that obtained for 1958. The 1958 data for Unit I indicated an appreciably greater density than did the data for 1959. The results of the two censuses are not directly comparable, however, since aircraft used in the two censuses varied significantly in maneuverability, speed, and observability. Furthermore, efforts of the 1959 census were directed toward areas shown by the 1958 census to contain higher population densities.

Bear Concentration Areas.

Table 4 presents census results as developed under P-R, W-3-R-13 and under the present survey, W-6-R-1. Again the two censuses cannot be considered directly comparable because of flight considerations. However, the data do indicate higher counts generally for surveys conducted later in the season. Future surveys should, perhaps, not begin before August 1 if maximum success is to be realized.

Table 4. Comparative bear concentration area census results, 1959 and 1959.

	1958		1959	
Name of Drainage	Date	Bears Observed	Date	Bears Observed
McNeil River	July 2,8	53	July 25	32
Black & Chignik Lks.	Aug. 1	75	Aug. 6	73
Meshik & Aniakchak Rv.	Aug. 1,14	70	Aug. 4,5	67
Ugashik Lakes	Aug. 12,13	32	Aug. 2	15
Cinder River	Aug. 1	14	Aug. 5	16
Pumice Creek	Aug. 1	7	Aug. 4	15
Old Creek	Aug. 1	8	Aug. 4	11
Total Bears		259		229

Recommendations:

Results of aerial surveys for 1958, as developed under Project W-3-R-13, and for 1959, as developed under Project W-6-R-1 indicate that the population status of Alaska Peninsula brown bear may be determined in this manner. The sensitivity of such assessment is, of course, unknown.

Future studies should, perhaps, be directed toward the establishment of a series of check areas which could be flown annually to reflect significant changes in both numbers of bears and in herd composition. Significant variations might then be investigated by more intensive surveys. In the establishment of check areas drainage systems which indicate reliable spawning runs of salmon should be selected. Since runs of individual salmon species are characteristically cyclic as to abundance, check areas supporting runs of several species are to be preferred over single species streams.

Prepared by:

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30 August 1959

Approved by:

Sigurd T. Olson
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James W. Brooks, Director
Division of Game

Volume 1 Report No: F-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: F Bear Investigations

Job No: 2 Title: Brown Bear Studies, Southeast Alaska

Objectives:

To determine bear numbers, cub ratios and mean litter sizes on portions of the bear range which may be subject to logging within ten years as a basis for current comparison with populations on other areas, and for future comparison with populations on the same sites after logging.

To determine hunting pressure and its effect on the bear population.

Procedures:

Cub ratios and mean litter sizes will be obtained in the spring and summer from both aerial and ground counts. Grass flat areas will be surveyed in May, alpine ranges in June, and streams in July and August.

Hunting pressure will be assessed from the collection of harvest data, hunting success and numbers, size and sex of bear taken, derived from interviews and guides' reports.

Findings:

No work was accomplished on this phase of the brown bear studies.

Recommendations:

This study should be initiated as soon as it is possible to assign suitable personnel to it.

Prepared by:

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P-R Coordinator

Approved by:

Sigurd T. Olson
P-R Coordinator

James W. Brooks, Director
Division of Game

Volume 1 Report No: F-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: F Bear Investigations

Job No: 3 Title: Polar Bear Characteristics of Harvest

Period Covered: October 1, 1959 - June 30, 1960

Abstract:

The known kill of polar bears off Alaska's coast by native and trophy hunters was 128 animals, and the estimated total kill was 163. Trophy hunters killed 101 animals, and native hunters took 62.

The sex ratio for trophy-killed bears was 649 males : 100 females and for native-killed 92 : 100. None of the trophy-killed bears, but 13, or 34 per cent of the native-killed bears, were cubs.

Kotzebue and Barrow trophy hunters accounted for 92 per cent of the trophy kill. Thirty-five per cent of the total trophy kill occurred during the two-week period in mid-April.

The native hunters at Barrow, Wainwright and Point Hope accounted for most of the native-killed bears. Seventy-four per cent of the kill occurred during December and January.

The number of bears seen per hour of flying decreased from 1.9 bears per hour in 1959 to 1.0 in 1960. The reason for the decrease is unknown.

Objectives:

To develop a program involving the systematic recording of guide and hunter observations of polar bear. To determine the magnitude of the polar bear harvest and types of animals included. To gather additional information on the breeding biology of the polar bear.

Techniques:

The collection of polar bear data during the winter and spring, 1960, was accomplished by Samuel J. Harbo and Robert A. Rausch; the evaluation of the data was done by Harbo.

Polar bear harvest information was obtained from both white sport hunters and native hunters. To record the take by sport hunters, polar bear guides and hunters were contacted either personally or by letter and requested to maintain records of their hunts on forms provided by the Department. The hunters and guides based at Point Hope, Kotzebue and Teller were very cooperative, endeavoring to provide all of the information requested. The hunters and guides at Barrow, however, were not as cooperative, and difficulties and delays were experienced in obtaining information from certain individuals. One guide, suspected of illegal guiding activities, repeatedly "forgot" to bring the completed forms to Departmental personnel, while other individuals presented data of questionable accuracy.

The forms contained an outline drawing of Arctic Alaska on which the flight patterns and locations of bear sightings and kills were plotted. On the reverse side the following information was requested:

1. Date and location of hunt.
2. Total flight time and time spent searching for bears.
3. Total number, sex and size of bears seen.
4. Number, sex and size of bears killed.
5. Miscellaneous information (breeding biology, food habits, etc.)

The size chronology, and composition of the native take of polar bears were determined by contacting residents of coastal villages and through the use of harvest report forms. The data from Point Hope were obtained by D. C. Foots, an anthropologist associated with Atomic Energy Commission's Project Chariot.

Military conservation personnel, contacted by members of the Department, furnished polar bear harvest data from remote military sites.

Findings:

Two diverse methods of hunting for polar bears exist in Alaska. The most productive method, from the standpoint of number of bears taken, is sport hunting with the use of aircraft. Trophy hunters, primarily white men, employ this method almost exclusively. The other method, restricted primarily to native hunters, consists of hunting on the ice using dog sleds or simply foot travel; the trophy value of a polar bear receives little consideration by these hunters.

Olson (unpublished) has described these two methods in a previous report.

Harvest by Trophy Hunters

All of the polar bears killed by sport hunters during 1959-1960 were taken with the aid of aircraft. One guide based at Point Hope normally employs sled travel exclusively on his hunts. During spring, 1960, however, that guide did not engage in any polar bear hunting activities.

The ice and snow conditions during spring, 1960, were not conducive to aircraft hunting of polar bears. Except for a short period prior to February 15, the ice along the northwest coast from Diomede to Cape Lisburne was very broken and nearly devoid of adequate tracking snow. Reports from guides in the Point Barrow area indicate that similar conditions prevailed there.

The unfavorable ice and snow conditions seriously hampered the air operations. Normally, the guides fly over the pack ice until they find a large set of tracks, generally made by trophy-size males. The tracks are then trailed, with the use of aircraft, until the bear is sighted. If the animal is acceptable, the planes are landed or maneuvered such that the hunter is placed in a favorable location for shooting. With suitable tracking conditions, the entire operation often takes less than two hours. During spring, 1960, aerial tracking was nearly impossible, however, and most of the trophy bears were sighted without being trailed.

The total known kill of bears by trophy hunters during winter of 1959-60 was 81 animals. The actual kill probably exceeds the known kill by 20 animals, producing a total kill by trophy hunters of 101 animals. This total is 49 per cent less than the record 1958-59 trophy kill (197), and probably reflects the decrease in the number of hunters as well as the unsatisfactory ice and snow conditions, although other factors also may have influenced the take. The decrease of hunters stemmed primarily from cancellations that occurred after three aircrafts employed by bear hunters crashed in the Kotzebue area, illing two people. A notable lack of trophy hunting by military personnel and adverse publicity concerning the unsuitable ice and snow conditions also contributed to the relative lack of hunters.

Fifty-three per cent of the known kill of trophy bears were taken by Kotzebue-based hunters, 39 per cent by Barrow hunters, and 8 per cent by Teller hunters. During 1958-59, the percentages were 59, 24, and 4, respectively, with Cape Lisburne and Barter Island also garnering 11 and 2 per cent, respectively. There were no known kills at the latter two sites during 1959-60. The data are shown in Table 1.

Table 1. Summary of the polar bear kill recorded in Alaska during the 1959-60 season (October - May).

Area	Native-Killed #	Native-Killed %	Trophy-Killed #	Trophy-Killed %	Total Kill #	Total Kill %
St. Lawrence	4	9	0	0	4	3
King Island	4	9	0	0	4	3
Diomede	1	2	0	0	1	1
Wales	2	4	0	0	2	2
Teller	0	0	6	8	6	5
Shishmaref	1	2	0	0	1	1
Kotzebue	0	0	43	53	43	33
Pt. Hope	18	38	0 (1)	0	18	14
Wainwright	7	15	0	0	7	5
Barrow	10	21	32	39	42	33
	47	100	81	100	128	100
	15 (2)		20 (3)		35	
Total Kill	62		101		162	

(1) All bears killed in vicinity of Point Hope by trophy hunters are included in the Kotzebue total.

(2) The estimated number of non-reported native-killed bear.

(3) The estimated number of non-reported trophy-killed bear.

Sport hunting of polar bears occurs during the period February - April. During 1960, the first trophy kill was made on February 5, by a Kotzebue-based hunter, and the last kill on April 30, the last day of the legal hunting season. Generally, the sport hunting of polar bears at Barrow commences at a later date than at Kotzebue, and the 1960 hunts followed that pattern; the first known kill at Barrow occurred during the first week of March.

Although weather and ice conditions influence the chronology of the sport kill, the kill distribution serves as a reliable indicator of the hunting pressure pattern. Figure 1 shows the chronology of the sport kill and reveals that mid-March and mid-April were the two most productive periods. The two-week period in mid-April (10 April - 23 April) alone accounted for 35 per cent of the total trophy kill. During spring, 1959, the most productive two-week period was March 15 - 28, which accounted for 42 per cent of the total trophy kill (Olson, unpublished). The two-week period of April 12 - 25, 1959 accounted for approximately 11 per cent of the total harvest. The differences in the 1959 and 1960 peaks probably reflect the large number of cancellations of March 1960, bookings. One guide at Kotzebue had six hunter cancellations during that period reportedly due to the adverse publicity regarding the dangers of polar bear hunting.

The sex and age composition of the polar bear kill by white trophy hunters was determined from information supplied largely by guides. In a few instances, principally in the Barrow area, the guides provided information of questionable accuracy, especially in recording the sex of bear. One guide, in particular, stated early in the season that his hunters were taking many more females than usual, yet the data he submitted at termination of hunting showed a total kill of nine bears: only two of which were listed as females. Perhaps a stigma is associated with the taking of female bears, and a few guides tend to minimize this accomplishment. There was no evidence of willful misrepresentation of facts at Kotzebue, however. The sex ratio of known sex, trophy-killed bears was approximately 649 males : 100 females (Table 2). Olson (unpublished) determined that the ratio for known sex animals in 1959 was 520 : 100. The higher proportion of males in the kill during 1960 is surprising considering the difficulties involved in finding trophy bear during that season, and the fact

Figure 1. Chronology of the polar bear kill by trophy hunters, February-April 1960, (based on 62 known kill dates.)

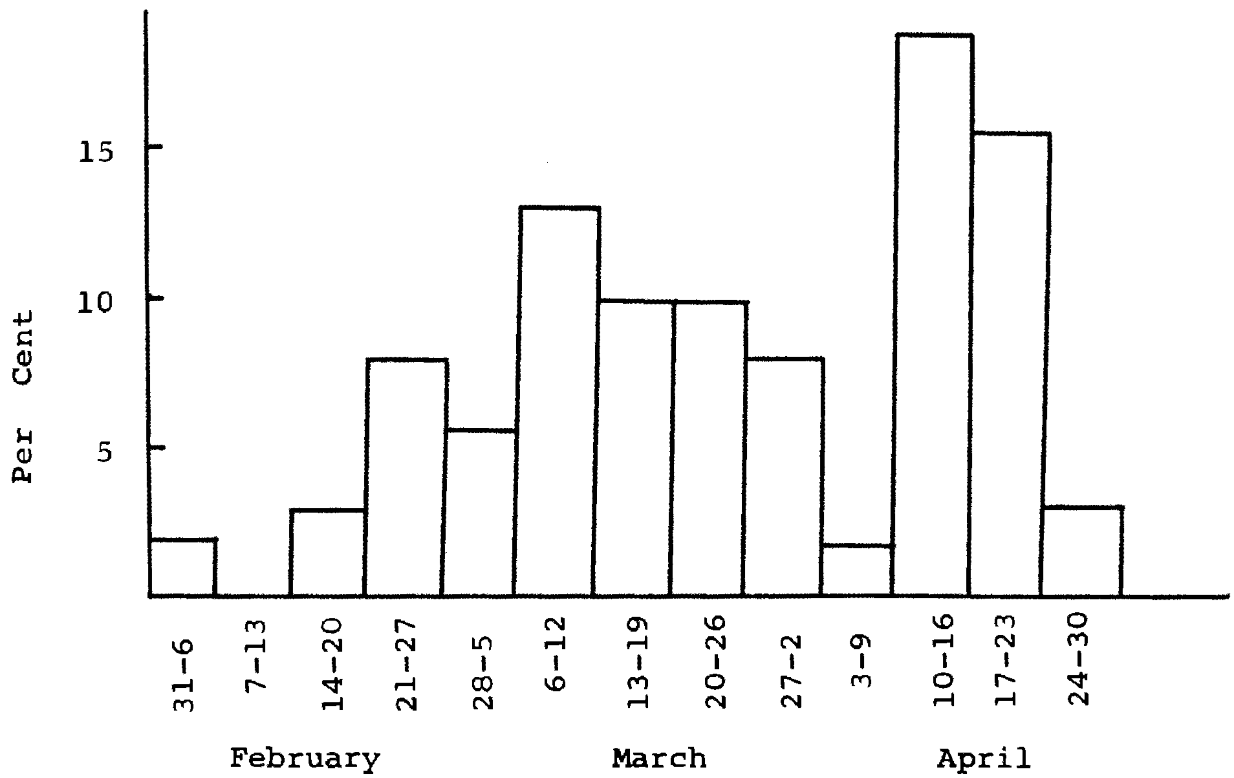


Table 2. Sex and age composition of the polar bear kill recorded in Alaska during 1959-60.

Area	Adults Male	Adults Female	Adults ?	Total Adults	Cubs	Total All Bear
Trophy-Killed Bear						
Teller	6	0	0	6	0	6
Kotzebue	35	3	5	43	0	45
Barrow	18	6	8	32	0	32
	59	9	13	81	0	81

Sex ratio of adult kills of known sex: 649 males:100 females

Area	Adults Male	Adults Female	Adults ?	Total Adults	Cubs	Total All Bear
Native-Killed Bear						
St. Lawrence	0	1	0	1	3	4
King Island	2	1	0	3	1	4
Diomede	0	0	1	1	0	1
Wales	1	1	0	2	0	2
Shishmaref	0	0	1	1	0	1
Pt. Hope	9	6	0	15	3	18
Wainwright	0	0	7	7	0	?
Barrow	0	4	0	4	6	10
	12	13	9	34	13	47

Sex ratio of adult kills of known sex: 92 males:100 females that the 1959 season was reportedly an excellent one, with a high rate of bear sightings and high percentage of large-size bears in the total kill. These conditions seemingly would contribute toward a higher percentage of males in the 1959 harvest than in the 1960 harvest, but the reverse actually exists. Perhaps the data are in error, or the actual composition of the polar bear population in the vicinity of Alaskan shores were different for the two years. Other influences could be the poor tracking and hunting conditions, or the smaller number of hunters during 1960, which would permit a guide to spend more time with each hunter thus lengthening the search phase of the hunt. Not enough information is available to fully evaluate any of these factors, however.

All of the trophy-killed bears were adults.

Harvest by Native Hunters

The data on native harvest of polar bears were collected by Harbo at all sites other than Wainwright and Barrow; R. A. Rausch collected the data at these two points.

Native hunters in Alaska had a known kill of 47 polar bears during the period October 1959 - May 1960. Most of the animals were taken by Point Hope or Barrow hunters, but a few were taken at other sites. The kill information from Barrow probably is incomplete; only ten bears were reported killed there. Undoubtedly others were taken but not reported, and perhaps the total kill by native hunters exceeds the known total by 15, producing a total kill of 62 animals. This figure exceeds the 1959 native take by 13 per cent. The data are shown in Table 1.

Polar bears were reported taken by hunters at St. Lawrence Island, King Island, Wales, Diomede Island, Shishmaref, Point Hope, Wainwright, and Barrow. Information obtained from King Island and St. Lawrence Island hunters indicated that many more bears were sighted during the winter of 1959-1960 than during the winter of 1958-1959. The King Island hunters also reported seeing an unusual abundance of thick Arctic ice, a factor undoubtedly influencing bear movements.

The native harvest of polar bears occurred during the period December through April; the April-killed bears, a sow and three cubs, were taken at St. Lawrence Island. January was the most productive month, accounting for 44 per cent of the kill. December was next highest with 30 per cent and February and April had 13 per cent each (Figure 2). No bears were reported taken in March. Nearly 75 per cent of the harvest occurred during the two months of December and January.

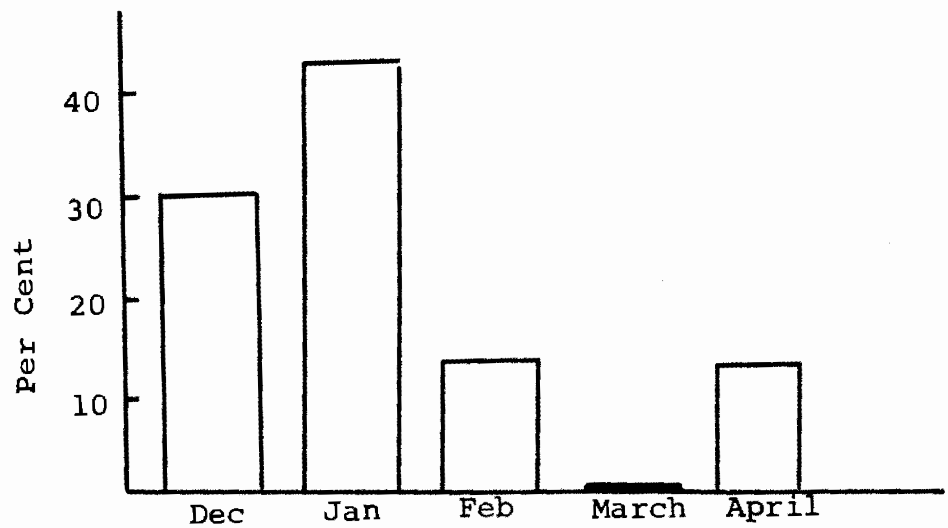
The polar bears harvested by native hunters include many females and cubs. Of 38 known age bears taken during 1959-60, 34 per cent were cubs. During 1958-59, only 19 per cent were cubs. The sex ratio of known sex adult bears taken during 1959-60, was 92 males:100 females; during 1958-59 the ratio was 262 males:100 females. The apparent increase of cubs and females in the 1959-60 native harvest is difficult to explain inasmuch as the harvest by sport hunters had an opposite trend. Perhaps a difference in reporting procedures for the two seasons accounts for part of the sex and age composition changes, but it is doubtful they are that influential. At present, insufficient data are available to determine the causative agent.

Comparison of White Hunter and Native Hunter Harvests

The total kill of polar bears by white hunters exceeded the kill by native hunters by 64 per cent during 1959-60; during 1958-59 the excess was 266 per cent. Although the kill by white hunters is much larger than the native harvest, the latter harvest, due to a larger proportion of females and cubs, probably is of more importance to the polar bear population. During 1959-60, the known kill by white hunters contained only nine females, whereas the native take included 13 females and 13 cubs. Even though it is presently illegal to kill cubs, or females accompanied by cubs, a large proportion of the native take still includes these animals.

The principal hunting period for sport hunters is mid-February-April. The harvest by natives preceeds this, occurring during December and January. This pattern of harvest - the harvest by natives preceeding that of whites - plus a reduced kill by natives during recent years form the basis for a common complaint by natives that sport hunting

Figure 2. Chronology of the polar bear kill by natives in Alaska during 1959 - 1960.



with aircraft is detrimental to the native effort. Other factors, however, influence this argument and must be considered before the affects can be determined. For instance, how does the present native hunting intensity compare with past intensities, what were the past harvest patterns, what was the average polar bear harvest 20 years ago by native hunters (hunters tend to remember the largest harvest) and to what degree do the areas hunted by sport hunters and native hunters overlap? Unfortunately, much of the historical data are either lacking, fragmentory, or of questionable origin. When considering more recent occurrences, such as the degree of overlap of hunting areas, we are on surer grounds. Olson (unpublished) determined that the outer limits of the area hunted by natives essentially was 15 miles and the inner limit one-half mile; aircraft hunting is accomplished further offshore, ranging seaward from ten to 160 miles, with the kills an average of 52 miles from shore. Thus the two areas have little overlap. Data obtained during 1959-60 also indicate that the two areas overlap only slightly. In fact the aircraft ranged further seaward during 1959-60, with the trophy kills an average of 79 miles from shore.

Population Density

Olson (unpublished), during previous polar bear investigation, requested that the guides and hunters record the number of bear sighted on each hunt and the number of hours spent in searching. Olson also determined that the individual in each plane could effectively scan only a 1/4 mile wide ground strip, and that standard was accepted for all observers. Olson thus was able to establish two indices: the number of bears seen per hour and the number of square miles scanned per bear.

Similar information was gathered during 1959-60, and the values of the two indices were determined. The data are shown in Table 3.

The number of bears seen per hour decreased greatly during spring, 1960. The values were 1.2 for Kotzebue-based hunters, 0.7 for Barrow, and 1.0 for the combined areas. These are much lower than the 2.2, 1.5, and 1.9 values recorded during 1959 for Kotzebue, Barrow, and combined areas respectively (Table 3), and if interpreted literally would indicate that the 1960 bear population off Alaskan shores was

Table 3. A comparison of the bear density indices based on number of bears seen per hour and number square miles per bear for 1956, 1957, 1958, 1959, and 1960.

Area	Year	No. Flying Hours	No. Bears Sighted	Bears Seen Per Hour	No. Sq. Miles Scanned	Sq. Mi. Per Bear
Kotzebue	1956	84	33	0.4	1,888	57
	1957	222	175	0.8	4,971	28
	1958	106	111	1.0	2,387	22
	1959	160	344	2.2	3,600	10
	1960	118	145	1.2	2,655	18
Total		690	808	1.2	15,501	19
Barrow	1956	---	---	---	-----	--
	1957	161	47	0.3	3,379	72
	1958	79	90	1.2	1,764	20
	1959	105	154	1.5	2,363	15
	1960	46	34	0.7	1,035	30
Total		391	325	0.8	8,541	26
Above Combined	1956	84	33	0.4	1,888	57
	1957	383	222	0.6	8,350	37
	1958	185	203	1.1	4,207	21
	1959	265	498	1.9	5,963	12
	1960	164	179	1.0	3,690	22
Total		1,081	1,135	1.0	24,098	21

half as large as the 1959 population. Perhaps there was a decrease in population size due to unfavorable weather or ice, or to some other unassessed factor, but more likely the unsuitable tracking conditions and rough ice made bears less obvious and more difficult to spot. As Olson has observed, however, until we have detailed information relative to seasonal distribution and numbers on a coordinated international basis, we will have difficulty in determining changes in the total bear populations inhabiting the Arctic Ocean.

Recommendations:

The collection of harvest information should be continued. In order to insure accurate recording of trophy-killed bears, investigators should be stationed at both Kotzebue and Barrow during the sport-hunting period. In addition to gathering harvest data, the investigators should collect specimens, especially skulls and reproductive tracts, and measure all available animals. Guides should be encouraged to transport investigators on hunting flights whenever space and other conditions permit, thus allowing the collection of valuable population distribution, composition and density data, and bear-ice relationships.

A method of age determination should be sought so that the age composition of harvested bear can be ascertained, and additional information of polar bear biology, movements and distribution should be obtained.

The present regulations governing the hunting of polar bears should remain unchanged.

Literature Cited:

Olson, Siguard T., 1959. "Report of Field Observations of Polar Bears." Bureau of Sport Fish and Wildlife, Fish and Wildlife Service. Job Completion Reports, Volume 13:5., 11 pp.

Prepared by:	Approved by:
Samuel Harbo, Jr. Research Biologist 30 June 1960	Siguard T. Olson P-R Coordinator
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Volume 1 Project No: F-4

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: F Fur Mammal Investigations

Job No: 4 Title: Environmental Factors Affecting Distribution and Movements of the Polar Bear

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Literature pertaining to the environmental factors affecting polar bear distribution, movements, and numbers was examined and abstracted during a two-year period from July 1958 through June 1960. Sixty-one seal references, 91 polar bear references, and three physical oceanographic references were abstracted. A limited amount of field work on the Arctic coast supplemented the library work.

The ringed seal probably is the most important item in the diet of the bear, and its availability is largely governed by ice conditions. Ringed seals are more available to the bear during the seal pupping season and the period of fasting-basking-molting. Seals are most abundant in areas of irregular coastal configuration which favorably influences the formation of shorefast ice. Youngest seals are distributed on the periphery of shorefast ice, where ice conditions are most unstable but are most suitable for seal hunting by the bear. Ice conditions appear more important in determining seal distribution than food.

Male bears move in response to females in oestrus. Bears follow the polar pack in summer and return to coastal areas in the autumn when shorefast ice reforms. There is also a movement of pregnant females landward in the autumn to find winter maternity den sites. Males and barren females may den up intermittently during extremes of winter darkness and weather or when they are well fed.

Objectives:

To compile existing information on the environmental factors affecting the distribution, movements, and numbers of polar bears.

Techniques:

A study of the environmental factors affecting the distribution, movements, and numbers of polar bears was initiated in July, 1958. The environmental factors that appeared to warrant principal study are the distribution of seals and other bear foods, ice dynamics, and oceanography. An extensive study was made of the literature pertaining to ringed seal, and to a lesser extent the bearded, harp, and hooded seals. This involved the compilation of a preliminary, semi-annotated seal bibliography of more than 160 references. Using the bibliography as a basis, 76 seal references were examined; 61 of these were abstracted.

A comprehensive polar bear bibliography, compiled by Nicholas Chura, a former University of Alaska student, served as a basis for examining 94 polar bear references. Ninety-one of these were abstracted.

A bibliography of 27 references on ice, ocean currents, etc., was prepared by the investigator; three of these have been abstracted. More ice information will be abstracted and applied to the study as needed to complete the picture of the environmental factors affecting polar bear movements.

Literature was examined at the University of Alaska library, the library of the Arctic Health Research Center in Anchorage, and at the library of the Arctic Research Laboratory at Barrow. In addition, several pertinent references were obtained as a result of correspondence between the Research Unit and various Russian biologists, as well as with Canadian and Scandinavian authorities.

In addition to the literature review, a limited amount of field work was done in March and April, 1959, at Kotzebue and Barrow. This was in connection with the period of harvest. All data collected and reports of the field work are on file at the Alaska Cooperative Wildlife Research Unit.

Findings:

The findings here expressed are only preliminary to a more complete analysis of all the data collected.

Literature covered. Of the 61 seal references abstracted, only 19 can be considered as making significant contributions to the project. Two of these, both by I. A. McLaren, can be considered as outstanding. Most of the information on the ringed seal that is available is qualitative, casual, and brief; very often it is incomplete and relies heavily on summer and short-term observations.

The literature on the polar bear appears to be similarly limited, but it deserves continued examination.

Polar bear distribution factors. Available data indicate that the ringed seal is the most important food item taken by the bear. This is likely so because the ringed seal is the most abundant and available food item throughout the circumpolar range of the polar bear. The other seal species are occasionally taken when they are seasonally and locally available, as is carrion in the form of whales, seals, and walrus. The bear is traditionally a wanderer and probably spends most of its life searching for food and, during the breeding season, for a mate. The bears probably move passively with their ice environment and inevitably become concentrated in areas of food abundance and availability.

Availability of seals is influenced by ice conditions, which in turn are influenced by tides, winds, oceanic currents, landforms, and seasonal climatological variations. Indications are that young, non-breeding seals (less than seven years of age) are distributed in regions of unstable ice conditions, that is, non-landfast ice at the mercy of the tides, winds, and ocean currents. Open leads and new thin ice are the rule in such areas. Evidence indicates that bears are attracted to areas such as these. It follows that the seals taken are probably the younger animals. Bears would have the easiest going, year round, in areas of unstable ice conditions.

Certain seal habits make seals especially available or vulnerable to predation by the bear. These habits are primarily related to the periods of basking-fasting-molting and pupping in the spring. Even here, ice conditions have their influence. During the seal pupping season the bears seek out the maternity dens, or "nutchuk igloos," of the seal in the rough landfast ice. The importance to bears of the fasting-basking-molting season--the season when the seals haul out onto the ice in large numbers--has not been fully determined.

As stated, the areas of seal parturition are in rough, heavy, and landfast shore ice. In such areas it would seem that the bear would have the toughest going. The youngest of the breeding seals tend to be distributed at the periphery of the landfast ice and would probably be the seals most available to hunting bears.

Evidence from the eastern Candian Arctic indicates that coastal areas with a rough configuration have the densest seal populations.

The ringed seal feeds on a variety of planktonic, benthonic, and pelagic food items. Seventy-two different food species were recorded by McLaren from the stomachs of 256 eastern Candian Arctic seals. Seals are often scarce in regions of food abundance, and factors other than food, particularly ice conditions, appear to be more important in governing seal abundance.

At the onset of oestrus in female bears in early spring, male bears are on the march until a female is found. Evidence indicates that a male will keep company with a female in heat for an indefinite period of time.

There appears to be a movement of pregnant female bears to land and areas of rough landfast ice in the autumn. In these places the females seek denning sites to give birth to their cubs and to spend the winter. The use of river beds in Alaska has been reported. Sightings of bears in coastal areas in the autumn are frequent. Some of these are undoubtedly male bears that appear with the reforming shorefast ice.

Generally bears retreat with the melting of the polar pack in the summer, but some may be stranded and spend the summer on land areas. Males and barren female bears may intermittently den up during the winter, possibly when they are well fed or during extremes of winter darkness and weather.

Recommendations:

Continued abstracting of information should be carried on until facilities are exhausted in Alaska. Since libraries in Alaska have such limited facilities, work in a more complete "outside" library might fill some of the gaps in the existing information. Further efforts should be made to obtain additional European literature, particularly the Russian, German, and Scandinavian. Money should be made available for translation as required.

Field projects on the ringed seal and polar bear in Alaskan waters should be initiated to evaluate the relationships suggested in the literature.

Final elucidation of polar bear movement patterns will require international cooperation and intensive field investigations involving a capture and marking program and other such techniques.

Prepared by:

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30 June, 1960

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James W. Brooks, Director
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Volume 1 Report No. G-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 1 (Part 1) Title: Pelt Primeness Study (Interior Alaska)

Period Covered: October 1, 1959 - June 30, 1960

Objectives:

The objectives of this job as stated in the plans, specifications and estimates were: To determine by area when fur animals are prime and of maximum market value.

Procedures:

This portion of the pelt primeness study report concerns the interior of Alaska, specifically the Lake Minchumina area. During a two year period mink and marten were trapped prior to the regular trapping season in order to obtain pelts from these animals that could be used in determining the average date that the fur of these species becomes prime. An experienced trapper was hired and asked to trap in a regular manner for a period of approximately one month prior to the beginning of the trapping season started on November 16 during each of the two years and the same individual was employed to do the trapping during these two periods. A total of 21 mink were caught, 10 in 1959 and 11 in 1960. A total of 22 marten were trapped during this same period, 15 in 1959 and 7 in 1960. The pelt from each animal caught was tagged and given a field number. The date caught, sex, weight, species, the trapper's name, the area trapped was recorded on each field tag. In addition the carcasses of these animals were saved and tagged in a similar manner.

The mink pelts were graded on the basis of leather primeness and fur primeness. The following criterion was used:

Fur Primeness:

A. The degree of development of the underfur.

B. The degree of development of the guard hair.

C. Color.

1. Presence or absence of characteristic luster.

2. Presence or absence of reddish color or singed guard hairs.

Leather Primeness:

In order to be considered prime, the flesh side of a pelt must have a creamy white appearance and be largely free of blue color, blotches, and dark spots.

In order for pelts to be considered fully prime, they must be both fur prime and leather prime. Pelts that are not fur prime have comparatively short sparse underfur and guard hair that does not extend appreciably beyond the under fur. The fur of unprime pelts also appears drab and reddish and lacks luster. Singed fur is characteristic of pelts that are past prime.

Because a gradation from totally unprime to prime was noted, three stages of fur pelt primeness was recorded - flat, marginal, and prime. The marginal group was recognized because it definitely did not belong in the "flat" group and it did help in establishing the date that these furs become prime and the rate at which the change from unprime to prime took place.

The method used in grading the mink furs in this report was suggested by Mr. Loren Croxton, Graduate Student, University of Alaska. Mr. Croxton assisted in grading the fur and was primarily responsible for the final grouping used.

The mink pelts included in this report were also examined on two separate occasions by the Seattle Fur Exchange. Each pelt was graded in reference to its merchantable value.

Findings:

Mink

The fur primeness data obtained from the ten mink collected during the fall of 1958 and the eleven mink collected during the fall of 1959 prior to the regular trapping season in the Lake Minchumina area is recorded in Table 1. Although the total sample for these two years is small, these data do indicate that the mink fur in this area starts becoming prime during the latter part of October. In 1958 the first mink pelt that was considered prime was caught on October 27. In 1959 the first prime pelt was obtained on October 23. These data also indicate that the majority of the animals in the population sampled become prime at about the same time. In other words, there appears to be little overlap in unprime and prime pelt conditions.

As indicated in the procedure section, the pelts of the animals obtained were graded on the basis of leather primeness as well as fur primeness. Although a gradation from a dark black or blueish color in unprime pelts to a creamy white color in prime pelts was evident, it was not possible to divide the degree of leather primeness into more than two groups, prime and unprime. The data obtained for leather primeness is recorded and compared with that for fur primeness for each of the two years in Table 2. The grade given each pelt by the Seattle Fur Exchange on two separate occasions is listed in Table 3.

These data indicate that mink pelts become fur prime a few days prior to the time that they become leather prime. This is apparently recognized in the fur trade. These data also indicate that mink fur in the Lake Minchumina area becomes completely prime, both from the standpoint of fur and leather primeness, by about November 1.

Marten

A total of 22 marten pelts were obtained and examined during the study period. Fifteen during the fall of 1958 and seven during the fall of 1959. The dates of capture in 1958 ranged from October 21 to November 13 and from October 24 to November 12 in 1959. All of these pelts were prime.

Table 1. Mink pelt primeness data for two consecutive years collected prior to the regular trapping season in the Lake Minchumina area.

1958						1959					
			Degree of Primeness								
Specimen Number	Date Caught	Sex	Flat	Marginal	Prime	Specimen Number	Date Caught	Sex	Flat	Marginal	Prime
1	Oct. 13	♂	X			11	Oct. 19	♀		X	
2	Oct. 15	♂	X			12	Oct. 23	♂			X
3	Oct. 16	♂	X			13	Oct. 24	♀			X
4	Oct. 17	♀	X			14	Oct. 26	♀			X
5	Oct. 20	♀		X		15	Oct. 28	♂			X
6	Oct. 26	♀		X		16	Nov. 1	♂			X
7	Oct. 27	♀			X	17	Nov. 3	♂			X
8	Oct. 28	♂			X	18	Nov. 4	♀			X
9	Nov. 2	♀			X	19	Nov. 5	♀			X
10	Nov. 9	♀			X	20	Nov. 10	♂			X
						21	Nov. 15	♂			X

Table 2. Mink fur and leather primeness data for two consecutive years collected prior to the regular trapping season in the Lake Minchumina area.

	Year	Date Furs Became Prime
Fur Primeness	1958	Oct. 27
Fur Primeness	1959	Oct. 23
Leather Primeness	1958	Nov. 2
Leather Primeness	1959	Nov. 1

Table 3. Fur grades assigned to pelts by the Seattle Fur Exchange on two separate occasions, Interior Alaska - 1958, 1959.

Pelt No.	Date Trapped	Grade (1)	Grade (2)
1F	10/13/58	4, TE	4, TE
2F	10/15/58	4, TE	4, TE
3F	10/16/58	4, TE	4, TE
4F	10/17/58	4, TE	4, TE
5F	10/20/58	4, TE	4, TE
6F	10/26/58	2, SE	2, SE
7F	10/27/58	2, SE	2, SE
8F	10/28/58	1, P	2, SE
9F	11/ 2/58	1, P	1, P
10F	11/ 9/58	1, P	1, P
11F	10/19/59	4, TE	4, TE
12F	10/23/59	1, P	1, P
13F	10/24/59	2, SE	2, SE
14F	10/26/59	1, P	2, SE
15F	10/28/59	2, SE	2, SE
16F	11/ 1/59	3, S	2, SE
17F	11/ 3/59	1, P	2, SE
18F	11/ 4/59	3, S	1, P
19F	11/ 5/59	1, P	1, P
20F	11/10/59	1, P	1, P
21F	11/15/59	1, P	1, P

Note: P - Prime
SE - Slightly early
TE - Too early
S - Singed

Summary:

During a two year period mink and marten were trapped prior to the regular trapping season in the Lake Minchumina area, Interior Alaska. The pelts from the animals captured were examined in an attempt to determine the average date that this fur becomes prime. Both fur primeness and leather primeness were taken into consideration. Three stages of fur primeness were recorded - flat, marginal, and prime. Only two stages of leather primeness were recorded - unprime and prime.

The dates obtained indicate that the mink fur starts becoming prime during the later part of October and that they become leather prime a few days after becoming fur prime. In addition there was little overlap between prime and unprime conditions in time. In other words, the bulk of the animals were either prime or unprime at any given time.

The fur graders at the Seattle Fur Exchange graded the fur in about the same manner as the project workers. The fur graders did record some of the fur as being "singed", a characteristic that should not show up in animals captured early in the fall.

Conclusions:

Although the total sample from which the pelt primeness information was obtained, was small, these data do indicate that mink fur in the Lake Minchumina area becomes prime, both from the standpoint of fur primeness and leather primeness, about November 1. Marten fur becomes prime prior to mink in this area.

Recommendations:

Since the season dates for these two species are generally made to coincide, these dates should be selected based on the pelt primeness data for mink. Based on the data obtained during the study the trapping season in the Interior could be opened as early as November 1.

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30 June 1960

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Volume 1 Report No. G-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 1 (Part 2) Title: Pelt Primeness Study (Southeastern Alaska)

Period Covered: October 1, 1959 - April 30, 1960

Abstract:

Forty-eight mink were collected between November 21, 1959, and January 27, 1960, from near Beecher Pass, located 18 miles south of Petersburg in Southeast Alaska. Two additional mink were collected during the land otter season in March, 1960. Pelts attained leather primeness about December 1, and remained prime throughout the balance of the study period. Fur showed consistently good quality about December 10, and began showing signs of deterioration after January 1. No noticeable difference was observed in male and female mink. Seventeen pelts showed some incidence of singeing, of which 76.5 percent occurred before December 15. The maximum value of mink pelts, considering market demand, fur quality and leather primeness, was from December 1, 1959, to January 1, 1960, inclusive.

Objectives:

To determine by area when fur animals are prime and of maximum market value.

Techniques:

A professional trapper was engaged by the Department to trap mink in the vicinity of Beecher Pass, 18 miles south of Petersburg, in Southeast Alaska. Special care was taken to obtain permission from trappers before mink were removed from trap lines. Trapping commenced on November 21, 1959, and continued through December 31, 1959. An additional ten pelts, taken from the same locality, were purchased from trappers during the regular trapping season in Southeast Alaska, which was open for mink from January 1, 1960, through January 31, 1960. Each pelt and carcass was tagged and numbered. The sex, date of capture, location, measurements and field number were recorded on each tag. Carcasses were sent to the Cooperative Wildlife Research Unit at the University of Alaska for further study.

After collecting and properly marking the furs they were sent to College, Alaska, where they were examined by Loren Croxton, a graduate student at the University of Alaska engaged in research on mink in Southeast Alaska, and by Elmer Norberg, Research Biologist, Alaska Department of Fish and Game, who was supervising the Pelt Primeness Study in the interior region of Alaska. When the furs were returned, they were examined by two local Petersburg trappers and by James R. Leckley, manager of the Experimental Fur Farm located near Petersburg. The pelts were then sent to the Seattle Fur Exchange where Mr. Michael Dederer, President, obligingly agreed to have them graded according to their commercial value. Pelts were classified as prime (proper, seasonable goods), slightly early, singed, sick or late caught mink and pelts which were taken too early to have any merchantable value. When the pelts were returned from the Seattle Fur Exchange they were carefully graded by the author. Some discrepancies were noted in pelts classified as singed and the pelts were returned to the Seattle Fur Exchange where they were graded a second time. The pelts were then again graded by the author, assisted by David R. Klein, Research Biologist, Alaska Department of Fish and Game, and each pelt given a numerical grade on a scale of four (one being a good, seasonable pelt and four being non-merchantable) on the basis of the quality of the fur and the primeness of the leather. Due consideration was given to the comments of all previous graders. The final grades, as well as the quality of the fur, primeness of pelt and the sex of the animal, were then correlated with the date of capture to determine the time at which mink pelts were in their optimum condition for the locality checked.

Findings:

Tables 1 and 2 show the quality of the fur, primeness of leather and the final grade assigned each pelt observed in the study. Table 3 gives the grade assigned each pelt by the Seattle Fur Exchange on two separate occasions. All pelts

Table 1. Quality of fur, leather primeness, and final grades of female mink taken in pelt primeness study - Southeast Alaska. November 21. 1959 - January 20, 1960.

Pelt No.	Date Trapped	Quality of Fur	Leather Primeness	Final Grade
1	11/21/59	F, SS	SE	4
2	11/21/59	F	TE	4
4	11/21/59	S	SE	3
6	11/27/59	SS	P	2
8	11/28/59	SS, SF	SE	3
9	11/28/59	SS, F	SE	4
10	11/29/59	SS, F	SE	4
12	11/30/59	F, M	TE	4
13	11/30/59	SS	P	1
15	12/ 7/59	SS	P	2
17	12/10/59	G	P	1
19	12/12/59	SS	SE	2
21	12/14/59	G	P	1
22	12/15/59	G	P	1
23	12/17/59	S	SE	3
26	12/22/59	G	P	1
28	12/23/59	F, M	P	3
33	12/28/59	SR	P	2
35	12/29/59	M	P	4
38	12/31/59	G	P	1
39	12/31/59	G	P	1
14A	Jan.,1960	SR	P	2
16A	Jan.,1960	G	P	1
17A	1/ 5/60	R, brown	P	2
20A	1/20/60	G	P	1

Note:

Fur Quality

F - Flat
SF - Slightly flat
S - Singed
SS - Slightly singed
R - Rough
SR - Slightly rough
M - Matted underfur
G - Good quality

Leather Primeness

P - Prime
SE - Slightly early
TE - Too early

Table 2. Quality of fur, leather primeness, and final grades of male mink taken in pelt primeness study - Southeast Alaska. November 21, 1959-January 27, 1960.
(Two mink included which were taken incidental to land otter season in March and April)

Pelt No.	Date Trapped	Quality of Fur	Leather Primeness	Final Grade
3	11/21/59	G	P	1
5	11/26/59	SF	TE	3
7	11/27/59	S, F	TE	4
11	11/29/59	SS	P	2
14	12/ 1/59	G	SE	1
16	12/ 8/59	S, SF	SE	3
18	12/11/59	SR	P	1
20	12/12/59	S	P	3
24	12/18/59	G	P	1
25	12/20/59	G	P	1
27	12/23/59	G	P	1
29	12/24/59	SR	P	1
30	12/24/59	G	P	1
31	12/25/59	SS	SE	2
34	12/28/59	F, M	P	3
36	12/30/59	G	P	1
37	12/30/59	G	P	1
15A	Jan.,1960	G	P	1
18A	1/ 5/60	SS, R	P	2
19A	1/15/60	SR	P	1
21A	1/24/60	SS, SR	P	2
22A	1/24/60	SR	P	2
23A	1/27/60	Short	P	3
83	March,1960	Short	P	3
84	March,1960	R, Brown	P	3

Note:

Fur Quality
- F - Flat
- SF - Slightly flat
- S - Singed
- SS - Slightly singed
- R - Rough
- SR - Slightly rough
- M - Matted underfur
- G - Good quality

Leather Primeness
- P - Prime
- SE - Slightly early
- TE - Too early

Table 3. Fur Grades assigned by The Seattle Fur Exchange on two separate occasions to mink pelts taken in pelt primeness study, Southeast Alaska - 1959-60.

Pelt No.	Date Trapped	Grade (1)	Grade (2)	Pelt No.	Date Trapped	Grade (1)	Grade (2)
1	11/21/59	4, TE	4, TE	26	12/22/59	1, P	1, P
2	11/21/59	4, TE	4, TE	27	12/23/59	1, P	3, S
3	11/21/59	1, P	1, P	28	12/23/59	3, Sick	3, R
4	11/21/59	2, SE	2, SE	29	12/24/59	1, P	1, P
5	11/26/59	2, SE	2, SE	30	12/24/59	1, P	3, S
6	11/27/59	1, P	1, P	31	12/25/59	2, SE	2, SE
7	11/27/59	4, TE	4, TE	33	12/28/59	3, S	3, R
8	11/28/59	2, SE	2, SE	34	12/28/59	3, M	3, M
9	11/28/59	4, TE	4, TE	35	12/29/59	3, M	3, M
10	11/29/59	4, TE	4, TE	36	12/30/59	1, P	1, P
11	11/29/59	1, P	1, P	37	12/30/59	1, P	1, P
12	11/30/59	4, TE	4, TE	38	12/31/59	1, P	1, P
13	11/30/59	1, P	1, P	39	12/31/59	1, P	1, P
14	12/ 1/59	1, P	1, P	14A	Jan.,1960	3, S	3, R
15	12/ 7/59	3, S	3, S	15A	Jan.,1960	1, P	1, P
16	12/ 8/59	2, SE	2, SE	16A	Jan.,1960	3, S	3, R
17	12/10/59	1, P	1, P	17A	1/ 5/60	3, S	3, S
18	12/11/59	1, P	1, P	18A	1/ 5/60	3, S	3, S
19	12/12/59	2, SE	2, SE	19A	1/15/60	1, P	3, S
20	12/12/59	1, P	1, P	20A	1/20/60	1, P	3, S
21	12/14/59	3, S	1, P	21A	1/24/60	1, P	3, R
22	12/15/59	1, P	1, P	22A	1/24/60	1, P	3, S
23	12/17/59	2, SE	1, P	23A	1/27/60	3, S	3, S
24	12/18/59	1, P	1, P	83	March,1960		3, R
25	12/20/59	1, P	1, P	84	March,1960		3, S

Note: S - Singed; SS - Slightly singed; R - Rough; M - Matted underfur; P - Prime; SE - Slightly early; TE - Too early taken after November 30 were leather-prime with the exception of pelts Nos. 19, 23, and 31 which were classified as slightly early. Fur was at its best quality from December 10 through January 1, inclusive. Four pelts, Nos. 3, 6, 11 and 13, taken prior to December 1, were leather-prime and No. 3, a male mink taken on November 21, showed both good quality fur and leather-primeness. All other pelts taken before December 1 were classified as slightly early or too early to be merchantable. No significant difference was noted in time of primeness of male and female mink.

Pelts were graded on the basis of quality of the fur and primeness of the leather. Maximum market value is obtained only from pelts which exhibit both high quality fur and leather-primeness. The leather of an unprime pelt is usually thin and black in color, or dark with a bluish or greenish cast. As the pelt approaches a prime condition, the leather becomes thicker and lighter in color, finally becoming creamy-white in the prime pelt. The pelt first becomes prime anteriorly and proceeds progressively posteriorly. The tip of the tail is the last portion of the pelt to become prime. A pelt is considered essentially prime when the hide at the base of the tail and over the hind legs becomes creamy-white, even though the rest of the tail may still show some dark spots.

The quality of the fur is subject to many variables. A good quality fur must show proper development of both the underfur and the guard hair. It must also exhibit both characteristic color and luster. Factors which detract from the quality of the fur are flatness, roughness, matting, poor color and singeing.

Lack of depth is normally termed flatness. This condition is usually observed in early pelts on which the guard hairs have not attained full development. Flatness is sometimes observed in pelts which are otherwise prime and may be due to poor health, diet or rubbing. A flat pelt has little commercial value.

Roughness is normally a characteristic of a late caught pelt. When observed from above, the guard hairs tend to stand out and are intermeshed. Roughness is often associated with a brownish color, also a characteristic of late caught mink. Only two pelts taken during the period from December 1, 1959, to January 1, 1960 showed enough roughness to be significant.

Matting is a condition of the underfur and may be present at any time. A matted pelt is usually also flat in luster and is often associated with animals in poor health. Matting will also occur if mink become soiled with dirt or remain in the water too long after being trapped.

Probably the most important single factor generally considered to lower the quality of otherwise prime mink pelts in Southeast Alaska is singeing. On a singed pelt the tips of the guard hairs become rolled over and, when observed in the proper light, detract from the luster of the fur. The entire cause of singeing is unknown, however, in Southeast Alaska it is generally attributed to exposure to sun and wind in combination with alternate wetting and drying of the fur. Singeing is generally first noticed on the rump and at the base of the tail. In more severe cases it may be observed along the entire length of the back, usually being greatest along the midline. It is generally accepted in the fur trade that singeing is associated with late-caught mink. However, in the sample of 50 mink observed, including two males taken in March which showed poor quality, but not singed fur, 76.5 percent of the 17 pelts showing singeing were taken prior to December 15. More variation was noted in the characteristic of singeing than any other classification in the grading of pelts by various graders. Thirteen pelts were classified as singed in the process of two gradings by The Seattle Fur Exchange. Of these, only four pelts were graded as singed in both gradings. Six pelts were classified as prime in one grading and as singed in the other grading. Of 19 pelts classified as singed or slightly singed by the author, only two of these grades corresponded with that of The Seattle Fur Exchange. It was found that even a slight amount of singeing was easily noted if the pelt was held at a proper angle in good light and given a good shake to make the guard hairs stand out. These observations were checked several times by both Mr. Klein and the author and the incidence of error was found to be very small. The importance of singeing can be readily observed, for a pelt which would normally be graded as a one or two is lowered to a three or four if it is considered singed. Of the pelts observed in this study, only Nos. 4, 7, 16, 20 and 23 showed enough singeing to detract from their commercial value. Of these, only No. 20 exhibited leather-primeness, and only Nos. 16, 20, and 23 were taken after November 31. It is obvious in the present study that singeing in mink was of little consequence from December 15, 1959, to January 15, 1960. A fairly high incidence of slight singeing was noted both before and after this period, however, rarely enough to detract from the commercial value of the fur. At the beginning of the trapping season demand for pelts is greatest. Toward the latter portion of the season, demand slackens and buyers tend to grade pelts more critically. At this time pelts are more likely to be classified as singed. There is little doubt but that some fur buyers grade down pelts for alleged singeing to increase their margin of profit.

In Southeast Alaska the mink season should open as soon as pelts become reasonably prime to take advantage of the greater demand for early pelts by the buyers. An early season is usually favored by Southeast Alaskan trappers because of the generally milder weather conditions. Colder weather is usually associated with the months of January and February when smaller bays, sloughs, and streams often freeze causing trap mechanisms to become inoperative. High winds and stormy weather at this time of the year often make tending of traplines by small skiffs dangerous or impossible. In the locality of this study, the optimum opening date for the 1959-60 season would have been December 1. Fur was not quite at its best quality, but the greater demand for pelts more than compensated for the condition of the fur.

The findings of this report are based on information gathered from a specific locality of Southeast Alaska during the winter season of 1959-60. It must be recognized that this data may not be valid in another locality or under different weather conditions.

Recommendations:

Pelt primeness studies should be continued.

Samples of pelts should be obtained from several localities to determine influence of local conditions.

Trapping seasons should be set as early as mink pelts become reasonably prime to take advantage of the greater buyer demand and the generally milder weather conditions.

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Volume 1 Report No. G-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 2 Title: Beaver Management Investigations

Period Covered: September 15 to October 10, 1959

Abstract:

In order to evaluate beaver population levels and trends two techniques were employed, aerial counts of food caches and an analysis of harvest affidavits. Utilization of these two methods, one to supplement the other, appears to provide a satisfactory basis for managing beaver in Alaska. The harvest affidavits were analyzed for the entire State and the aerial counts were made in Wildlife Management Unit 24; the Koyukuk River drainage. Beaver are increasing in number in Management Unit 24 with the exception of the area around Huslia where a decrease was found. Indications from the affidavit analysis are that most Management Units are being cropped in a satisfactory manner with four exceptions. Units 7 and 15 appear to be overtrapped while Units 9 and 17 are undertrapped. Aerial counts should be conducted in the other major producing Units to supplement the affidavit analyses.

Objectives:

To continue annual estimations of beaver population levels and trends.

Techniques:

Two methods were employed to provide a basis for estimating beaver populations and trends. The first method utilizes an aircraft to make counts of food caches on transects and check areas. The second method is an analysis of harvest affidavits.

Aerial counts were made from October 1 to 6 in Wildlife Management Unit 24 and on the Chatanika River. These surveys were flown, as nearly as was possible, in the same manner they had been since 1953. The aircraft, a two place Champion 7GC, was flown at 500 feet above the surface and at 70 miles per hour indicated air speed. Fresh winter food caches within one fourth mile of each side of the plane were counted and plotted on a chart. (See Figures 1 and 2 showing the location of aerial transects, aerial check areas, in Wildlife Management Unit 24; and the Chatanika River). The writer served as pilot observer and Elmer Norberg as observer.

Harvest affidavits were sorted, tabulated, and analyzed to find the total take of beaver, average number per trapper, number of trappers with limits, and the number taken per size group; kits, yearlings, and adults.

Findings:

Table 1 presents a summary of data obtained by the aerial checks and the data found for previous years back to 1952.

Table 2 presents an analysis as obtained from the beaver affidavits.

The Chatanika River since 1954 has shown a steady downward trend from a high in 1954 of 56 colonies to a low this year of 36. This downward trend probably could be attributed to five main causes: Indiscriminate shooting by tourists, fishermen, etc., legal trapping, natural mortality, mining operations, and live trapping operations.

There is an increase in the number of food caches in all areas of Unit 24 with the exception of the Huslia check area and transect. The definite drop in this area probably is due to a fire that devastated approximately 8/10 of the transect and 1/3 of the check area in 1958. The apparent increase in the rest of the areas is partially due to the use of a more suitable aircraft for this type of work this year. The aircraft used flies at slower air speed and has better visibility. In addition, the unusually cold temperatures during the last half of the season last year probably resulted in less trapping pressure. In any case, the data seem to indicate a healthy beaver population.

The 1959 beaver affidavits were tabulated and the results are compared with those of 1957 and 1958 in Table 2. Using the

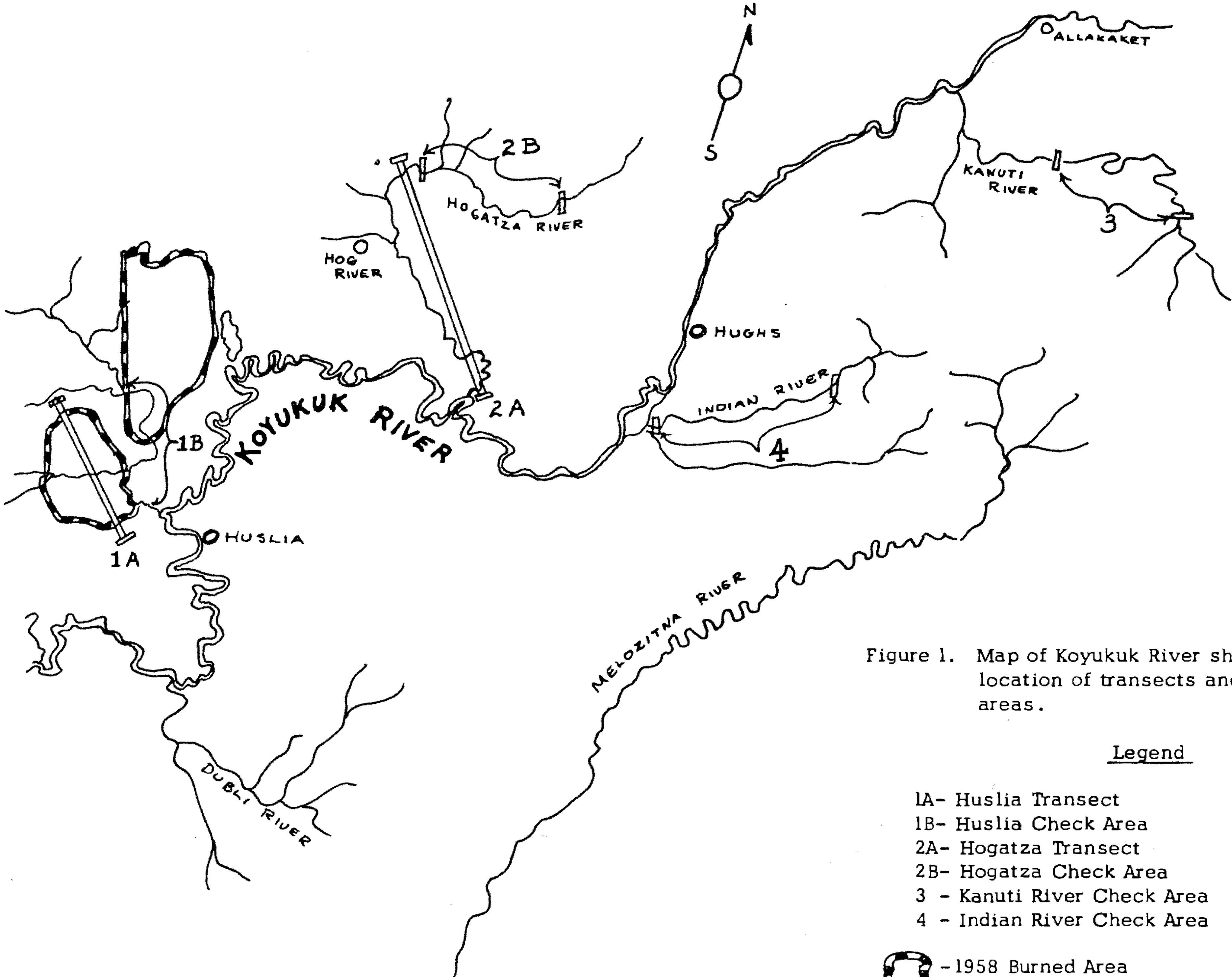

Figure 1. Map of Koyukuk River showing location of transects and check areas.

Legend

1A- Huslia Transect
1B- Huslia Check Area
2A- Hogatza Transect
2B- Hogatza Check Area
3 - Kanuti River Check Area
4 - Indian River Check Area

-1958 Burned Area

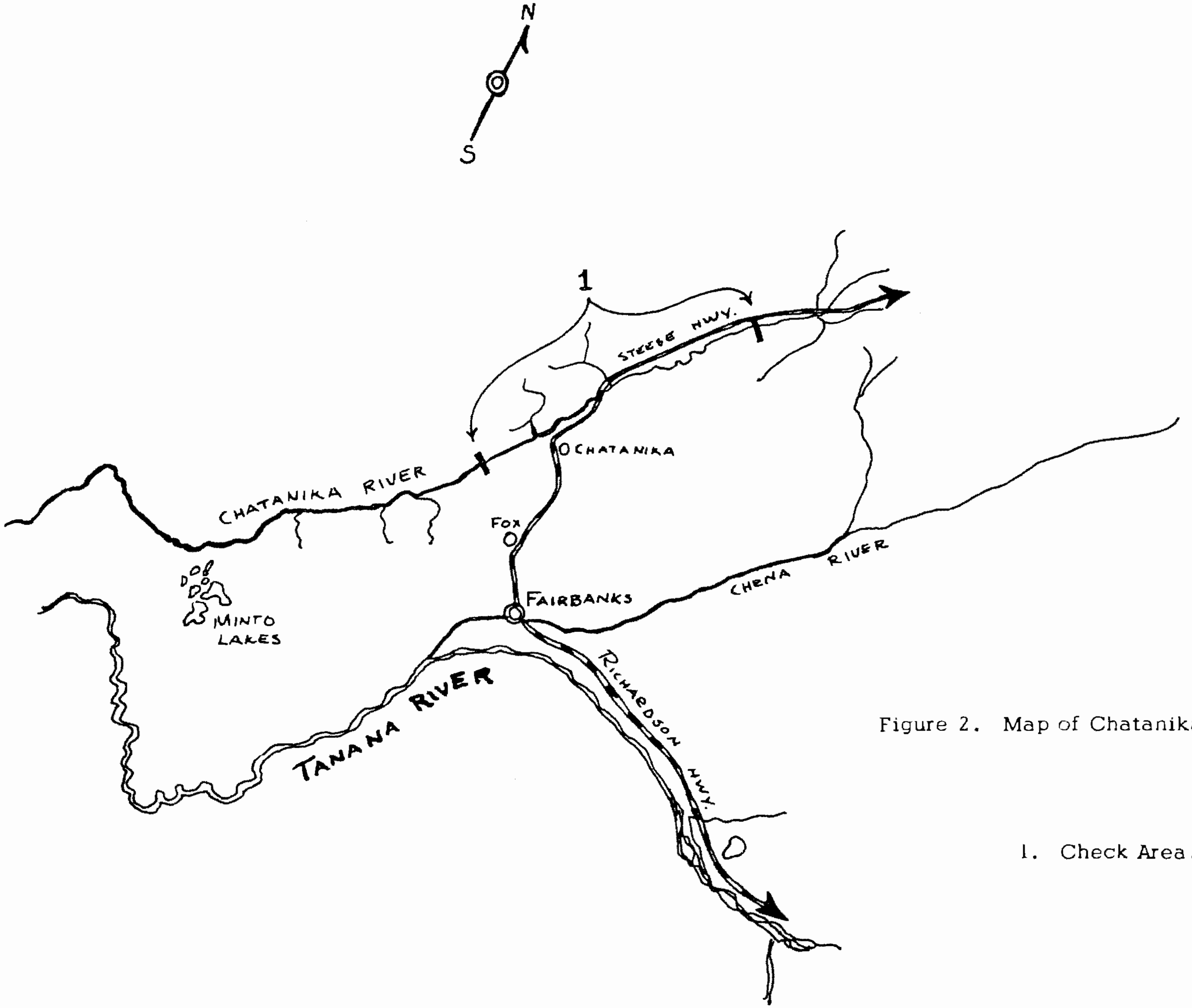

Figure 2. Map of Chatanika River Check Area

1. Check Area.

Table 1. Beaver Colonies on Check Areas and Transects Flown Since 1952.

		Number of Active Colonies							
Transects	Check Area	1952	1953	1954	1955	1956	1957	1958	1959
Hog River		26	21	34	29	18	36	34	55
Huslia River		21	15	37	14	19	16	not flown	3
	Hog River		39	23	19	35	38	32	41
	Huslia River		47	33	44	55	62	not flown	43
	Indian River		10	16	24	26	36	20	28
	Kanuti River		14	21	41	39	44	31	49
	Chatanika River		56	56	42	not flown	not flown	39	36

Table 2. Beaver Affidavit Analysis - 1957-1959.

Wildlife Mgmt. Unit	Date	Limit	% Kits	% Kits and Yrlings.	% Adults	# of Beaver	# of Trappers	# of Trappers w/Limits	% of Trappers w/Limits	Ave. No. Beaver/ Trapper
1	1957	No open season								
	1958	15	24.84	35.75	64.25	330	38	5	13.16	8.68
	1959	15	24.63	37.67	62.33	69	8	2	25.00	8.62
2	1957	No open season								
	1958	15	22.73	36.36	63.74	22	10	0	0.00	2.20
	1959	15	22.22	37.03	62.97	27	2	0	0.00	13.50
3	1957	No open season								
	1958	15	0.00	0.00	100.00	115	13	5	38.46	8.85
	1959	15	6.25	6.25	93.75	16	3	0	0.00	5.33
* 6	1957	20	24.08	40.00	60.00	245	16	7	43.80	15.31
	1958	20	12.88	28.03	71.97	264	15	9	60.00	17.60
	1959	20	14.28	20.23	79.76	168	11	3	27.27	15.27
7	1957	20	22.66	47.99	52.01	75	14	0	0.00	5.36
	1958	20	15.74	34.84	65.16	89	18	1	5.6	4.94
	1959	20	34.09	52.27	47.73	44	8	0	0.00	5.50
8	1957	15	23.57	32.86	67.14	140	15	6	40.00	9.33
	1958	20	21.28	35.74	64.26	235	24	6	25.00	9.79
	1959	20	22.72	40.90	59.10	154	12	3	25.00	12.83
9	1957	15	16.95	25.94	74.06	1,469	138	44	31.90	10.64
	1958	15	22.44	34.17	65.83	1,515	141	59	41.80	11.00
	1959	15	23.94	34.72	65.28	1,975	170	74	43.52	11.61

Table 2. Continued

Wildlife Mgmt. Unit	Date	Limit	% Kits	% Kits and Yrlings.	% Adults	# of Beaver	# of Trap- pers	# of Trappers w/Limits	% of Trappers w/Limits	Ave. No. Beaver/ Trapper
* 11	1957	20	12.82	15.38	84.62	39	5	0	0.00	7.80
	1958	20	0.00	0.00	100.00	20	4	0	0.00	5.00
	1959	20	8.47	16.94	83.06	59	5	2	40.00	11.80
12	1957	5	2.83	13.21	86.79	106	40	7	17.50	2.65
	1958	15	10.51	13.94	86.06	409	85	1	1.22	4.81
	1959	15	11.58	15.12	84.86	423	80	1	1.25	5.28
13	1957	20	20.00	28.48	71.52	165	24	2	8.30	6.88
	1958	20	12.93	22.46	71.54	473	59	3	5.10	8.00
	1959	20	16.36	28.30	71.70	385	37	4	10.81	10.40
14	1957	20	17.65	36.17	63.83	923	84	19	22.60	10.99
	1958	40	16.36	30.65	69.35	1,204**	96	4	4.20	12.58
	1959	40	27.20	50.69	49.31	647	49	0	0.00	13.20
15	1957	20	17.16	37.95	62.05	303	26	5	19.20	11.65
	1958	40	16.39	27.50	72.50	360	30	2	6.70	12.00
	1959	40	29.76	46.42	53.58	168	15	0	0.00	11.20
16	1957	20	19.35	41.93	58.07	62	5	2	40.00	12.40
	1958	40	13.68	25.70	74.30	1,148**	45	16	35.60	25.51
	1959	40	22.09	39.69	60.29	1,715	72	19	26.38	23.81
17***	1957	10	22.89	36.79	63.21	367	46	23	50.00	7.98
	1958	15	19.12	33.02	66.98	3,165***	263	116	44.10	12.02
	1959	10	19.63	29.42	70.58	3,245	369	243	65.80	8.79

Table 2. Continued

Wildlife Mgmt. Unit	Date	Limit	% Kits	% Kits and Yrlings.	% Adults	# of Beaver	# of Trappers	# of Trappers w/Limits	% of Trappers w/Limits	Ave. No. Beaver/ Trapper
18	1957	No open season								
	1958	No open season								
	1959	10	31.20	45.08	54.92	2,766	357	165	46.21	7.74
19	1957	15	12.53	24.84	75.16	2,218	200	109	54.50	11.09
	1958	20	15.52	23.96	76.04	3,852	256	103	40.20	15.05
	1959	20	16.31	29.32	70.68	4,034	284	111	39.08	14.20
20	1957	15	8.91	16.59	83.41	651	74	24	32.40	8.80
	1958	20	8.67	19.74	80.26	1,869	152	47	30.90	12.30
	1959	20	4.10	17.70	82.30	1,242	119	28	23.52	10.43
21	1957	15	12.33	23.41	76.59	5,460	490	210	42.80	11.14
	1958	20	11.03	22.61	77.39	6,871	499	179	35.90	13.77
	1959	20	12.68	26.23	73.77	5,771	425	136	32.00	13.57
22	1957	No open season								
	1958	10	45.24	54.76	45.24	42	10	1	10.00	4.20
	1959	10	18.75	35.41	64.59	48	14	1	7.14	3.42
23	1957	15	0.00	0.00	100.00	5	1	0	0.00	5.00
	1958	No open season								
	1959	15					0			
24	1957	20	8.21	22.01	77.99	1,486	96	43	44.70	15.48
	1958	25	6.17	23.19	76.81	1,841	105	37	35.20	17.53
	1959	25	6.76	17.63	82.37	1,434	97	21	21.64	14.78

Table 2. Continued

Wildlife Mgmt. Unit	Date	Limit	% Kits	% Kits and Yrlings.	% Adults	# of Beaver	# of Trappers	# of Trappers w/Limits	% of Trappers w/Limits	Ave. No. Beaver/ Trapper
25	1957	15	21.74	31.58	68.42	630	77	18	23.30	8.18
	1958	15	25.92	37.12	62.88	625	77	15	19.50	8.12
	1959	15	21.10	38.34	61.66	725	86	17	19.76	8.43
Totals	1957		13.79	25.80	74.20	14,344	1,351	519	38.40	10.62
	1958		14.15	26.15	73.85	24,484	1,940	609	31.40	12.62
	1959		17.88	30.96	69.04	25,115	2,223	830	37.33	11.29

* No open season, either 1957, 1958 or 1959 in Units 4, 5, 10, and 26.

** Some Anchorage and Kenai trappers trapped in Unit 16. These were recorded under Unit 14 in 1957.

*** Part of Unit 17 closed in 1957 and 1958.

arbitrary standards of relative abundance of beaver from the affidavit analysis as described by Libby,[1] it would appear that Units 7 and 15 are overtrapped whereas Units 9 and 17 are undertrapped. The rest of the Units appear to be harvested in keeping with the limits. The two Units that appear to be overtrapped are relatively unimportant as they represent only 23 trappers and a catch of 212 beaver or an insignificant quantity of the total catch for the State in 1959.

Recommendations:

The analysis of affidavits is a very useful index to beaver management but for an accurate and true picture, additional data are necessary. These data can be obtained by the use of aerial transects and check areas as has been done in Unit 24 where we have a much better picture of the available harvest.

Aerial transects and check areas should be established in the other major producing Units in order to obtain data as to the available harvest as well as the actual harvest information obtained from affidavit analysis.

[1]Libby, Wilber L.
1954. A Basis for Beaver Management in Alaska. Thesis, University of Alaska.

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1 January 1960

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Volume 1 Report No. G-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 3 Title: Study of Factors Affecting Production of Beaver in the Upper Tanana Valley

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

The analysis of beaver trapper success for this area has revealed conditions below average and therefore deserving investigation. The project must be approached from both a biological and a sociological viewpoint, since a marginal native economy is involved. The first year's work was devoted primarily to background investigations, developing a familiarity with the area and the problem, setting up aerial transects and sampling beaver abundance, and in preparing for intensive field studies in 1960-61.

Objectives:

To conduct an ecological study in the area of the Tetlin Indian Reservation to determine what factors are responsible for the previously poor production of beaver in that area.

Techniques:

For information concerning the abundance and distribution of the beaver, aerial transects, summer field work with additional aerial surveys, and trapper interviews were employed. The latter involved personal contact with as many trappers as possible so that they might be plotted on maps, with the location of their traplines and the lodges present.

A habitat study was initiated in two areas: one where trapping pressure is heavy and concentrated, another where little trapping is done, to serve as a control. Under consideration were food preferences and requirements, terrain, water and its fluctuations, ice conditions, and other factors.

Findings:

The Upper Tanana beaver problem is primarily one of management significance. The distribution and abundance of the beaver and their subsequent harvest is a function of the local residents engaged in the trapping of furbearers. These people are natives with centers of population at the towns of Tanacross, Tetlin, and Northway. Prior to 1955, the people of this area complained about the poor trapping and requested that the limit allowed each trapper be reduced from ten to five. A short survey was made to investigate the situation, and on the strength of this the change was made for the 1955 season and maintained through 1957. Analysis of the beaver affidavits from each trapper has revealed poor trapping success, as few people have been able to fill their limits. Also a low average number of beaver per trapper is common.

Since the problem is in a sense created by and in reference to man, a study of the relationships between man and the animal is necessary. Interview in many cases is the only method for the determination of historical data, and this allows for great error especially when dealing with natives. An analysis of this information is being made, however, which may very well strengthen determinations of a biological nature.

The summer months of 1959 were spent in preliminary investigations as to the nature of the problem. At this time general information on beaver abundance, activity, and food habits was recorded, while the investigator was employed on another project. A review was made of the game laws regulating the harvest of beaver from 1925 to the present, and these are being examined for possible influence upon the past harvest.

Study areas were designated around the three towns of Tanacross, Tetlin, and Northway and transect lines located for a fall aerial census which took place on the 26th, 27th, and 28th of September, 1959. Live colonies were recorded as bank or lodge to determine if a preference exists. Dead lodges and other data were also noted.

March 9 through 12 was spent in the field to observe trapping patterns over the area and to assist in sealing pelts for a close look at the harvest. The beaver trapping season was then in its second and final month.

An analysis of beaver affidavits from 1949 to the present yielded some interesting information concerning the fluctuations in past trapping success, and this will be reported upon in detail in a subsequent project segment.

As an interesting sidelight, the political and legal status of the Tetlin reservation relative to control of game and trespass is under investigation.

Recommendations:

Field work should be continued for another year as outlined above.

Prepared by:

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30 June 1960

Approved by:

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ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 4 Title: Southeastern Mink Management Studies

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

Mink management in coastal southeastern Alaska was studied from June 1, 1959 to January, 1960. Mink summer along rivers and streams and in upland muskegs, but they winter in a narrow beach zone. Present trapping removes more than the harvestable surplus with trapping on yearly basis but not if restricted to alternate years. Optimum harvest can be sustained on yearly basis if only surplus is taken. Illegal trapping is widespread. A few mink were caught and tagged; live-trap mortality was nearly eliminated with an all-wood protective trap. Full pelt primeness was reached by December 10 and extended to mid-January. Recommendations include December 10 to January 10 trapping seasons in alternate years only, registered trap lines, and sealing of pelts.

Objectives:

To determine the sex and age composition of the mink populations; movements, population and reproductive habits of the mink in southeastern Alaska to be used as an index of population changes, as an aid in developing census methods, and in order that harvest data can be evaluated. To determine the population dynamics and social relationships of mink introduced into unoccupied habitat.

Techniques:

Mink populations were studied in coastal southeastern Alaska during 1959 and 1960, with the following intervals devoted to field work: February 12 to February 27, 1959; June 1 to September 3, 1959; and January 1 to February 8, 1960.

Live-trapping and tagging were carried on along the beaches, using a specially designed wooden live-trap. Pelt and carcass specimens were obtained from local trappers for age, sex, and primeness studies. Other data regarding trapping pressures and harvest rates were obtained by questionnaires and trapper interviews. Life history observations and collections were made in the various mink habitat types throughout the study.

A detailed report in thesis form was prepared and is on file at the Alaska Cooperative Wildlife Research Unit.

Findings:

Trapping and tagging. A total of 30 captures was recorded during the 1959 summer live-trapping and tagging program involving 26 different mink. Four of the captures were females, and two were juveniles. Only four recaptures were made. A female was recaptured once in the trap in which it was originally caught and was caught a second time in a set approximately 100 yards from the site of the original capture. A female was recaptured 40 yards from the site of the original capture, and one male was recaptured 16 yards from the site of the original capture. Two of the females captured showed no evidence of nursing; two had active mammae; one showed three active mammae; and one had five mammae that were active.

An extensive survey of the area showed that during the summer months the muskeg areas, the streams, and the rivers of the area are utilized by mink.

An all-wood live-trap sharply reduced trap mortality of the captured animals. Only one mink died in a trap. The all-wood trap was found to be superior to the collapsible all-wire trap in all respects except for its weight and bulkiness. In this study where all trapping was conducted along the beaches and all travel was accomplished by skiff, these factors were not objectionable.

Two tagged animals were taken during the commercial trapping season. Both of the returns were from the Castle Islands and showed no appreciable movement from the site of tagging.

Dens. Five natal den sites were located--three on Castle Island and two along the bank of the Castle River, approximately one-half mile from the mouth of the river. Observations indicate that the more suitable areas for mink are the rocky, fairly steep beaches, and the points of land extending out from the beach. It is the broken, rugged shore line, rather than the more open, longer, sloping beaches, that affords the more suitable habitat. Three such areas--16 miles of beach at Tokeen Bay, Koscuiska Island; 18 miles at Barrier Bay, Prince of Wales Island; and 14 miles at Salmon Bay, Prince of Wales Island--produced a total catch of 636 mink, an average of 13.2 mink per mile of beach.

The shore areas above such beaches contain many suitable den sites such as crevices in rocks, rock piles, natural and constructed holes beneath trees and stumps. Many such sites that had been used as winter den sites were located. Three such sites that had been used as natal den sites were located on Castle Island. One natal den was found on a rocky point between two small islands. It was located six yards above the high tide mark and occupied an abandoned squirrel den beneath a large spruce stump. Another natal den was found occupying a natural cavity in a rocky bluff overlooking a small inlet. The third active den was located within 500 yards of the cabin occupied as summer living quarters by the investigator. It occupied a natural crevice at the base of a small rocky cliff near an extensive sea urchin bed. The den area was littered with the remains of many meals of this invertebrate.

All of the natal dens were identifiable by the well worn trails leading to them, by the abundant fecal deposits, and by the inedible remains of many invertebrates in the immediate vicinity.

Food habits. One hundred stomachs from commercially trapped mink were analyzed for content. Seventy-nine per cent were found to be empty. Much of the contents were difficult, and in many cases impossible, to identify. Unlike the larger predators which consume their food in chunks or bolt smaller items whole, the mink thoroughly masticates what is eaten. This mastication plus the fact that much of their diet consists chiefly of the non-bony portions of various invertebrates makes specific identification of food items difficult.

During the winter months the mink of southeastern Alaska live on a narrow strip only a few yards in width along the beaches. They were frequently seen feeding on various forms of invertebrates during nocturnal low water. The various forms of invertebrate life that abound in this littoral zone form the bulk of their diet and probably remain quite stable in availability. Year-to-year fluctuations in food levels are probably slight. This stability plus the high productivity of the invertebrate population ensures that food, at least on the more suitable beaches, is not a limiting factor.

The low incidence of food found in the stomachs of trapped mink can probably be explained by the fact that the mink thoroughly masticates its food and the entire digestive process is a rapid one, being completed within one hour under confined conditions. Undoubtedly this digestive process is accelerated under the stress and excitement of being trapped. Another factor to consider might be that the majority of the animals were trapped while they were in the act of hunting food; quite probably many of them had not eaten prior to being caught.

Trapping harvest. An analysis of the commercial trapping returns from the 1956-1957, the 1957-1958, and the 1960 trapping seasons furnished data with which trapping effects were measured. An index based on the average number of trap days required per mink caught per mile of beach was used to measure trapping success during those years. This index increased from 326.6 trap days per mink caught per mile of beach in 1956-1957, an open season following a year of no trapping, to 524.2 in 1957-1958, an open season following a successful trapping year. It decreased to 351.6 for the 1960 season, one that followed a year of no trapping.

A test for correlation between the trap days per mile of beach and the number of mink caught per mile of beach showed that there was only slight, if any, correlation between these factors for the three seasons. Therefore, the 62.3 per cent increase in effort and the 46 per cent decrease in the total catch shown for the 1957-1958 season must have been due to the lower population density of mink during that season. It was therefore concluded that the high trapping pressures exerted on the mink populations of coastal southeastern Alaska are capable of reducing the mink populations to the extent that they cannot rebuild to their previous levels in one reproductive season, when trapping occurs in successive years.

Productivity. Three hundred and ninety-six carcasses collected from 34 trap lines during the 1960 season furnished data from which productivity and trapping pressures were determined for that year.

The age determination methods for skinned carcasses involved baculum conformation for the males and the presence or absence of zygomatic arch sutures and supra-sesamoid femoral tubercles for the females.

The following conclusions can be made if the catch is assumed to be an accurate sample of the pre-harvest population. A juvenile:adult female ratio of 271:100, when compared to known production of ranch mink, indicates high production during the reproductive season of 1959. The catch data show a preponderance of females and juveniles. A ratio of 72:100 for the juvenile male:juvenile female segment of the commercial catch indicates that differential mortality between the sexes had occurred prior to the trapping season; this plus the male: female ratio of 81:100 found in the total catch probably indicates that an even sex ratio did not exist in the population prior to the trapping season. High trapping pressures are indicated for the 1960 trapping season.

Recommendations:

Although this study was aimed principally at the management aspects of the southeastern Alaska mink fur industry, it has revealed many research, as well as management, problems that are in need of solution.

The complete life history of the mink of that region is still unknown. A better method of measuring trapping pressures is needed. One unaccomplished objective of this study was to transplant a number of live-trapped wild mink onto an unoccupied island. Much of the life history, as well as trapping pressure data and population sex ratios, could be gained by studying such an isolated mink population.

Calculations show that a higher harvest could be achieved on a yearly basis if trapping intensity were reduced to the degree that only the surplus animals were taken each year. It is suggested that registered trap lines combined with a pelt-sealing system might come closest to accomplishing this.

At the present time the practice of illegal trapping (trapping before and after the legal seasons as well as trapping during the years closed to trapping) is quite widespread in the relatively isolated southeastern mink areas. This situation could be alleviated by the initiation of a pelt sealing system and better enforcement of the trapping regulations.

The mink of coastal southeastern Alaska were found to reach a condition of full pelt primeness by December 10. This, plus the fact that mink from that region command their highest prices if caught before they become singed or lose much of their natural color, which occurs in early January, suggests that the mink trapping seasons be set to occur between the dates of December 10 and January 10.

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ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: G Fur Mammal Investigations

Job No: 5 Title: Sea Otter Abundance, Distribution, Movements and Composition Studies

Period Covered: July 1, 1959 to May 1, 1960

Abstract:

1. Aerial surveys indicate minimum sea otter populations of 200-250 animals in the Kayak-Wingham Island area, 850-1,300 in Prince William Sound, 1,000-2,000 in the Kodiak Archipelago, and 75-125 at Augustine Island. There were no sea otters observed between Cape Douglas and Cape Providence on the Alaska Peninsula.

2. Movements of otters appear to have occurred in all populations. Movements in the Kayak-Wingham Island area, may involve establishment in a new foraging area but those in Prince William are probably normal seasonal movements. Possible movements of sea otters between Shuak Island and the Barren Islands in the Kodiak Archipelago are suggested by survey data but are not understood.

3. Considerable variability in survey counts indicates that light aircraft such as the Pacer or Cessna 180 are much superior to the heavier Grumman Widgeon for sea otter surveys.

4. Recommendations include the continued protection of sea otters in the area covered by this report, and a repetition of surveys to provide a better understanding of movements in sea otter populations and to better determine the effectiveness of various aircraft for surveys.

Purpose:

Between 1956 and 1957 sea otter habitats in the Kodiak Archipelago along the Alaska Peninsula and in part of the Aleutian Islands had been surveyed by the Fish and Wildlife Service. During 1959 the Service planned to complete surveys in the Aleutians leaving only the Prince William Sound area unsurveyed. Consequently the Department of Fish and Game proposed to survey the Prince William Sound area, as well as the Kodiak Archipelago and part of the Alaska Peninsula where earlier survey results were believed unreliable. These surveys would thus complete a survey of all Alaska sea otter habitats and with the repetition of surveys in Prince William Sound, the most accessible area, would also provide information on movements of sea otters and on the reliability of various aircraft that have been used on surveys.

Objectives:

To determine the abundance, distribution, sex and age composition, and rate or tendency for dispersal of sea otters in Prince William Sound, in the Kodiak Archipelago, and along the Alaska Peninsula with its adjacent islands.

Procedure:

Aerial surveys were flown in the Kodiak Archipelago and from Augustine Island to Cape Providence on the Alaska Peninsula, July 22-30, 1959; in Prince William Sound, August 9-10, 1959 and April 9-12, 1960; and in the Kayak-Wingham Island area, August 7, 1959 and April 10, 1960. Chartered commercial aircraft were used on all flights.

In the Kodiak Archipelago surveys were conducted with a Piper Pacer piloted by Bill Harvey of Harvey's Flying Service; and in the Prince William Sound and Kayak-Wingham Island areas with a Cessna 180 and Grumman Super Widgeon piloted by Cal Ward, Ben Calhan or Jim Osborne of Cordova Airlines. All pilots except Osborne have had experience in flying wildlife surveys and all proved capable and cooperative. Characteristics of the aircraft used are summarized below:

Aircraft	Air Speed on Survey	Remarks
Pacer	95 m.p.h.	Maneuverable. Excellent visibility for pilot and

Aircraft	Air Speed on Survey	Remarks
		one observer and fair for a second observer.
Cessna 180	90 m.p.h.	Same as above.
Grumman Super Widgeon	110-115 m.p.h.	Less maneuverable than the preceding planes but the two engines provide a safety margin for offshore flying. Visibility is good for pilot and one observer. Communication is difficult for second observer.

Calvin J. Lensink was an observer and in charge of all flights. Other observers who assisted on one or more flights include Ralph Pirtle, Arthur Sheets, Paul Garceau, and Charles Wells of the Alaska Department of Fish and Game.

Survey flights were restricted to periods when good to optimum visibility conditions prevailed. Wind velocities greater than 10 knots or which produced marked chop on the water surface were considered substandard and caused cancellation of flights. Most surveys were flown during conditions under which the water was "mirror" calm. Sun glare from the water was the most adverse condition encountered.

All flights were conducted between 0800 and 1800 hours with fueling breaks at noon. This period for flights corresponds with normal foraging routines of sea otters and data from various time segments of flights should be comparable.

The routine flight path paralleled the shoreline at an altitude of 300 to 400 feet and at a distance of approximately 1/8 to 1/2 mile offshore, depending on the character of the shoreline and water depth. Large open water areas were generally crossed at an altitude of 400 to 600 feet to increase the area of visibility. Detours in the flight path were made to examine all small, off-shore rocks or islets and beds of kelp or to completely cover shallow areas of large bays. Detours were also made to examine all objects distantly visible on the water's surface that could not be identified from the normal flight path.

Population estimates are based on the premise that only 50 to 75 percent of animals present are observed under optimum survey conditions. That even this estimate may be conservative is suggested by the following observation:

1. Ground and boat surveys on Amchitka, Kanaga and Adak Islands indicate that pups may form from 15 to 22 percent of the population, but are seldom identified during aerial surveys.

2. Surveys are flown during active foraging periods when some otters are submerged.

3. Repeated discovery of even large groups of animals on a second passage over an area indicates that observers miss some animals although they are within the flight path.

4. Because of the vast areas involved the flight path covers only those areas where otter concentrations are to be expected. Animals well off-shore or those which occasionally come near the shore are thus not considered.

Previous surveys by the Fish and Wildlife Service within the area covered by this report which provide comparable data include boat and aerial surveys of the Kodiak Archipelago in 1957, an aerial survey of the Shuyak area of the Kodiak Archipelago in 1958, a boat survey of the Alaska Peninsula in 1957, and an aerial survey of Augustine Island in 1957. Lensink participated in all surveys with the exception of the aerial surveys of the Shuyak area in 1957 and 1958 and the Augustine Island area in 1957. The Prince William Sound and Kayak-Wingham Island areas had not been surveyed prior to the present investigation.

Findings:

Kayak-Wingham Island Area

The August 1959 surveys in the Kayak-Wingham Island area with a Cessna 180 resulted in a total count of 165 sea otters, whereas the April 1960 survey with a Grumman Widgeon accounted for only 97 animals. On the earlier surveys the majority of the animals (109) were found scattered along the Southeastern shoreline of Kayak Island and a large group of 52 in Controller Bay included most of the remainder. In April 1960, however, only three sea otters were encountered on all of Kayak Island but 82 were found in scattered groups in Controller Bay. Error in counting of animals in the large open water area in Controller Bay on the latter survey caused by lack of reference points for orientation as to area covered, and the greater fear reaction of animals to the larger, noisier plane, may in part account for the variation in survey totals.

During a survey of harbor seals with a Cessna 180 on April 29, 1959, a total of 94 sea otters was encountered at Kayak and Wingham Islands. Controller Bay was not covered, however, on May 1 about 50 animals were observed in the Bay from a boat, and were believed to have been missed on the aerial survey. The distribution change may thus not be merely a seasonal shift but rather a major shift in a foraging area though distances involved are from less than one mile to a maximum of 20 miles. Local fishermen have long known of the existence of sea otters at Kayak and Wingham Islands but are unanimous in their observation that sea otters were seldom encountered previously in Controller Bay.

The present population of sea otters in the Kayak-Wingham area probably numbers between 200 and 250 animals.

Prince William Sound

A total of 541 sea otters was counted in Prince William Sound on surveys with a Cessna 180 in August 1959 and 361 in April 1960 surveys with the Grumman Widgeon. As in the case of the Kayak-Wingham Island area, distribution changes had occurred in the interval between the surveys.

Nearly all sea otters present in Prince William Sound are found in the vicinity of Hinchinbrook, Montague, Green, Latouche, Elrington and Evans Islands although occasional strays may be observed far removed from population centers. The distribution of sea otters is clearly correlated with the amount of shallow water in which they can obtain food.

The most noticeable changes in distribution between the two surveys was a shifting of animals from Hinchinbrook and Montague Islands to the Latouche-Elrington Island area. The distribution change was not nearly so prominent, however, as that which occurred at Kayak Island and may have resulted from normal seasonal movements. Distances involved, however, are greater with minimum distance of travel at least eight miles in water too deep for foraging. Some otters probably moved as much as 35 miles.

Variation in total count was of approximately the same magnitude as occurred in the Kayak-Wingham Island area, and suggests the inadequacy of the Grumman Widgeon as a survey aircraft.

An estimate of a sea otter population of 850-1,300 animals in Prince William Sound is based on the August 1959 survey. Distribution of this population is indicated in the following summary:

Area	Counts	Estimates
Hinchinbrook Island	58	75-125
Montague Island	349	500-700
Green Island	42	125-175
Latouche-Elrington Island area	87	50-100
Other, including reports in unsurveyed areas	28	100-200
		850-1,300

Kodiak Archipelago

Aerial surveys of the Kodiak Archipelago in July 1959 with a Piper Pacer accounted for a total of 667 sea otters of which 395 were observed in the Shuyak Island area and 272 in the Barren Islands. No otters were seen in the Trinity Islands although reports which are considered reliable indicate the presence of animals in that area. The various reports, mostly by fishermen, were verified by Fisheries Research Institute Biologist Ronald Lopp who counted 15 animals at Sitkinak Island in 1957.

During boat surveys in June 1957, 94 otters were counted in the Shuyak area and 117 in the Barren Islands. The boat surveys were immediately followed by aerial surveys in a Super Cub from which FWS Refuge Manager Willard Troyer counted 281 animals in the Shuyak area and 234 in the Barren Islands, although coverage was incomplete in the latter area. In August 1958 aerial surveys Troyer counted 581 animals in the Shuyak area but did not survey the Barren Islands.

The discrepancy between the counts for the 1957, 1958, and 1959 aerial surveys of the Shuyak area (281, 581, and 395) strongly suggests movements by sea otters between Shuyak Island and the Barren Islands, a distance of 14 miles. If movements do not cause the discrepancy, the aerial surveys are considerably more variable in results than we suppose.

Estimates of the magnitude of the sea otter population in the Kodiak area must account for either movement or lack of movement between Shuyak Island and the Barren Islands and also for the uncertainty of observations on the Trinity and Chirikof Islands population. Thus the estimates of 1,000 to 2,000 animals in the total population as summarized below take both possibilities into consideration.

	Observation	Estimates
Shuyak Island	395-581	525-975
Barren Islands	272	350-450
Trinity and Chirikof Islands	14	100-400
	Rounded Total	1,000-2,000

Alaska Peninsula

During July 1959 surveys with a Pacer, 52 otters were seen at Augustine Island but the count was considered conservative because a boat had just been around the island and had caused an off-shore scattering of animals. In addition it was not possible to survey the adjacent mainland where animals have been reported. No sea otters were observed in the 180 mile area between Cape Douglas and Cape Providence.

The results of the 1959 survey largely confirm the results of the 1957 boat and aerial surveys. FWS Refuge Supervisor David L. Spencer counted 40 animals at Augustine Island but none on the adjacent mainland in aerial surveys with a Grumman Widgeon. As in 1959, no otters were seen in boat surveys of the area between Cape Douglas and Cape Providence, although satisfactory habitat is plentiful and expansion of adjacent populations into this area should soon occur.

The total population at Augustine Island probably numbers between 75 and 125 animals.

Recommendations:

1. Although sea otter populations in the region covered by this report appear to have increased rapidly in the last decade, there is still sufficient habitat for considerable expansion of the population, and there should be no change in the policy which now provides complete protection for animals in the area.

2. Surveys should be repeated in the Shuyak Island and Barren Islands to provide conclusive evidence of movements of sea otters between the two areas.

3. Surveys should be repeated in Prince William Sound and the Kayak-Wingham Island areas with both the Cessna 180 and the Grumman Widgeon to provide an index to the variability inherent in aerial census of sea otters and to determine how the type of aircraft used in surveys may affect counts. Present survey figures as summarized below suggest that variation in counts resulting from different types of aircraft used in surveys is significant.

Area Surveyed	Cessna 180	Grumman Widgeon	Percent Increase with Cessna
Kayak-Wingham Island	165	97	70
Prince William Sound	541	361	50
Augustine Island	52	40	30
	758	498	52

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Volume 1 Report No. H-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: H Snowshoe Hare Investigations

Job No: 1 Title: Determining the Home Range of the Snowshoe Hare in Interior Alaska

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

An investigation of the home range, population size and natural history of an Interior Alaska snowshoe hare population was conducted from April, 1959, through April, 1960. Live-trapping and tagging were used to gather the bulk of the data.

The track count method, pellet count method and strip census were not usable under subarctic conditions. The Lincoln Index, Schnabel Method and calendar-graph method gave an indication of the population size. The population was estimated to be between a high of 255 hares in August and a low of five in January, 1960.

Home range was calculated using the boundary inclusive method. Males had a home range of 11.8 acres. Females had a home range of 13.0 acres. There was no significant difference between the annual and early breeding season home ranges.

Objectives:

To determine the home range of the snowshoe hare during all seasons; to devise and use methods for determining population densities.

Techniques:

A 160-acre study area was established two miles north of the University of Alaska to determine the home range of the snowshoe hare, to ascertain what census methods might be used under subarctic conditions and to gather natural history of the hare in its northern range. The topography, soils, climate, vegetation, and fauna of the area are described. The study was made between April, 1959, and April, 1960.

Live-trapping and tagging were used to gather the bulk of the data presented. To determine the level of the population several methods were attempted with varying degrees of success. The track count method, pellet count method and strip census were not usable under subarctic conditions. However, the Lincoln Index, Schnabel Method and calendar-graph method did give an indication of the population size.

A detailed report in thesis form was prepared and is on file at the Alaska Cooperative Wildlife Research Unit.

Findings:

Home range was calculated using the boundary inclusive method. It was found that the home range of males averaged 11.8 acres and that of females was 13.0 acres. There were no significant differences between the annual and the early breeding season home ranges.

Trapping success tended to be higher in the spring and summer and dropped quite low during the winter. The low level of trapping success during the winter was probably due in part to the cold metal traps and the tendency of the hares to remain relatively inactive during cold weather. Recapture per cent was low during the summer due to recruitment, but after September the recapture proportions rose steadily until 89 per cent of the captured hares were recaptured.

Snowshoe hares varied in their use of runways depending on the density and hardness of the snow. During the early winter when the snow was loose, and again during the April thaw when the snow was in a state of flux, hares used packed runways. Throughout the rest of the winter hares used the entire snow cover for movements.

The summer and winter forms used by hares are described. Summer forms usually were between the trunks of small trees, whereas winter forms were established under trees bowed by the snow.

Hares reacted to danger in several ways, depending on the age of the hare and the season of the year. During the summer adult hares would hop and "freeze" until they were out of sight, but juveniles remained immobile. During the winter all age classes seemed to depend on immobility for protection.

Food preference is described as observed in the field and from feeding a hare in captivity. Summer food consisted of most of the green vegetation in the area. Winter foods were the bark of willow, birch, alder and spruce.

Data gathered indicated that the hares did not show a cover preference.

Interior Alaska hares began their autumnal molt in early August and were seen in all stages of color change until November 1 when the molt was completed. The vernal color change commenced late in March and was completed by mid-June. At least 68 days were required for a complete molt.

Hare movements were influenced by climatic conditions. During a heavy rain or cold weather (-30 F^{o} or below) the hares remained inactive. Three dispersal movements are described. One hare was shot 12.5 miles away from its tagging site. This is the longest recorded movement of a snowshoe hare.

The breeding season extended from mid-March to mid-July. Three juveniles weighed an average of 52 g. at birth. A growth curve was drawn for Alaskan hares and is compared with two other hare growth curves. Alaskan hares grew at a greater rate than Montana hares. The Alaska hares grew at a similar rate to captive Maine hares until 60 days after birth, at which time the Alaskan hares grew at a greater rate.

A field method for aging juvenile and adult hares based on the external characteristics of the genitals of both sexes is described.

Predation and shock disease were two mortality factors observed. Lynx, hawks and owls were the main predators.

Recommendations:

Studies of hare biology should be continued through the changing levels of population density, and reliable methods of determining relative abundance under Alaskan conditions should be devised.

Prepared by:

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30 June 1960

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Volume 1 Report No. H-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: H Snowshoe Hare Investigation

Job No: 2 Title: Experimental Study of Kodiak Snowshoe Hare Populations

Period Covered: July 1, 1959 to June 30, 1960

Abstract:

Studies of population size, reproductive biology, and home range of the snowshoe hare were conducted from May, 1959, through September, 1959, on two islands near Kodiak, Alaska. Live-trapping and specimen-collecting provided most of the data.

Population densities were computed as 1.49 hares per acre on the Woody Island study area as of July 5, 1959, while density at Deranof Island was .35 hares per acre as of September, 1959. The reproductive season extends from mid-March to August. The average number of litters was determined to be 2.21, and the mean number of young was computed to be 4.88. Young born during May have the most influence on population size. The peak of lactation occurred the last half of June.

Size of home range averaged 7.8 acres for adult males, and 9.7 acres for adult females. Immature males occupied a home range of 4.8 acres as compared to 6.6 acres for immature females.

Objectives:

To determine the rate of increase and population dynamics of four snowshoe hare populations in the Kodiak area with secondary interests allotted to movement and home range of the snowshoe hare.

Techniques:

A 160-acre study area was established on Woody Island, located two miles northeast of Kodiak, Alaska. Deranof Island, located at the confluence of Afognak and Kupreanof Straits, was also used as a study area to determine the rate of increase and population densities of a newly established population. This 102-acre study island was planted with two pairs of snowshoe hares during June, 1958. Prior to the introduction of snowshoe hares on Deranof Island, two exclosures were erected and vegetation surveys were conducted by using the method of line-plots spaced along a 100-foot intercept.

Live-trapping using the grid system of trap placement furnished most of the data on snowshoe hare populations. All of the snowshoe hares released were tagged in both ears. Three methods were employed to estimate population size on Deranof Island and the Woody Island study areas. These were the original Schnabel, the Schumacher, and the Lincoln Index methods. The calendar-graph method gave an indication of the minimum population size of juveniles produced during the summer of 1959.

Adult female snowshoe hares captured on the Woody Island study area were visually examined and palpated to determine reproductive status; additional females collected outside the boundaries of the Woody Island study area were used for reproductive tract analyses.

A detailed report in thesis form is being prepared for filing at the Alaska Cooperative Wildlife Research Unit.

Findings:

Live-Trapping

During the live-trapping operation at the Woody Island study area, 190 captures of 149 individual hares were tallied in a total of 2,328 trap nights. Trapping at Deranof Island produced 31 captures of 23 individual hares in 386 trap nights. Adverse climatic conditions have a pronounced effect on trapping success, for it was noted that during persisting rain storms trap response was in many instances negligible. After storms abated, trapping success increased markedly.

Thirty-three hares, 30 juveniles, and three adults, died in traps on the Woody Island study area. No trap mortalities were recorded at Deranof Island. Juvenile mortality may be correlated with body weight. Of 30 mortalities, 67 per cent were less than 500 grams, while 33 per cent were 500 grams plus in body weight. Shock disease and exposure were the primary causes of trap mortality.

Productivity

Changes in the proportions of juvenile and adult hares caught indicated both the time and intensity of recruitment during the reproductive season. These data revealed that the hares born in May have the most influence on population size. The occurrence of births throughout June and the first half of July proceeds almost constantly to mid-July, after which the birth rate becomes negligible.

The snowshoe hare population on the Woody Island study area was estimated as 75 hares, which amounts to 0.96 hares per acre as of July 5, 1959. During mid-July, it was estimated that a minimum of 65 juveniles was present on the study area. Density of the juvenile population was computed as 0.53 hares per acre, an increase of 55 per cent over the adult estimate. An estimate of 36 adult and juvenile hares was obtained from recapture data collected on Deranof Island during September, 1959. This amounts to an 81 per cent increase in population size over the original population of four hares which were released on the island the preceding year. The density estimate was .35 hares per acre as of September, 1959.

Reproductive Biology

The reproductive status of adult males was ascertained by noting testicular development. The reproductive period is initiated during the first half of March, and after July sexual activity in the male diminishes.

Fertilization was estimated to have occurred near mid-April, with the majority of females conceiving the last half of the same month. Adult female sexual activity terminates by the end of August.

Lactation begins no later than the day following parturition. The rate of lactation in nursing females proceeds at a moderate rate through May, increasing the first half of June and reaching a maximum during the last half of the same month.

The longest known record of lactation was at least 57 days in one recaptured female. During September, no females were found to be lactating.

Based on examination of 44 females between May 18 and August 24, 1959, the average number of litters was determined to be 2.21. This figure reflects pregnancies during about 91 per cent of the reproductive season. Litter sizes were estimated from the number of placental scars and prenatal young. The mean number of young per pregnancy was computed to be 4.88. The first litter averaged 6.3, as compared to only 2.2 young in the second litter. A female collected May 23, 1959, carried the unusually large number of nine embryos and also contained five placental scars, indicating recent parturition. Embryo resorption was noted in a lactating female pregnant with six normal young.

Weight increases of postnatal young reflect a rapid rate of growth, and by September most leverets are difficult to distinguish from adults by external characteristics. The average increase in weight exhibited by seven juveniles amounted to 8.5 grams per day between the first and last time of weighing.

Home Range

The boundary inclusive method was used to calculate home range. The home range of the adult males averaged 7.8 acres, as compared to 9.7 acres for adult females. Immature males occupied a home range of 4.8 acres, as compared to 6.6 acres for immature females.

Predation

Second to man, the goshawk is the most important mortality agency affecting the Woody Island snowshoe hare population. Weasels were the only predators observed on the Deranof Island study area.

Recommendations:

Population densities and reproductive biology of the snowshoe hares on Deranof Island should be studied at changing levels of population density. The effects of population densities upon the flora should also be objectively investigated.

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30 June 1960

Approved by:

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Volume 1 Report No. I-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 1 Distribution and Abundance of Gallinaceous Birds in Alaska

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

The main task during the first year of this project was to determine the procedures to be followed in reaching the objectives. An outline is presented which summarizes the approach decided upon. Sixty-four observations of grouse and ptarmigan were obtained by other members of the Alaska Department of Fish and Game and forwarded to the investigator; 70 records were obtained from local residents in interior Alaska by the investigator. No analysis of the data is feasible yet.

Objectives:

1. To determine the distribution of grouse and ptarmigan in Alaska.

2. To describe the general ecological niche of each species.

3. To determine the relative abundance of each species over various parts of its range in Alaska.

Findings:

The primary task in the initial year of this project was to decide upon methods for obtaining the necessary information. Only a scant beginning was made on the work of collecting the actual data. An outline of the approach to the problem that was decided upon is given here:

I. Sources of Data

A. Written information - published and unpublished reports.

B. Correspondence and personal contact with residents.

C. Field observations carried out by the project investigator.

II. Determining Distribution and Abundance

A. Collecting the information.

1. Compile all pertinent records from published reports, as well as from unpublished information from the files of federal and state wildlife agencies.

2. Contact as many Alaskan residents as possible, obtaining specific information on places where grouse and ptarmigan have been seen.

3. Record all observations of Tetraonidae made by the project investigator while in the field.

B. Examining and analyzing the data.

1. Determine the reliability of the records, especially those obtained by conversations with residents.

2. Tabulate all reliable observations.

3. Prepare a map showing all places where grouse and ptarmigan observations have been made; on species where enough data are available, two maps will be prepared giving breeding and non-breeding occurrence.

III. Determining Ecological Niches

A. Collecting the information.

1. Read pertinent literature on ecological requirements of each species, particularly (but not exclusively) where studies have been made in Alaska.

2. Describe the places in which grouse and ptarmigan are seen during field work, especially in terms of the form of the vegetation and the physiography of the terrain.

3. Examine aerial photographs, where such are available, to determine vegetation and topography in places where birds have been reported by others.

B. Analyzing the data.

1. Prepare written synthesis in which information from all sources is combined into generalized descriptions of species habitats.

2. Using aerial photographs, physiographic maps and vegetation maps, outline areas that seem to be suitable (potentially) for each species.

3. Combine the maps showing the known records and possible distribution of each kind of grouse and ptarmigan.

Up to the present time, only a small amount of basic information has been collected. As an experiment, several members of the Alaska Department of Fish and Game (Ed Keough, Ronald Skoog, Arthur Sheets and Harry Merriam, Biologists; Sigurd Olson, Federal Aid Coordinator) were asked to solicit information from a few persons in their locality, and to record this information on maps and forms provided to them. A total of 64 observations of blue grouse and ptarmigan was obtained in this way, several of which were from areas where certain species had not been reported previously. Seventy observations of grouse and ptarmigan were recorded by the investigator during talks with Alaskans in the Fairbanks area. Many of these observations are of considerable interest, although some must be substantiated by field work.

It is anticipated that the first attempt to tabulate and plot the observational information will be made during the winter and spring of 1961. By this time a sufficient volume of information should be available to make preliminary analyses meaningful.

Prepared by:

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April 25, 1960

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Volume 1 Report No. I-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 2 Title: Population Characteristics of Rock and Willow Ptarmigan

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

The basic objectives of this study are to describe the rise and fall in numbers of ptarmigan within one year on a selected study area, to record any year-to-year changes in numbers and to determine from those data the harvestable portion of the fall population. Data obtained in 1959 show that the late summer and early fall proportion of immature birds to adult hens was about 7.5:1. An effort was made to discover a reliable indicator of age in rock ptarmigan after December, without success. Neither the "pointed primary" nor "speckled primary" methods, as described by others, appear satisfactory for the ptarmigan studied. Some information obtained in the study indicate that flock formation occurs early in September, and that extensive movements from one area to another may take place in September and October. The reproductive cycle probably begins in March, with testis enlargement and behavioral changes becoming evident early in April. Some data on weights of ptarmigan are given.

Objectives:

1. To compare the annual numerical increase and decrease of ptarmigan on selected areas from one year to the next;

2. To discover the means by which variations in productivity and mortality are accomplished;

3. To describe general changes in populations of ptarmigan in various regions of Alaska;

4. To determine the harvestable portion of the fall population of ptarmigan.

Techniques:

The preliminary studies reported here were accomplished mainly by field observation. An estimate of the productivity of rock ptarmigan was obtained through counts of broods in July and August, and by determinations of age ratios of fall-collected specimens. More than 230 rock ptarmigan (*Lagopus mutus*) and 30 willow ptarmigan (*L. lagopus*) were collected to determine age, food, weights, parasite infestation, and other data. The carcasses of birds of known age were saved to test methods for age determination. The habits of ptarmigan were observed on many short field trips, including several to the study area at Eagle Creek. A punch-card system was established to record data pertinent to the study.

Study Area

One area has been chosen in which to carry out most of the intensive field work for this project. The area, consisting of about 25 square miles of arctic-alpine tundra 100 miles northeast of Fairbanks, was selected for the following reasons: 1) it is the site of three previous investigations of ptarmigan, beginning in 1951; 2) it is reached easily by car from Fairbanks from May to September; 3) it is part of a large mass of hilly tundra that probably is representative of ptarmigan habitat throughout interior Alaska. Because its boundaries outline the upper drainage system of Eagle Creek, the area is referred to as either "Eagle Creek" or "Eagle Summit" study area.

The Eagle Creek study area is near the northern and western end of a broad band of hills that extends for more than 300 miles from south of Dawson, Yukon Territory, to a point 100 miles northwest of Fairbanks, Alaska. Ancient uplifting of Precambrian rocks, the subsequent and continuing erosion of the exposed surfaces, and occasional intrusions of igneous materials have produced a range of hills whose summits (usually rounded, rarely precipitous) rise from 2,000 to 5,000 feet above the valleys of the Tanana and Yukon Rivers.

Nearly all of the land above 2,700 feet is covered with tundra vegetation. Because of the great changes in site that occur over short distances in hilly country, diverse vegetational communities exist in any given locality. Perhaps the most widespread kinds of tundra occurring on the Tanana Hills are associations of dwarfed shrubs and sedge-dryas meadows. In mid-summer, the tundra appears as a vast, mosaic-patterned pasture - now dotted with low shrubs, or clothed in a dense mantle of bushes; now grassy, or even devoid of vegetation; sometimes soggy with accumulated melt-water of the thawing earth, occasionally as dry and rocky as a desert gravel pit.

Two species of ptarmigan breed in this region. One species, the willow ptarmigan, is relatively uncommon; its preferred breeding habitat is restricted to narrow strips along valley bottoms between 2,000 to 2,700 feet. Rock ptarmigan occupy much of the area above 2,700 feet, and usually nest between the 2,700 and 3,500 foot contour levels.

Findings:

Productivity of Rock Ptarmigan

No estimate can be made this year of the total number of young rock ptarmigan produced on the Eagle Creek area, as the number of hens successful in hatching chicks was not determined. From counts of broods in late July and early August (when most chicks were about one month old), and from ratios of young birds to adult females in mass collections made in September, however, it is possible to estimate the number of young per adult female.

Counts of Broods

Thirteen broods of rock ptarmigan were counted at Eagle Creek from July 26 to August 5. This may have represented roughly one-third of the number of broods actually present on the 25 square miles. The chicks were old enough to flush readily when alarmed, and only a few counts felt to be incomplete (and not included here) were obtained. The counts are listed in Table 1 and compared with those of 1951 and 1956 obtained in previous studies (DeLeonardis, 1952 and Weeden,

Table 1. Comparison of numbers of chicks in rock ptarmigan broods in 1951, 1956 and 1959.

Year	Area	Period	2	3	4	5	6	7	8	9	10	11	AV.
			NUMBER OF CHICKS PER BROOD / NUMBER OF BROODS										
1951*	Steese Highway	Up to July 20				1	3	3	4	2			7.3
	Fortymile Highway	Up to July 20			2	2		1	1				5.5
1956**	Steese Highway	Up to July 20	1	2	1	1	2	1					4.5
		After July 20		2	2		2						4.3
1959	Steese Highway	After July 20				2	4	1	1	2	2	1	7.5

* Approximate numbers of broods in each brood size, calculated from DeLeonardis' (1952) data on total number of chicks, and mean size.

** Data from studies by Weeden (1959).

1959). There is considerable variation in brood sizes between years, especially when data for 1956 are compared with those of 1951 and 1959. The 1956 and 1959 data are for young of about the same age; no information is available for 1951 broods. The variation probably reflects changing clutch sizes and changes in juvenile mortality, and may prove to be important mechanisms resulting in fluctuations in ptarmigan numbers. However, too few data are available now to discuss the matter fully.

Age Ratios in Fall-collected Birds

In order to substantiate the data from counts of broods, a mass collection of rock ptarmigan was carried out on September 29 and 30, at Eagle Creek. A total of 150 birds was shot from two flocks numbering between 100-200 individuals in each. As far as females and young are concerned, this collection probably resembles closely the actual population structure at the time. There are indications from samples of ptarmigan shot by hunters, that juveniles are more easily shot than adults in the fall. This bias may not be important in the collection made for the study, as such a high percentage of each flock was collected. The chance of getting a disproportionately large number of young would seem much less than when many hunters shoot a few birds from a number of different flocks.

The age of each bird was determined by the presence (in young) or absence (in adults) of the bursa of Fabricius. The state of plumage and condition of the ovaries were supplementary characteristics used occasionally.

Of the 150 birds collected, 5 were adult males, 17 were adult hens, 55 were immature males, 72 were immature females. The sex of one young rock ptarmigan could not be determined. On the basis of this proportion of sex and age groups, the following classes of ptarmigan probably comprised the original flocks: 1) A few adult cocks who either remained with the brood all summer (an uncommon occurrence in this species) or who returned after the summer molt; 2) old females, the great majority of which had raised chicks; 3) young birds.

The proportion of young to each adult female (128:17, or 7.5:1) was the same in the collection as the average brood counts made two months before. Although the samples are small, it can be inferred that the young suffered no disproportionate mortality, as compared with adult hens, in this period.

One segment of the population that cannot be accounted for at present is that including unproductive hens. In late July and early August, all hens had broods, and all broods were attended by hens - at least all that were observed in this study. It is very unlikely that all females bred successfully - the question is, did the unproductive hens join the flocks in the fall (and "dilute" the young:hen ratio), or did they remain aloof from the large aggregations from which the birds were collected?

Determination of Age in Rock Ptarmigan

The possibility that changes in population structure can be followed throughout the year rests on the ability to distinguish young-of-the-year from birds more than one year old. After the young have attained the first winter plumage (late in September), the best way of determining age is by looking for the bursa of Fabricius (an outpocketing of the large intestine at the cloaca, visible internally), which is present in young galliformes and absent in most adults. This structure begins to regress in young birds in the fall, and has been found unreliable after December; at that time, a few young have lost all traces of the structure, or it has become so small as to be indistinguishable from a bursal remnant which may persist in a few adults. From January onward, the usefulness of the bursa as an indicator of age diminishes rapidly. At present, no studies have been made tracing the growth and regression of the bursa in ptarmigan. In this investigation, it has been assumed that the bursa is useful at least until October and November.

From December until July, therefore, the problem of distinguishing adults and young is difficult. Petrides (1942) suggested two characteristics useful for age determination, based on the fact that young Tetraonidae retain primaries 9 and 10 (counting distally) through the first winter, spring and early summer. Adults undergo a complete molt of primaries in July and August. Petrides found that in the ptarmigan he examined, primaries 9 and 10 were speckled with brown in juveniles, pure white in adults. Also, the outer primaries of young ptarmigan tended to be more pointed than those of adults. Because the number of specimens available to Petrides was small, both criteria were tested on wings of ptarmigan of known age collected in 1959.

Test of the "Speckled Primary" Method

The basic color of the remiges of all North American ptarmigan is white. Rock ptarmigan, and many willow ptarmigan, have black shafts on all primaries. Various amounts of speckling or blotching with black or brown are present on the primaries of rock ptarmigan, especially on the outer three primaries of young birds. The age-specificity of this characteristic was tested. The results are shown in Tables 2 and 3.

It can be concluded that the presence or absence of dark areas on any of the outer three primaries, in any combination, cannot be relied on as an indicator of age. About 96 percent of the young had dark areas on P9, but so did 33 percent of the adults. The effect of the error resulting from use of this characteristic would vary with the proportion of young:adults in the population sampled. There may be a sexual difference in the tendency to have dark markings on the primaries (Table 3). Females seem to possess dark areas more often than males; as a result, errors in placing adult wings in the "young" class occur more frequently among females, while more of the young birds erroneously called "adults" are males.

Several of the color combinations of P8, P9, P10 suggest at least moderately accurate means of determining age. However, it must be remembered that the answer being sought - the ratio of young:adults - is also necessary to determine the probabilities that any unknown specimen with a certain characteristic of the outer primaries is either a young bird or an adult. To clarify this, the following example is given:

> Assuming (Table 2) that 96 percent of the young have P9 speckled, and that 4 percent do not; and assuming that 33 percent of the adults have P9 speckled, and 67 percent do not; what is the chance that a wing with P9 speckled belongs to a young bird?
>
> 1. A speckled P9 could belong to either an adult or a young bird. Therefore, the probability of choosing a young bird must be calculated.
>
> 2. If the ratio of young to adults were 1:1 in the population, the chance of choosing a young bird would be 1/2.

Table 2. Color characteristics of primaries 8, 9 and 10 of young and adult rock ptarmigan collected in Alaska, 1959.

CHARACTERISTIC	YOUNG Number Positive	YOUNG Percent Positive	ADULTS Number Positive	ADULTS Percent Positive
P8, P9, P10 with dark areas	2	1.2	4	12.1
P9, P10 dark*, P8 light*	17	10.4	0	
P10, P8 dark, P9 light	0		0	
P9, P8 dark, P10 light	13	7.9	6	18.2
P8 dark (not considering P9, P10)	15	9.1	16	48.4
P9 dark (not considering P8, P10)	158	96.3	11	33.3
P10 dark (not considering P8, P9)	19	11.6	4	12.1
P8 dark, P9, P10 light	0		6	18.2
P9 dark, P8, P10 light	126	76.8	1	3.0
P10 dark, P8, P9 light	0		0	
P8, P9, P10 light	6	3.6	16	48.4
No. young examined	164	No. adults examined	33	

* Primaries which were speckled or marked in any way with dark color on the vane (the shafts were not considered) were termed "dark". Feathers without such markings were called "light".

Table 3. Color characteristics of primaries of male and female rock ptarmigan.

	MALE				FEMALE			
	ADULTS		YOUNG		ADULTS		YOUNG	
Characteristic	Number Positive	Percent Positive	Number Positive	Percent Positive	Number Positive	Percent Positive	Number Positive	Percent Positive
P9 with dark	1	11.1	65	92.3	10	41.7	93	98.9
P8, P9, P10 light	7	77.8	5	7.7	9	37.5	1	1.1
P8, P9, P10 dark	0		0		4	16.6	0	
P8 dark, P9, P10 light	1	11.1	0		5	20.8	0	
	9		70		24		94	

3. The chance of a young bird having P9 speckled is .96; thus, 1/2 x .96 = .48 is the probability of choosing a young bird with a speckled wing.

4. The chance of getting an adult would be 1/2 x .33 = .17.

5. The chance that a wing with P9 speckled belongs to a young ptarmigan, under those conditions, is .48/.17 times greater than that the wing is from an adult.

6. If the ratio of young to adults were 3:1, the chances are 3/4 x .96 = .72 for young, 1/4 x .33 = .08 for adults.

Test of the "Pointed Primary" Method

Primaries 9 and 10 tend to be more pointed in many Tetraonidae less than one year old than in those which have completed their post-nuptial molt. In some areas, this method has been satisfactory for determining the age of ptarmigan (Watson, in lit.). However, no one has verified, in quantitative terms, the extent of the alleged difference in shape. The test reported here was an attempt to do this. Table 4 gives the results of the analysis of data on about 31 adult and 150 rock ptarmigan. All specimens were collected in August, September or October, 1959, when age could be determined by the bursa of Fabricius. Measurements were made with vernier calipers.

The measurements did not demonstrate any reliable age-specific differences. It is possible that experienced observers could detect, by eye, differences not brought out here. The eye allows the assessment of all of the components of feather shape, only a few of which were measured in this study. However, in the region from which these specimens were taken, it seems probable that enough overlap in shape occurs to make it impossible to rely on this method alone.

Observations of the Habits of Ptarmigan, August-April

Field observations of ptarmigan were restricted in the period August, 1959 to April, 1960, by office duties and difficult travel conditions. The few trips that were made, and some information received from other qualified observers,

Table 4. Results of measurements of primaries of adult and young rock ptarmigan.

		NO. MEASURED		MEAN (mm.)		STANDARD DEVIATION** (mm.)	
		Adults	Young	Adults	Young	Adults	Young
(1) Width 2 mm. from tip	P9	31	144	4.4	3.6	.5	.4
	P10	27	150	4.1	3.4	.5	.4
(2) Length of barb 5 mm.	P9	31	149	4.6	4.5	.1	.4
from tip	P10	26	150	4.4	4.0	.4	.1
(3) Sum of (1)+(2)		25	142	17.5	15.5	1.4	1.0
(4) Width 2 cm. from tip	P9	29	145	11.4	11.2	.7	.8
	P10	24	150	8.9	8.8	.8	.8
(5) Ratio: (1)/(4)	P9	29		.39	.33	.05	.04
	P10	24		.46	.39	.05	.05

* Explanation of measurements:

(1) Width 2 mm. from tip: The total width of the feather, measured perpendicular to the shaft at a point 2 mm. from the tip. Primaries no. 9 and 10 measured, as in succeeding measurements.

(2) Length of barb 5 mm. from tip: The length of an individual barb on the wide (proximal) side of the feather, which originates at a point on the shaft 5 mm. from the tip.

Table 4. Results of measurements of primaries of adult and young rock ptarmigan (cont.).

(3) The sum of values of the previous two measurements.
(4) Width 2 cm. from tip: The total width of the feather, as in (1), at a point 2 cm. from the tip.
(5) A ratio of the value obtained in (1) to the value in (4).

** Calculated largely from data processed by IBM methods.

yielded some data on flock formation, flock behavior, dispersal, feeding, habitat preference and the onset of the reproductive cycle.

Flock Formation

A list of observations made pertinent to the formation of flocks of rock ptarmigan is given in Table 5.

Table 5. Observations of rock ptarmigan, July-October, 1959.

Date	Observation
July 26	Broods, with 11, 9, 7, 7, and 9 chicks plus F
August 2	Broods, F + 2 (incomplete), 5, 8, 10 young
August 3 (snowing)	Flock of 9 with at least 2 adult males; also 2 males singly close by; another group of 3
August 4	Broods, F + 6, 9, 6, 10, 6; 5;* flock of 5 adults*
August 22	Broods, F + 3, 6 young
August 25	Flock 4 adult males*
August 29	Flock of 20-25
August 30	Flock of 20-30; 20-25;* flock of 12*
September 5	2 birds; single F
September 6	Flock of 30, 7
September 7	Flocks of 35, 2, 5, 1, 1, 65-70
September 15	Flock of 35-45; 1, 1
September 17	Flocks of about 150, 200
September 21	Flock of 100*

Table 5. Observations of rock ptarmigan, July-October, 1959 (cont.).

Date	Observation
September 29	Flock of 150 or more
October 19	Flock of 8

* Reported by others.

These observations suggest that broods, consisting usually of a hen and her chicks, retain their identity as family units until late August. Until this time, adult males may be found in small groups, usually apart from the broods (although the August 3 observation indicates that they may join the broods, at least temporarily, on occasion). Quite abruptly, in late August, broods combine to form small flocks. The size of these flocks suggests that they are formed from only a few broods, which probably have not travelled far from their hatching place. Another abrupt change took place in mid-September, resulting in the formation of large flocks.

Flock Behavior

On September 17, the investigator spent one morning observing the behavior of about 350 rock ptarmigan at Eagle Creek. Their behavior was similar to that of other flocks seen during the next two weeks. During the period from 6:00 to 8:00 a.m. the birds were restless as individuals, and very wary as a flock. The restlessness of the members of the group, as they fluttered or ran from one patch of food to another, occasionally triggered the movement of the whole flock; without apparent warning, they would fly across a small valley to the opposite slope. At this time of day, too, the presence of a human a few hundred yards away, or the sudden appearance of a hawk or eagle, would alarm the ptarmigan and send them sailing off to other places up to a mile away. As the feeding period waned, however, the wariness of the birds decreased enough so that they could be approached and shot at without causing more than a momentary disturbance.

Males (including young cocks) called frequently during the month of September, especially early in the morning and during snow flurries. It appeared that this calling activity often resulted in the movement of the flock from one place to another. If one or two cocks flew away from the flock for a short distance, and croaked as they landed, other males would follow shortly. Soon small groups of both sexes would fly to those birds, and finally the remainder of the flock would join them.

Flocks containing both rock and willow ptarmigan were seen in September. In one case, a large group of rock ptarmigan flew from a hillside at Eagle Creek to a nearby stream-bed, joining about 30 to 50 willow ptarmigan there. As this group was pursued up the creek, it was noted that the rock ptarmigan, when flushed, usually flew out of the valley bottom and onto the adjacent slopes. The willow ptarmigan remained near the stream, flying from one thicket of willow shrubs to the next.

Dispersal from Breeding Grounds

Two bits of evidence were obtained which suggest that rock ptarmigan become nomadic in September and October. First, the occurrence of very large flocks, and their restless behavior, indicates that the birds were being drawn together from a large area, and were travelling together. Second, small groups of rock ptarmigan began to appear in October in places somewhat distant from the nearest breeding habitat. Most of these birds were from four to eight miles from the nearest suitable tundra, in open vegetation types such as muskegs, burns and marshes.

More data will have to be obtained before the nature of this movement can be described, and before its effect is known. It seems possible that by this mechanism, rock ptarmigan prevent over-utilization of food supplies in winter on the breeding grounds, and may continually re-populate many marginal or unfilled habitats.

Feeding and Habitat Preference

The crops of all ptarmigan specimens collected in this study have been saved, and will be analysed later. A few observations were made in the field which indicate something of the feeding periodicity and food preferences of rock and willow ptarmigan. These are not sufficient to warrant much discussion of the subject, however. Two tendencies are apparent, which will be tested with further data: 1) Willow ptarmigan tend to eat the buds of willows (Salix) more than any other item; rock ptarmigan, on the other hand, eat more buds of Betula (dwarfed birch). This may be due to availability and/or preference. 2) Two important feeding periods in the winter are early in the morning, just after dawn, and in mid to late afternoon.

Three trips, made on November 6, February 25 and April 7, yielded some information on the habitats used by rock and willow ptarmigan prior to the breeding season in interior Alaska. Again, only suggestions can be offered at present as to specific habitats preferred. Rock ptarmigan were found in two distinct areas: 1) At the upper limit of shrub growth, where shrubs (particularly dwarfed birch and willow) were not completely covered by snow; 2) On windswept, bare ridgetops, where dryas and sedges dominated the sparse vegetation. The former kind of place was used apparently from early November to early spring. Ptarmigan were seen on the bare ridgetops only during the April trip, although a search was made in similar habitat in early March. Willow ptarmigan were seen in three types of areas: 1) Extensive, shrub-grown openings in boreal forest, especially where logging or burning had occurred near timberline; 2) riparian willow thickets along the upper reaches of streams, but often within the forest zone; 3) extreme upper limit of spruce woodland, where willow shrubs occur abundantly, especially in hollows at the headwaters of creeks. Two kinds of vegetation, adjacent to utilized types, that apparently did not attract ptarmigan were: 1) Dense timber (deciduous, evergreen or both); 2) "muskegs" found on north-facing slopes at and below timberline, where only alder (Alnus sp.) and black spruce (Picea mariana) remained above the snow.

No information is available on the effects of weather on the habitat preferences of ptarmigan in winter, nor on the degree to which the area used by each species overlap.

Beginning of the Reproductive Cycle

The testes of two rock ptarmigan collected April 10, 1960 were larger than any seen previously in winter specimens. Three male willow ptarmigan also had enlarged testes on that date, and feathers of the spring plumage were visible under the white winter feathers on the neck. Seven female willow ptarmigan had ovaries containing a few follicles that had begun to enlarge. Cocks of the latter species were heard calling at dawn during this field trip; the calls ceased shortly after dawn, and were not heard at all during the day or the following evening. There was no opportunity to check on whether male rock ptarmigan were calling early in the morning. Both species were still in flocks in early April. From this meagre information, it seems that the first visible evidence of sexual rejuvenation in ptarmigan appeared in late March or early April. Territorial behavior had not appeared as of April 10.

Weights of Rock Ptarmigan, September 29-30

Weights were obtained from 150 ptarmigan collected at Eagle Creek on September 29 and 30, 1959. The birds remained frozen from a few hours after being shot to the time they were weighed, a few days later. A triple-beam scale, accurate to tenths of grams, was used. The weights, as given in condensed form in Table 6, are those of the entire carcass, including crop contents. The weight of the crop and its contents was recorded for 25 specimens; the range was 2.0 (empty crop) to 19.1 grams, with the average 9.3 grams. Although the weights of the birds are not true body weights as a result of including the crop contents, it is believed that all sex and age classes are affected similarly, so that no bias exists. One specimen was omitted because its sex could not be determined with certainty. Another bird, an immature male, was omitted because its body weight (365.9 grams) was so much lower than any other young male. This bird may have been younger than other immatures, or may have been in poor physical condition.

The significance of the differences among the means was tested with Snedecor's (1940) formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s\bar{x}}$$

$$s\bar{x} = \sqrt{s_1^2 + s_2^2 \left(\frac{n_1 + n_2}{n_1 n_2}\right)}$$

Table 6. Statistics concerning weights of ptarmigan collected at Eagle Creek, September 29-30, 1959.

STATISTIC		ADULT MALE	ADULT FEMALE	IMMATURE MALE	IMMATURE FEMALE
No. collected		5	17	54	72
Range	high	525.1*	468.1	507.0	474.6
	low	468.7	401.5	403.9	374.1
	difference	56.4	66.6	103.1	100.5
	fiducial limits	± 46.5	± 14.3	± 12.6	± 6.9
Mean ($\bar{x}$)		493.5	427.0	452.5	420.3
Standard deviation	s^2	506.6	414.2	597.8	478.0
	s	22.5	20.4	24.5	21.8
Standard error $S\bar{x}$		10.1	4.94	3.42	2.58

Formulae Used (Snedecor, 1940)

1) Standard Deviation (s) = $\sqrt{\frac{\Sigma(\bar{x} - n)^2}{n - 1}}$

2) Standard Error ($S\bar{x}$) = $\sqrt{\frac{s^2}{n}}$

3) Fiducial Limits = $\bar{x} \pm$ (t at 1% level x $S\bar{x}$)

* All weights given in grams.

It was found that: 1) There is less than one chance in 100 that the difference between the means of young males and young females is due to chance alone; 2) there are less than two chances in 100 that the difference between the means of young males and old males, and adult males and adult females, is due to chance alone; 3) there are more than five chances in 100 that the difference between the means of adult and immature females is due to chance.

It appears that although young males grow faster than young females (in terms of weight gained per day from hatching until fall), young females reach the weight of adults more quickly. This is true because the weight of adult hens in autumn is less than that of adult cocks. The range in weights is greater for young than for old birds, primarily because of the relatively large difference in the ages of the young, and because the young were not quite full grown.

Probably the greatest value of these data will come when comparisons can be made with weights of birds of known sex and age at other times of the year, especially in spring.

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Volume 1 Report No. I-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 3 Title: Waterfowl Investigations

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

No field work was accomplished during this initial year of waterfowl studies due to the late-summer arrival of the investigator. Several basic tenets regarding Alaska's place in the continental waterfowl program were suggested as guides to future planning, and three field projects were set up for the 1960-61 fiscal year. The State's first permanent, full-time waterfowl biologist has been hired, and will arrive in Alaska on July 1, 1960.

Objectives:

1. To determine the flyway distribution of migrant waterfowl from nesting areas not previously investigated.

2. To determine waterfowl production on selected nesting areas.

Findings:

No field work was done this year on the waterfowl project, as the investigator, after arriving in Alaska on July 26, was committed to other duties until September 1. The primary tasks relating to this project have been to decide on an overall approach on the part of the State to the problems of waterfowl research and management, to plan for the

1960 field season, and to hire the necessary personnel.

The Overall Approach.

It seems that the main factors to consider in establishing the waterfowl program in Alaska are these:

1. Alaska is an area where waterfowl are produced in large numbers, but where few live from October to May. There are almost no waterfowl that winter on any of the important breeding areas. The birds wintering on the coast from the Aleutians to Ketchikan are not an important source of recreation, and probably are not a major segment of the summer breeding population.

2. The harvest of Alaska-produced waterfowl is made by sportsmen in other states. Some species migrate and winter within the administrative boundaries of the Pacific Flyway. Significant numbers of many species of waterfowl migrate through Canada to each of the other three Flyways. Thus, it is of the utmost importance that the program of the State of Alaska be coordinated closely with the continental scheme, as well as with the program for Pacific Flyway states.

3. The current continental waterfowl situation suggests that the following problems will be of paramount importance in Alaska: a. Assuring that the major breeding areas in the State remain suitable for maximum production of waterfowl; b. Preventing the loss or undue disturbance of a few major resting areas used by migrating waterfowl; c. Developing more accurate and efficient methods for estimating annual production; d. Obtaining further information on migration routes, migration schedule and areas used in winter by waterfowl breeding in Alaska.

4. Within the State, the program should provide sportsmen and others a greater opportunity to utilize waterfowl, and, at the same time, should give the State management control of certain production and resting areas.

Of necessity, it will be several years before the long-term plans for waterfowl investigations will be formulated completely. Until then, the statements made above may serve as general guides to research activity.

Plans for 1960.

At various times throughout the winter of 1959-1960, the investigator conferred with Sigurd T. Olson, State Coordinator for P-R projects in Alaska; Leslie E. Whitesel, Federal Aid Coordinator for Alaska; James W. Brooks, Chief of the Game Division, Alaska Department of Fish and Game; and Henry Hansen, Waterfowl Biologist, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service. The suggestions of these people were of tremendous value in helping the investigator to set up the projects to be carried out in 1960. The proposals for work in the 1960-61 fiscal year have been reported in detail in job descriptions submitted earlier; only the project titles and objectives will be repeated here.

Job 3a Mortality in western Canada geese

Objective: To determine the mean annual mortality rate among western Canada geese breeding on the delta of the Copper River.

Job 3b Distribution and abundance of black brant in Alaska

Objectives: 1) To determine the location and approximate size of breeding or summering populations of black brant in Alaska.

2) To determine the pattern of natural mortality, and mortality from hunting, among juvenile and adult black brant.

Job 3c Production, distribution and migration of waterfowl in Alaska

Objectives: 1) To determine nesting areas and migration routes for species where these facts are unknown.

2) To determine the amount of production of waterfowl on selected nesting areas.

Most of the field work on the above projects will be done by Research Biologist Peter E. K. Shepherd, with the assistance of Biological Aides. Shepherd and Weeden will report on the projects and do the preliminary planning for subsequent studies.

Prepared by:

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April 20, 1960

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Volume 1 Report No. J-1a

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: J Marine Mammal Investigations

Job No: 1-a Title: Walrus Biology and Population Status

Period Covered: October 15, 1959 - June 30, 1960

Abstract:

Data and biological specimens are being collected from the principal harvest areas in Alaska. Upon completion of the collection phase, the specimens will be processed and the data analyzed.

Objectives:

To obtain additional information about the life history of the walrus, with special attention to breeding biology and growth, and to obtain methods for estimating productivity, population size and trend.

Procedure:

Walrus population and life history data were collected by biologists at two sites during the 1960 spring walrus migration. Howard Kantner, a biological aid, observed the migration as it passed King Island, and Samuel Harbo recorded data during part of the migration past Little Diomede Island. In addition to walrus numbers, migration patterns, and other life history facets gathered by personal observations and reports from hunters, biological specimens, principally teeth and female reproductive tracts, were collected.

In order to facilitate the collection of specimens, and to reimburse the hunters for the time involved in collecting, the hunters were paid a set amount per speciman. A walrus tooth, complete with a notation of sex, tusk length and date taken, was valued at 50¢, and a female reproductive tract at $2. The teeth were placed in small coin envelopes furnished to the hunters, and the reproductive tracts in plastic bags.

Whenever possible, Departmental personnel collected the specimens, thus insuring that proper measurements and data were recorded. When hunters collected teeth, they were instructed in the proper procedures, and the two lower canines for each walrus were requested. Requiring the collection of these two teeth removed the temptation to collect all of the teeth from one animal and then to submit them as teeth from many individuals. The collection method proved successful.

After collection, the teeth will be cross-sectioned, and the sections polished. By inspecting these under low magnification, the number of cementum rings can be counted, and the number of rings correlated with age using the method outlined by Fay (1955).

The data gained through tusk measurements and tooth analysis will be evaluated and interpreted in relation to population size and trends.

Previous walrus investigations in Alaskan waters were reviewed, and data obtained during a walrus study at King Island during spring 1959 were analyzed in order to become familiar with current walrus studies.

Findings:

Howard Kantner, biological aid, and Samuel Harbo, biologist, are collecting specimens and data during spring 1960. The analysis of the material will be accomplished by Harbo.

Data and specimens are being collected from Gambell, Savoonga, King Island, Diomede, Wales and Nome. To date, teeth have been obtained from more than 170 walruses taken at Diomede, from 155 taken at Gambell, from 137 at Savoonga, and from seven at Wales. Additional walrus teeth are expected from King Island, and also from some of the villages that have already submitted a few. Reproductive tracts were collected from 14 females taken at Diomede, and additional ones are being collected by Kantner at King Island. When the collection phase is completed, the data and specimens will be analyzed and evaluated.

Approximately 140 walrus teeth, collected during spring 1959 at King Island, were sectioned during the year, however, they have not been analyzed. The analysis of these teeth will be completed during the processing of those collected during 1960.

Upon receipt of the data collected at King Island, the information pertaining to walrus biology and life history will be evaluated.

Recommendations:

The collection of specimens, and of walrus biology and life history data should be continued, and accurate methods for estimating productivity, population size and trends sought.

Literature Cited

Fay, F. H. 1955. The Pacific walrus; spatial ecology, life history and population. University of British Columbia Ph.D. thesis, unpublished.

Submitted by:

Samuel J. Harbo
Research Biologist
30 June 1960

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Volume 1 Report No. J-1b

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: J Marine Mammal Investigations

Job No: 1b Title: Walrus, Harvest and Utilization

Period Covered: September 1, 1959 to June 30, 1960

Abstract:

The majority of the annual walrus harvest occurs during the period April through June, and in an area extending from St. Lawrence Island to Pt. Barrow. Eskimo hunters account for nearly all of the kill.

Approximately 1,153 to 1,453 adult and juvenile walruses were harvested (killed and retrieved) by Alaskan natives during spring 1959. The total number killed, however, ranged from 2,700 to 3,600 animals, of which approximately 34 per cent were adult and juvenile males, 42 per cent adult and juvenile females and 24 per cent calves. The number of animals killed and lost or abandoned and left to die (calves) exceeds the number killed and retrieved.

Only two parts of a walrus are invariably saved, the tusks, from both males and females, and the bacula of large males. In some villages more than half of the yearly income is derived through the sale of walrus ivory.

Walrus meat is used as human and dog food. The degree of utilization depends largely on the size of harvest, ranging from nearly 100 per cent utilization in those villages having a small harvest to less than 10 per cent in those having a large harvest.

Female walrus skins are used as boat coverings; the degree of utilization depending on harvest size. In some villages the harvest of females is insufficient to meet demand, but in others less than 15 per cent of the skins are used. A market exists for split female skins, but few are sold due to the work involved in fleshing and splitting each hide.

Male skins are used in the jewelry industry, and a market exists for them in Seattle, but none were processed and shipped during 1959 due to the labor involved and the cost of shipping. Marketing these hides would be profitable, however, if a sufficient number were processed each year.

An accurate tally of the harvest and kill of Pacific walruses should be obtained each year.

The value of the walruses as game trophies should be publicized and the sport hunting of these animals promoted.

Objectives:

To determine the magnitude, utilization and value of the walrus harvest in Alaska.

Techniques:

The computation and evaluation of the walrus harvest and utilization in Alaskan waters during spring 1959 was accomplished by Samuel J. Harbo.

Walrus harvest and utilization data were obtained from northwestern Alaska coastal villages by direct observations, by interviewing hunters and store keepers, and by corresponding with other individuals possessing relevant information. Often the size of the harvest was not stated numerically but in relative terms such as "poor," "no good," "good," etc. Only by correlating such evaluations with known harvests could a numerical value be derived.

A review of the literature and past investigations furnished information relating to the sex and age composition of the harvest and to the loss through sinking or abandonment. Hunters and other individuals provided additional pertinent data.

Findings:

The walrus populations inhabiting the Bering and Chukchi Seas are very important to the coastal Alaska natives. Prior to the advent of white man's influence in the native economy, walruses were sought for their meat and skins; their tusks provided little or no incentive to native hunters. The present-day pattern has nearly reversed, however, with greatly increased emphasis placed on ivory. This emphasis, plus improved hunting equipment and methods, has resulted in large kills of walruses during the last decades.

These large kills, coupled with the slow reproductive rate of these animals, cause concern for the future of this pinniped. In order to correctly assess the effects on the populations, however, an accurate tally of the kill, including the animals killed and lost plus those killed and retreived, must be accomplished. Recent studies at St. Lawrence, King and Little Diomede Islands partly furnish this information and provide a basis for estimating the total walrus kill in Alaskan waters.

Harvest

Although a few walruses are killed during every month of the year in Alaska, the principal harvest occurs during April, May and June. During these three months the animals migrate northward through the Bering Straits and into the Chukchi Sea and Arctic Ocean, and are available to the Gambell, Savoonga, King Island and Diomede hunters.

The southern terminus of the area in which walruses are harvested essentially is St. Lawrence Island, and the northern terminus, Pt. Barrow. Fay (unpublished) states that May and June are the two most productive months for walrus hunting at St. Lawrence Island, although a few are obtained during the winter. Further northward, at King Island and Diomede, the principal harvest occurs during late May and June, while at the northern terminus, Pt. Barrow, June and July are most productive. Probably more than 90 per cent of the annual harvest in Alaskan waters occurs during the three spring months of April, May and June.

Nearly all of the walruses harvested in Alaska are taken by native hunters. During spring 1959 I know of only two sport hunters that hunted walruses, and both were successful at Savoonga.

St. Lawrence Island.--There are two villages, Gambell and Savoonga, on St. Lawrence Island, and both normally harvest substantial numbers of walruses.

Gambell.--No Departmental personnel were at Gambell during the spring hunting period of 1959 so an accurate tally of the harvest was not obtained. However, data furnished by Dr. Francis Fay of the Public Health Service, by villagers, and by other informed individuals indicate that Gambell hunters killed and retreived approximately 250 to 350 adult and juvenile walruses during the spring hunts.

Fay, on the basis of surveys made during the years 1952 through 1958, reveals that the average composition of the spring harvest is approximately 35 per cent adult females, 35 per cent newborn young, 20 per cent adult males and 10 per cent juveniles. This disproportionate sex ratio and non-representative age composition results from deliberate selection and the relative availability of each sex and age class. Assuming that the 1959 harvest had similar composition, the Gambell hunters killed and retreived 137 to 192 adult females, 137 to 192 newborn calves, 75 to 105 adult males and 25 to 35 juveniles.

Not all of the animals hit by rifle fire are killed and retreived; some sink, while others escape wounded. Brooks (1954) and others have observed that adult males and juveniles nearly always sink when killed in the water, but adult females frequently float. Fay (ibid.), during 1958, estimated that only 51 per cent of the total number of adults and juveniles shot by Gambell hunters were killed and retreived; of the remaining 49 per cent, 41 per cent were wounded with their ultimate fate unknown, although Fay estimates that at least half of these eventually die from loss of blood and wound infections, and 8 per cent were killed and sunk. Applying these percentages to the 1959 harvest results in a total of 490 to 686 adults and juveniles hit by rifle fire, of which 250 to 350 were killed and retreived, 201 to 281 were wounded, with their fate unknown, and 39 to 55 were killed and sunk. If Fay is correct in stating that half of the wounded animals eventually die, a total kill of approximately 389 to 545 adults and juveniles results. Including calves, the total kill during spring 1959 probably is 496 to 745 animals. The data for Gambell are included in Table 1.

Savoonga.--The harvest data from Savoonga for spring 1959 was obtained from Dr. Fay. His estimate of 100-200 adults and juveniles was based on conversations with villagers, and their comparison of the 1959 harvest with known kills of past years.

Fay, in determining the annual kill of adults and juveniles at Savoonga, assumed that the harvest is equal to approximately 60 per cent of the total kill; the percentile figure is based on data obtained at Gambell. Using that figure, approximately 166 to 333 adults and juveniles were killed during spring 1959.

Fay has also determined in past harvests that 90 to 95 per cent of the harvest is comprised of males. On that basis, 149 to 280 of the animals killed during the spring were males and 15 to 53 were females. Assuming that one-half to two-thirds of the females had calves that would die when abandoned, approximately 7 to 35 calves were killed. This produces a total kill of 173 to 368 animals. The data are shown in Table 1.

King Island.--Accurate harvest information is available from King Island during spring 1959 for Harbo, a biologist with the Alaska Department of Fish and Game, collected data throughout the hunting period.

Two hundred and fifty six adults and juveniles and 18 calves, a total of 274 animals, were killed and retreived by King Island hunters. Of the adults and juveniles, 152 were females, 89 were males and 15 were unidentified as to sex. Of the known sex animals, 63 per cent were females and 37 per cent were males.

Harbo (unpublished) observed that the number of severely wounded, or killed and lost, animals at least equalled and probably exceeded, the number retreived. Kenyon (unpublished), studying the 1958 walrus harvest at a similar locality, Little Diomede Island, also noted that at least as many animals were killed and lost as were retreived. On the basis of the above data, the kill of adults and juveniles at King Island totaled 512, of which 323 were females and 189 were males. Assuming that one-half to two-thirds of the females had calves that would die when abandoned, a total of 161 to 215 calves were killed. Including all ages and sexes, a total kill of 673 to 727 walruses occurred at King Island during spring 1959. The data are shown in Table 1.

Table 1. The estimated number of Pacific walruses killed in Alaskan waters during spring 1959.

	No. Harvested* (Juv. and Adult)	Numbers Killed			
		Males	Females	Calves	Total
Gambell	250-350	140-196	249-349	107-200	496-745
Savoonga	100-200	149-280	15-53	7-35	173-368
King Island	256	189	323	161-215	673-727
Little Diomede	350-450	259-333	441-567	220-378	920-1,278
Point Hope	32	32	32	16-21	80-85
Wales	20	20	20	12-16	52-56
Nome	35	48	22	11-15	81-85
Point Barrow	35	70	0	0	70
Others	75	75	75	37-50	187-200
Totals	1,153-1,453	982-1,243	1,177-1,441	571-930	2,730-3,614

* Number killed and retreived.

Little Diomede Island.--Information obtained from Little Diomede hunters and from the Native Store manager at Wales (his store purchased more than 200 walrus tusks from Diomede hunters during May and June, 1959) furnished walrus harvest information for Little Diomede. Although an accurate count is unavailable, the data indicate that 350 to 450 adult and juvenile walruses were taken during spring 1959.

Kenyon (unpublished) visited Little Diomede during the spring of 1958, and he determined that the number of animals lost through sinking at least equalled the number retreived. If the same situation existed during 1959, which undoubtedly it did, at least 700 to 900 adults and juveniles were killed.

Brooks (1954) has observed that the walrus harvest at Little Diomede includes many more females than males, a condition that also exists at King Island. Assuming that the proportions of female in the harvest were similar for the two islands during 1959, then the Diomede kill would consist of 441 to 567 adult and juvenile females and 259 to 333 adult and juvenile males. If one-half to two-thirds of the females had calves that would perish when abandoned, approximately 220 to 378 calves were killed, which produces a total kill of 920 to 1,278 walruses. The data are contained in Table 1.

Pt. Hope.--The harvest information for Pt. Hope was obtained by D. C. Foote, an anthropologist associated with the Atomic Energy Commission's Project Chariot. Foote did not observe the walrus harvest during the spring 1959, but a survey of the village during October of that year revealed a take of 32 animals.

The sex ratio of the harvest is not known, however, Foote observed that five of the seven animals taken during fall 1959 were females. Perhaps an even sex ratio estimate for the spring harvest would be appropriate.

Loss data are not available for Pt. Hope, but there is no reason to believe that the loss rate there is significantly different from that reported for other villages. Assuming that half of the animals killed were lost, approximately 64 adults and juveniles were killed. If one-half to two-thirds of the females (50:50 sex ratio) had calves that would perish when abandoned, a total kill of 80 to 85 animals results. The data are contained in Table 1.

Wales.--Conversations with Wales hunters revealed that 20 walruses were harvested during spring 1959. Assuming that an equal number were lost, that the sex ratio of harvested animals was similar to that reported for Little Diomede and King Islands, and that one-half to two-thirds of the females had calves that would perish when abandoned, a total kill of 52 to 56 animals results. The data are contained in Table 1.

Nome.--Based on hunter interviews, an estimated 35 walruses were taken by Nome hunters during spring 1959. The sex ratio is unknown, but the hunters reported taking many more males than females. Assuming that one-third of the harvest consisted of females, that half of the animals killed were lost, and that over half to one-third of the females have young that die when abandoned, a total computed kill of 81 to 85 animals results. The data are contained in Table 1.

Pt. Barrow.--No harvest data are available for Pt. Barrow, however, Brooks (op. cit.) reports that the harvest consists almost entirely of males, and Fay (unpublished) indicates that a harvest of 35 adults and juveniles is average. On that basis, and assuming that half of the killed animals were lost, a total kill of 70 animals is computed. The data are shown in Table 1.

Other areas.--A few other areas, such as Mekoryuk, Pt. Lay, Shishmaref and Teller, also take walruses but their combined harvests probably do not exceed 75 juveniles and adults. Assuming that the harvest was 75 animals, that an even sex ratio existed, that half of the animals killed were lost, and that one-half to two-thirds of the females had calves that would die when abandoned, a total kill of 187 to 200 animals is computed. Table 1 contains this information.

Total kill.--The estimated total kill in Alaskan waters during spring 1959 is 2,730 to 3,614 walruses, of which 982 to 1,243 were adult and juvenile males, 1,177 to 1,441 were adult and juvenile females, and 571 to 930 were calves. The composition is approximately 34, 42, and 24 per cent respectively.

Utilization

The degree of utilization of walruses varies in the villages of Alaska, but in general those villages experiencing the smallest harvests have the highest rates of utilization.

Ivory.--Income derived from carved and uncarved walrus tusks forms the basis of the economy in many coastal villages. Harbo (unpublished) computed that during the period October 1958 - May 1959, the hunters and carvers at King Island sold approximately $11,000 worth of raw (uncarved) and carved ivory to the Native Store, and an additional $5,000 to $10,000 worth of carved ivory to tourists in Nome during summer 1959. More than half of the King Islanders yearly income was derived from ivory.

The Diomede, Gambell and Savoonga economies also rely heavily on walrus ivory. At times the walrus harvest is so large that the supply of tusks exceeds the supply needed for carving, and the excess are sold raw. Such a situation existed during the spring, 1959, at Diomede when the hunters harvested 350 to 450 adults and juveniles. Part of the excess, more than 200 tusks, was sold to the Wales Native Store, and the remainder in Kotzebue, Nome, Teller and Shishmaref.

Fay has estimated that an average set of walrus tusks has a value of approximately $125. On that basis, the ivory acquired from walruses harvested during spring 1959 had a value of $156,000 to $175,000.

Bacula.--The Diomede and King Island hunters indicate that bacula, especially the large ones, are desired by the tourists that visit Nome and Kotzebue. The price ranges from $10 to $25 depending on size. The Diomeders and King Islanders save the baculum from virtually every adult male, yet the demand apparently exceeds the supply.

Meat.--The size of the harvest influences the rate of utilization of walrus meat, although other factors, such as the abundance of seal and reindeer meat, also effects it. In general, the meat from calves, cows and young bulls is used as human food, whereas the meat from adult bulls serves as food for dogs.

The Gambell, Savoonga, King Island and Diomede walrus harvests normally exceed the amount needed for food. Fay reports that during winter and early spring at Gambell nearly 100 per cent of each adult walrus is utilized but that as spring progresses and the hunting improves the degree of utilization decreases. Undoubtedly the same conditions apply apply to Savoonga, King Island and Diomede, with perhaps a lower utilization rate obtained during the height of the spring hunting season. Harbo determined that only 10 per cent of the meat from females was utilized during spring 1959 (256 adult harvested) at King Island, with virtually none of the male meat saved. Kenyon visited Diomede during the relatively unsuccessful hunting season in 1958 (only 85 adults and 32 calves were taken), and he recorded only 28 per cent utilization of all animals. Undoubtedly, the rate of utilization during 1959, when the Diomeders killed and retreived 350 to 450 adults and juveniles, was much lower, perhaps even lower than the 1959 rate for King Island. These data indicate that a greatly-reduced harvest would still provide an adequate meat supply.

The villages of Wales, Teller, Pt. Hope, Nome and others obtaining a small harvest normally have a much higher rate of utilization, perhaps approaching 100 per cent for most villages. In some instances the need for walrus meat is so great, especially for dog food, that the headless carcasses washed ashore during June and July are salvaged for dog food. It seems inconceivable to such villagers that the Diomede, King Island and Savoonga hunters can willfully waste so much meat.

The meat from calves essentially is never wasted.

Considering the entire 1959 spring harvest, probably less than 25 per cent of the meat from animals killed and retreived was utilized.

Skins.--The skins of female walruses, and occasionally those from young males, are used as boat coverings by the Eskimo hunters. This is the principal use of skins, although a few serve as human and dog food, and a few are made into rawhide lines.

The split outer half of a female skin serves as a tough, light boat covering for the hunting boats, the inner half serves as a tarpauline or roof covering and infrequently as a boat covering. Generally, the large 25 to 35 foot boats need 5 skins each and the smaller boats 3 skins, with the skins changed every 2 or 3 years.

The King Islanders saved 17 female skins during spring 1959. Apparently that number is sufficient to cover their seven small and five large hunting boats. The 17 skins were the only ones gathered, although approximately 160 females were harvested. A market for split skins exists in Nome and a few other coastal villages, and the current price is $20 to $25 a skin. Few skins are sold by the King Islanders, however, for they believe the work involved in fleshing and splitting a skin outweighs the returns. Kenyon reports that the Diomeders also sell few skins, presumably due to the same reasons.

Male skins are seldom utilized, except for the occasional mungona stored for winter use. Male skins of one inch minimum thickness are in demand as a buffing material in the jewelry industry, however, and an average skin brings $150 F.O.B. Seattle. To my knowledge, no male skins have been sold from either Diomede or King Island, and only two from Gambell. The reasons given are (1) no storage facilities are available, and (2) there is no means to transport the hides from the islands. Actually, those are invalid arguments, for the hides could be salted and stored on the beach until a barge or tug arrived to take them to Nome for further shipment to Seattle via Alaska Steamship Company vessels. If the natives would harvest a sufficient number of male skins, probably less than half of the present annual harvest would be sufficient, a very profitable business would result, both for the hunters and the concern marketing the skins. If the natives would utilize all suitable male skins, the annual harvest of walruses, particularly of females, would decrease.

<u>Other uses of walruses</u>.--Additional parts of a walrus are utilized, but they are of secondary importance to the native economy. Among some of the items and their uses are: stomach linings - for ceremonial drum coverings; stomach contents (clams) - human food; intestines - waterproof parkas; and blubber - fuel in stoves and lamps.

<u>Summary of Utilization</u>.--The pattern of utilization in those villages having large harvests clearly indicates that ivory is highly prized by the Eskimo hunters. Walruses in excess of those needed for food and boat coverings are taken, and only the tusks, and the bacula of large males, are collected. In some instances only 10 per cent of the animals are needed for meat and skins; the remaining 90 per cent are taken only for their ivory.

Recommendations:

Harvest

An accurate tally of the annual harvest, and of the annual kill of Pacific walruses should be obtained, and their effects on the population determined. Inasmuch as these animals frequent both American and Russian waters, and are harvested by both American and Russian hunters, knowledge of the total population size and of the kill by hunters of both countries is essential, and an effort should be made to acquire the data from both areas.

Utilization

Increased utilization of various parts of a walrus are possible, and perhaps major emphasis should be placed on marketing male hides. At present, most natives believe it is unprofitable due to shipping costs to sell a male hide. Perhaps it is when skins are shipped singly, but if substantial shipments were made from Little Diomede, King Island, Gambell and Savoonga, the shipping costs per pound would decrease. Based on current harvests, approximately 100 skins from Little Diomede, 50 from King Island, 50 from Gambell and 100 from Savoonga could be acquired each year if the natives would salvage them. Unless they can gain immediate returns for each hide, the natives will not develop the market. It can be developed, however, if a promoter would purchase the skins at each village and would handle all shipping and marketing details.

Each male skin sells for approximately 50 cents per pound, or $150 per skin, F.O.B. Seattle. If 300 skins annually could be purchased at $30 each at the island villages, approximately $36,000 would remain for freight, handling and processing charges and profit. The cost of removing the skins via small tug and barge from the islands to Nome should not exceed $5,000, and the shipping expenses from Nome to Seattle should not exceed $9,000. If $5,000 are allowed for handling and miscellaneous expenses, a net profit of $17,000 results. Undoubtedly, a very profitable enterprise could, and should, be developed.

Sport Hunting

The value of walruses as game trophies should be publicized, and the sport hunting of these animals promoted. Both the walruses and the native economy would benefit, for fewer animals would be killed by the native hunters, and the guiding fee, board and lodging costs, and incidental expenses would bolster the native economy. In order to be successful, however, the promoter should be perceiving of the culture and philosophy of both the hunters and the guides.

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Volume 1 | Report No. J-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 | Name: Game Investigations of Alaska

Work Plan: J | Marine Mammal Investigations

Job No: 2 | Title: Seals, Magnitude and Characteristics of Harvest

Period Covered: July 15, 1959 to March 31, 1960

Abstract:

Harvest Report forms provided harvest information from native villages.

Ringed seals accounted for nearly ninety per cent of the seals harvested during the period November 1959 - March 1960; harbor and bearded seals accounted for five per cent each.

November and March were the two most productive months for seal hunting during the five-month period; January was the least productive.

Virtually every part of a seal is utilized by native hunters. A limited market exists in Nome for seal meat, blubber, skin and oil. On the basis of the Nome prices the seals taken by Wales hunters during the five-month period had a value of $6,700.

The seal bounty program in northwestern Alaska is not justified from the standpoint of fish conservation.

The present regulations governing seals should remain unchanged.

Objectives:

To determine the magnitude, characteristics, and value of the harvest of various species of hair seals in Alaska; to determine seasonal movements and abundance of seals; and to determine the food habits, and other life history characteristics of seals.

Techniques:

The principal method of gathering seal harvest data involved the use of printed forms termed Wildlife Harvest Report forms. These forms contained the names of the most important wildlife species in northwestern Alaska; the four seals inhabiting the area were included.

The forms were designed to record the wildlife harvested by the natives in the area. Before instituting the program, letters of explanation were sent to the villages, or preferably, visits to the villages were made by members of the Department of Fish and Game. On the basis of information obtained by these two means, an individual from each village was selected to record the harvest information. The response and cooperation in some villages was gratifying, but in other villages the enthusiasm and cooperation was short lived. Initially, 14 villages received the forms, which were distributed during October, 1959, but by March, 1960, the number had decreased to 12. Frequent correspondence with the participating villages and a submittal of a monthly summary of the harvest, by village, helped to maintain interest in the program.

Contacting hunters and other informed individuals also provided information relating to the abundance, distribution and harvest of seals. Additional information was gathered during investigations for other projects.

Fur dealers, skin sewers, meat markets and other individuals or organizations dealing in parts of, or products made from, seals were contacted in attempts to assess the value of the harvest. The prices of seal meat, blubber, oil and skins were determined, and an attempt made to ascertain the quantities purchased. In addition, the number of seal scalps submitted for bounty at Nome was determined.

Findings:

Most of the information obtained during the study concerned the magnitude and characteristics of the seal harvest.

Size of Harvest

Many of the coastal villages in northwestern Alaska largely depend on seals for their food. In some villages seals are the only reliable meat supply, although walruses are eagerly sought and very abundant during short seasonal periods.

Harvest Report forms provided seal harvest information from nine coastal villages during the period November 1959 - March 1960, but the returns are incomplete or questionable from four of them. Part of the unreliability is related to terminology. On the forms the bearded seal was listed as "oogruk" and the harbor seal as "spotted seal;" the ringed and ribbon seals retained their correct nomenclature. The terms "oogruk" and ribbon seal did not create confusion but the names "spotted seal" and ringed seal did. In all but one instance the differences were resolved; the exception was the White Mountain report. During March 1960, the recorder from that village listed eight "spotted seals" taken, however, doubt exists as to whether the seals were ringed or harbor seals, and a discussion with the recorder failed to resolve the problem. Therefore, the White Mountain data are not included in the computations.

The Pt. Hope, Deering and Shishmaref data are not included in the computations for their returns are incomplete. At Pt. Hope, an anthropologist associated with the Atomic Energy Commission's Project Chariot hired an individual to collect seal harvest data and other aspects of native-wildlife relationships. Consequently, our program, which lacked direct compensation to the recorder, appeared unattractive, and faltered. The reports from Deering and Shishmaref are not included for they were incomplete during the months of December through March.

The seal harvest data from the five villages submitting reliable records are contained in Table 1. Unfortunately, the reports are limited to only a segment of the year and do not include the productive months of April, May and October. Therefore, during the discussion of these data the fact that they represent only a portion of the year must be borne in mind.

Table 1. A summary of the seal harvests reported by the five villages participating in the Harvest Report program.

Village	November	December	January	February	March
Elim				RS - 1	RS - 5 BS - 1
Golovin	BS - 4 HS - 9				RS - 8 BS - 3
Shaktoolik			RS - 3 BS - 2	RS - 5 BS - 3	RS - 27 BS - 3
Stebbins	RS - 1 BS - 2		RS - 3	RS - 37	RS - 18
Wales	RS - 226 BS - 14 HS - 21 RiS - 3	RS - 69 BS - 1 HS - 2	RS - 28	RS - 40	RS - 73 BS - 2
Totals	RS - 227 BS - 20 HS - 30 RiS - 3	RS - 69 BS - 1 HS - 2	RS - 34 BS - 2	RS - 83 BS - 3	RS - 131 BS - 9

Key: RS = Ringed seal HS = Harbor seal
BS = Bearded seal RiS = Ribbon seal

The total catch of seals reported by the five villages was 644 animals. However, undoubtedly more seals were taken than were recorded, for some hunters probably failed to report their catches. Of the 644 animals reported, Wales hunters accounted for 479, or seventy-four per cent. Apparently the Bering Straits site of Wales is very suitable for seal hunting.

Fragmentary reports from King and Little Diomede Islands, whose locations are comparable to the Wales site, indicate that their harvests are similar to the one recorded at Wales. In general, when seal hunting was productive at Wales it was equally productive at King and Little Diomede Islands, with the composition of the kill also similar.

The large catches at Wales contrast with the small catches reported at other localities. For instance, the hunters from Candle and Deering, two villages located at the head of Kotzebue Sound, reported few or no seals taken during the period. Fast shore ice extends out many miles from the shore at these two locations and the few seals present largely are inaccessible to the hunters. During spring and fall, however, these hunters take seals, with fairly large catches infrequently occurring. During the last week of October, 1959, the Deering hunters had favorable hunting conditions and they took 27 ringed and 5 bearded seals. However, such a catch appears small when compared with the 72 ringed, 8 bearded, and 5 harbor seals taken the following week by Wales hunters.

Composition of the Harvest

The catch composition reveals striking differences in the availability of the seal species during the winter months. Ringed seals, inhabitants of the pack ice, comprised eighty-nine per cent of the total catch, with the other three species, the bearded, harbor and ribbon seals, garnering only five, five, and one per cent respectively. Figure 1 shows these differences.

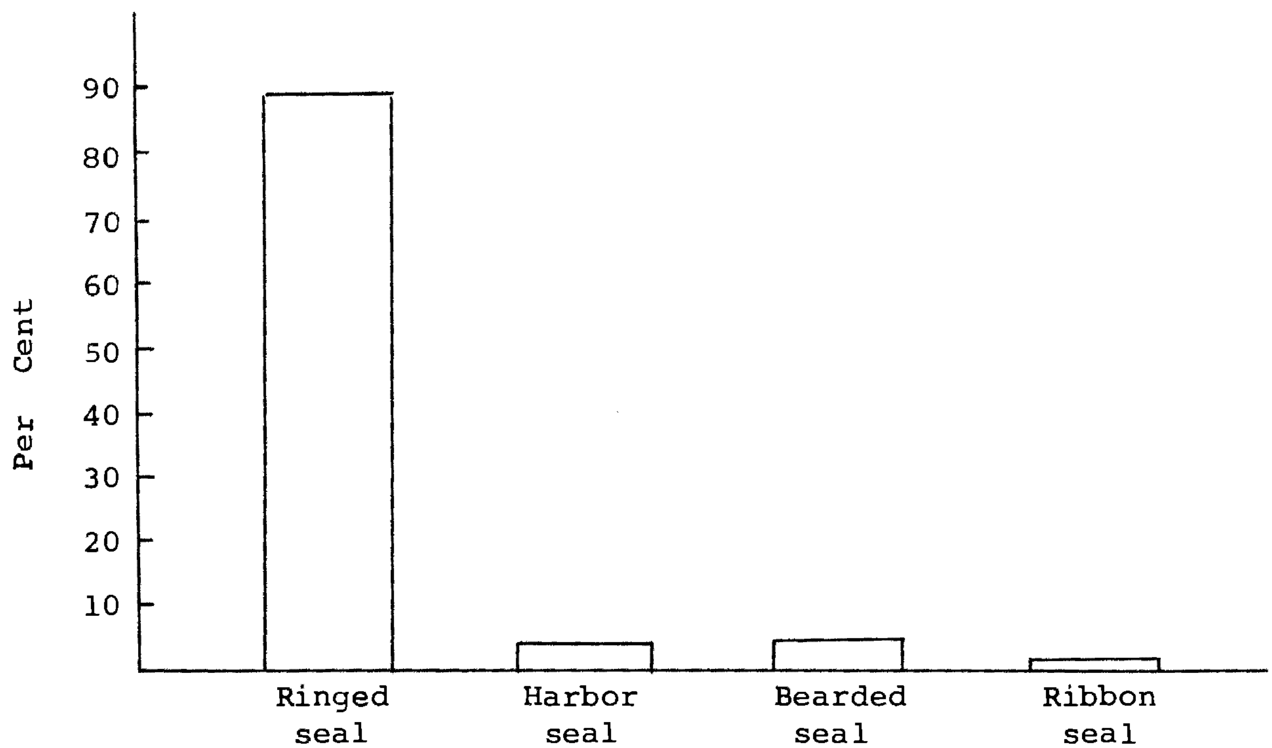


Figure 1. Composition of the seal harvest during November, 1959 - March, 1960, in the five villages participating in the Harvest Report program.

The preponderance of ringed seals in the harvest is expected for they are the most abundant seal in the area during winter. Harbor seals are abundant at other times of the year, but their affinity for ice-free water and shores makes them unavailable during most of the winter. The monthly catch composition shown in Figure 2 reflects this affinity, for harbor seals were taken only during November and December, prior to the formation of heavy sea ice. Undoubtedly, if data for the months of May, June September and October were available, the per cent of harbor seals in the total harvest would have been greater. The low densities of the bearded and ribbon seal populations, plus the tendency of ribbon seals to inhabit the edge of the ice pack, contribute to the small catch of these animals.

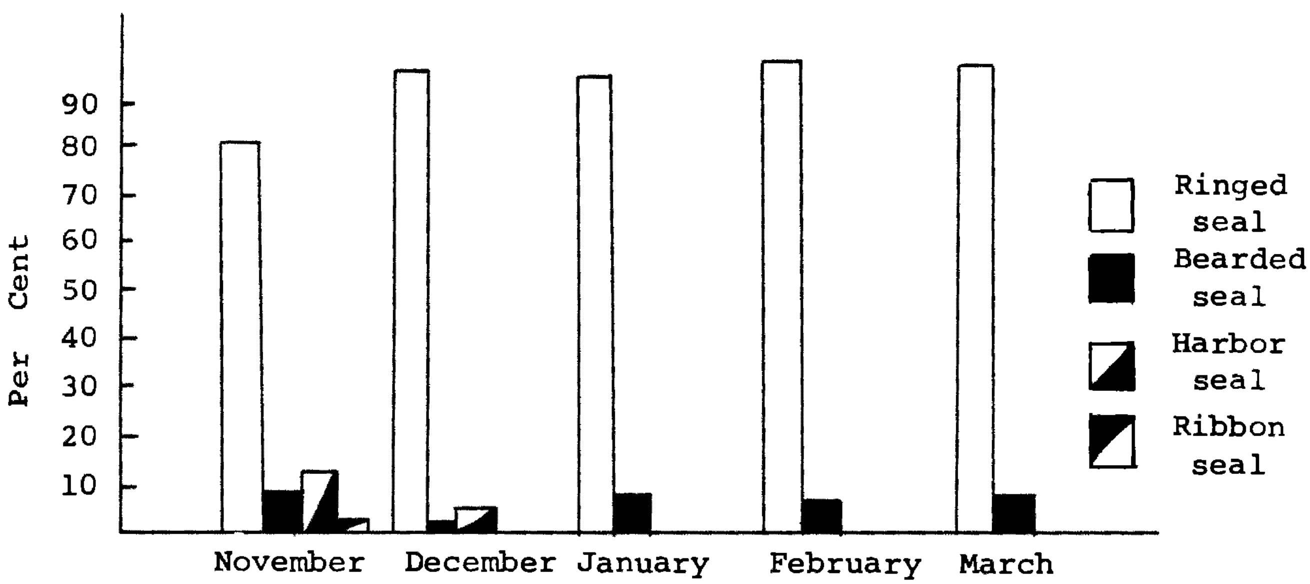


Figure 2. Monthly composition of the seal harvest for the months of November 1959 through March 1960 in the five villages participating in the Harvest Report program.

The preponderance of ringed seals in the harvest apparently is characteristic of the Arctic areas, for Scheffer (1958) states that this seal is the most important of all pinnipeds in the economy of the natives of the far north.

The monthly composition of the seal harvest, shown in Figure 2, reveals that during November, 1959, essentially an ice-free month along the Seward Peninsula and southward, bearded seal accounted for seven per cent of the total take; this was the largest value recorded for bearded seals during the period. These facts seemingly conflict, inasmuch as bearded seals are normally associated with the ice pack, or at least the edge of the pack (Scheffer, 1958). Apparently, however, not all of these seals are restricted to the ice. During August, September, October and November, these large pinnipeds are taken in coastal areas and river mouths in the Seward Peninsula and adjacent areas, and, according to reports from hunters and a few personal observations, nearly all are immature animals. At times these animals ascend rivers for distances of twenty miles or more.

The biological significance of this seeming disparity in the migration or ice-pack adherence, of immatures and adults is not known, but it may be related to feeding needs. Immature bearded seals perhaps cannot feed efficiently in the deep waters over which the summer pack ice floats, and as a result at least a segment of the population of immatures remain in the ice-free, but accessible, coastal areas.

November and March were the two most productive months during the five-month period, accounting for forty-four and twenty-six per cent of the total harvest (Figure 3). January was the least productive, perhaps due in part to unfavorable weather and short days. The breakdown of the harvest of ringed and bearded seals also reveals that November and March were the best months for hunting; sixty-eight per cent of the ringed seals and eighty-three per cent of the bearded seals were taken then. January was the least productive month for ringed seals, and December the least productive for bearded seals (Figure 4).

Figure 3. The percentage of seal harvest occuring during each month of the reporting period.

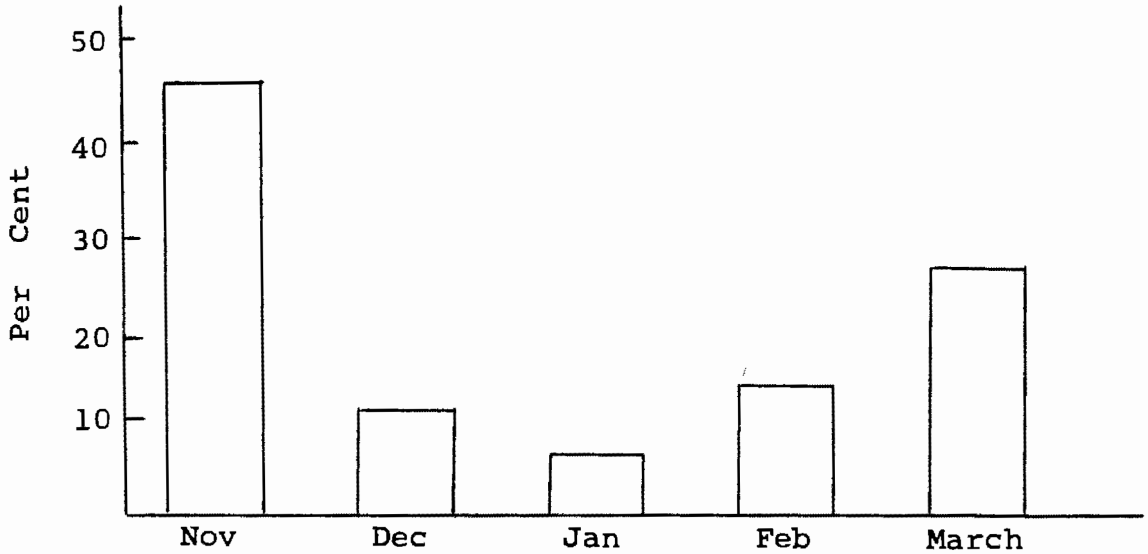
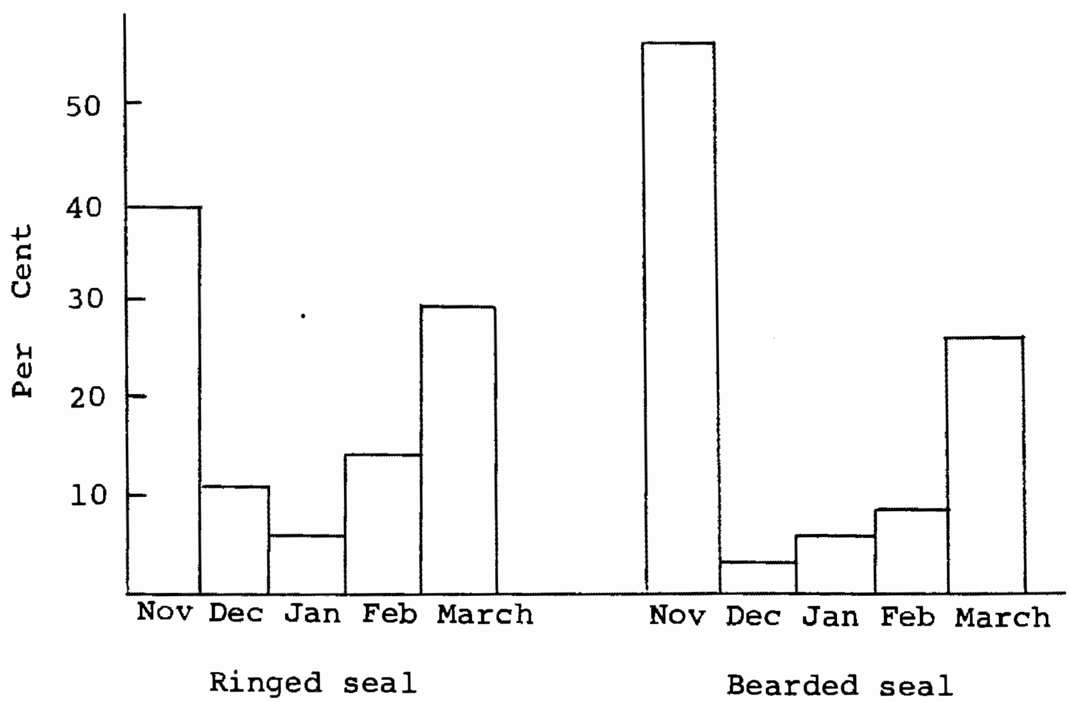


Figure 4. The monthly distribution of the ringed and bearded seal harvests during the months of November 1959 - March 1960.



Harbor seals were taken only during November and December, and ribbon seals only during November. The hunters at King Island, Wales and little Diomede Island indicate that the latter usually are found along the ice pack edge, and hence are available only during the passage of the edge past these localities.

Value of the Harvest

The value of the seal harvest is difficult to ascertain for the meat and skins of seals are not equally important in all villages. In some, seals form almost the entire meat supply but in others seal meat only supplements that garnered from reindeer, walruses and other animals.

Meat, blubber and viscera.--Virtually all of the meat, blubber and viscera of seals are utilized.

Seal meat and blubber normally are used as human and dog food. Most of the meat is air dried and the blubber is either rendered for its oil or cut into chunks and eaten with the meat. Blubber also serves as oil for lamps and stoves, and as a preservative for plant greens.

The amount of meat and blubber obtained from an individual seal varies according to sex, age and species, but the following averages probably approximate the amounts obtained: Ringed seal, 30 pounds; bearded seal, 200 pounds; and harbor seal, 50 pounds. On that basis and using the data obtained from the Harvest Reports, Wales, a village depending largely on seals, got 13,080 pounds of meat and blubber from ringed seals (436 x 30), 3,400 pounds from bearded seals (17 x 200), and 1,150 pounds from harbor seals (23 x 50) during the period November-March, for a total of 17,630 pounds. The 18 families thus averaged about 980 pounds each, or 196 pounds a month. The importance of seals to the Wales economy is obvious.

A limited market for seal meat and blubber flourishes in Nome. One market pays 20 cents per pound of fresh meat and resells it for 35 cents a pound. It handles both dried and frozen meat, and seldom has an adequate supply. The same establishment sells a five-gallon drum of seal oil for $9, or approximately 23 cents a pound. A neighboring store sells a four-pound tin of blubber for $1.50 and bearded seal oil for $1.50 a quart.

On the basis of the Nome purchase price, the Wales harvest of 17,630 pounds had a value of approximately $3,526.

Seal viscera serves as food or as clothing. That obtained from small seals usually is dried, or cooked and eaten, but the viscera from adult bearded seals often is used for making rainproof parkas.

Skins.--Seal skins are used as clothing, rawhide lines, roof and boat coverings, containers and tarpaulines; they seldom are wasted. Perhaps the most obvious use is in parkas and mukluks.

A demand for ringed and harbor seal pelts exists in Nome but the relationship of supply and demand is not known. Generally, a good condition, average size, raw ringed seal pelt sells for $3, and a similar harbor seal pelt for $8. Assuming that the ringed and harbor seal pelts at Wales would average the Nome prices, the total value of the Wales' pelts would be $1,724. Undoubtedly the value would be greater if it were based on the prices of finished products such as mukluks and parkas instead of raw pelt prices.

The value of bearded seal pelts has not been ascertained, but it undoubtedly is large. Pelts from this species are eagerly sought, and they are used extensively for mukluk bottoms and rawhide lines, and frequently as boat coverings.

Income from bounties.--The State of Alaska pays a $3 bounty for the scalp of any hair seal killed in certain areas of Alaska, and the Seward Peninsula is included. Not all seals taken by hunters are bountied, but many are. During the five-month period of November, 1959 - March, 1960, 529 seals were bountied at Wales. This total is larger than the number of seals reported on the Harvest Report forms submitted during the same period, however, the bounty and harvest data are not comparable, for some of the seals bountied during the period were obtained prior to it. Therefore, assuming that 479 of the bountied seals were taken during the report period, an income of $1,437 results.

Total value of the Wales seal harvest.--The total value of the seal harvest at Wales for the reporting period approximates $6,700. Undoubtedly the figure is conservative, but it illustrates the importance of seals to the native economy.

Food Habits and Other Life History Characteristics

Biological specimens are being collected, however, they have not been analysed. When the analysis phase is completed, the data will be compiled and reported.

Management

The abundance and distribution of the harbor, ribbon, ringed and bearded seals in the Bering and Chukchi Seas, and the inaccessibility and extent of the habitat makes the present regulations of no-closed season and no limit biologically sound. The importance of seals to the native economy also dictates that liberal regulations are in order. At present, the regulations should remain unchanged.

One facet of the seal management program in northwestern Alaska that needs revision, however, is the seal bounty program. Instituted in 1927 by the Alaska Territorial Legislature and variously modified since then to include the coastal area from Stebbins to Cape Kruzenstern but excluding the off-shore islands, the program provides a $3 payment for the scalp of any harbor, ringed, bearded or ribbon seal. Protection and preservation of commercially important fish stocks prompted the action.

Most students of wildlife ecology agree that a bounty system is ineffectual in controlling predators. Generally the control effort is neither directed, concentrated nor sustained, resulting in a cropping of surplus animals but no control.

Perhaps the principal argument against a seal bounty in northwestern Alaska concerns the type of seals bountied. Ringed, bearded and ribbon seals comprised ninety-five per cent of the catch recorded on the Harvest forms, and presumably a like percentage of the seals bountied, but these three pinnipeds essentially do not prey on commercially important fishes. These seals are, however, of extreme importance to the native economy. From the standpoint of fish conservation, bountying seals in northwestern Alaska is not justified.

Recommendations:

The acquisition of seal harvest data should be intensified. Additional villages should be incorporated into the

Harvest Report program and a year-long record of the take maintained.

The collection of biological specimens and life history data should be continued. The food habits study, especially of the important ringed and bearded seals, should be enlarged.

The seal bounty program in northwestern Alaska should be discontinued, inasmuch as it does not affect fish conservation, its principal reason for existence. If the bounty program is continued for welfare reasons, then additional specimens, such as reproductive tracts and a tooth from each animal, should be submitted with the scalp for bounty. Through this means, important specimens could be collected.

The present regulations appear adequate and should remain unchanged.

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Volume 1 Report No: K-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: K Wolf Investigations

Job No: 1 Title: Wolf Population Studies in Southeastern Alaska

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Light snowfall, mild weather, and poor flying conditions during the winters of 1957-1958, 1958-1959, and 1959-1960, generally precluded tracking and counting wolves by air.

During February of 1959, one relatively successful aerial survey of several days duration was made in which several packs of wolves were sighted on Revillagigedo Island, one on Cleveland Peninsula and one on Prince of Wales Island. Surveys conducted in the fall of 1959 and the spring of 1960 were inadequate for population studies.

Objectives:

To determine the abundance, distribution, and extent of movements of wolves in Southeastern Alaska, and to determine the relationship between wolves and deer at various levels of abundance. This information will provide a basis for evaluating the wolf as a tool in the management of the Sitka deer.

Techniques:

To lend continuity and scope to the studies, this report is supplemented with data collected during wolf investigations and control programs conducted by the Alaska Department of Fish and Game in co-operation with the U.S. Fish and Wildlife Service during the period from November, 1957 through June, 1959.

Aerial surveys using a Cessna 180 during February in 1959 were conducted on parts of Revillagigedo, Prince of Wales, Etolin, Kupreanof, and Mitkof Islands, and Cleveland Peninsula on the mainland. Surveys during the spring of 1960, using a Piper Super Cruiser, included parts of Kupreanof, Mitkof, Zarembo, and Woewodski Islands. Survey flights were made over snow covered muskegs and frozen lakes. Weather conditions did not permit standardization of surveys.

Past data collected under Work Plan A, makes possible a comparison of deer population dynamics between islands with wolves and those without. A review of the Federal wolf control programs in Southeastern was used to try to determine whether these data reflect periods of high and low wolf densities.

Findings:

Distribution and movements. In Southeastern Alaska the distribution of the wolf includes all of the islands and the mainland with the exception of Baranof, Chichagof, and Admiralty Islands. Frederick Sound, Stephens Passage and Icy Strait possibly act as physical barriers and restrict wolves from these islands.

The extent of wolf movements between islands south of Frederick Sound is not known. It is generally accepted, however, that wolves are excellent swimmers. In March of 1957, Mr. William Tucker killed three of six wolves just after they had swum to Read Island in Faragut Bay.

Water channels between some of the major islands in Southeastern do not restrict wolf movements. This is especially true of Kuiu, Kupreanof, and Mitkof Islands, north of Sumner Strait. Wolves theoretically can move from Kuiu to Kupreanof to Mitkof and then to the adjacent mainland with swims amounting to well under one half mile. The same situation exists between some islands south of Sumner Strait. Revillagigedo Island is within easy swimming distance of the mainland, as is Wrangell Island. Etolin Island is separated from Wrangell Island by less than one half and at extreme low tide barely one quarter mile of water. Situations where islands are in close proximity to one another exist throughout the wolf range in Southeastern and movements of wolves from island to island undoubtedly occur.

Except for four very limited observations of wolf pack movements during February of 1959, efforts to record wolf movements by air during the past three winters were generally unsuccessful due to poor tracking and/or flying conditions. Table 1 summarizes three observations and a description of the observations follows.

Table 1. Observations of wolf packs in Southeastern Alaska.

Observation Number	1*	2*	3*
Number of wolves in the pack	9	5	9
Number of days movements accounted for	3	3	2
Linear distance covered in miles	16	21	8
Number of observed deer killed	2	2	3
Minimum number of deer killed/day	.6	.6	1.5
Minimum number of deer killed/day/wolf	.1	.1	.2
Calculated days between kills/wolf	13.5	7.5	6

1* Orchard Lake, Revillagigedo Island

2* Patching Lake, Revillagigedo Island

3* Moser Bay Lakes, Revillagigedo Island

<u>Discription of observations in Table 1</u>. On February 13, at around noon, tracks of a pack of wolves were sighted at the extreme eastern end of Orchard Lake on Revillagigedo Island. A fresh snow cover of from one to two inches had fallen sometime between midnight and daylight of the same morning. The tracks led down the lake and along its edge. About half way to the end of the lake a deer had been killed and eaten after having been chased out of the timber onto the ice. Near the outlet end of the lake were eight grey wolves. Lee Ellis, Fish and Wildlife Predator Control Agent, reported that he had seen a ninth wolf enter the timber. As we made a second pass seven wolves ran into the timber and the remaining one entered the timber on our third pass over the area.

On February 14, the wolves were still in the area as evidenced by their fresh tracks. Tracks from the day before had been blotted out by the wind. On February 16, we saw four of the pack just above the lake at the beginning of a pass that leads from Orchard Lake to Neets Bay.

On February 17, at about mid-morning, we flew over the area and tracks indicated that the wolves hunted back and forth in the pass to Neets Bay. Remains of a deer, presumably killed and eaten by the wolves, were seen in the pass. The pack's tracks led back to and along the lake until they were lost to us in the timber at the lake's end. Most likely the wolves had left Orchard Lake the previous day following our flight over the area.

On February 12, we saw tracks of what appeared to be eight wolves in the fresh snow cover at the outlet of Hickman Lake on Revillagigedo Island. We followed the tracks along the entire length of the lake and then to Patching Lake. At Patching Lake it appeared that the pack had divided. We followed the tracks of five or six wolves along the lake until we came on five black wolves almost at the lake's end. The wolves all ran into the heavy timber as we flew by on our first pass. Poison baits were dropped on the lake in the immediate area and along the anticipated route that these wolves would take.

Returning to the area on February 13, we saw that the wolves had crossed the lake from where they were seen last.

At the point where they had reached the opposite shore there was a confusion of tracks and an eagle was sitting on the remains of a dead animal. It was not determined what sort of animal this had been, whether the wolves had killed it, or whether it had been killed by poison.

The wolf tracks were followed from this point to the end of Chamberlain Lake and the five black wolves were again seen in the sparse timber just beyond the end of the lake.

Attempts to trace the movements of this pack were unsuccessful on the next day because of turbulent winds. Flying over the area on February 17, it was observed that the wolves had climbed an almost perpendicular 1,000 foot ridge at the point where they were last seen. From here they had dropped down to the lakes in Traitors Cove. Two deer had been flushed onto the ice and killed. From appearances it was determined that the tracks had been made on or before February 14.

By backtracking this pack's movements it was determined that they had left the Traitors Cove Lakes on February 12, and had travelled through a pass to Hickman and Patching Lakes where they were seen. On February 13, they had continued to the end of Chamberlain Lake where they were again seen and then they had climbed the ridge and gone back to their starting point by February 14, circumscribing a 21 mile counter clockwise circle.

Late in the afternoon of February 14, in the vicinity of Moser Bay, Revillagigedo Island, tracks of a wolf pack were followed for several miles. These led to a small lake above Moser Bay, where we came on nine grey wolves on the ice. After the first pass seven wolves remained on the lake. Four additional passes were made over the seven wolves.

On February 16, five wolves were seen on the muskeg next to the lake. Three of these eventually ran out onto the lake and watched the airplane. From the network of tracks it was evident that the wolves had stayed and hunted in the area since we saw them on February 14. On a small muskeg pond close by there was remains of a deer that had been chased onto the ice, killed, and eaten. Another kill was located a short distance below the lake toward Moser Bay. Returning to the area again at mid-morning on

February 17, a third kill was seen on the muskeg, presumably made after our flight over the area the day before. Tracks indicated that the pack had left the area.

Miscellaneous observations. On February 13, we saw six grey wolves eating a deer which they had just killed on a small lake near Yes Bay on Cleveland Peninsula. All of the wolves ran into the timber as the plane passed over them. On February 16, tracks in the area indicated that the wolves had remained close by but whether the wolves still remained in the area, and if not, the duration of their stay could not be determined.

Some additional observations of distances traveled by wolves are listed below:

Date	Location	# Wolves	Miles	Duration
Feb. 12, 1959	Periphery Sweetwater Lakes, Prince of Wales Island	2	3	6 hrs.
Feb. 14, 1959	Thorne River to Sweet-water Lakes	6	30	Less than 2 da.
Feb. 14, 1959	Big John Bay to Salt Chuck, Kupreanof Is.	?	12	"
Feb. 17, 1959	Thorne Bay to Klawack Inlet and return, Prince of Wales Island	?	30	Less than 3 da.

Population surveys. A population survey using a Cessna 180 was made on December 10, 1958, following a fresh snow-fall. The flight covered approximately 110 linear miles of Kupreanof Island. A second survey conducted from a Piper Super Cruiser on March 7, 1960, covered 170 linear miles and included parts of Kupreanof, Mitkof, Woewodski, and Zarembo Islands. Light conditions were poor and the surveys were unsuccessful because no fresh wolf tracks were observed or were not positively identified.

Although our experience in flying wolf surveys in South-eastern is limited, they do give standards to go by in future surveys and these are:

1. A slow flying airplane is best for following wolf tracks.

2. Wolves appear to choose routes of open travel like frozen lakes. Surveys in areas where lakes are numerous should begin within a few hours after a fresh snowfall.

3. In areas without lakes at least a full day should pass following a fresh snowfall before surveys begin. This gives wolves time to make tracks and increases the frequency of encounters.

4. All surveys should be conducted during bright sunshine. Visibility on cloudy days makes tracking difficult and sometimes impossible.

<u>Numbers and relation to deer and control of wolf numbers</u>. The numbers of wolves in Southeastern Alaska or any island therein has never been accurately determined. An insight to the numbers of wolves present, expressed as wolves per square mile of land area, or actual numbers at specific locations, would be of obvious value in evaluating the effects of their predation on the deer population. The presence of a given number of wolves in an area would have significantly different implications at various levels of deer abundance.

Two mechnisms have been used in an effort to control wolves in Southeastern without these data. These are the bounty system, which encourages the unregulated destruction of wolves by hunters and trappers, and the State and/or Federal control progra which allow control to be relegated to areas where it is needed.

Government control of wolf numbers during the last ten years in Southeastern included the use of wolf getters, lethal stations, and air drops of lethal station baits onto frozen lakes.

Wolf getters are designed to shoot cyanide into the mouth of a wolf when an attached bait or lure is pulled.

Death results almost immediately and it is reported that wolves are seldom found more than 50 yards from a fired getter. Getters are not without disadvantages. In Southeastern Alaska the working mechanism often malfunctions or the seal that keeps water out of the cyanide often leaks and makes the getter harmless. The getter's biggest fault is that only one wolf can be taken at a time. When one member of a pack fires a getter, the remaining wolves are probably frightened away.

Lethal stations placed where wolves are known to travel are somewhat more satisfactory. The carcasses of seals, Phoca vitulina, are cut into chunks and allowed to decompose in 50 gallon drums. About 11 seals fill a drum. Five gallons of the decomposing seal, which is largely oil, is used for the lure to attract wolves to the station. One hundred lethal baits, made from fresh seal blubber cut into marshmallow sized chunks are treated with about two grams of strychine each and are placed around each station. Unlike a getter, a lethal station is capable of killing an entire pack of wolves. Lethal stations are put out after October and are destroyed before April to prevent killing black bears. One of the most obvious disadvantages of lethal stations is the impossibility of evaluating numbers of wolves killed. Without tracking conditions, the chances of recovering carcasses of wolves that have visited a station are somewhat remote. Unless stations are checked at least at two week intervals, wolf carcasses become badly decomposed or are eaten by birds (eagles, ravens, and crows) and their value as biological specimens is greatly reduced.

Air drops of lethal station baits is perhaps the most efficient method of control on islands that have large or numerous lakes, but near optimum conditions are needed for flying and lakes must have sufficient ice thickness to support the wolves. Baits are destroyed when the ice melts since strychnine is soluable in water. Recovery of carcasses is often impossible but recoveries have been made.

Table 2 summarizes the numbers of wolves seen dead, recovered, or reported killed, in control operations conducted by the Fish and Wildlife Service in Southeastern Alaska. These data are taken from Annual Reports, Alaska District, Fish and Wildlife Service, Predator and Rodent

Table 2. Numbers of wolves reported killed in Southeastern Alaska during control programs.

Fiscal Year	Wolves Killed
1949	53
1950	22
1951	30
1952	25
1953	20
1954	43
1955	43 to 56
1956	88
1957	69
1958	9 + 5 reported
1959	7

Control, Fiscal Years 1949-57, and in 1958 and 1959, from records of the Alaska Department of Fish and Game at which time control was done in cooperation with the Fish and Wildlife Service. The method of reporting in the Fish and Wildlife Service reports does not allow a breakdown of wolves taken by area, island, or method.

Providing that wolves were recovered in some consistant proportion to those killed, and that the methods of control were standardized and could be calculated on a wolf per unit of effort basis, and that the number of wolves taken in specific areas could be determined from reports, a trend of wolf abundance might be established from these data. Such is not the case so the figures in Table 2 in no way indicate the trend of wolf abundance.

At present there are several logical methods which provide a sound basis for evaluating the need for wolf control. The first of these is a comparison of deer population dynamics between islands that have wolves with those that do not. This comparison was made by Klein and Olson using data collected from 1952 through 1956 under Federal Aid in Wildlife Restoration Project W-3-R.

<u>Wolf Range</u>

1. Rapidly increasing deer populations.
2. Light winter mortality from starvation.
3. Winter ranges in fair to good conditions.

<u>Non Wolf Range</u>

1. Stable or slowly increasing populations in excess of the winter range capacity.
2. Heavy winter mortality.
3. Severly deteriorated winter ranges.

During the study the wolf range generally supported a greater annual hunter harvest of deer per unit of area under comparable hunting pressure. (Klein and Olson, 1960.)

It is recognized that additional ecological factors have a role in comparisons like this.

Since the control of wolves is primarily designed to benefit the deer hunter, highs and lows of hunter success, especially when hunting conditions are given consideration, can be used to evaluate the need for wolf control. Data presented in Table 3 are from Federal Aid In Wildlife Restoration Project W-3-R, Sitka Black-Tailed Deer Studies, June 30, 1960.

The extremely high hunter success presented in Table 3 makes a wolf control program difficult to justify.

A third criteria that indicates a need for relaxation of wolf control is the age composition and the physical condition of the deer population as determined from hunter-killed male deer. Every range can support a limited number of animals and no more. As deer populations approach the carrying capacity of the range, a change in their rate of increase is reflected by the age structure of the hunter kill. When it can be shown that the hunter harvest is not adequate to insure high productivity and that deterioration of the range is eminent, then control of wolves should be relaxed.

Recommendations:

Aerial surveys to record wolf movements and population numbers should be continued during the winter of 1960-61.

A more detailed study of wolf control programs is needed to determine whether or not the existing data can be used to show periods of high and low wolf abundance.

An evaluation of wolf bounty records is needed since time did not permit an examination of these in 1959.

The feasibility of marking wild wolves should be investigated during the winter of 1960-61.

Table 3. Deer harvest data collected during 1956 through 1959 in Southeastern Alaska.

	1956	1957	1958	1959
Petersburg:				
% Successful Hunters	83	74	93	89
Ave. No. Deer/Hunter	1.7	2.1	2.8	2.4
Ave. No. Days Hunted/Hunter	5.8	6.7	7.5	7.9
Wrangell:				
% Successful Hunters	81	76	92	80
Ave. No. Deer/Hunter	1.7	1.8	3.1	2.2
Ave. No. Days Hunted/Hunter	5.3	4.6	5.9	6.4
Ketchikan:				
% Successful Hunters	72	59	89	76
Ave. No. Deer/Hunter	1.3	1.2	2.3	1.8
Ave. No. Days Hunted/Hunter	4.1	5.2	6.7	5.2

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Volume 1 Report No: K-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: K Wolf Management Studies

Job No: 2 Title: Reproduction, Growth and Mortality of Wolves, Southeast Alaska

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

In the fall of 1958 a wolf denning area was found on Kupreanof Island. During the spring of 1959, five wolves were encountered in the area and the den was located. Two of the five wolves were killed and seven wolf pups were removed from the den to be raised in captivity. Growth of the seven captive wolves was recorded during their first year of life.

Thirty-three wolf skulls were cleaned and used for age determination studies. Twenty-two of the skulls represented animals under two years of age. Eighteen of these were from animals one year or less in age.

Measurements of 33 wolves recovered during wolf control programs and received from bounty hunters were compiled. Reproductive organs from 11 female and 12 male wolves were collected and these are currently undergoing analysis.

Objectives:

To determine the chronology and sequence of events in the reproductive cycle, the rate of reproduction, the development of young, the age at maturity, and the factors of mortality of wolves in Southeastern Alaska.

Techniques:

Carcasses of wolves taken in the course of State or Federal wolf control programs and those received from bounty hunters were weighed, measured, and examined for evidence of injury, disease, and parasites. The skulls, reproductive organs, and parasites were preserved for laboratory examination. As sufficient material becomes available, the gross and histological examination of reproductive organs will provide reliable information on the chronology and sequence of events in the reproductive cycle and the number of young born. Information on the development of young was obtained from seven captive wolves.

Findings:

Den Studies: On August 3, 1958, C. Lensink, Alaska Department of Fish and Game Biologist, and I found an area on Kupreanof Island that was being used extensively by wolves as evidenced by their scats and beds, and we presumed that a den was close by. During our examination of the area, I saw a dark grey wolf standing about 50 yards from me on a grass flat adjacent to a timbered point. Lensink joined me and as he did so the wolf saw us and took several steps away from the edge of the timber. Another wolf, smaller and lighter colored, came from behind the timbered point. It saw us almost immediately and rose on its hind legs momentarily to get a better look before bounding back around the point from where it had come. It was followed by the first wolf seen. Further investigation revealed that the wolves had also used the timbered point extensively. Beds were hollowed out at the base of trees and at the extremities of low hanging branches. A decomposing hemlock stump had been chewed and the punk chips surrounded its base. The bedding area under the timber was park-like and trails were numerous throughout the area. In the mud we found an old set of pup tracks measuring 2-1/4 inches long and 2-1/2 inches wide. Since we were unsuccessful in our attempts to locate a den we referred to the location as the "rearing area." Before leaving the area I marked 2 fresh wolf scats and 20 days later no scats were observed fresher than those I had marked, and beds and trails had not had recent use by wolves. Presumeably the wolves had not returned as a result of our previous disturbance. Lensink and I had seen no deer tracks in the rearing area but at the time of my second visit deer tracks in the immediate vicinity were prevalent.

On October 23, 2 months later, R. Laguire and C. Graham, Fish and Wildlife Service agents, killed a 78 pound male wolf at the denning area and they reported that they had heard at least 4 others howling. I later determined that the dead wolf was a pup of approximately six months of age and quite likely one of the pups reared in this area.

On December 10, while flying over the area, I saw four sets of wolf tracks in the snow.

On May 18, 1959, I returned to the rearing area which was located at the end of an arm joining a large intertidal mud flat. I spent about half a day scouting the flats for wolf tracks without success. At approximately 4:30 p.m. I arrived in the arm below where the two wolves were seen the year before by Lensink and myself. Here I kneeled behind an old tree that had fallen outward from the timber onto the grass flats and started to observe the rearing area ahead of me. I had not had the binoculars to my eyes for more than a minute before I heard, and then saw to my left, five grey wolves running across the mud flats toward me. I stood up, shouted, and waved my arm and the leading wolf stopped for a moment just below the slight slope at the edge of the grass flat. Two wolves passed about 15 yards to my left and the wolf farthest behind continued toward me. A fifth wolf behind and to the left of the lead wolf stopped. The lead wolf started up the slope toward me and when it was 18 steps away I shot and killed it. I then turned and killed the wolf that had been farthest behind as it turned 90 degrees and started up the arm toward the area I had been watching.

Sighting back along the wolves' tracks in the mud it was apparent where they had come out of the timber onto the flats. The den was just inside the timber. At the time I was wearing hip boots and a green, knee-length rain parka complete with hood. The wolves, lying around the den, undoubtedly saw me kneeling beside the downed tree and mistook me for an animal such as a black bear. Black bears were common in the general area as evidenced by four that I had seen in the bay that afternoon. However, their absence at the denning area probably indicates that wolves do not tolerate bears close to the den. There is small doubt that the wolves would have dispersed had I thought to fire a shot in the air. After killing the two wolves I returned to the boat for about an hour to obtain specimen recording material. In my absence the three remaining wolves had reunited and they howled during the time I took measurements of the two dead wolves. Three wolves were heard so the total number in the pack had probably been the five that I had seen. The first wolf killed was a one year old male which undoubtedly was from the litter of the previous year and brother to the wolf killed by Graham and Laguire. The second wolf killed was a female. Superficial examination of her uterus indicated that she had recently given birth to seven pups.

On the afternoon of the following day I returned with Graham, located the den, and found five male and two female pups which we took to the Experimental Fur Farm at Petersburg to be raised in captivity for growth studies. Figure 1 shows diagramatically the location of the den and rearing areas in relation to cover types.

The den proper was situated 15 yards within the edge of the timber under a decaying hemlock stump that was 12 feet high and had a diameter of 36 inches at 4 feet above the ground. The main entrance was located about four feet below the base of the stump. The opening was 15 inches high and 19 inches wide. On the opposite side of the stump from the main entrance another opening measured 20 inches wide and 14 inches high. A third opening measured 10 inches in diameter. From the main entrance a tunnel sloped downward for 90 inches to the den's lowest level which was 18 inches below the main entrance, and then up along a 30 inch slope rising 6 inches to the second entrance. Figure 2 shows the den's features in profile and as viewed from above.

Little is known about the denning activities and family life of wolves in Southeastern Alaska but observations taken at the above described den coupled with other observations offer a basis for some generalizations.

Here in Southeastern Alaska it is accepted that wolves are born during April and May following a gestation period of about 63 days. On April 24, 1955, Mr. Gainhard Samuelson, a cattle rancher at Farragut Bay, killed a female wolf that was ready to give birth to seven pups. I believe that the pups we found on May 19, 1959, were born in April. The pups born in 1958 probably left the den to frequent the rearing

Figure 1. Diagramatic sketch showing the location of the wolf den and rearing area as related to cover types.

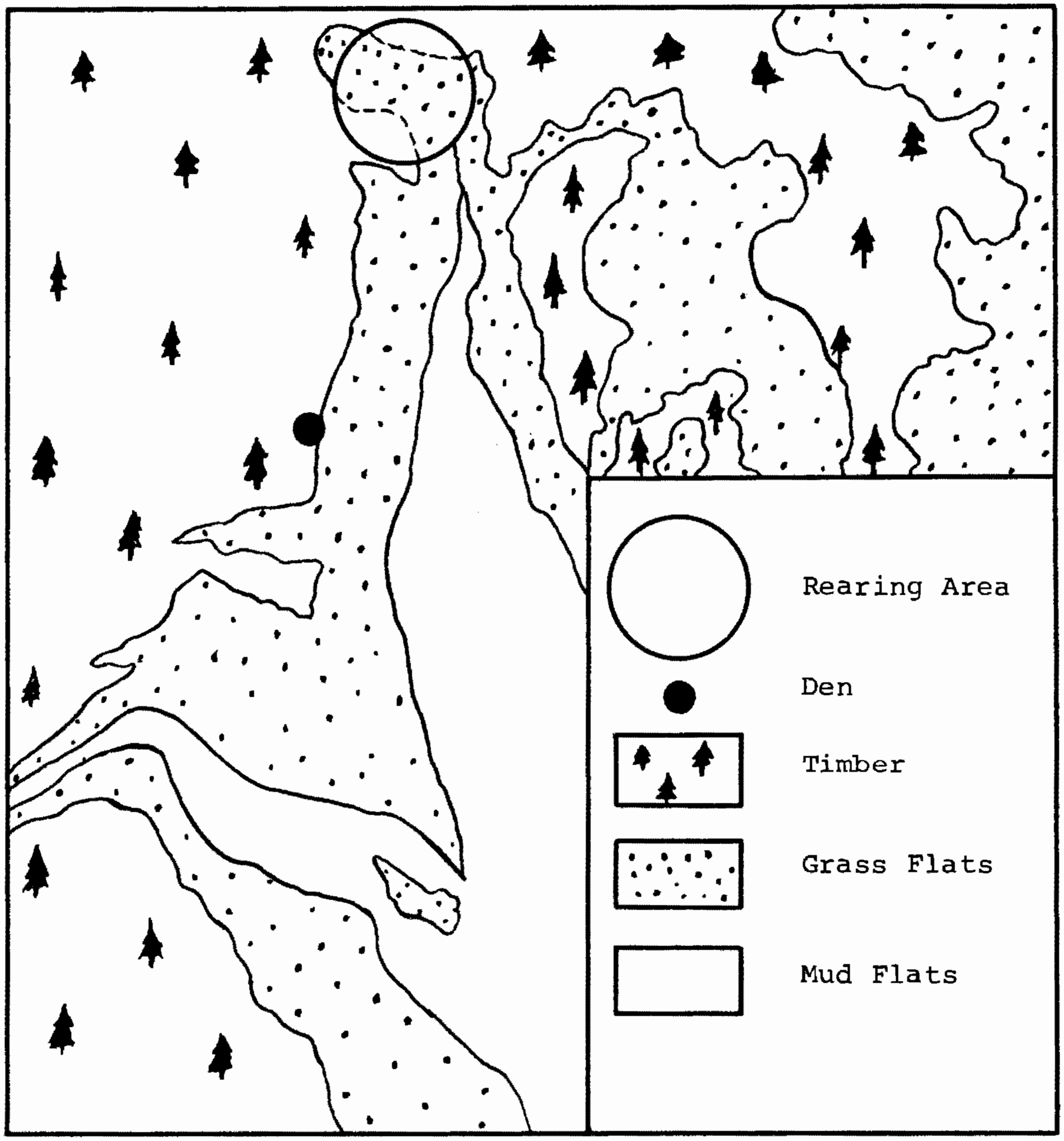
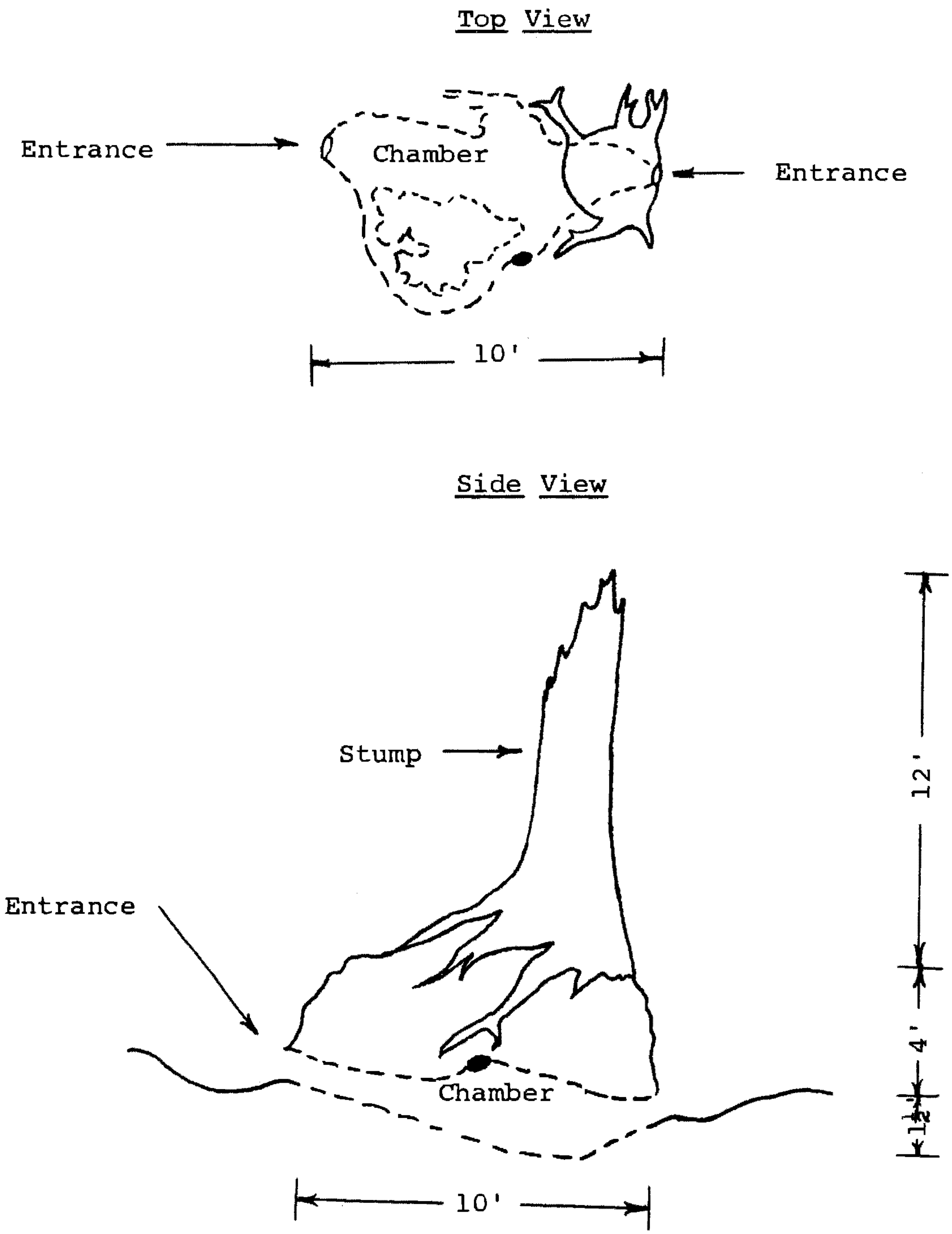


Figure 2. Top and side views of the wolf den characteristics.



area 100 to 200 yards distant during June. During May and June of 1950 Louie Hamilton of Craig steel trapped 12 wolves, about half of which were pups. The wolves were all taken within the confines of a small bay on San Fernando Island. This may indicate that pup movements away from the den at about a month of age are characteristic. The den we investigated in 1958 indicated that the wolves used the closely adjacent area until at least August, at which time they were of sufficient size to travel with the hunting pack. The denning and rearing area is probably frequented throughout the remainder of the year as evidenced by the six month old wolf killed by Laguire and Graham and the tracks I had seen in the area during December. The young wolves apparently stay with the pack and may help to raise the litter born the following spring. Wolves reach maturity at two years of age. Existing data seem to indicate that during the winter wolf packs are made up of adults accompanied by wolves one year or less in age, therefore, young wolves probably leave the family pack sometime during their second year of life. However, more information on the age structure of wolf packs is needed before this can be shown conclusively.

Aging Techniques: A reliable method for aging wolves is needed. Studies to date indicate that wolf skulls can be used for age determination using combinations of several criteria. The most important of these include the degree of suture ossification, the development of the sagital crest, and the appearance of the angle of the ramus. Table 1 outlines the present cirteria for aging wolves by the use of skull characteristics. Since these are non-specific, factors such as toothwear and the time of year that wolves are killed have to be given consideration. Toothwear as an aging criterion has limitations since the teeth of trapped wolves are usually damaged as a result of the animals' efforts to free themselves by biting the traps.

At present it is believed that certain combinations of skull measurements, the bacula in males, the reproductive tracts of females, and the examination of sectioned teeth will greatly enhance aging techniques. Table 2 summarizes the estimated age of 33 wolves as determined by the criteria outlined in Table 3.

Knowledge of the ages of wolves is desirable because the age structure of animal populations reflects their

Table 1. Defining skull characteristics used to age wolves in Table 4.

Ages	Ossification of Sutures (Scale of 4)	Type
Under one year	Nasal bones gaping and sutures not well ossified	1
Around one year	Slightly advanced over type 1	2
Over one year	Sutures well ossified	3
Over four years	Sutures closed and not easily discernable	4

Ages	Saqital Crest (Scale of 4)	Type
Under one year	Very little development	1
Around one year	Development incomplete anteriorly	2
Over one year	Development more complete anteriorly	3
Over three years	Gaining in bredth dorso-posteriorly forming a T in cross section	4

Ages	Angle of the Ramus (Scale of 3)	Type
Under one year	A porous, blunt knob	1
Around one year	Starting to form a hook posteriorly but development incomplete	2
Over one year	Fully developed hook posteriorly, non-porous, sharply defined edges	3

Table 2. Estimated ages of wolves by skull characteristics.

Specimen No.	Sex	Ossification of Sutures	Sagital Crest	Angle of Ramus	Tooth Wear	Bacula Weight grams	Bacula Length m.m.	Estimated Age	Remarks
PG-1-57	M	1	1	1	nil	0.9	86	7 months	
PG-3-58	M	2+	3	3	slight	4.0	122	21 months	
000165	M	1	1	1		0.7	77	6 months	
PG-4-59	F	4	4	3	heavy			very old	
PG-5-59	M	3	3	3	slight	3.9	118	22 - 34 months	
PG-6-59	F	3	3+	3	medium			minimum 34 months	
PG-7-59	M	3	3	3	slight	3.9	108	22 - 34 months	
PG-8-59	M	1	1	1	slight	1.5	92	10 months	
PG-9-59	F	1	2	1+	slight			11 months	
PG-10-59	M	1	1+			2.2	104	9 months	skull broken
PG-11-59	F	1	1	1				9 months	
PG-12-59	F	3		3				minimum 2 years	skull broken
PG-13-59	M	3	3+	3	medium	5.9	124	minimum 3 years	
PG-14-59	M	2+	2+	2+		3.8	115	23 months	
PG-15-59	F	2+	2	2	slight			12 months	
PG-16-59	M	3		3		4.8	118	minimum 2 years	skull broken
PG-17-59	M	3	2+	2+	slight	4.3	110	minimum 2 years	
PG-18-59	M	2+	3	2	slight	2.3	108	12 months	
PG-19-59	F	3	3	3	well worn			minimum 4 years	
PG-20-59	M	2	2	2	nil	2.3	108	12 months	
PG-21-59	F	3	2	3	slight			18 months	
PG-22-59	F	1	1	1	nil			7 months	
PG-23-59	F	1	1	1	nil			7 months	
PG-24-59	?	1	1	1	nil			7 months	
PG-25-59	F	2+	2	2	slight			19 months	
PG-26-59	F	1		1	nil			8 months	skull broken
PG-27-59	M	1	1	1	nil	1.3	85	8 months	
PG-28-60	F	2+	2	3				minimum 2 years	
HZ-1-58	F	1	1	1	nil			9 months	
40-59	M	3	4	3	well worn			minimum 3 years	
PG-29-60	F			1+				11 months	skull broken
PG-30-60	F		2	1				11 months	skull broken
PG-31-60	?	2	2	2	nil			11 months	

Table 3. Southeastern Alaska wolf measurements.*

Specimen Number	Location	Date	Sex	Weight	Total Length	Tail Length	Hind Foot	Chest Girth	Height at Shoulder	Color
PG-1-57	Etolin I.	12/57	M	85	63 1/4	19 1/2	11 1/4	26	31	black
PG-3-58	Revilla I.	2/58	M	98	66	18 1/2	11	28	31	grey
000165	Kupreanof I.	10/58	M	78	67 1/2	20	11			grey
PG-4-59	Suemez I.	2/59	F	55	60	16	10 1/4	23	21	lt.grey
PG-5-59	Prince W.I.	2/59	M	95	66	20	11	30	31 1/2	grey
PG-6-59	Suemez I.	2/59	F	70	59	17	10	26	28 1/2	grey
PG-7-59	Suemez I.	2/59	M	84	64	17	10	27	30	grey
PG-8-59	Baker I.	2/59	M	77	61	16	10 1/2	27 1/2	29	grey
PG-9-59	Prince W.I.	3/59	F	71	62	18	10 1/2	26	28	grey
PG-10-59	Kupreanof I.	1/59	M	89	67	19	11			grey
PG-11-59	Kupreanof I.	1/59	F	68	64	18	10 1/2	26	29 1/2	grey
PG-12-59	Wrang. Narrow	2/59	F	72	66 1/4	18 1/4	11			grey
PG-13-59	Mitkof I.	3/59	M	114	70 1/4	17 1/4	11 1/4			grey
PG-14-59	Kupreanof I.	3/59	M	82	65 1/4	16 1/4	10 1/4			black
PG-15-59	Wrang.Narrow	4/59	F	70	59 1/2	17 1/2	10	26	29	grey
PG-16-59	Kupreanof I.	4/59	M	87	65	17 1/2	11	28	31	grey
PG-17-59	Mitkof I.	4/59	M	97	65	18	11 1/4	30 1/2	32 1/4	grey
PG-18-59	Mainland	5/59	M	98	65	17	11 1/2	28 1/2	31	grey
PG-19-59	Kupreanof I.	5/59	F		61	16	11	30	30	grey
PG-20-59	Kupreanof I.	5/59	M		64	19	11	31 1/2	31	grey
PG-21-59	Kupreanof I.	11/59	F	75	62	18	11	26 1/2	29	grey
PG-22-59	Mainland	12/59	F		59	17	10 1/2		28 1/2	grey
PG-23-59	Mainland	12/59	F				11 1/4		29	grey
PG-24-59	Mainland	12/59	F				11		27 1/2	grey
PG-25-59	Mainland	12/59	F	76	58 1/2		11		28	grey
PG-26-59	Duck I.	12/59	F	68	62		10 1/4	25	27	grey
PG-27-59	Duck I.	12/59	M	85	60		11	29	29	grey
PG-28-59	Kupreanof I.	2/60	F	72	61 1/4	16 1/4	10	26 1/2	29 1/2	grey
40-59	Zarembo I.	9/59	M	98	66	18 1/2		31 1/2		grey
000151	Read I.	3/57	M	101	66	15 1/4	11 1/2	28 1/4		grey
000152	Read I.	3/57	F	79	60 1/2	13 1/4	10 1/4	27 1/4		grey
000153	Read I.	3/57	F	74	60 1/4	16	10 1/4	27 1/4		grey
000154	Wrangell I.	2/57	M	82	64	18	10 1/2			

* Measurements are in inches and weights are in pounds.

tendencies toward increase, decrease, or stabilization.

An insight to the age structure of wolf populations would be valuable for evaluating the effectiveness of wolf control programs.

Measurements of Wolves: Aside from their academic value, measurements of wolves may show periods of stress during adverse growing conditions caused by lack of an adequate food supply during lows in the deer population. At such times wolves may not reach their growth potential and measurements will be less than those of wolves reared during periods of near optimum conditions.

A lowering of the reproductive capacity of wolves may be coincidental with periods of decreased growth.

Table 5 gives measurements of some wolves killed in Southeastern Alaska.

Reproductive Cycle: The reproductive organs of 11 female and 12 male wolves are currently undergoing histological examination. These data will be presented in a future report.

Growth Rates of Captive Wolves: On May, 1959, five male and two female wolf pups were taken from a den on Kupreanof Island. The age of the pups was probably between three and five weeks. All of the pups had their eyes open and would readily eat meat. At the time of their removal from the den all of the pups were docile, but they preferred a darkened to a lighted environment. The pups were delivered to the Experimental Fur Farm at Petersburg by the author with the cooperation of Fish and Wildlife Service personnel, D. Klein, C. Graham, H. Larsen, and J. Johnson. The pups residence at the Fur Farm was made possible by the excellent cooperation of J. Leekley, Superintendent, and the actual feeding was done by Fur Farm personnel E. Thyness, R. Peterson, and F. Wooten.

From May to September, my activities were directed away from Petersburg and during my absence, Alaska Department of Fish and Game Biologists, H. Merriam and D. Klein, took responsibility for the care of the captive wolves, and therefore, the growth measurements in Tables 4 through 10 and the accompanying Figures 3 through 9 are principally the result

Table 4. Growth measurements* of a captive female wolf - ear tag # 12.

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.2	20 3/4	5 7/8	4	7 3/4	11 1/2	1 1/2
May 28	7.1	23 7/8	5 7/8	4 1/2	8 3/4	12 5/8	1 5/8
June 4	9.6	26 1/2	7 1/8	5 1/8	9 1/2	13 1/2	2 1/8
June 13	12.4	32	8	6 3/8	12	14 3/4	2 3/8
June 19	14.4	34	9 1/4	6 5/8	12 1/4	14 7/8	3
June 26	17.3	38	9 1/2	7 3/8	12 3/4	15 7/8	3
July 3	20.0	39	11 3/4	7 5/8	14 1/2	17 1/2	3 1/2
July 10	22.6	42	12	8 1/8	16 1/2	17 3/8	3 1/4
July 22	27.3	44	13	8 3/4	17 1/2	18 1/2	3 1/2
Aug. 17	38.0	51 3/4	15 1/2	9 5/8	19 1/2	21 3/4	3 3/4
Sept. 1	43.0	54 3/4	15 3/4	9 3/4	22 3/4	23 3/4	4
Sept. 15	51.0	58 1/2	17	10 1/2	22	24 5/8	3 7/8
Oct. 7	61.0			10 1/2		25	
Nov. 10	70.0	62	18	10 1/2		27	4 1/8
Dec. 7	63.0	61	18	10 3/8	24	27	4 1/2
Jan. 14	81.0	64	17 1/2	11	24	28	4 3/8
Feb. 18	80.0	64	17 3/4	10 1/2	25	30	4 3/8
April 1	75.0	65	19	10 3/4	25	30 3/4	4 1/2
May 10	78.0	64 1/2	18 3/4	11 1/8	26 1/2	29	4 3/8

*Measurements are in inches and weights are in pounds.

Figure 3. Cumulative growth of female wolf - ear tag # 12.
(Data from Table 4)

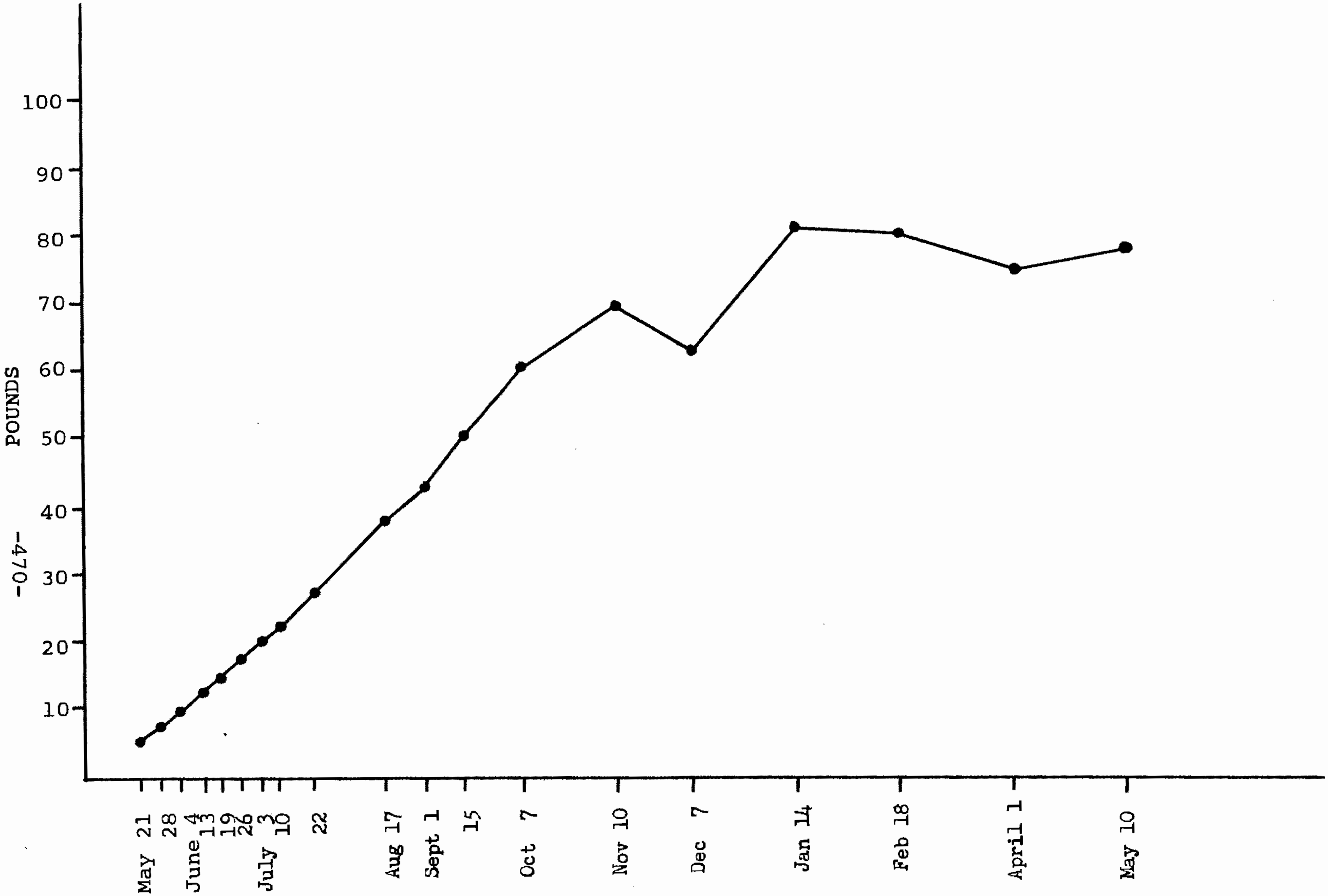


Table 5. Growth measurements* of a captive female wolf - ear tag # 11

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.5	21 1/4	5 7/8	4 1/8	7 3/4	11 1/4	1 1/2
May 28	7.4	24 1/8	5 7/8	4 1/2	9 1/4	12 5/8	1 5/8
June 4	9.6	26 1/2	7	5 1/4	10	13 1/4	2 1/8
June 13	12.5	31 1/2	8 1/2	6	11 3/4	15 1/8	2 5/8
June 19	14.9	32 1/2	9 1/4	6 3/8	13 1/4	15 1/8	2 7/8
June 26	17.5	35 1/4	10 3/8	7 1/4	13 1/2	16	3 1/8
July 3	20.9	40	10 3/8	7 3/4	13 1/2	17 1/4	3 3/8
July 10	22.4	41 1/4	12 1/4	8	16 1/2	18 1/8	3 1/4
July 22	27.8	43	13 1/4	8 3/4	18 1/4	19 3/8	3 1/2
Aug. 17	38.0	51	15	9 1/2	20 1/4	22	4
Sept. 1	42.5	53 3/4	16	9 3/4	22 1/2	24 3/4	4
Sept. 15	50.5	57	17 3/4	10 3/8	22 1/2	24 1/4	3 7/8
Oct. 7	59.0	59 3/4	18 1/2	10 1/2	23 1/2	25 1/2	4 3/8
Nov. 10	70.0	65	18 1/2	10 5/8	25	26	4
Dec. 7	67.0	62	17 1/2	10 1/2	26	27 1/4	4 1/4
Jan. 14	78.0	63	17 1/2	11	27	29	4 1/4
Feb. 18							
April 1							
May 10	77.0	66	18 1/2	10 7/8	27	29 1/4	4 1/8

*Measurements are in inches and weights are in pounds.

Figure 4. Cumulative growth of female wolf - ear tag # 11. (Data from table 5)

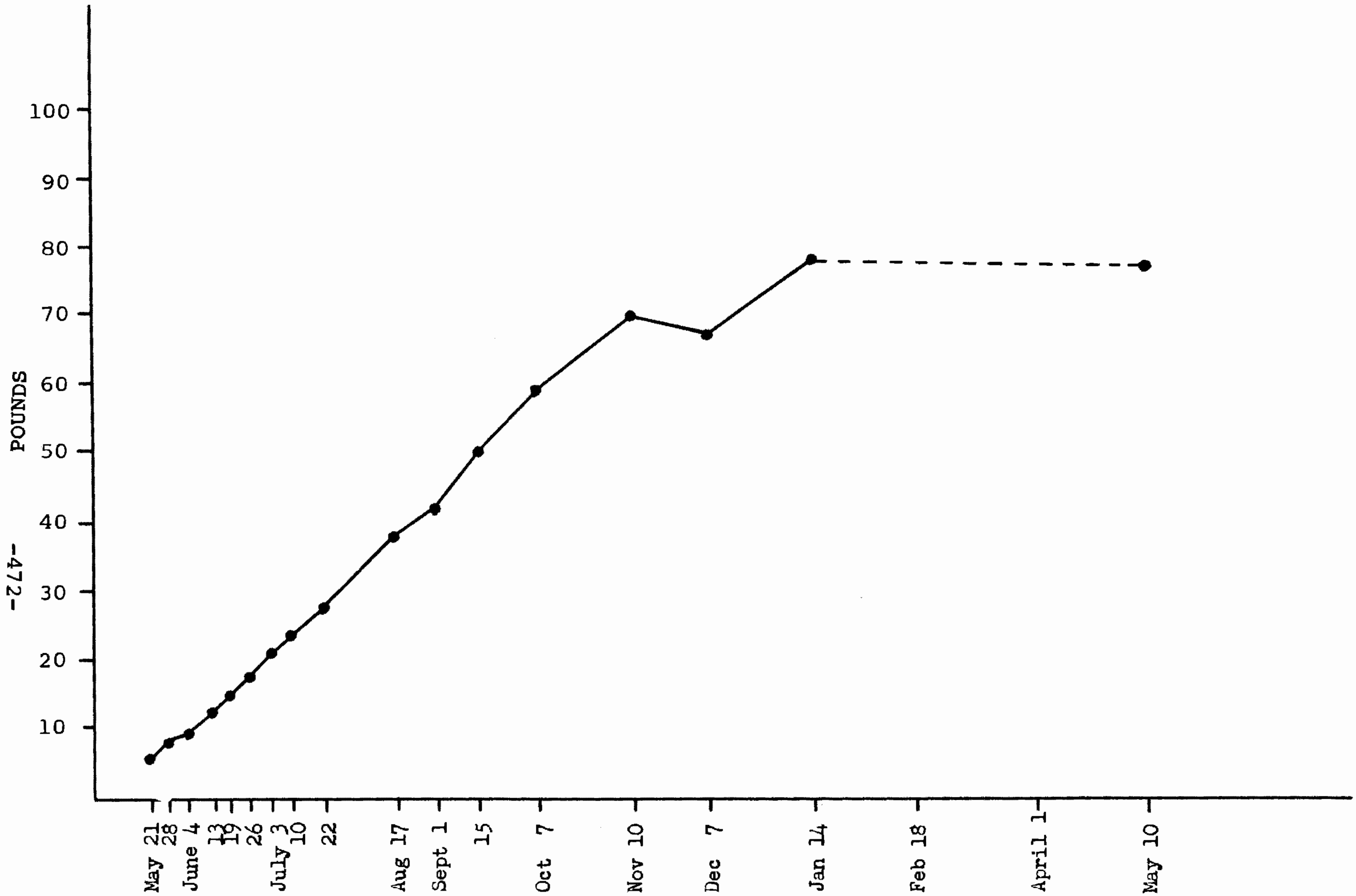


Table 6. Growth measurements* of a captive male wolf - ear tag # 3.

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.4	20 5/8	5 5/8	4	7 3/4	11 7/8	1 5/8
May 28	7.2	24 1/8	6 3/8	4 3/8	8 7/8	12 1/4	1 1/2
June 4	9.9	26 1/4	7 3/4	5 1/8	10	13 5/8	1 7/8
June 13	13.7	31 3/4	8 1/4	6 3/8	13	15 1/4	2 7/8
June 19	16.5	34	9 1/4	7 1/8	13	15 5/8	3 1/8
June 26	19.7	37 1/2	10 1/2	7 1/2	14 1/2	16 1/2	3
July 3	23.1	39 3/4	11	8	14 3/4	17 1/4	3 1/4
July 10	25.1	41 1/4	12	8 1/2	17 1/2	18 1/2	3 5/8
July 22	31.5	46 1/4	13 1/4	9	18 3/4	19 5/8	4
Aug. 17	42.0	51	15 1/8	10 1/8	20 3/4	22 1/8	4
Sept. 1	48.5	53 1/2	16 3/4	10 1/2	24 1/2	25	4
Sept. 15	58.0	57	17 1/2	10 5/8	23	25	4 1/4
Oct. 7	70.0		17 1/2	11 1/8	24	26 1/2	4 1/4
Nov. 10	85.0		18	11 1/2	26	29	4 3/8
Dec. 7	80.5			11 1/4		30	
Jan. 14	100.0			11 5/8		30 1/2	
Feb. 18	101.0		17	11 1/2	28 3/4	32 1/4	
April 1	96.0		17 3/4	11 3/4	28	30	
May 10	100.0		18 1/4	11 5/8	28 1/4	32 7/8	5

*Measurements are in inches and weights are in pounds.

Figure 5. Cumulative growth of male wolf - ear tag # 3.
(Data from Table 6)

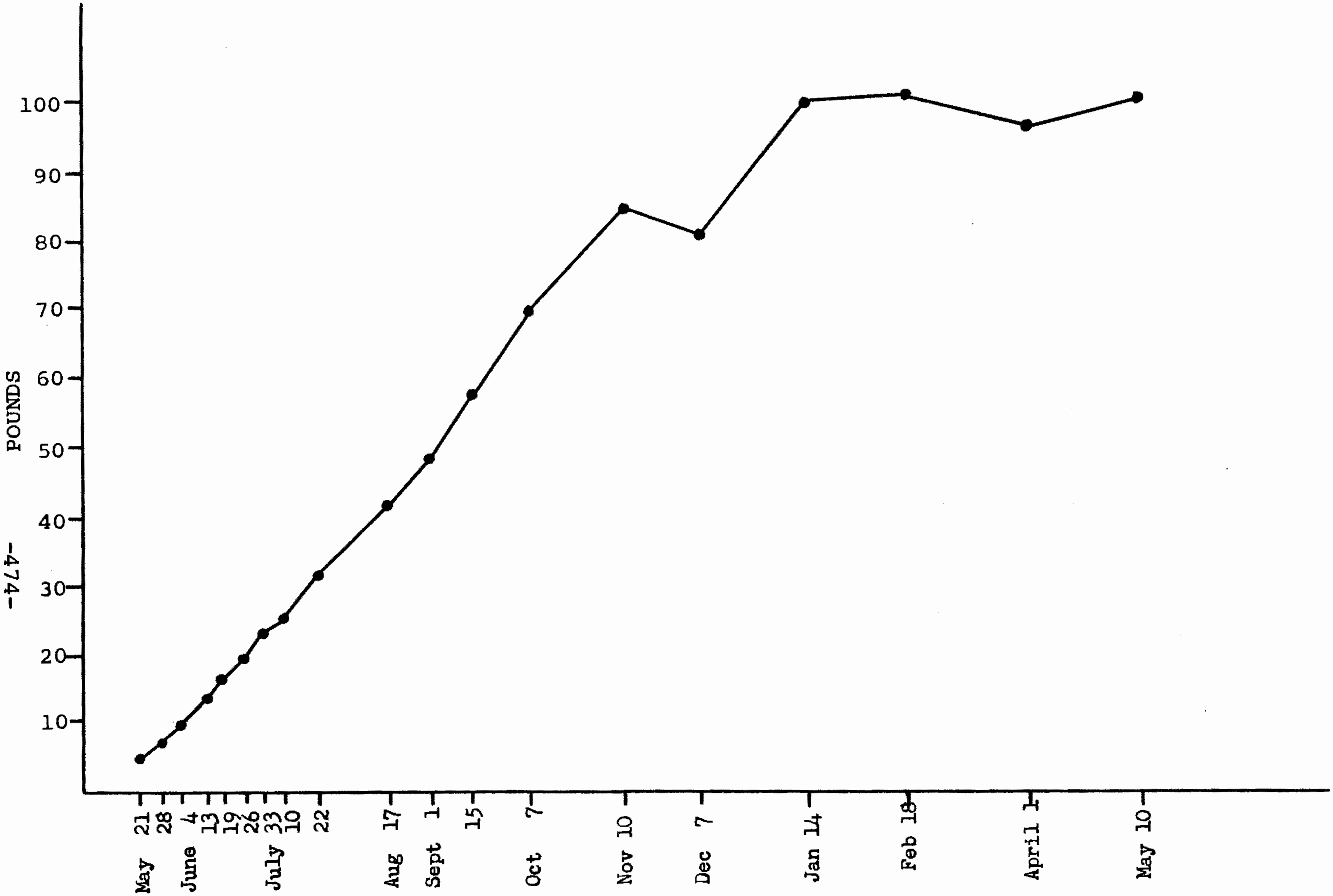


Table 7. Growth measurements* of a captive male wolf - ear tag # 2

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.1	20 3/4	5 1/4	4	7 1/2	11 3/4	1 3/8
May 28	6.5	22 1/4	6	4 5/8	8 3/4	12 3/8	1 1/2
June 4	9.3	25 1/2	7 1/8	5	10	13 3/4	1 3/4
June 13	12.8	30 1/2	8 3/4	6 1/8	11 7/8	14 3/4	2 7/8
June 19	15.3	32 1/2	9	6 3/8	12 1/2	15 1/8	2 7/8
June 26	18.5	36 1/2	10	7 1/8	13 3/4	16 1/4	3 1/8
July 3	22.0	37 3/4	10 3/4	8	13 1/2	16 1/2	3 3/8
July 10	25.0	39 1/2	11 1/2	8 1/4	17	18 1/4	3 3/8
July 22	31.4	44	13	9	18 1/2	19	3 5/8
Aug. 17	42.0	52 1/4	14 1/2	9 3/4	21 1/4	22	4
Sept. 1	48.0	55 1/4	16	10	23 3/4	24 1/4	4
Sept. 15	59.0	58	15 5/8	11	25	25 3/8	4 1/8
Oct. 7	73.0			11 1/8	27		
Nov. 10	87.0	67 1/4	18 1/4	11	26	28	4 1/4
Dec. 7	89.0			11 1/4	27	30	
Jan. 14	103.0		18	11 5/8		31	
Feb. 18	106.0			11 3/8	29	33 3/4	
April 1	101.5			11 3/8	27 1/2	31 1/2	
May 10	101.0		18 1/8	11 5/8	28 1/4	31 3/4	4 1/2

*Measurements are in inches and weights are in pounds.

Figure 6. Cumulative growth of male wolf - ear tag # 2.
(Data from Table 7)

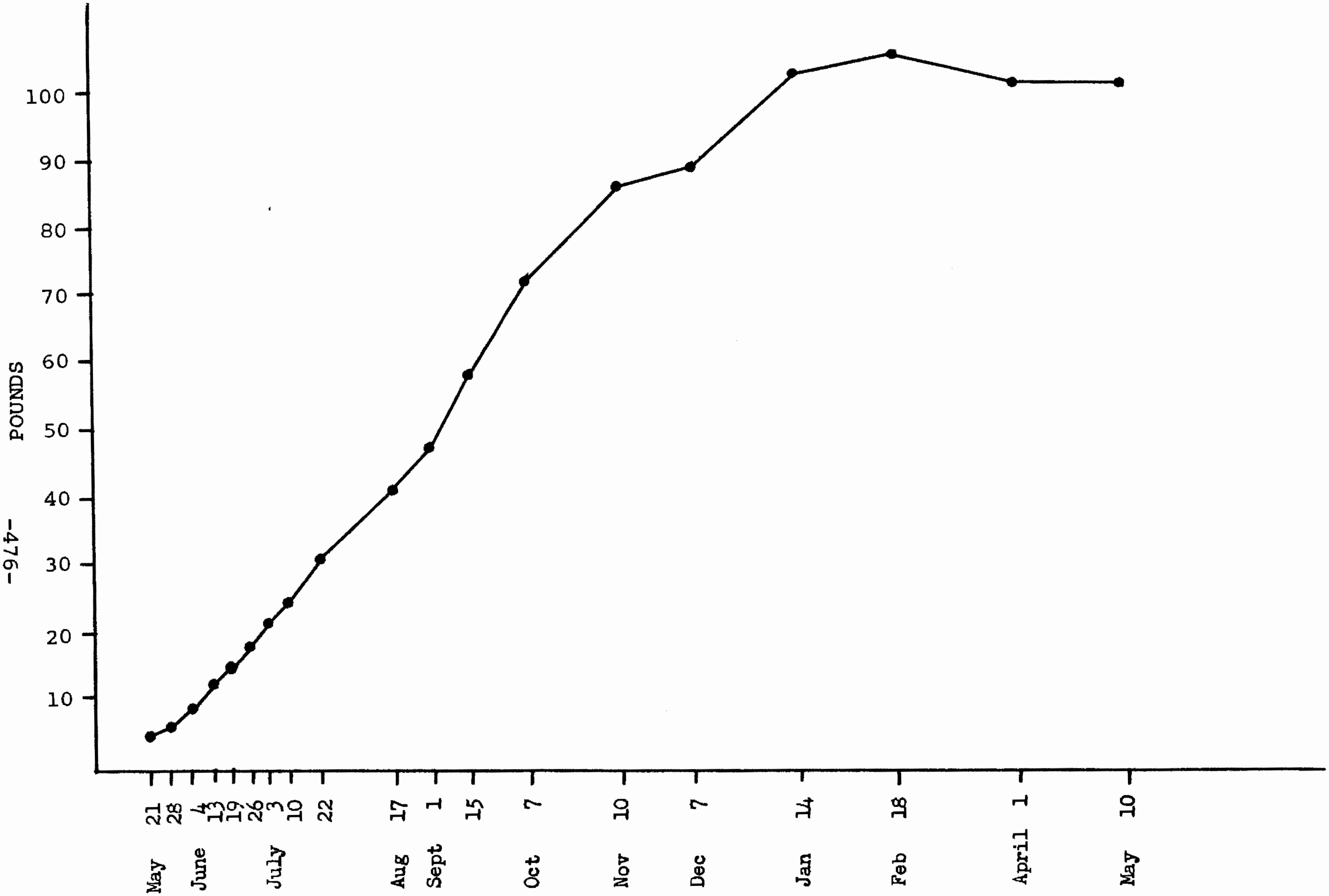


Table 8. Growth measurements* of a captive male wolf - ear tag # 5

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.5	20 1/8	5 3/8	4 1/8	7 7/8	12	1 3/8
May 28	7.6	24	6 5/8	4 3/4	9 1/2	12 7/8	1 5/8
June 4	10.2	27	7 5/8	5 3/8	10 1/8	13 1/2	2
June 13	14	31 1/2	8 1/2	6 1/4	12 1/4	15	2 5/8
June 19	16.5	33 3/4	9	6 3/4	13 1/4	16	3
June 26	19.8	36 3/4	10	7 1/2	13 5/8	17	3 1/8
July 3	23.2	38 1/2	11 1/4	8 1/4	14 3/4	17 1/8	3 3/8
July 10	26.1	42 1/2	11 7/8	8 1/2	16 3/4	18 5/8	3 3/8
July 22	33.4	46	13 1/4	9 1/8	19 1/4	20 1/8	3 5/8
Aug. 17	43.5	52	15 1/4	10	21 1/4	22 3/4	3 3/4
Sept. 1	49.5		15 3/4	10 1/4	22		4 1/2
Sept. 15	58.5	57	17	10 1/2	24	26 1/8	4 1/8
Oct. 7	71.0						
Nov. 10	81.0			10 1/2			
Dec. 7	77.0			11 1/4		30	
Jan. 14	99.0			12		30	
Feb. 18	102.5			11		32 1/2	
April 1	101.5			11 1/4	27 3/4	31 3/4	
May 10	104.5		18	11	27	31	4 7/8

*Measurements are in inches and weights are in pounds.

Figure 7. Cumulative growth of male wolf - ear tag # 5.
(Data from Table 8)

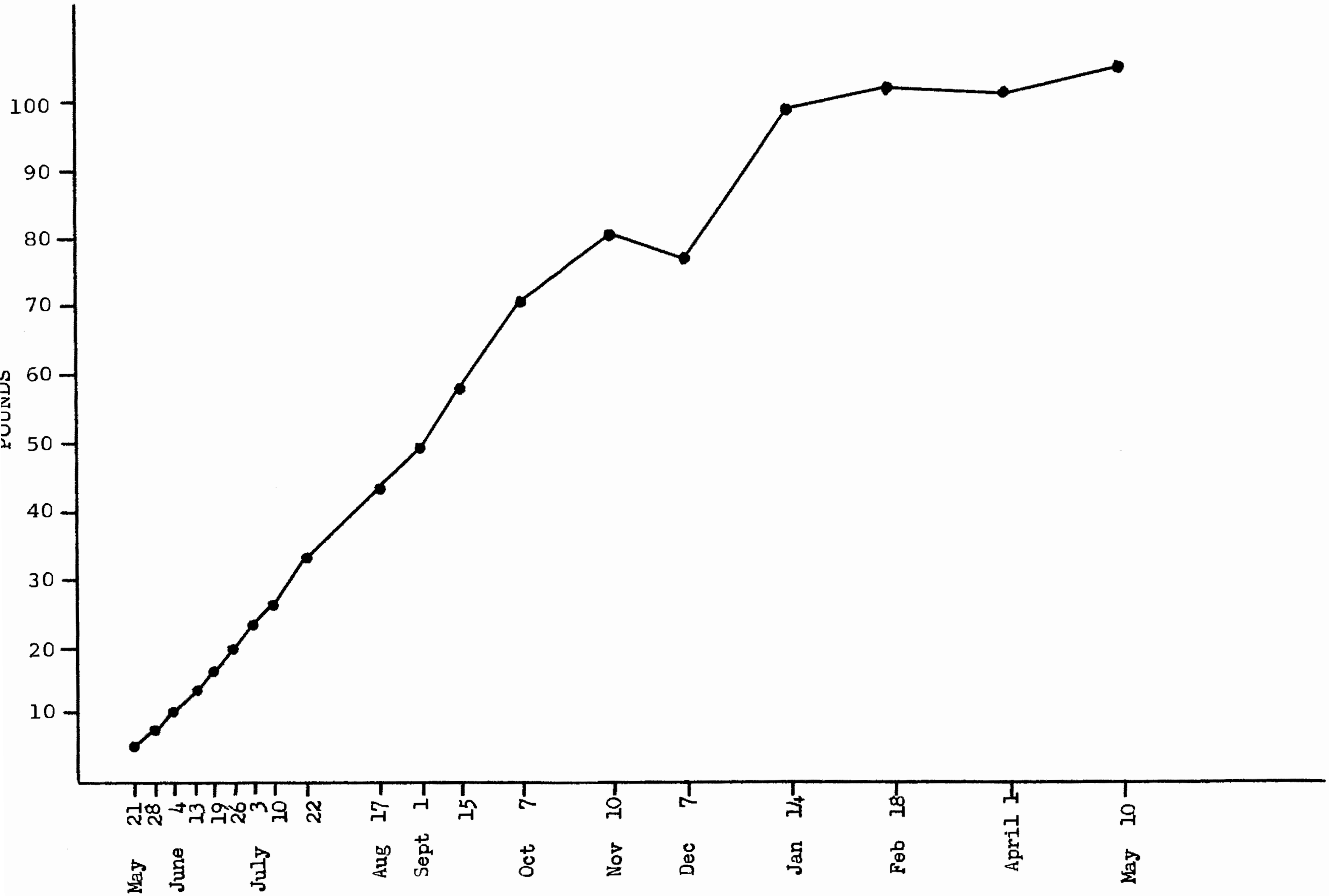


Table 9. Growth measurements* of a captive male wolf - ear tag # 13.

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.7	22 3/8	5 3/4	4 1/8	7 5/8	12	1 3/8
May 28	8.1	25	6 1/4	5	9 1/8	14	1 5/8
June 4	10.9	27	7 1/2	5 1/2	10 1/8	14 1/4	2 1/8
June 13	14.1	32 1/2	8 1/2	6 3/8	12 5/8	15 5/8	2 1/2
June 19	17.1	34 1/4	9 3/4	7	13 1/8	16 14/	3
June 26	20.0	38 1/2	10 1/4	7 3/4	13 3/4	17 1/8	3 1/8
July 3	23.2	42	11 3/4	8 1/8	14 3/8	17 3/4	3 3/8
July 10	26.1	43 1/2	11 3/4	8 5/8	17	19 1/4	3 3/8
July 22	33.3	46	13	9 1/4	18	19 5/8	3 3/4
Aug. 17	43.5	52 3/4	15 1/2	10 3/8	20 1/4	22 1/2	4
Sept. 1	50.7	58 1/2	16	10 1/2	23 1/2	25 1/2	4
Sept. 15	61.0	62 1/2	18	11 5/8	24	25 3/4	4
Oct. 7	72.0	62 1/2	18 1/2	11 5/8	25	27	4 5/8
Nov. 10	89.5	66	18	11 1/8	25	30 1/2	4
Dec. 7	93.0			11		30	
Jan. 14	98.0	65	19	11 1/2		30	4 1/2
Feb. 18	108.0	68	17 1/2	11 1/2	29	31 3/4	4 3/4
April 1	110.0			12 1/4		34	4 1/2
May 10	107.5		17 3/4	12	28 7/8	31	4 1/2

*Measurements are in inches and weights are in pounds.

Figure 8. Cumulative growth of male wolf - ear tag # 13.
(Data from table 9)

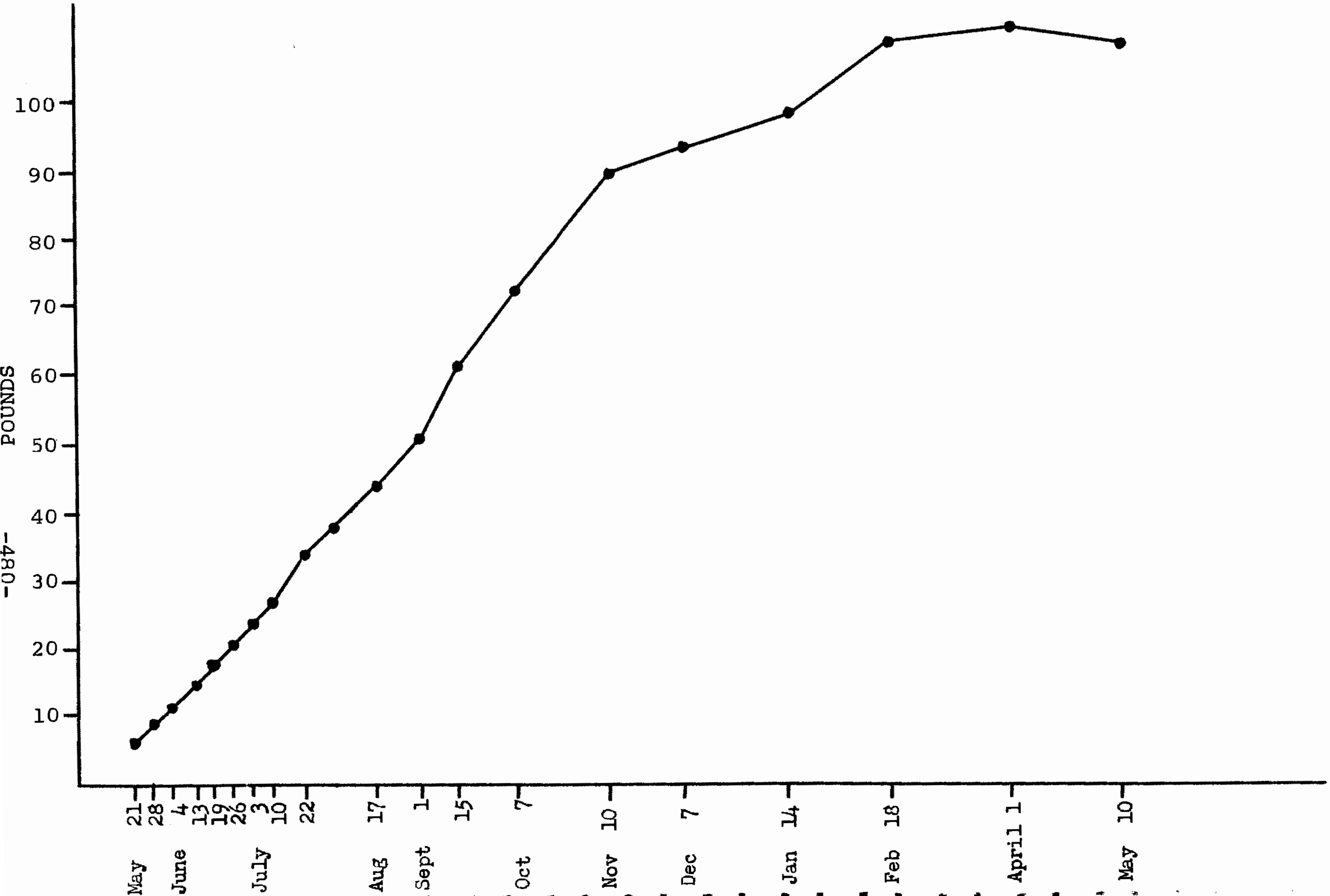
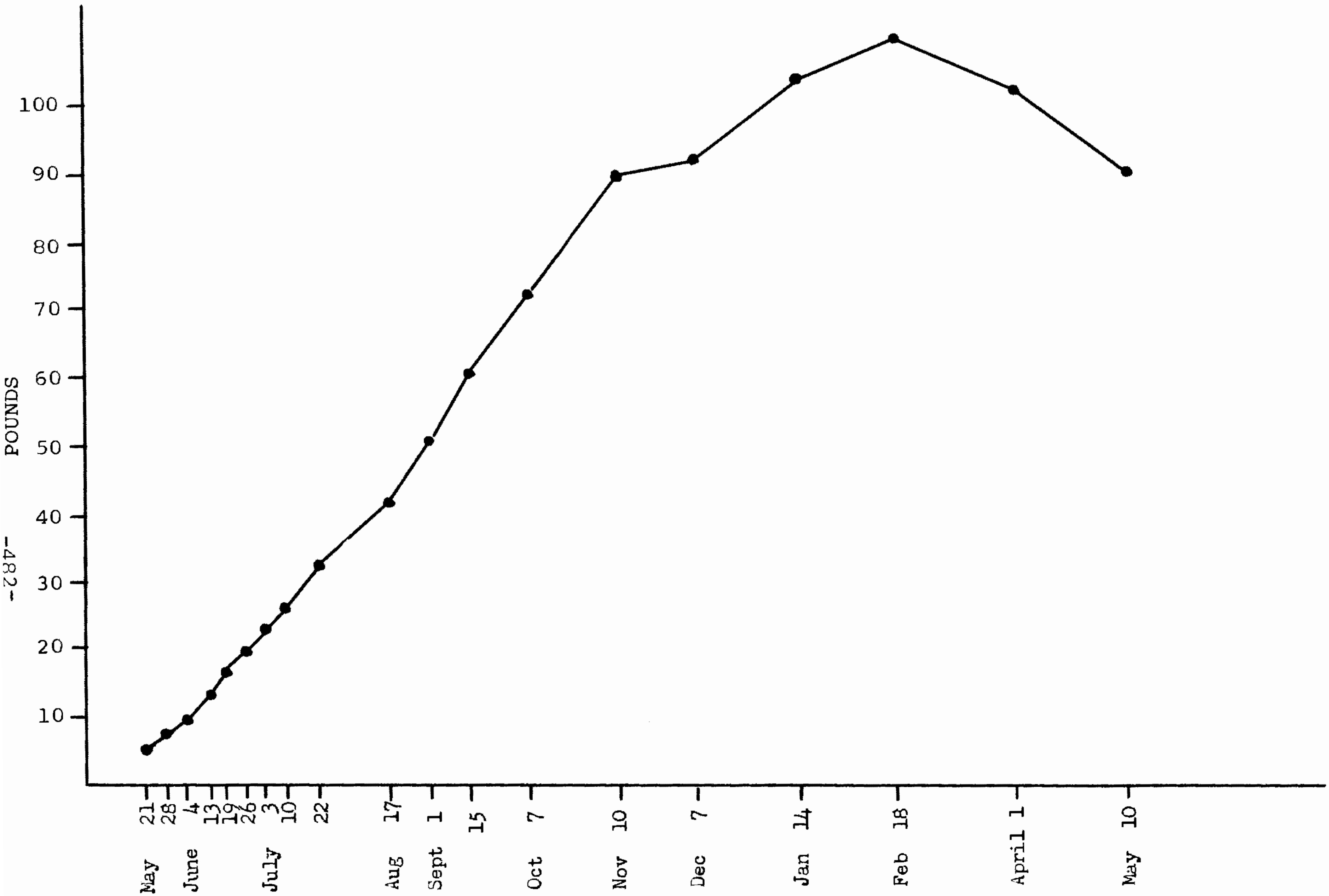


Table 10. Growth measurements* of a captive male wolf - ear tag # 15.

Date	Weight	Total Length	Tail Length	Hind Foot	Height at Shoulder	Chest Girth	Ear
May 21	5.4	21 1/4	5 7/8	4 1/8	8	11 3/4	1 1/2
May 28	7.6	24	6 1/4	4 7/8	9	13	1 1/2
June 4	9.9	27	7 1/8	5 1/4	10	14	2
June 13	13.6	32 1/2	8 3/4	6 1/8	12 1/4	15 5/8	2 5/8
June 19	16.5	34 1/2	9 1/8	6 3/4	13	16	3
June 26	19.8	37	10 3/4	7 1/2	13 1/2	17 1/2	3 1/4
July 3	23.1	40 1/4	10 3/4	8 3/8	14 5/8	17 1/8	3 3/8
July 10	26.0	42 1/2	11 3/4	8 1/2	17	19 1/4	3 1/2
July 22	32.5	46	13 1/4	9 1/8	19	19 1/2	3 1/2
Aug. 17	44.0	52	16	9 7/8	20 1/4	23 5/8	4
Sept. 1	50.5	56	16 1/4	9 7/8	22	25	4
Sept. 15	60.5	59	17 7/8	10 5/8	24	26 1/8	4
Oct. 7	72.5			11	27 1/2		
Nov. 10	90.0		18	11 1/4	26	31	4 1/8
Dec. 7	92.0			11 1/4		31	
Jan. 14	104.0	64	18	11 5/8	28	31	4 5/8
Feb. 18	109.0	67 1/2	17	11 3/4	29 1/2	33 1/4	5 1/4
April 1	101.5	68	17 1/2	11 3/4	28 1/2	33	4 1/8
May 10	89.5		17 3/4	11 7/8	29	32 1/2	4 1/4

*Measurements are in inches and weights are in pounds.

Figure 9. Cumulative growth of male wolf - ear tag # 15.
(Data from Table 10)



of their efforts.

The captive wolves were not anesthetized to facilitate handling, so apparent errors in the tabulation of some measurements are the result of the individual wolf's activity during the time that measurements were being taken. A lowered rate of weight gain was apparent for the period November 11 to December 7. The reason for this has not been determined. During December 8 through January 14, an increase in the wolves' rate of weight gain accompanied a rise in the average daily food consumption.

Table 11 summarizes the food consumed by the wolves during their first year of captive life and Table 12 gives the average pounds of food consumed during intervals between growth measurements.

Recommendations:

This report has been directed toward the compliation of the various interrelated data collected from wolves in Southeastern Alaska. An evaluation of these data will be possible when the analysis of the reproductive specimen material is completed. Efforts to collect material from wolf specimens should be continued.

Additional areas that have physical features like those of the den located on Kupreanof Island should be investigated for signs of wolf activity during August at which time the accumulation of tracks resulting from wolf movements across mud flats near denning areas makes den hunting practical.

Prepared by: Approved by:

Paul Garceau
Research Biologist
30 June 1960

Sigurd T. Olsen
P-R Coordinator

James W. Brooks, Director
Division of Game

Table 11. Summary of food consumed by seven captive wolves between May 19, 1959, and May 10, 1960.

Date	Pounds Evaporated Milk	Table Spoons Pablum	Pounds Dry Dog Food	Miscel-lanious	Pounds Pickup*	Pounds Water Added	Total Weight Consumed	Pounds Left Uneaten
May 19 - May 21	6.3	12	0.0	1 lb.	?	?	10.0	.8
May 22 - May 28	13.6	15	3 cups		4.2	43.2	61.5	3.6
May 29 - June 4	11.9		11.0		40.4	10.3	74.0	
June 5 - June 13	17.2		18.0		74.2	15.3	116.0	8.8
June 14 - June 19	7.3		14.5		64.0	19.7	96.0	9.5
June 20 - June 26	8.2		14.5		103.4	26.9	148.5	4.5
June 27 - July 3	7.3		15.0		131.5	28.7	179.1	3.4
July 4 - July 10	7.3		10.5		159.1	40.6	180.0	28.1
July 11 - July 22	20.8		12.0		390.0	63.2	388.2	97.8
July 23 - Aug. 17	45.5		68.5		826.0	143.7	929.3	154.5
Aug. 18 - Sept. 1	27.1		22.5		529.1	72.4	528.9	122.1
Sept. 2 - Sept. 15	0.0		0.0		440.0	0.0	440.0	0.0
Sept. 16 - Oct. 7	1.8		1.5		811.2	10.3	811.2	13.6
Oct. 8 - Nov. 10	0.0		9.0		1100.1	26.0	1103.1	32.0
Nov. 11 - Dec. 7	0.0		10.0	20 lbs.	905.3	15.0	950.3	0.0
Dec. 8 - Jan. 14	0.0		0.0		2165.5	0.0	2165.5	0.0
Jan. 15 - Feb. 18	0.0		0.0		1756.2	0.0	1756.2	0.0
Feb. 19 - April 1	0.0		0.0		1513.5	0.0	1513.5	0.0
April 2 - May 10	0.0		0.0	8 beavers	1527.0	0.0	1527.0	0.0

*Pickup was generally 75% fish, 15% cerial, and 10% water.

Table 12. Average pounds of food consumed per day per period.

Periods	Pounds of Food Consumed	Number of Days	Average Pounds per Day
May 19 - 21	10.0	3	3.3
May 22 - 28	61.5	7	8.8
May 29 - June 4	74.0	7	10.7
June 5 - 13	116.0	9	12.9
June 14 - 19	96.0	6	16.0
June 20 - 26	148.5	7	21.2
June 27 - July 3	179.1	7	25.6
July 4 - 10	180.0	7	25.8
July 11 - 22	388.2	12	32.3
July 23 - Aug. 17	929.3	26	35.7
Aug. 18 - Sept. 1	528.9	15	35.2
Sept. 2 - 15	440.0	14	31.4
Sept. 16 - Oct. 7	811.2	22	36.9
Oct. 8 - Nov. 10	1103.1	34	33.3
Nov. 11 - Dec. 7	950.3	27	34.9
Dec. 8 - Jan. 14	2165.5	38	57.0
Jan. 15 - Feb. 18	1756.2	35	50.1
Feb. 19 - April 1	1513.5	43	35.2
April 2 - May 10	1527.0	38	40.1

Volume 1 Report No: K-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: K Wolf Management Studies

Job No: 3 Title: Food Habits & Hunting Behavior of Wolves In Southeastern Alaska

Period Covered: July 1, 1959 - June 30, 1960

Abstract:

Existing information on wolf food habits indicates that wolves are nearly, if not entirely, dependent on deer on the islands of Southeastern Alaska.

At certain times, wolves localize their hunting activities and it appears that they choose to travel and hunt along frozen lakes when conditions permit.

Objectives:

To determine the food habits of wolves on a seasonal basis and with varying conditions of prey availability, the techniques of hunting and taking prey, the extent of intraspecific competion for food, and the reaction of prey to the presence of wolves.

Techniques:

Analysis of scats found along trails on Kupreanof Island during June, July, and August, and in the rearing area near a wolf den provided the means of determining food composition.

Aerial observations of wolf kills provided some information on the manner in which the prey is hunted and killed.

Findings:

<u>Food habits</u>. On August 3, 1958, forty scats were examined by C. Lensink and myself in the vicinity of a wolf den on Kupreanof Island. All of these contained remains of deer. Remains of other animals were not apparent. On August 23, 79 additional scats were taken from the area and these showed a 95 percent frequency of deer remains when examined in the laboratory. Of the scats containing deer remains, 62 percent contained remains of fawns. These data cannot be shown to indicate a selective predation on fawns. Hair texture, teeth, and parts of hooves were used as criteria for distinguishing fawn from adult remains.

Field examination of 12 scats found on trails in 1958 showed 83 percent frequency of deer remains of which at least 40 percent were fawn.

Beaver remains constituted the second highest frequency of occurrance in scats but the degree to which beaver and other foods act as buffers cannot be shown until deer numbers fall considerably below their present level of abundance. At present the data clearly indicates that wolves are dependant on deer as a food on the islands in Southeastern Alaska.

A summary of food habits based on scat material is presented in Table 1.

<u>Hunting behavior</u>. The several observations of wolf packs described in Job 1 indicate that wolves frequently spend several days hunting over small (under 1/2 square mile) areas before moving to another area.

During cold periods it appears that wolves prefer to travel on frozen lakes. Deer that run out of the timber

Table 1. Summary of analysis of wolf scats collected on Kupreanof Island during June, July, and August, 1958.

Location	No. Examined	Deer No.	Deer %	Beaver No.	Beaver %	Mice No.	Mice %	Bird No.	Bird %
Den Site Kupreanof Is.	79	75*	95	18	23	7	9	4	5
Den Site Kupreanof Is.	40	40	100						
Trails Kupreanof Is.	12	10	83	2	17				

* Of the 75 scats containing deer remains, 46 or 62% contained remains of fawns.

One scat found at the den site contained a small piece of harbor seal hide.

onto the open ice are usually overtaken easily by pursuing wolves. It is not known if wolves deliberately chase deer onto frozen lakes or if pursued deer choose to run onto frozen lakes.

Recommendations:

Food habits of wolves as reflected by an analysis of scats can be useful information during changes in levels of deer abundance. Until there is a change in the present level of deer abundance, the time allotted for hikes on trails for the purpose of scat collection, should be reduced.

An examination of the stomach contents of dead wolves should continue whenever these are available.

Observations on the hunting behavior of wolves should be continued whenever possible.

Literature Cited:

Klein, David R. and Sigurd T. Olson, 1960. Natural Mortality Patterns of Deer in Southeastern Alaska. Journal of Wildlife Management, 24 (1):80-88.

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30 June 1960

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Volume 1 Report No: L-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: L Wildlife Data Collections

Job No: 1 Title: Wildlife, Reconnissance, Northwest Coastal Alaska

Period Covered: July 15, 1959 - April 15, 1960

Abstract:

Printed forms, maintained by selected individuals in various native villages, were used to gather harvest data from native communities in Northwestern Alaska. Of the 12 villages that participated during the period October 1959-March 1960, 3 depended primarily on wild terrestrial animals and the remainder on either domesticated reindeer or marine mammals.

Sport hunters largely limit their activity to terrestrial animals, except for one marine animal, the polar bear.

Waterfowl hunting is not restricted to the legal season.

The three most important management problems in Northwestern Alaska are (1) enlightening the people in regards to our regulations and conservation aims, (2) enforcing fish and game regulations, and (3) managing the caribou herds and reindeer industry so that maximum benefits accrue.

Objectives:

To determine the distribution and abundance of fur and game mammals and birds. To determine the magnitude and characteristics of the harvest of fur and game mammals and birds. To identify specific wildlife management problems, if such exist, in the previously little studied west and northwest coastal regions of Alaska.

Techniques:

The collection of wildlife data in Northwestern Alaska largely is still in the cataloging stage. Few of the localities or species have received intensive study, and in many instances distribution and harvest have been the only facets investigated to date. The process of enlightenment undoubtedly will continue at a slow pace, due in part to the high cost of research, the remoteness and vastness of the area, and the international aspect of a number of important wildlife species.

Much of the data relating to this project were obtained during surveys and investigations designed for other projects. Numerous moose survey flights were made in Northwestern Alaska during the winter, and any observations relevant to the Wildlife Reconnaissance project were recorded. During visits to many native villages, interviews with hunters and storekeepers furnished information about game abundance and harvest. Conversations with bush pilots, guides, and other residents possessing local knowledge produced much information about abundance and distribution of game species; these individuals were encouraged to report observations throughout the year and in some instances the response was gratifying. Acquiring accurate harvest information from interviews is difficult, however, and another method was instituted to gain harvest data.

A printed form termed WILDLIFE HARVEST REPORT lists the most important wildlife species in the area and was devised for recording the harvest in selected villages. Each form contains the entries for one week. It is shown in Figure 1.

The native store managers or other appropriate individuals were charged with obtaining the data and submitting the completed forms. However, only 12 actively participated in the program. Interest in harvest data collection was

WILDLIFE HARVEST REPORT

Village ______________________ Period ______________________

	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
SUNDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
MONDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
TUESDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
WEDNESDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
THURSDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
FRIDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		
	OOGRUK____	WALRUS	WHALES	MOOSE____
		Adults____	White____	
	SEALS	Calves____	Dark ____	CARIBOU____
SATURDAY	Ringed____	POLAR BEAR		
	Spotted____	Adults____		SHEEP____
	Ribbon	Cubs		

REMARKS: (USE OTHER SIDE OF SHEET)

Figure 1. A sample of the Wildlife Harvest Report form used to gather harvest data from native villages.

maintained by frequent correspondence. At the end of each month the harvest was computed and a summary of the take submitted to all participating villages. The accuracy of the data undoubtedly varied greatly; this aspect will be discussed later.

Findings:

Nearly all of the information obtained has been of a general nature, however, such information is essential for the definition of future investigations and problems.

Wildlife Utilization

Many species of wildlife are heavily utilized by the people of Northwestern Alaska. Some species, such as seals and walruses, are harvested almost exclusively by native peoples, while other species, such as polar bear, are rapidly assuming more importance as sport trophies. Undoubtedly such trends will continue as the native populations continue to desert a hunting economy.

Utilization by natives. Wildlife harvest reports furnished most of the information concerning wildlife utilization by natives. However, only the most important wildlife species were included; the species of lesser importance, such as ptarmigan and snowshoe hare, were excluded so that the forms would remain simple and easily completed. Even so, some of the villages reported difficulty in maintaining accurate records.

The harvest reports from different villages are not equally reliable. Many of the recorders were as accurate as their ability and time permitted; the fingerprint smudged, seal oil stained, and generally abused sheets attested to that. Other recorders, although professing cooperation and immense interest, were lax in recording observations; their spotless, unwrinkled report forms possessed a stereotyped appearance. Although such forms are of doubtful value in assessing the harvest quantitatively, they are of value in determing the availability, and to a limited extent, seasonal abundance of various species.

Another problem encountered involved the terminology of seals. Generally through conversations with the villagers I could correlate their terminology with mine so that the recorder could mark the forms correctly. Discrepancies arose, however, even after I had visited the villages and conversed with the recorders. For instance, at Wales the ringed seals are termed "common" or "common-heared seals," and on the first forms the Wales recorder submitted, the words "common seal" had been added to the forms. An affirmative, but often impassive, shake of a native's head does not necessarily denote understanding.

Although I had instructed them otherwise, a few of the recorders believed that if no game were taken during the week no forms need to be submitted. Consequently, during some of the periods for which no reports were received no game was taken. Other reasons, such as a lack of enthusiasm or the absence of the recorder from the village, also contributed to the number of reportless periods; undoubtedly various amounts of game were taken during those intervals. Thus it is impossible to evaluate those periods during which the harvest was not recorded. In general, the reports proved satisfactory in obtaining harvest data.

The Harvest Report program was instituted October 25 in all villages except Wales; there the program started October 18. The monthly breakdown of the harvest data for the period October 1959 - March 1960 is contained in Table 1.

Of the 12 villages that submitted reports throughout most of the period, two depended primarily on wild terrestrial mammals and the remainder on either domesticated reindeer, which are not included in the Harvest forms, or marine mammals. Unfortunately, the reporting period does not include the months of April, May, and June; during those months many seals and walruses are harvested by coastal hunters.

Fur-bearers are locally important, but the low prices offered for most pelts has curbed the trapping effort. However, the prices of mink, Arctic fox and beaver pelts were sufficiently large during 1959-60 to generate interest in those species.

VILLAGE	OCTOBER#		NOVEMBER		DECEMBER		JANUARY		FEBRUARY		MARCH	
Buckland		0		0		0		0		0		0
Deering	BS	5		0*		0		0		0		0
	RS	27										
Elim	BS	1	HS	2		0		0		0	RS	35
	RiS	1									BS	1
Golovin	HS	12	HS	9*		0		0		0	RS	8*
			BS	4							BS	2
Kobuk		0	Car	18	Car	8	Car	22	Car	3*	NR	
Pt. Hope	Wal	1	Wal	1*	NR		NR		NR		NR	
			RS	21								
			HS	24								
Selawik	Car	2	Car	5	Car	245	M	2	Car	31		0
					M	8						
Shaktoolik	BS	1		0		0	BS	2	BS	3	BS	3*
	HS	3					RS	3	RS	5	RS	27
Shishmaref	BS	3	BS	1*	NR		S	12*	RS	30*	NR	
	RS	6	RS	44					PB	1		
	HS	2	HS	1								
	M	1										
Shungnak		0	Car	54	Car	31	Car	32	Car	49	Car	5*
Stebbins	BS	1	Bs	2		0	RS	3	RS	37	RS	18*
	RS	5	RS	1								
Wales	BS	2	BS	13*	BS	2	RS	28	RS	40	BS	2
	RS	15	RS	161	RS	134					RS	71
	Wal	1	HS	16	HS	7						
			Wal	1	RiS	3						
					PB	2						
White Mountain		0	HS	1		0		0		0	HS?	8
											BS	3

Reporting period started October 25, 1959, for all villages except Wales; October 18 is the date for that village.

* Reports not received for one or more weeks during the month.

Key: BS=bearded seal, NR=no reports received, RS=ringed seal, Car=caribou, PB=polar bear, S=seal, species not designated, M=moose, HS=harbor seal, RiS=ribbon seal, Wal=walrus.

Table 1. A summary of the game reported taken during the period October 1959 - March 1960 by the 13 villages participating in the Wildlife Harvest Report program.

Mink occur throughout most of Northwestern Alaska, but only in the Selawik area were large catches reported. There, a store owner reported that the proficient trappers caught 40 or more mink each; the total catch was the largest recorded during the last five years.

The value of Arctic fox pelts increased greatly during 1959, and the trapping effort increased accordingly. These foxes are available only to the coastal and island trappers for this fur-bearer is associated with pack ice. However, the females often desert the pack ice during late winter and spring, remaining ashore on islands or coastal areas to whelp and raise their young. When the pack ice returns in early winter, the animals, both young and old, leave the land and again inhabit the ice pack. On St. Lawrence Island this situation often produces excellent trapping conditions during late fall and results in substantial catches. Such conditions apparently existed during fall and winter 1959-60, for Dr. Francis Fay of the Public Health Service reported approximately 2,000 foxes taken on the island. The trappers from other island and coastal areas also take Arctic foxes, but they catch fewer animals than do the St. Lawrence Island natives.

Beaver occur in coastal stream valleys north and south of the Seward Peninsula, but none have been sighted on the peninsula. The trapping effort and harvest of beaver have not been determined.

Many other species of wildlife are also utilized by the native populations, but the importance of those species to the native livelihood has not been ascertained.

Utilization by sportsmen. Sport hunters in Northwestern Alaska largely limit their activity to terrestrial animals, except for one marine mammal, the polar bear. The centers for sport hunting are Unalakleet, Nome and Kotzebue, due primarily to the white populations in those villages.

The hunting of polar bear and moose are discussed in two other reports and will not be included here.

Waterfowl and ptarmigan are the species sustaining the heaviest hunting pressure in the Seward Peninsula area, with Arctic hare and snowshoe hare also receiving some attention in early fall and winter.

Substantial fall populations of ducks and geese are available to sport hunters of Nome. Safety Lagoon, an extensive lagoon-marsh-stream complex located 20 miles east of Nome, is available by road and receives most hunting pressure. Golovin Lagoon and the Kuzitrine River system also harbor waterfowl, but the former, located 70 miles east of Nome, is largely restricted to airplane-borne hunters and the latter area is reached only after a combination road and boat trip. Essentially, Safety Lagoon is the hunting area for Nome waterfowl shooters.

Safety Lagoon was visited frequently during August, September and early October, 1959, in attempts to assess the availability of waterfowl. Many Nome sportsmen claimed that no fall waterfowl hunting was available in their area and the only recourse was to spring waterfowl hunting. Our findings dispute those claims.

Table 2 shows estimates of the number of ducks and geese sighted during a few trips to Safety Lagoon. Generally, only a small segment of the marsh was visited for at times the only transportation available was foot travel. Undoubtedly we saw just a fraction of the birds present. The salient point, however, is that ducks and geese were available for longer than one month of the season. The Nome sportsmen have adequate waterfowl hunting during the fall.

Date	Estimate of Number of Birds Sighted	
	Ducks	Geese
August 4	200+	
September 1	300+	200-300
September 6	1,000+	200+
September 12	1,000+	250
October 8	8	1,000
October 10	20	500+

Table 2. The estimated numbers of ducks and geese seen at Safety Lagoon during the fall, 1959.

Ptarmigan were hunted intensively during the fall in the Nome area prior to road closures. Much of the hunting consisted of "road hunting" and after a few weeks a common complaint of "no birds" arose. The person venturing off the road systems had no difficulty in finding birds, however.

Only desultory ptarmigan hunting occurred during the winter, with most attention focused on an accessible, two mile section of Anvil Creek. Birds remained in that area all winter. About 200 birds sighted on February 7 was the largest number I saw during my visits to the area.

Arctic and snowshoe hares were seldom hunted by Nome sportsmen; the two species elicit little interest. Undoubtedly the low returns per unit of hunting effort for Arctic hare and the hour plane flight required to reach snowshoe hare habitat reduce the attractiveness of those two species.

The importance of, and hunter interest in, waterfowl, ptarmigan and hares in other parts of Northwestern Alaska has not been ascertained.

Management Problems

The three most pressing management problems in Northwestern Alaska are (1) enlightening the people in regards to our regulations and conservation aims, (2) enforcing regulations, and (3) managing the caribou herds and reindeer industry so that maximum benefits accrue.

Public enlightenment. The native peoples of Northwestern Alaska are woefully ignorant of our game and fish regulations; the conservation principals underlying the regulations are even more incomprehensible. Familiarization with the regulations can be accomplished through repeated visits by Departmental personnel to all native villages, by numerous press releases and by utilizing the Nome radio station. At present, many natives are unaware that certain species have closed or open seasons, or that restrictions are placed on methods and means. Further, many natives believe that the regulations basically are made for white men, thus exempting natives. Unfortunately some pseudophilanthropists foster this belief.

Ensuring an understanding of the conservation principals underlying the regulations will be more difficult. The experiences of Dr. Francis Fay of the Public Health Service aptly depict the problem. Although Dr. Fay has spent approximately one and one-half years of the last eight at Gamebell, St. Lawrence Island collecting walrus specimens and other material essential for his research, his repeated dissertations have failed to convince the Gambell natives that the specimens are desired only for their scientific value and not for any economic gain. Apparently the people are unable to grasp the basic reasons for studying wild populations.

Conservation education must begin with school-age children if we hope to solve the problem, and the logical place to start is in the school. Educating only the adults will not solve the problem, although it may alleviate it for a time; basically such a practice only defers it. To be successful, a school conservation education program must be geared to Alaskan conditions. Instead of dealing with irrigation, mulch farming, soil errosion, etc., familiar topics such as walrus hunting, tundra fires, gill-netting and other daily occurrences should be incorporated into the program. A program that commences with a known subject and progresses to the unknown has more chance of success than one having its basis in unfamiliar tenets.

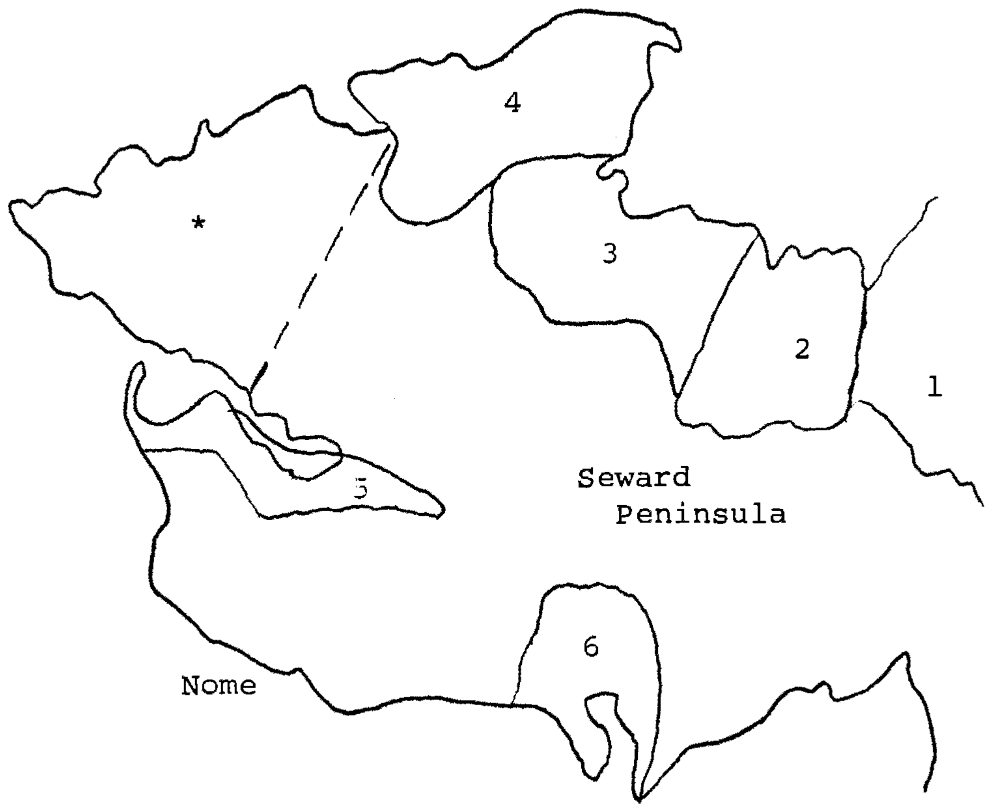
Enforcement. Unfortunately, enforcement must play a major role, at least for the next few years, in any management program in Northwestern Alaska. Both white and native peoples knowingly violate many game regulations, a practice they have safely followed for many years due to the infrequent visits from enforcement personnel. Some of the illegal practices are extremely common and widespread, with no attempts at subterfuge. Waterfowl hunting during spring falls in this category. In Nome during late April and early May, 1959, goose decoys, shotgun shells, waterfowl calls and other paraphanalia normally associated with the fall season suddenly appeared on hardware store display cases concurrent with the sighting of the first flocks of returning ducks and geese. A check of the stores later in the year revealed that only one goose decoy was left in stock. The spring hunts have reached such stature that many plane owners have their "own hunting areas" which they fly to for their shooting. One white Nomeite condemned the spring hunting practices of the natives but lauded the "conservation" measures of the whites by stating, "The natives shoot a lot of geese, pile them in their cabins and let many of them spoil, but the whites quit when they get four or five geese." Such practices will be stopped only through active enforcement.

Many game laws in addition to the waterfowl regulations are violated and with one species of game, moose, the illegal kill on the Seward Peninsula probably is sufficiently large to control the populations. Until there is adequate enforcement, manipulations of seasons and limits will be of no avail.

Caribou-Reindeer Conflict on Seward Peninsula. In Northwestern Alaska the reindeer-grazing industry is of some importance in the economy. The enterprise is beset with difficulties, however, and at times is not in harmony with sportsmen's interests or other enterprises. In order to ensure that maximum benefits accrue from the reindeer industry and our wild caribou populations we need additional information.

The number of reindeer, as well as the number of herds, are increasing in Western Alaska. According to a recent newspaper release by the Bureau of Indian Affairs, 17 herds contain a total of approximately 40,000 reindeer. The reindeer-grazing occurs in the coastal area from Stebbins to Kivalina, with the major emphasis in the Seward Peninsula-Kotzebue area. In addition, Nunivak Island supports a large herd. Reindeer ownership is limited to natives, and the program is controlled and administered by the Bureau of Indian Affairs, although the Bureau of Land Management soon will be charged with delimiting the grazing leases and presumably the number of reindeer thereon.

At present there are six grazing areas established on the Seward Peninsula with one new area proposed. These are shown in Figure 2 with a notation of the owner, acreage and herd size based on data provided by the Bureau of Land Management. The herd sizes as specified are open to question, however, for Seigfried Aukongak states that he has over 5,000 animals instead of the 750 listed by the Bureau of Land Management. Other herders also have cited larger figures for their herds than those listed in Figure 2. The differences probably can be attributed to population growth during the years since the Bureau of Land Management figures were current. Undoubtedly,



Key:

Number	Owner	Acreage	Herd Size
1	Hadley	2,500,000	2,000
2	Clark	800,000	2,000
3	Karmun	900,000	600
4	Dimmick & Goodhope	1,160,320	1,562
5	Kakaruk	400,000	2,000
6	Aukgonak	600,000	750

* New grazing area proposed by the United States Bureau of Indian Affairs.

Figure 2. The reindeer grazing areas and herd sizes recorded on the Seward Peninsula on June 5, 1958, by the United States Bureau of Land Management.

every herder as well as the participating Bureau of Indian Affairs personnel have labored to increase the size of each herd; they have been successful. They have not been successful in increasing the market for the animals in the same ratio, however, thereby resulting in still greater herd increases. For example, Aukongak butchered approximately 300 head during the winter of 1959-60, or only six per cent of his herd. Unless he increases his annual kill to at least 25 per cent of his herd, the herd size will continue to increase. The other herds on the Seward Peninsula also appear to be underharvested. The Bureau of Indian Affairs personnel administering the program seem unaware of the dangers inherent in this uncontrolled increase.

Many of the herders on the Seward Peninsula exert little influence on their herd's movements. In fact, Kakaruk, a herder operating in the Nome-Teller area, could not fulfill some market commitments during the fall, 1959, because he could not locate his animals. Only after diligently searching his area from the air could he find the bulk of his herd. Not knowing the location of the herd is customary with many herders, resulting in the oft repeated query to bush pilots, "Have you seen my reindeer?"

The inability, or lack of desire, of herders to control their animals undoubtedly contributes to the belief held by many Nome sportsmen that substantial numbers of feral reindeer or caribou exist on the Seward Peninsula. A few of these animals have been killed by hunters, with some of the nimrods sincerely believing they shot caribou. Such an incident during the fall, 1959, precipitated a news release in the September 30 issue of the Nome Nugget. The article was authored by Vern V. Hirsh, the Bureau of Indian Affairs representative charged with administering the reindeer program. In part his news release stated the following:

WARNING NOTICE TO HUNTERS

> There are NO caribou on the Seward Peninsula. . . . .The reindeer grazing there (near the Kougarok and Kuzitrine Rivers and in the area of Belt Creek) are property of either Johnny Kakaruk or the U.S. Government. The Larceny of Animals Act provides for a fine and one to ten years in a penal institution.

Notwithstanding this statement, many of the Seward Peninsula herders feel that a few caribou exist on the Peninsula and a few of the persistent reports of herders killing one or two caribou from their herds probably are based in fact.

The number and distribution of feral reindeer and caribou on the Seward Peninsula should be determined and a program of wise utilization established. Such a program is especially important in the Nome area for no big game animal, except for a very restricted and sparse moose population, is available to the sportsmen.

Wildlife Data Collection

A collection of miscellaneous wildlife data is being made.

Recommendations:

The Wildlife Harvest Report program should be intensified. Additional villages should be incorporated into the program and all present and future recorders should be contacted frequently by departmental personnel in order to maintain a satisfactory level of interest and cooperation.

The collection of other harvest data should continue.

The organization responsible for establishing the school curricula and adult education programs should be informed of the pressing need for conservation education. In addition, the Department of Fish and Game should institute a vigorous education and information program, stressing maximum utilization of local radio stations, for these news outlets reach more native peoples than do other news media.

An active enforcement program should be continued in Northwestern Alaska. Readily accessible, unencumbered aircraft should be available to enforcement personnel.

Aerial surveys should be conducted during fall and winter to determine the distribution and abundance of caribou and feral reindeer in the Seward Peninsula and adjacent areas.

In addition, a large series of measurements from carcasses of both species should be obtained for use in determining the specific morphological differences of the two ungulates.

The collection of miscellaneous wildlife data and observations should be contined.

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