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ELK INVESTIGATIONS

WILDLIFE DATA COLLECTION

by

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1-c Productivity Analysis

1-d Mortality Studies, Afognak and Adjacent Islands

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

ABSTRACT

Composition counts made of elk observed on 4 distinct ranges of the Afognak Island group during the summer of 1961 yielded a total of 610 animals that were categorized according to sex and age class. Of this number, 395 or 64 per cent were cows, 56 or 9 per cent were spikes, 58 or 10 per cent were bulls, and 104 or 17 per cent were calves. The bull-cow ratio varied from a low of 16 to a high of 90 per cent for the 4 herds with an average of 29 per cent for all herds. The calf-cow ratio averaged 26 per cent and varied from 23 to 33 per cent.

Aerial surveys of the Afognak Island group conducted in conjunction with composition counts revealed the distribution and number of elk within the region. Based on these surveys and supplemental information, a population of no fewer than 1,100 elk are believed to inhabit the Afognak group at this time.

An experimental elk calf tagging operation was undertaken in 1961 as a cooperative venture of the Department of Fish and Game and the U.S. Coast Guard. Objectives of the experimental operation were to (1) determine the feasibility of capturing elk calves with the use of a three place helicopter operating in mountainous terrain, (2) provide data relating to calf survival, and (3) refine aging techniques. During the 6 day operation 23 calves were captured, tagged and released in southwestern Afognak and western Raspberry Islands.

As a means of assessing the progression of calving, periodic aerial surveys were flown the last two weeks of May and the first 10 days of June. Results of these periodic flights were negative, for neither calves nor calving grounds were observed from the air during this period. In 1961, the first calf recorded was spotted from the air on June 12. This animal, judging from its size and vigor, was noted to be several weeks old and was observed traveling with the Malina herd.

The rut in the Afognak Island region has been observed to commence in early September and continue into October. At this time elk band together into large herds numbering as many as 220 animals. Contrary to observations made on the Olympic Peninsula and western Oregon, no herd break-up or harem formation has been noted during the rut.

No cases of mortality other than hunter harvest were noted for herds occupying Raspberry and Afognak Islands during fiscal year 1962.

RECOMMENDATIONS

None.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State:	Alaska		
Project No:	W-6-R-3	Name:	Alaska Wildlife Investigations
Work Plan:	D	Title:	Elk Investigations
Job No:	1-a	Title:	Herd Distribution, Abundance and Composition
	1-c		Productivity Analysis
	1-d		Mortality Studies, Afognak and Adjacent Islands

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

OBJECTIVES

To determine the distinctness, size and seasonal distribution of recognizable elk herds, and to ascertain the age and sex composition of each; to obtain data relating to elk breeding, fertility and parturition; and to obtain data concerning the annual mortality sustained by Raspberry and Afognak Islands' elk herds and to identify and evaluate the degree to which individual mortality factors are acting.

TECHNIQUES

During July and August of 1961, aerial surveys were flown to determine the location of recognizable Roosevelt elk herds inhabiting Afognak and adjacent Raspberry Islands. Upon locating each herd, ground observations were made to determine sex and age structure and numbers of animals in each population. Due to the highly gregarious nature of Afognak elk, aerial counts did not provide complete and reliable composition information and were thus discontinued in favor of ground observations.

The methods used in making ground counts of the various herds require no explanation. Objectives of these counts were

to obtain sex and age identification of all animals under observation and to provide, if possible, a reliable count of the total animals in each herd.

Since Afognak elk spend most of the summer months in large bands numbering to 222 animals, little difficulty, save inclement weather and/or dense timber, is encountered locating and counting each of the major herds. Elk composition counts made elsewhere are usually conducted during the winter months when animals are found on their wintering ranges. However, Afognak elk frequently inhabit densely timbered areas at this time of year making reliable ground or aerial counts impossible.

The various sex and age categories recorded were specifically as follows: cows, all antlerless animals other than calves; spikes, those bulls possessing unbranched antlers; branched antlered bulls, self-explanatory; and calves, young of the year.

Ground counts were conducted in the Malina, Raspberry Strait (Afognak side), central interior regions of Afognak Island and adjacent western Raspberry Island. Similar counts were attempted of herds in the Tonki Cape area of northeastern Afognak, but due to inclement weather, all but total counts were unsuccessful. All information gathered during these initial counts provides a basis for future comparison of population performance and changes from one year to the next.

Observers during these counts were Department Biologist Ron Batchelor and Fish and Game Aide Errol Claire.

Field observations of the timing, duration and behavior of elk during the rut were conducted in the Malina Lakes and Raspberry Strait areas during late August, September and early October. Concurrent with other investigations, surveys were made throughout the year as a means of attempting to assess and also evaluate mortality acting on Afognak elk herds.

An experimental elk calf tagging operation was initiated in 1961 as a cooperative venture of the Department of Fish and Game and the U. S. Coast Guard. Objectives of this experiment were to determine the feasibility of capturing elk calves in the Afognak area, to provide data relating to

calf survival, and to refine aging techniques.

FINDINGS

Herd Composition, Distribution and Productivity

Herd composition data for Afognak elk herds are summarized in Table 1. Two hundred and twenty-two animals were observed and classified in the Malina Lakes area, 156 in the vicinity of Raspberry Strait (Afognak side), 67 in central interior Afognak, and 165 on Raspberry Island. All animals under observation for each of the above herds were counted and identified as to sex and age. The locations and numbers of animals in each herd are presented in Figure 1.

Malina Lakes area: Sixteen bulls per 100 cows were recorded for the Malina herd, the largest single herd inhabiting the Afognak group at this time. This figure represents the lowest bull-cow ratio recorded for any of the four herds categorized during 1961 and is believed attributable to the heavy hunting pressure and sustained harvest experienced by this herd. Of the herd of 222 animals, cows accounted for 72 per cent, bulls 4 per cent, spikes 7 per cent and calves 17 per cent.

Raspberry Strait Region: Prior to the 1961 elk season, a significant difference existed between the bull-cow ratio of the Malina and Raspberry Strait herds even though their ranges adjoin. The former having a ratio of 16 bulls per 100 cows and the latter twice this number at 33 per cent. The variation between herds is believed proportional to the degree of harvest experienced by each. The Raspberry Strait herd, occupying a range of which a major portion is climax spruce forest, frequently is unavailable to hunters throughout much of the fall; however, the Malina herd, ranging over terrain that is treeless for the most part, is seldom unavailable to hunters throughout the season.

Of the 156 elk classified in the Raspberry Strait herd, 62 per cent were cows, 7 per cent bulls, 14 per cent spikes and 17 per cent calves.

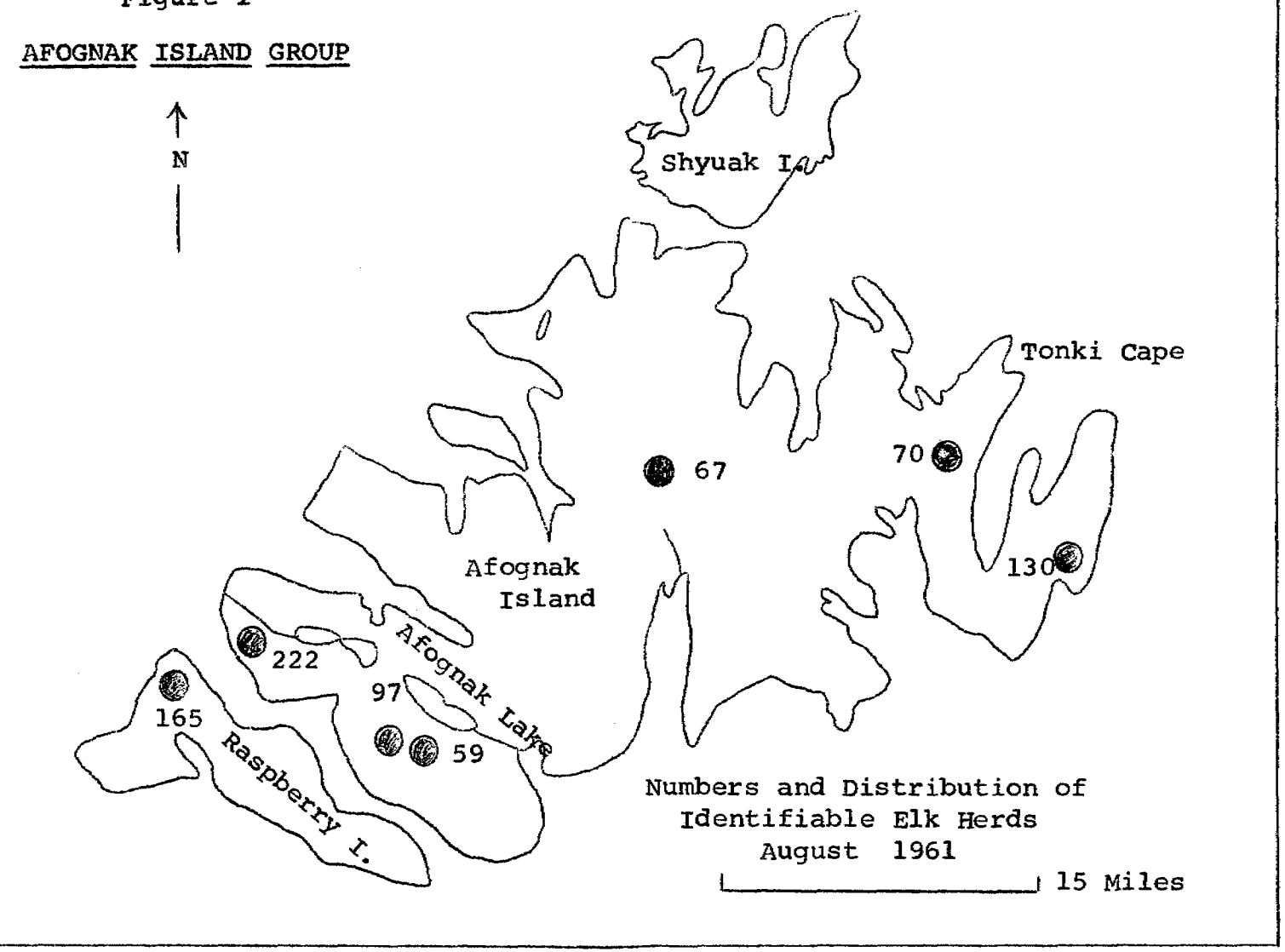
Central Interior Afognak: The general area of this region is illustrated in Figure 1. Composition counts for this portion of Afognak Island showed a ratio of 90 bulls per 100 cows, the highest such figure recorded for any herd during the 1961 survey. Remoteness and inaccessibility of major portions of interior Afognak Island have for many years prohibited the harvesting of elk from this region, resulting in an unexploited population where the sexes approach being equal. The inability of obtaining a nearly complete count of all animals in this heavily timbered country may mask a sex ratio other than that recorded.

Composition categories for this area were as follows: 44 per cent cows, 33 per cent bulls, 9 per cent spikes, and 14 per cent calves.

Raspberry Island: One hundred and sixty-five animals were classified in the Raspberry Island herd, of which 65 per cent were cows, 10 per cent bulls, 7 per cent spikes, and 18 per cent calves. A bull-cow ratio of 27 per cent was recorded for this herd. The percentage of spike bulls observed is comparable to that recorded for all herds with the exception of the Raspberry Strait herd where this figure represented 14 per cent of the total classified animals.

Figure 1

AFOGNAK ISLAND GROUP



Summation of All Areas: Counts made of all elk observed on 4 distinct ranges during July and August of 1961 yielded 610 animals that were categorized according to sex and age class. Of this number, 395 or 64 per cent were cows, 56 or 9 per cent were spikes, 58 or 10 per cent were bulls and 104 or 17 per cent were calves. These observations are presented in Table 1.

The determination of the yearling segment for both sexes is made by doubling that given for spikes. This would give 18 per cent as the yearling population and would subsequently reduce the cow population by half this number, to 56 per cent. Counts made of all cows and calves observed during the summer composition assessment yielded 392 cows and 104 calves. This would indicate that approximately 27 per cent of all cows produced calves, and allowing for a reasonable degree of post-natal mortality among the calf crop during late May and June, it would seem safe to suggest that this percentage would be even higher. Therefore, if it is assumed that 56 per cent of all elk are adult females (not including yearlings) and 30 per cent of these are parturient, the breeding cow segment would then average 17 per cent in a typical Afognak herd. This figure is much below the 43 per cent reported by Schwartz and Mitchell (4) for Roosevelt elk on the Olympic Peninsula. Reasons for this seemingly low percentage of parturient cows can only be speculated at this time; however, whether this rate reflects high male survival, trends in productivity, poor recruitment of 1961, an overaged female segment of the population, or a combination of any of these factors, cannot be determined at this time for comparable data are not available.

Age composition data collected from hunter harvested elk during 1960 indicated that 47 per cent of the female sample was represented by animals 4.5 years or older. In 1961 this figure amounted to 35 per cent of the sample, suggesting the female segment of the population consisted of a high percentage of old aged animals. The resultant longevity coupled with possible barrenness among many females could account for this low percentage of breeding females in the population as observed during 1961.

Calving: Periodic aerial surveys were conducted during the last two weeks of May and the first ten days of June as a means of attempting to determine the location of calving grounds

Table 1. Summary of elk population composition counts, August 1961.

Area	Total Elk Classified	Spikes #	Spikes %	Branched Antlered Bulls #	Branched Antlered Bulls %	Total Bulls #	Total Bulls %	Cows #	Cows %	Calves #	Calves %	Bulls/ 100 Cows	Calves/ 100 Cows
Malina	222	16	7	10	4	26	11	159	72	37	17	16	23
Interior Afognak	67	6	9	21	33	27	42	30	44	10	14	90	33
Raspberry Strait	156	22	14	10	7	32	21	97	62	27	17	33	29
Raspberry Island	165	12	7	17	10	29	17	106	65	30	18	27	28
Totals	610	56	9	58	10	114	19	392	64	104	17	29	26

and assess the progression of calving. Results of these periodic surveys were completely negative, for not only were there no calving grounds located, but likewise, not one calf was observed during these flights. The first calf recorded in 1961 was spotted running with the Malina herd on June 12, one day prior to the undertaking of an experimental calf tagging program. The lack of earlier observations is believed attributable to the fact that prior to calving, parturient cows seek areas of dense timber or brush to calve, and once born the calves remain in these areas until they have stamina enough to travel with a herd. This period may last two, three or more weeks as was noted from frequent aerial surveys of southwestern Afognak and western Raspberry Islands during May and June.

On June 14 while tagging calves in the Malina Lakes area, two cows each accompanied by a single calf, were observed in a brushy ravine on a steep mountain slope and were subsequently watched for three days without either cows or calves leaving the ravine. When the animals were initially spotted, both calves were very weak, suggesting they were but a few days old. On the fourth day all animals moved out of the ravine and one of the calves was subsequently captured by the tagging crew, tagged and released. Unfortunately, circumstances prevented either the weighing or measuring of this animal which would have suggested its age.

Available data indicate that the main calving period extends from approximately May 15 to June 10, with a peak occurring between the 20th and 25th of May. Additional observations are required to add to the present knowledge regarding calving progression.

Productivity, as expressed by summer calf-cow ratios, varied between herds with an average of 26 per cent and a range of from 23 to 33 per cent for all herds observed. This figure is well below a 3 year average of 39 per cent reported for this species by the Oregon Game Commission (3). The Malina herd, representing the largest single population on Afognak with 222 animals, exhibited a herd increase of 17 per cent and a cow-calf ratio of 23 per cent, the latter figure being the lowest of any herd. In contrast, the interior Afognak herd, numbering 67 animals, had the highest ratio with 33 calves per 100 cows.

On September 1, 1961, during a routine collection of

reproductive tracts from hunter-harvested female elk, a male fetus was collected from a two year three month old elk cow which had been killed September 1 in the Malina Lakes area. The age of the cow was determined by dentition.

In comparing the weight and measurements of the collected fetus with those of known-aged Rocky Mountain elk, Cervus canadensis nelsoni, embryos reported by Morrison, Trainer and Wright (2), it is believed the fetus was approximately 200 days old at the time of death. Using Morrison's figure of 247 days for a term calf would place conception during the week of February 12 to 18, or some 4 months past the normal rutting season for the Roosevelt elk on Afognak Island (5).

This late conception is believed to have resulted from 1 of the 3 factors: (1) the cow, approximately 20 months old at time of conception, experienced a late initial estrus, or (2) she was bred after several recurrent estrums, or (3) her initial estrus was late and she was bred during a subsequent estrus.

To further substantiate pregnancy in yearling Roosevelt elk, an examination of the udder of a two year three month old cow killed September 3, 1961, on Raspberry Island indicated the cow had bred as a yearling and produced a calf at the time of her second birthday. This animal had been lactating as indicated by its milk engorged udder.

Although the literature mentions the occurrence of pregnancies in yearling Rocky Mountain elk (1), data pertinent to the breeding biology of the Roosevelt elk are scant and suggest that the cow first breeds in the third rutting season after birth at an age of about two years and four months.

The significance of these two occurrences of yearling pregnancy in the population ecology of the Roosevelt elk of the Afognak group can not be fully evaluated at this time.

Breeding Period

Bugling commences in late August and continues through mid-October. During this time elk of both sexes band together to form the largest herds observed throughout the year. Unlike the Roosevelt elk on the Olympic Peninsula, no herd break-up or harem formation had been observed in the Afognak region;

however, bands of bulls representing all age classes frequently congregate a few hundred yards from the larger herds of cows and calves. Bulls within these bands have been noted to spar with one another, although no actual combat has been noted. At the peak of the rut, which apparently occurs between September 25 and October 1, bulls can be found evenly scattered throughout the herd and breeding is frequently noted. In September 1961, the Malina herd, consisting of 220 animals at the time, was under observation for several days during the last week of the month. During this period, bulls of all ages, including yearlings, were observed to mount and breed cows. In the course of these observations no fighting between bulls was recorded.

Estimation of Current Population

Aerial surveys of Raspberry and Afognak Islands conducted during the summer of 1961 indicated the distribution and numbers of elk inhabiting these areas. Because of the many difficulties associated with a complete assessment of any big game population, the figures obtained during the 1961 surveys indicate a minimum population. On the basis of population estimates thus obtained, the observed and approximated numbers of elk inhabiting the Afognak Island group are as follows:

Herd	Observed	Estimated
Malina	222	222
Raspberry Strait	156	175
Raspberry Island	165	240
Tonki Cape	200	225
Interior Afognak	67	125
Totals	810	987

Considering the difficulties of attempting to assess elk numbers over all the Afognak group, it is believed safe to assume that no fewer than 1,100 elk presently occupy this region.

Experimental Elk Calf-Tagging Program

An experimental calf-tagging program was initiated in 1961 as a cooperative venture of the Department of Fish and Game and the U. S. Coast Guard during an eight day period commencing June 12. The objectives of the experimental operation were to (1) test and evaluate the feasibility of capturing a significant number of elk calves in the Afognak region, (2) provide data relating to calf survival and intermixing of herds

and (3) refine aging techniques through later collection of known-aged specimens. A Bell HUL three-place helicopter and two-man crew consisting of Lt. Paul Breed, pilot, and Charles Stout, mechanic, were furnished by the Coast Guard Air Detachment ment of Kodiak for the experimental operation. In addition to the author, the tagging crew consisted of Errol Claire and Alfred Craig of Kodiak.

All tagging was accomplished in the treeless portions of southwestern Afognak and western Raspberry Islands (Figure 2).

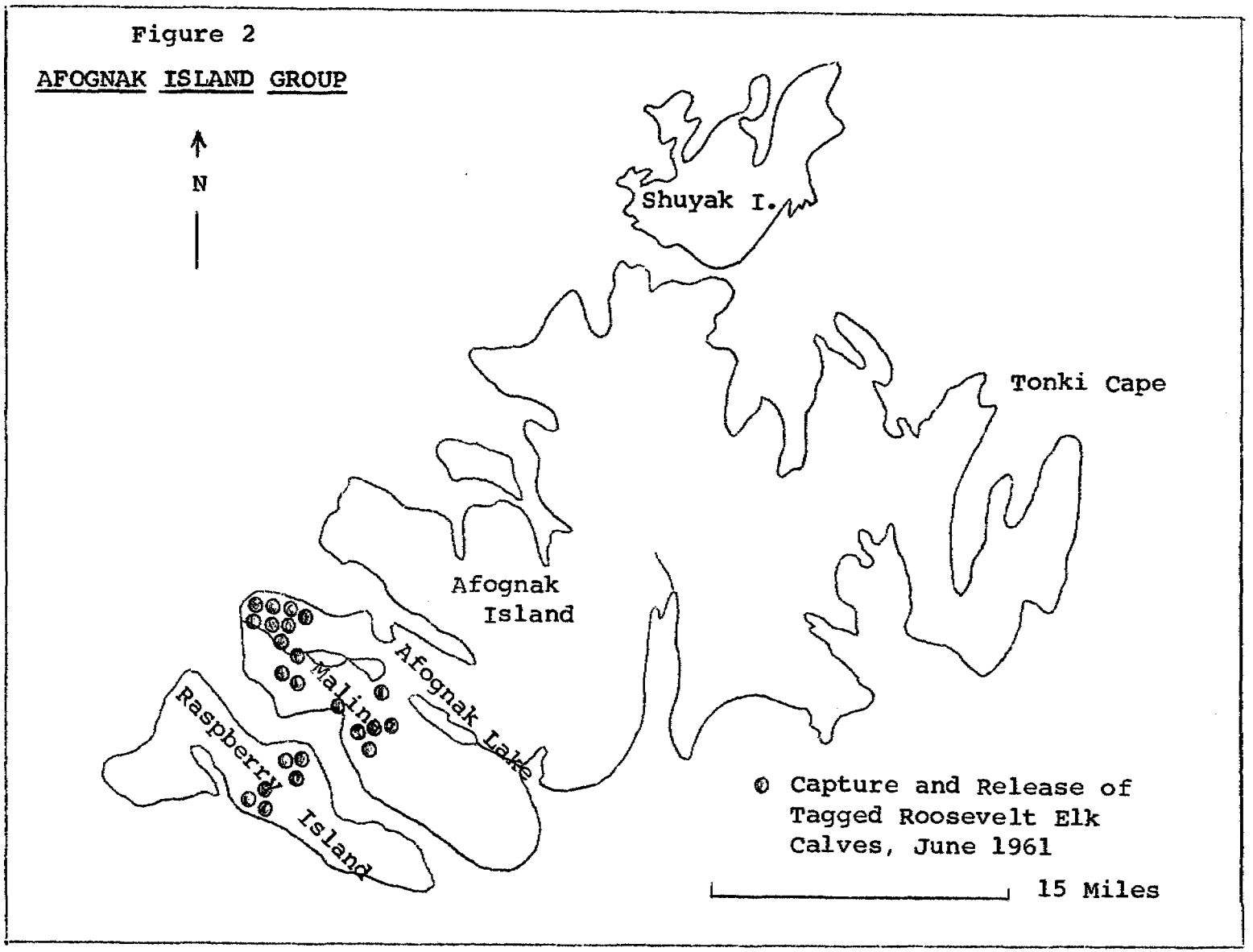
Observations conducted on various calving grounds indicated the peak of calving occurred within the last two weeks of May; however, few if any calves could be found prior to June 12. Experience has shown that parturient cows seek areas of dense timber or brush to calve and once the calves are born they remain hidden until they are vigorous enough to travel with a herd. This was found to be as long as three weeks. In his book "The Elk of North America", Murie states that at birth an elk weighs between 30 and 40 pounds. In contrast, the average weight of 7 calves captured during the tagging operation was 84 pounds, with a range of from 54 to 108 pounds. These weights, coupled with measurements, indicated the advanced age of calves captured during the tagging program and suggest problems that arose attempting to capture these animals.

Difficulties encountered capturing or attempting to capture such large calves governed, for the most part, the success of the operation. Due to the size and stamina of calves, techniques developed by moose tagging crews for capturing calves in south-central Alaska were found inadequate for this operation. Crews capturing and tagging moose calves deal with animals only hours or a few days old, while elk-tagging crews dealt with animals frequently several weeks old.

Flying conditions during the 1961 operation were excellent for the Afognak Island. Light turbulence and early morning fog occasionally prevented aerial work in certain areas but for limited times only. Aerial surveys using a Piper Super Cub were flown each morning between 2:30 and 5:00 to ascertain the location and numbers of calves in each herd. Once the herds were reconnoitered, the aircraft returned to the base of operations at the Afognak Lake Navy recreation camp, and the helicopter and tagging crew were deployed to the herd containing the greatest number of calves.

Figure 2

AFOGNAK ISLAND GROUP



Because of the small pay load and limited fuel capacity of the Bell HUL helicopter, special techniques were required to capture calves using this aircraft. Once a herd was located and the calves spotted, the pilot would land the helicopter several hundred yards ahead and above the herd while the two-man tagging crew would deplane. The pilot would then proceed to drive the herd in the direction of the tagging crew, attempting to "cut out" the calves. After a chase usually lasting several minutes, the smallest calf with the least stamina would lag behind the others and the helicopter pilot would then concentrate on this animal. A short time later the calf would tire and seek rest by laying prostrate in what ever cover it could find. At this point the pilot would hover the helicopter a few feet above the animal while the down-draft from the rotor blades drowned out all but the noises of the helicopter and often times frightened the calf sufficiently enough to keep it down. Meanwhile, the tagging crew would run to the site where the calf was hidden. Upon receiving visual instruction from the pilot the men on the ground would approach the animal from behind, taking care to keep as low as possible so as not to be observed, and when close enough, leap onto and capture the calf. After the animal was caught and its feet tied, it was measured, sexed, weighed and tagged with metal and plastic ear tags. When the animal was released the helicopter was summoned to pick up the ground crew, and search for another calf was resumed. Occasionally, however, several calves were encountered together, and while the tagging crew captured and tied one animal the pilot proceeded to chase another. When the first animal was secured, its location was marked and the crew left to capture an additional calf, to return to the tied animal later.

The success of capture varied from day to day and from herd to herd with a low of two captures and a high of eight per day of operation. At the conclusion of the operation, 23 calves were captured, tagged and released during 47 hours of flight time for an average of 1 calf for each 2 hours flown (Table 2). The greatest single factor contributing to this low return per hour flown was the inability of pilot and tagging crew to locate a sufficient number of calves. For example, the Malina herd, consisting of 222 animals, of which 37 were calves when counted in July, only contained 15 calves during the period of tagging, 12 of which were subsequently captured and tagged.

Table 2. Elk calf tagging record, June 1961.

Number	Date Tagged	Herd Area Tagged	Plastic Tag No.	Metal Tag No.	Sex
1	6/14	Malina	1	1001	Male
2	6/14	Malina	2	1002	Male
3	6/15	Malina	3	1003	Male
4	6/15	Malina	4	1004	Female
5	6/15	Malina	5	1005	Male
6	6/16	Malina	6	1006	Female
7	6/16	Malina	7	1007	Female
8	6/16	Malina	8	1008	Female
9	6/17	Malina	9	1009	Male
10	6/17	Malina	10	1010	Male
11	6/17	Malina	11	1011	Female
12	6/17	Malina	12	1012	Male
13	6/18	Raspberry St.	13	1013	Female
14	6/18	Raspberry St.	14	1014	Female
15	6/18	Raspberry St.	15	1015	Female
16	6/18	Raspberry St.	16	1016	Male
17	6/18	Raspberry Isl.	17	1017	Male
18	6/18	Raspberry Isl.	18	1018	Male
19	6/18	Raspberry Isl.	19	1019	Male
20	6/18	Malina	20	1020	
21	6/19	Raspberry Isl.	21	1021	Male
22	6/19	Raspberry Isl.	22	1022	Male
23	6/19	Raspberry Isl.	23	1023	Male

Time required for frequent refueling of the Bell helicopter was somewhat reduced by placing gas caches at strategic points during the operation; however, the operating time between fuelings varied depending on the demands made of the helicopter. Such factors as hover time, working altitude, topography, and wind all had a direct bearing on the operating time between fuelings. Much of the terrain where tagging was attempted was either too mountainous, too densely covered with vegetation, or so uneven as to provide but few locations where a helicopter could land. After several days of operation and familiarity with the terrain, many good landing sites were found and later utilized which increased calf-capture success. The low-pay load of the HUL under mountainous operation oftentimes necessitated the ferrying of tagging crew members one at a time from one location to another, thus reducing the overall effectiveness of the program. However, the high maneuverability of this helicopter was a distinct advantage under the varied flying conditions encountered throughout the operation.

Mortality Assessment

During fiscal year 1962 no cases of elk mortality, other than hunter harvest, were noted for herds occupying either Raspberry or Afognak Islands. Observations during the past year lead the writer to believe that any mortality occurring at this time is of little significance to the well-being of Afognak group elk herds.

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: D Title: Elk Investigations

Job No: 1-b Title: Elk Range Studies

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

ABSTRACT

The range investigation segment of the Roosevelt elk work plan was initiated in the spring of 1962 with the development of techniques for measuring range utilization, condition and trend. Based on the methods and techniques developed, 27 willow and 19 elderberry transects were installed on a portion of the Litnik Lake game range of southwestern Afognak Island during late April and May of 1962.

Analysis of transect data pointed to a state of reduced vigor and productivity of major portions of the Litnik Lake range. This reduction in vigor and productivity stems from the impact of an elk population upon the browse resource and competition between major species of important browse producing communities through seral advancement.

An analysis of trend data indicated that 95 per cent of all elderberry and 54 per cent of all willows were classed as retrogressives, being unable to maintain their present state of health under existing environmental conditions.

The work accomplished to date marks the beginning of the range evaluation program for Afognak Island elk ranges. The need for continued range evaluation speaks for itself, for one year's data do not provide a sufficient base to manage a range resource.

RECOMMENDATIONS

The U. S. Forest Service having responsibility over the habitat, and the Department of Fish and Game responsibility for the game thereon, it behooves both Agencies to enter into a cooperative program of range evaluation for Afognak Island elk range as a means of more efficiently utilizing present available personnel.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: D Title: Elk Investigations

Job No: 1-b Title: Elk Range Studies

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

OBJECTIVES

The objectives of this study are to develop a rapid method of determining, on an annual basis, the relative degree of utilization of key browse species used by Roosevelt elk on Afognak Island winter-spring ranges, and to evaluate changes in browse condition and trend as influenced by existing elk herds.

TECHNIQUES

This phase of the Afognak elk investigation reports on a method developed for determining utilization, condition and trend of key browse species used by Roosevelt elk. The method as developed is especially suited to situations where range-use and data must be obtained on an annual basis, over large areas of range with limited funds and personnel. The problem of developing a method or technique for browse evaluation was a comparativly simple task as only a single species of elderberry and a limited number of species of willow constitute the principal browse species utilized by elk during the winter and early spring months. The method was therefore designed to evaluate these two species primarily. If other browse species occupy a given range,they can be assessed in a similar manner or with little modification of the criteria that befits their growth form.

The Alnus - Sambucus association which, together with lesser understory species, comprise the dominate shrub community of southwestern Afognak Island and is seral in nature; the soil not yet supporting climax vegetation. Accordingly, changes in condition and trend can be observed qualitatively within a period of a few years.

Browse Evaluation Surveys

Period of Surveys: Browse utilization and condition surveys are to be conducted each spring at such time elk have drifted off the winter-spring range. On Afognak Island this period would commence approximately May 1.

Selection of Key Browse Species: A key range unit is one that represents an important forage source which must be maintained in a productive state. Generally, that portion of a big game winter range which receives the heaviest use is considered a key unit.

Procedures for Installing Browse Transects: The pattern of transect lines and the distance between stations (individual shrubs) are varied to meet sampling needs and range types. After stratification by range type, a transect consisting of 30 stations is installed within the community to be sampled. The bearing of the transect, transect shape, and distance between stations are dependent upon the terrain and size of the sampling unit. Each transect within a sampling unit is designed to evaluate a single browse species. Whenever possible, all transects are installed parallel to the contour of the land (Figure 1). The distance of interval between stations is randomly determined so as to minimize bias. At such time the sampling unit has been selected, the starting point, transect bearing and station interval are determined.

A modification of the "closest plant" sampling technique has been incorporated in this method (Figure 2). The transect course is run from the starting point (the first plant selection) for a predetermined interval to the closest browse plant within a 180 degree selection zone, for the predetermined interval to the closest browse plant within a 180 degree selection zone, etc., etc., for a total of 30 stations. The 180 degree selection zone may be maintained without use of compass by orienting the imaginary line perpendicular to the slope or on the contour. The location of each transect is then permanently marked on an aerial photograph for future reference.

Sampling Intensity: Measurements are obtained from 30 browse plants, all of the same species, for each transect installed. The number of transects per sampling unit is dependent upon sampling needs, size and uniformity of the range type to be evaluated. One experienced technician may sample and measure browse plants and record the data along a transect at a slightly slower rate than two persons. Transects for evaluating elderberry require greater attention and thus are

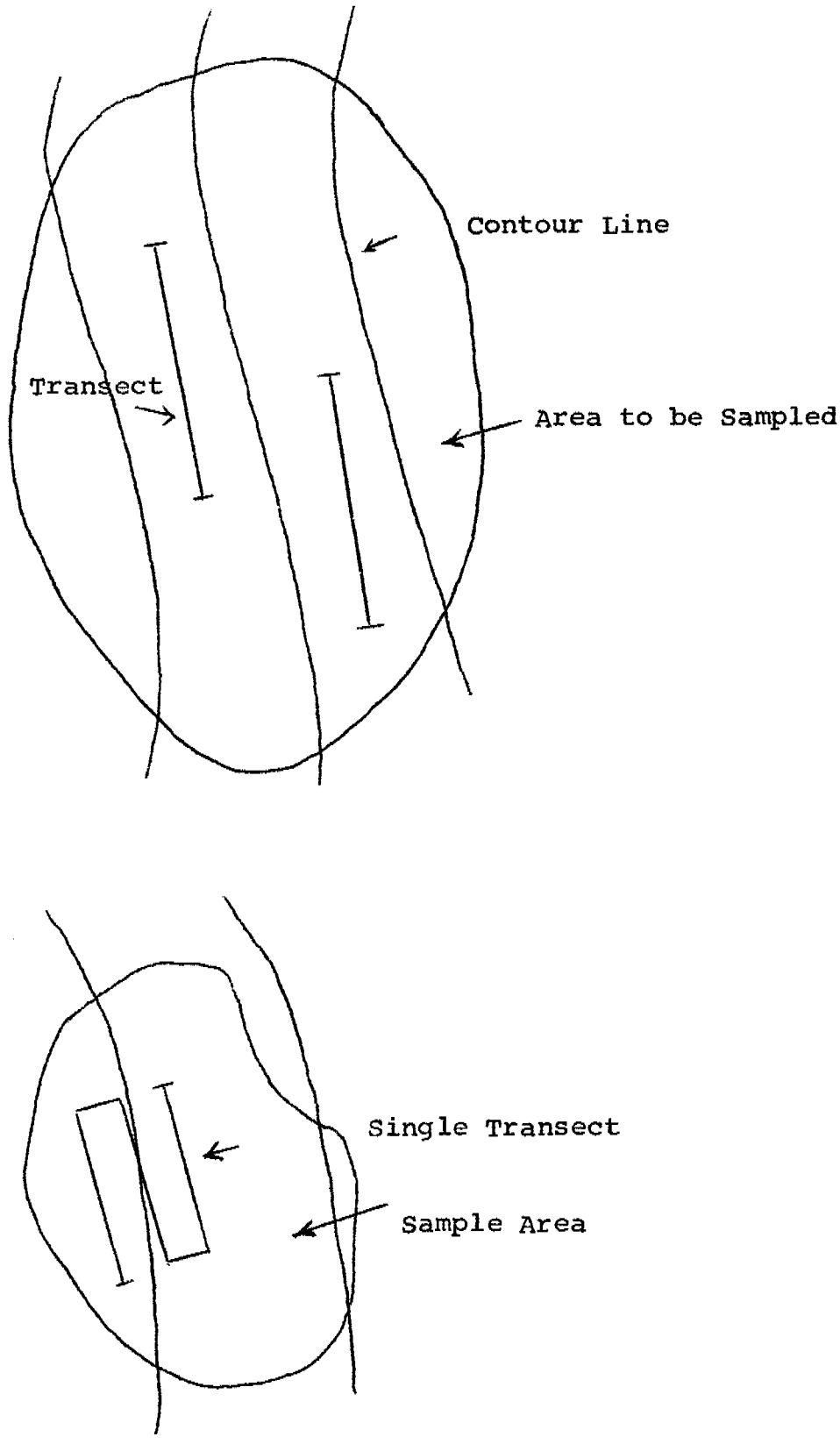

Figure 1. Two methods of installing transects.

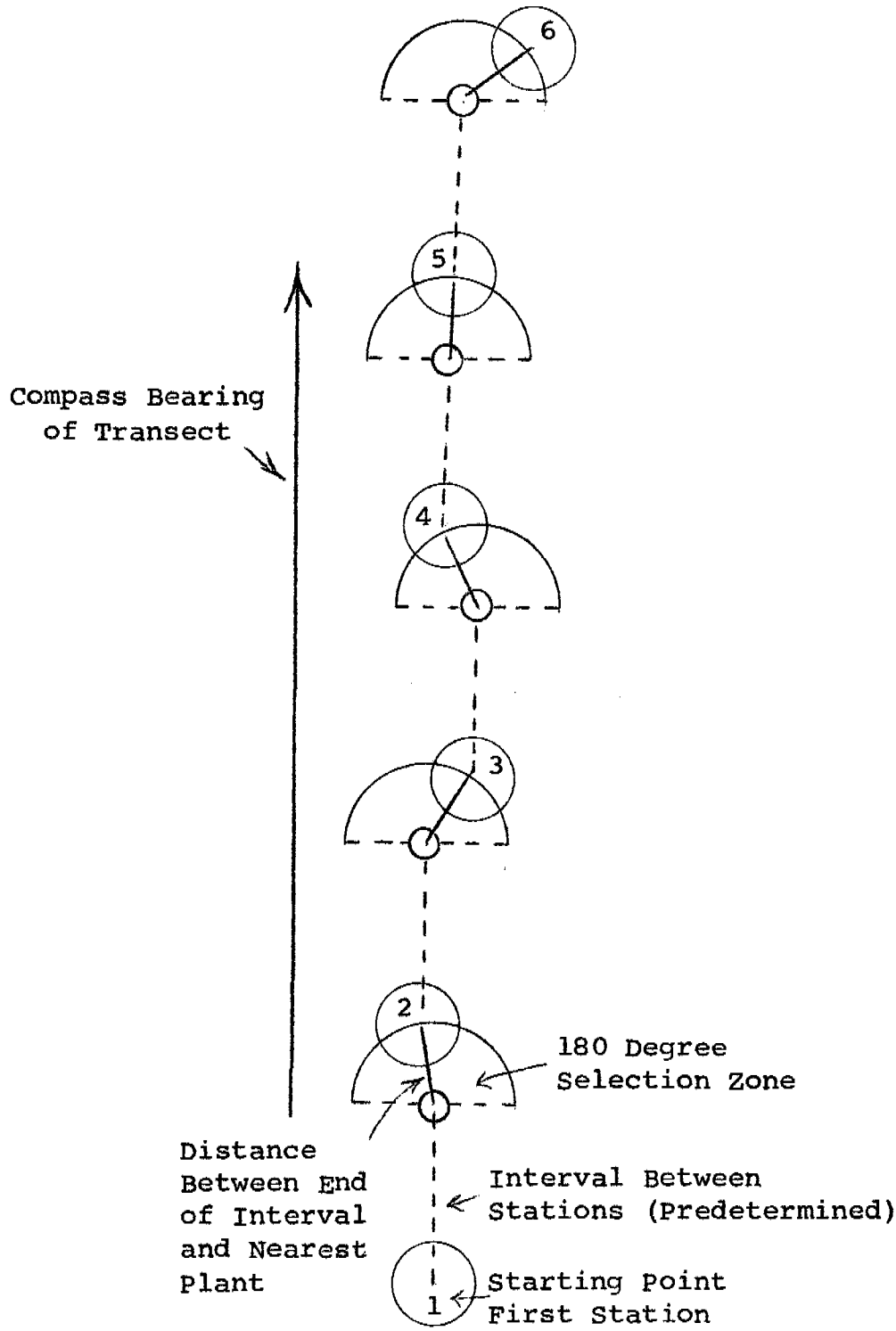

Figure 2. Modified "closest plant" sampling technique.

more effectively run by two persons.

Measurements for Evaluating Willow and Associated Species: Because of ephemeral nature of Afognak Island ranges the growth form of plants under assessment is of importance. For convenience, willow and other woody plants are classified with regard to comformation. The following categories are used:

1. Basal - low plants less than three feet high. They are either young or seedling plants or those resprouting from old rootstock or a lowland form.

11. Shrub - Those plants not exceeding six feet in height that produce a majority of twigs above three feet of the ground.

111. Tree - Those plants exceeding six feet in height which have a majority of twigs originating above that height.

Form and Age Class Evaluation: Form and age class assignments are considered measurements and are treated in this section. They are as follows:

Form Classes	Age Classes
1 - All available, lightly hedged	S - Seedling
2 - All available, moderately hedged	Y - Young
3 - All available, closely hedged	M - Mature
4 - Largely available, lightly hedged	D - Decadent
5 - Largely available, moderately hedged	R - Resprout
6 - Largely available, closely hedged	
7 - Mostly unavailable	
8 - Unavailable	
9 - Dead	

Availability is gauged for snow conditions on each particular range. In general, a zero to six foot zone is considered to include available browse on Afognak ranges.

Assignments for age classes will vary with different browse species. Generally, plants with stems up to 1/8 inch in diameter (at the base), are considered as seedlings. Those stems between 1/8 and 1/4 inch are classed as young, while stems above these measurements are considered mature. Plants are classed as decadent if 25 per cent or more of the crown

area is dead. An "R" suffix denotes resprouting and is added to young, mature or decadent classes if new stems arise from root systems where older stems are evident.

Leader-Use Measurements: Leader-use estimates are used as an index to current utilization. They are based on the percentage utilization of the total available leaders browsed. For example, a plant having 60 per cent of its available leaders browsed for an average of 40 per cent of their volume would have a current use factor of 24 per cent which would be rounded to 25 per cent. To minimize variation between workers, the following recorded estimates and their percentage ranges have been adopted:

Estimated Leader-Use by Volume (%)	
0	No Use
5	1-10
25	10-40
50	40-60
70	60-80
90	80-100

Assessment of Current Browsing Intensity: The intensity of use during the past winter is assessed for each plant along a transect. This is subjective and may appear to be a repetition of previous assessment of leader measurements; however, it is important in the judging of range deterioration due to excessive use by elk or by a combination of factors such as plant succession and disease. Assessments are based on the following categories:

Trace: Self explanatory.

Light: Where twigs have been browsed lightly.

Moderate: Where the supply of browse on the plant is not drastically reduced and where vigor and form of plant is unlikely to be largely affected.

Heavy: Removal of sufficient leaders to alter growth progress of the plant.

Severe: Removal of almost all previous years' twigs, or more, sufficient to reduce vigor of plant and leaving very little for further use.

Trend and Vigor in Range Condition: Trends in range condition are derived from the dynamics of individual plants. Each plant is categorized into one of three categories depending upon the apparent trend of the plant under scrutiny. These categories are:

Retrogressive: Denotes a plant suffering from excessive browsing, competition with other vegetation where plant vigor is not being maintained.

Static: Where plant form and vigor are being maintained.

Progressive: Vigorously growing plants where growth exceeds cropping.

As a measure of plant health or condition, each plant encountered along a transect is subjectively evaluated for its current state of vigor, using the following scale which is based on growth form, leader production, and percentage of dead material:

Current Vigor

E - Excellent
G - Good
F - Fair
P - Poor
V - Very Poor

Estimation of Dead Material Within Plant Crown: As a further measurement of plant vigor, estimates of the per cent dead material in the plant crown are made at 5 per cent intervals.

Measurements for Evaluating Elderberry: Due to the nature of its growth form and semi-woody characteristics, elderberry evaluation requires special consideration. Measurement categories developed for willow and other woody species as described above are not suitable for assessing use, vigor and

trend of elderberry. The mechanics for installing elderberry transects, however, are identical to those followed for installing willow transects with the exception of the measurements taken (Figure 3). The following categories have been developed for elderberry evaluation:

Total Viable Stems:	Stems that are alive to the end of each branch and produce viable buds at each node along the stem.
Total Live Stems:	Stems that, unlike viable stems, are alive for only a short portion of the branch and produce only a few viable buds usually at the base of the stem.
Total Stripped Stems:	A measurement of the number of stems that have been stipped of all or a portion of their cambium. Its influence on plant vigor can be great, as stipping usually results in the girdling and eventual killing of the stem.
Total Trampled Stems:	A measure of reduced vigor resulting from stem breakage caused by trampling of elk.
Total Dead Stems:	Self-explanatory.
Plant Vigor:	The assessment of vigor is expressed as a ratio of the total viable stems : total dead stems.
Age Class, Browsing Intensity and Trend:	Same standards as those used for evaluating willow and other woody browse species.

FINDINGS

The Afognak elk during the winter-spring period of 1961 - 1962 used a variety of wintering grounds widely scattered throughout their range, as light snowfall over the entire island

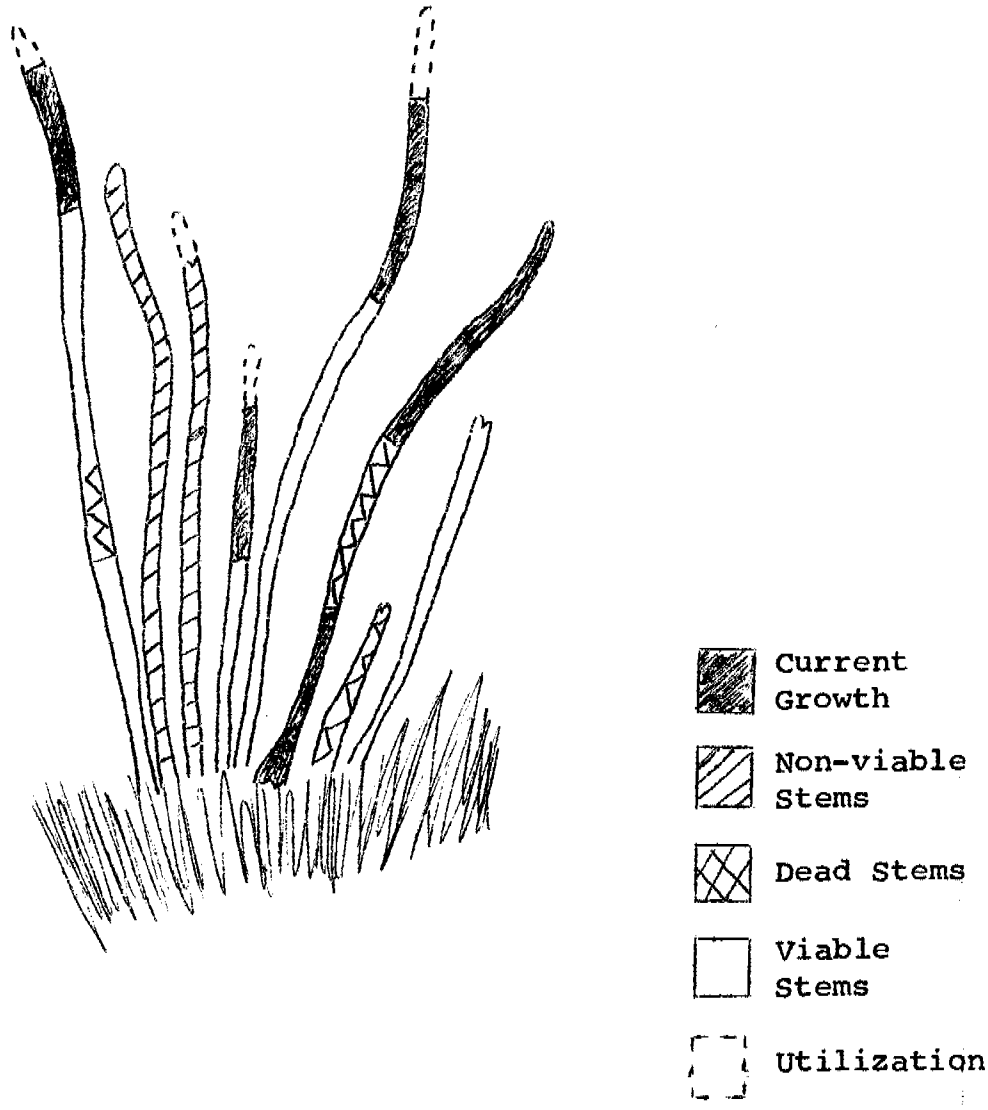

Figure 3. Characteristics and conditions of a typical browsed elderberry, Sambucus racemosa, plant.

provided little restriction to their movement. The Malina herd, which normally spends the winter and early spring months in the Litnik Lake area, did not arrive on the wintering grounds until the middle of March, while the Raspberry Strait herds, which also normally winter in this area, were never observed to move onto this range during the winter-spring period.

Range studies for 1962 were restricted to a month and a half of field work during which time 27 willow and 19 elderberry transects were installed on segments of the Litnik Lake game range (Figure 4). The establishment of these 46 transects initiated the range evaluation segment of the Roosevelt elk work plan for Afognak Island.

A two-man team supervised by Batchelor spent the last two weeks of April and all of May in the Litnik Lake region assessing current browse removal, plant vigor and trend.

The Alnus-Sambucus association, together with lesser understory species, constitutes the dominate shrub community of southwestern Afognak Island, yet it also comprises the most significant browse producing community on the Island. In many of the lowland valleys and beaches, willow associations serve as important browse producers.

Together these two species constitute the principal browse plants supporting elk throughout the year and especially during the winter-spring months. Elderberry and a few willows have been found so palatable that elk rely almost entirely upon these two species for winter-spring browse, which has led to heavy overuse of these plants in certain areas of the Litnik Lake range. In many such areas willow has been subjected to such severe over-cropping and resultant loss of vigor that many stands are now decadent and non-productive (Table 1).

As both willow and elderberry ranges on Afognak are seral, they accordingly are relatively short lived and changes are rapid and can be noted over a period of a few years. In several key elderberry stands the successional pattern has been advanced by excessive elk use, to such a point, that this species is expected to be eliminated from the community within a relatively short period of time.

The interspecific relationship between Sambucus racemosa and Alnus crispa in this major Afognak community is not presently

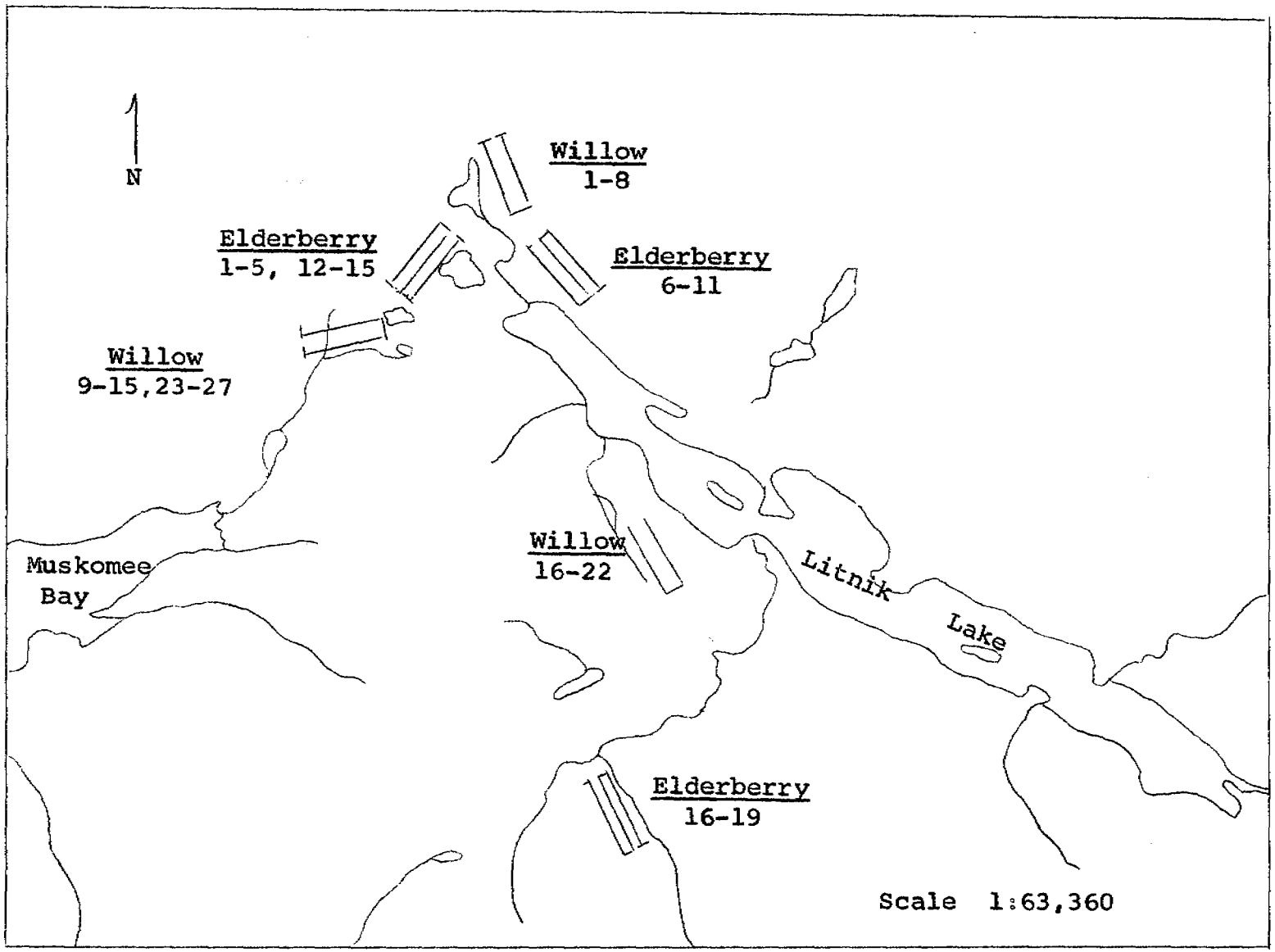

Figure 4. Distribution of transects installed May-April 1962, by clusters, Litnik Lake Elk Range, Afognak Island, Alaska.

Transect Number	Mean Viable Stems Per Plant	Mean Live Stems Per Plant	Mean Stripped Stems Per Plant	Mean Trampled Stems Per Plant	Mean Dead Stems Per Plant	Browsing Intensity by per cent						Age Class by per cent					Plant Trend	
						None	Trace	Light	Moderate	Heavy	Severe	Seedling	Young	Mature	Decadent	Resprout	Retrogressive	Progressive
1	2.6	4.2	2.3	.46	8.3			4	42	38	16			100				
2	2.3	3.8	1.6	.13	9.0		10	30	30	27	3		27	50		23	94	6
3	2.8	4.0	1.8	.16	8.9		3	11	41	26	19		47	33	10	10	100	
4	2.3	3.6	1.5	.13	8.3		7	25	21	44	3		50	44	6		100	
5	1.8	3.7	1.7	.03	8.1		6	32	24	28	10		54	40	3	3	97	6
6	1.5	3.4	1.7	.23	8.5		10	3	20	32	35	7	40	40	3	10	97	3
7	1.3	3.3	1.8	.10	11.2		7	14	18	47	14	3	26	61	10		100	
8	1.0	3.3	1.4	.03	9.0		10	31	10	31	18		67	24	3	6	100	
9	2.3	3.2	1.0	.10	7.4		14	10	45	21	14	6	30	35	3	26	94	6
10	1.6	3.0	0.3	.03	4.4		54		25	14	7	14	33	30	6	17	97	3
11	3.2	4.1	1.2		8.4		59		10	21	10	16	21	44	3	16	90	10
12	5.0	5.6		.03	14.2		82		18				20	61	6	13	93	7
13	3.0	4.5	1.3	.13	9.8		27	16	27	16	14		10	37		53	97	3
14	1.3	2.9	0.4	.06	8.0	46	6	25	13	10			20	27	20	33	91	9
15	0.9	3.6	0.8		8.9	71			16	10	3	3	10	17	33	37	94	6
16	5.1	5,8			14.7	100								70		30	94	6
17	5.3	10.1			14.6	100						3		77		20	84	16
18	5.3	6.1		.10	15.8	100								61	3	36	90	10
19	4.3	4.9			17.4	100							3	77		20	97	3

Table 1. Condition, trend and browsing intensity of elderberry in the Litnik Lake area as measured by 19 transects.

known. It appears, however, that alder is asserting community dominance as the overstory species, while elderberry, a light tolerant species, is suffering from reduced vigor and may eventually be eliminated from this community.

Analysis of Utilization, Vigor and Trend Data

Utilization: Range utilization deals with the removal of the current year's browse production. The amount of plant growth removed each season largely determines whether the productivity of the range will be maintained or improved and thus directly influences range vigor and trend. Measurements of utilization for a period of years may help answer perplexing problems as to why certain ranges deteriorate while others improve.

Utilization for a single plant or species is the amount, usually expressed as a percentage, of current plant growth within reach of browsing animals which has been cropped. It should be viewed as the complement of unbrowsed plant material remaining on the plant for forage and soil maintenance.

The mean utilization of current leader growth for all 27 willow transects average 24 per cent, with a range of from zero to 43 per cent for the 3 areas sampled. The 24 per cent mean can be considered to fall within the allowable use factor for the range as a whole; however, it must be remembered that only 50 per cent of the "normal" wintering elk population occupied the Litnik Lake range during 1962, and for only a short period of the spring at that. Assessment of past browsing intensity revealed that 45 per cent of all plants sampled (810) fell into the heavy and severe classes. For transects 1-8, and 9-15 and 23-27, this figure was 80 per cent and 49 per cent, respectively, which certainly points to excessive over-utilization in certain areas during the past. Should this excessive over-cropping again occur, additional permanent damage to the range will result.

Due to the nature of its life form and semi-woody characteristics, utilization of elderberry requires special consideration. Measurement categories developed for willow and other woody species are not suitable for assessing forage removal, vigor and trend of this species. The browsing intensity assessment, as applied to elderberry, was found not to be sensitive enough a measurement of the impact made by elk on this species,

due in part to its life form and pattern of use by elk; however, it does serve as a subjective rating of browse removal. Using this measurement, though realizing its shortcomings, it can be noted in Table 2 that 30 per cent of all elderberry plants sampled fell into the heavy and severe classes. Transects 6 through 11 exhibited the greatest impact of browsing with 48 per cent of plants falling into the heavy and severe classes.

Range Condition: Range condition deals with range health and is expressed as the relative position of a range with regard to its potential productivity. Satisfactory condition involves both a stable soil and plant cover as dense as climatic and edaphic conditions allow, with the assurance of the successful reproduction of desired forage species. Unsatisfactory conditions involve situations that do not meet these requirements. These involve erosion rates greater than "normal", lowered vigor and density of decreaser plants and frequently the increased vigor of increaser and invader species.

Indicators of satisfactory condition are those usually associated with "balance" between the various components of the range and its use - plants, animals, soil, topography and climate. In this report range condition is broken into two sections - soil and plant.

Soil Conditions: The soils of all transects sampled were recorded to be in satisfactory condition based on gross examination. All contained a rich humus layer, were fertile, high in organic matter, stable and showed little or no sign of advanced erosion.

Plant Vigor: Plant vigor is synonymous with plant health. It denotes the relative appearance, vitality, rate of growth and herbage production of the plant. A vigorous plant has reserve vitality, is free from insects and disease, and for maximum vigor it requires a favorable ecological environment.

Plant vigor is a relative abstract term, and is difficult to describe, measure or interpret precisely. It is a composite expression of the influence of all environmental growth factors. Changes or modifications of any growth factor, such as soil fertility, soil moisture, rainfall, or the biotic influences of insects, rodents and browsing animals, affect the vigor of the plant.

Transect Number	Mean Viable Stems Per Plant	Mean Live Stems Per Plant	Mean Stripped Stems Per Plant	Mean Trampled Stems Per Plant	Mean Dead Stems Per Plant	Browsing Intensity by per cent						Age Class by per cent					Plant Trend	
						None	Trace	Light	Moderate	Heavy	Severe	Seedling	Young	Mature	Decadent	Resprout	Retrogressive	Progressive
6-11	1.8	3.4	1.1	.08	8.2	26	16	13	10	21	27	8	36	39	4	13	96	4
16-19	5.0	6.7			15.6	100						1	1	71	1	27	91	9
1-5 12-15	2.4	4.0	1.3	.13	9.3	8	15	16	26	22	13	1	26	45	9	19	96	4
All	2.7	4.4	1.0	.10	10.3	25	16	10	19	19	11	3	24	49	6	18	95	5

Table 2. Condition, trend and browsing intensity of elderberry by transect clusters.

On many ranges plant vigor is closely associated with grazing intensity. Whenever ranges are overgrazed, deterioration is often first reflected in plant vigor followed by changes in plant density, composition and soil stability. Plant vigor, forage production, species density, plant composition, soil stability and litter have been used to classify range condition and serve as criteria for evaluating range improvement or deterioration. Increase in plant vigor is also one of the first expressions of range improvement.

Plant vigor is manifested, or indicated in several ways:

Size and appearance of plants
Height and number of stems
Number and size of fruiting bodies
Size and color of foliage
Rate of foliage development
Herbage production

Measurements of observations on any of these criteria provide information on plant vigor, however, most investigators measure and evaluate several. The greater the number of valid factors considered and measured, the greater the confidence in the results and interpretations obtained.

The assessment of plant condition as defined in this report includes all of the above points which, together, serve as a basis for the rating of vigor. An analysis of vigor data obtained from 27 willow transects, using the above criteria, revealed that 50 per cent of the plants examined were classed as either very poor or poor, with an equal distribution between these 2 vigor categories. The range between transect clusters (groups of transects) was found to vary considerably. For transects 1 through 8, which sampled highly palatable willow in an area frequently used by elk, these 2 vigor classes represented a high of 79 per cent, while the same 2 classes accounted for only 13 per cent of plants sampled by transects 16 through 22. The latter sampled basal willow which has been observed to be of low palatability in an area infrequently visited by elk during the winter-spring months. The age class distribution data for all plants sampled indicate that only 2 per cent were classed as seedlings and these, together with young plants, accounted for a low of 19 per cent of the total distribution, while 29 per cent of the plants sampled were classed as decadent. The apparent lack of thrifty reproduction coupled with an average of 21 per cent dead material for all plants further indicates the present state of reduced vigor sustained by sampled willow stands.

As previously stated, conventional methods for determining utilization, vigor and trend must be modified when evaluating elderberry. Elderberry vigor, as referred to in this report, is expressed in part as the ratio between the total viable stems and total dead stems. Figure 5 expresses this ratio at the 95 per cent confidence limits for the 19 transects installed during 1962. Further consideration is given to the extent, numerically expressed, of stem stripping and trampling by elk. The influence of stripping can be significant as it usually results in the girdling and eventual killing of stems bringing about reduced plant vigor.

Examination of vigor data obtained from the 19 elderberry transects reveals that only 18 per cent of the total stems sampled were viable, indeed a low percentage. The mean of 2.7 viable stems per plant compared to 10.3 dead stems further points to the present state of reduced vigor of all elderberry stands sampled to date. The trampling and stripping rates, thought to be significant prior to the installation of transects, were found to be of little importance in the overall health of elderberry at this time.

Range Trend: Trends in range condition are derived from the dynamics of individual plants sampled which are evaluated as a whole. Trend is the measure of change from one condition to another. Progressive trend is change toward a fully productive range while retrogressive trend is change away from this state. Accurate determination of trend in range condition is extremely important and yet may be very difficult to assess. Where standards for rating condition and trend have been developed, these can be used in evaluating local situations. However, in those instances where standards are lacking such as on Afognak, those standards and indicators developed for other types can often serve as helpful guidelines in evaluating local conditions.

Based on the criteria described above under plant and range condition, 54 per cent of all willows examined fell within the retrogressive class. For transects 1 through 8 this category accounted for a high of 88 per cent of the sample and 55 per cent for transects 9-15, 23-27. Only transects 16 through 22, which sampled willows of seemingly inferior palatability, registered well in the progressive range at 86 per cent.

Elderberry, seemingly more susceptible to the influence of browsing and plant competition than many woody species, apparently is unable to maintain itself under conditions which presently exist on many portions of the Litnik Lake game range. An analysis of trend data as presented in Table 3 indicates that 95 per cent of all

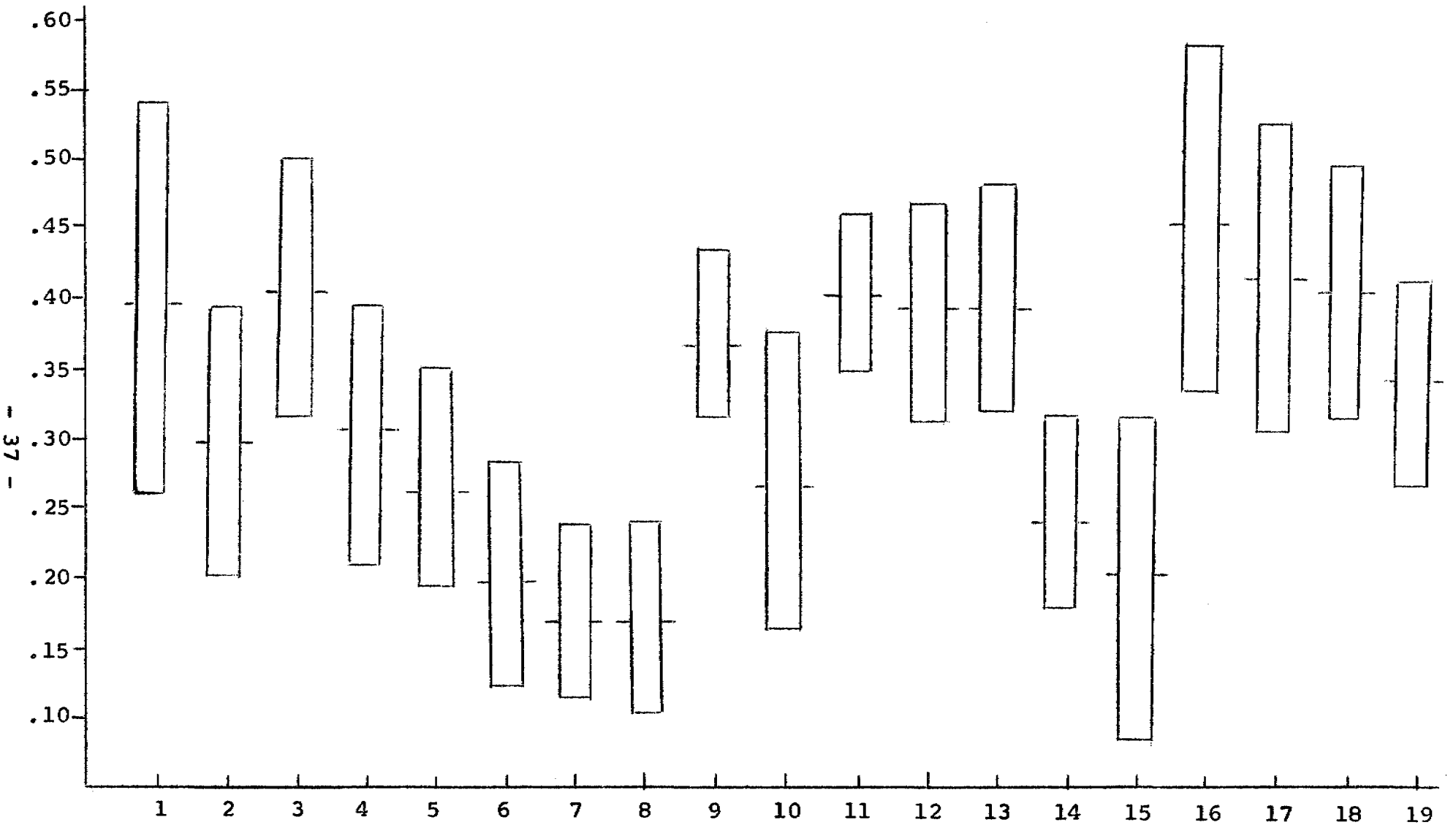

Figure 5. Ninety-five per cent confidence limits for mean of ratio $\frac{\text{viable stems}}{\text{dead stems}}$, for 19 elderberry transects.

plants sampled were classed as retrogressives, unable to maintain their present state under existing browsing intensity and plant competition. Whether the trend has been unerringly interpreted can only be speculated at this time; however, it is the belief of this writer that no radical change for the better can be expected within the foreseeable future.

DISCUSSION

The analysis of transect data furnished information on the present state of reduced vigor and productivity of major portions of the important Litnik Lake game range. The reduced vigor and productivity of much of this range results from (1) the impact of an elk population upon the browse resource and (2) competition between species of important browse producing communities through successional advancement. To what extent each of the above are responsible for the present state of range health is not fully understood at this time. That much of the range has regressed from a once highly productive resource to its present state is apparent; however, what period these changes have taken place can only be pondered. The work accomplished during 1962 represents only the beginning of a range program for Afognak Island.

The need for continued range evaluation speaks for itself, for one year's data do not provide a sufficient base to manage or attempt to manage a range resource. To keep abreast of changes in range trend, assessments should be made on an annual basis to provide a source of information upon which to base future management plans.

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: D Title: Elk Investigations

Job No: 1-e Title: Characteristics of the Hunter Harvest, Afognak and Adjacent Islands

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

ABSTRACT

During 1961, 260 hunters were in the field and harvested 120 Roosevelt elk during a 78 day either-sex season. Of the total kill, 69 were bulls, 46 cows, 4 calves, and 1 animal was unidentified as to sex. A collection of 65 jaws, representing 54 per cent of the total harvest, revealed that 35 per cent of the female sample was composed of animals in the 4.5+ year classes, while 42 per cent of the male sample was from the 2.5 year class animals. Data gathered in 1961 further support the theory that a differential age distribution exists between the male and female segments of the population. Hunter success for the 1961 season was 46 per cent or an increase of 8 per cent over the 1960 figure. The 26 day special season during November accounted for the harvest of only 4 elk.

RECOMMENDATIONS

Every effort should be made to increase the hunter harvest of elk to more nearly approach the level required to maintain a high productivity without jeopardizing the range resource.

The construction by the U. S. Forest Service of permanent campground facilities at Afognak and Malina Lakes, which include shelter cabins, should encourage additional hunting pressure during late October and November when the weather is frequently unsettled and often inclement. In addition, the development of a proposed Forest Service trail system for southwestern Afognak Island will favor greater use of this area throughout the summer and fall.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
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Work Plan: D Title: Elk Investigations

Job No: 1-e Title: Characteristics of the Hunter Harvest, Afognak and Adjacent Islands

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

OBJECTIVES

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

TECHNIQUES

Data regarding characteristics of the harvest for the 1961 elk season were gathered in a similar manner to that in 1960. Harvest information was obtained in part through contact with hunters in the field. As an additional check on the kill, hunter harvest forms were again distributed to local meat processors, air lines in the Kodiak area, and to the military. Aerial surveys and hunter camp checks were conducted throughout the elk season as a means of ascertaining the extent of the harvest.

Hunters contacted in the field were requested to report their kills and turn in elk jaws to Department personnel. In addition, hunters harvesting female elk were encouraged to remove the complete reproductive tract and turn it in to a Department biologist. Instructions describing how to remove a reproductive tract from a female elk were furnished to hunters met in the field.

To keep informed of the hunting effort and harvest in the popular Afognak Lake recreation area, a Fish and Game Aid was stationed during the entire season at the Department's cabin on Afognak Lake.

Jaw-collection posters were distributed locally prior to the opening of the deer and elk seasons. Several advertisements were placed in the Kodiak Mirror reminding hunters to report their kills and turn in deer and elk jaws to the Department of Fish and Game.

As a means of obtaining data relevant to the population dynamics of the Afognak elk, lower jaws were collected and analyzed to establish the age structure of a sample of the 1961 harvest.

FINDINGS

Sex and Age Distribution

A knowledge of age class distribution is of value to elk management as with all game species. Data concerning population densities and ages, if systematically gathered, will indicate the survival rate and resulting population trends, and will also show when mortality occurs and what it may mean to future populations. Knowledge of ages and densities permit the prediction of population trends, providing important ecological factors are known or can be assessed.

During the 1961 season a sample of 65 elk jaws, representing 54 per cent of the total legal harvest, was collected for aging.

Sex Breakdown of the Kill

The sex ratio of the 1961 harvest was 58 per cent bulls as compared to 53 per cent for 1960 and 87 per cent in 1959. The total harvest in 1961 decreased 5 per cent below 1960. The cow take, however, increased 6 per cent, apparently the result of liberalization of the either-sex season, for the number of hunters decreased by 25 per cent below 1960. The distribution of the 1960 and 1961 elk harvests are shown in Table 1.

There were 43 days of either-sex season (Sept. 1-20, Oct. 14-Nov.4) on all of Raspberry and Afognak Islands with the exception of the Tonki Cape area where a 78 day any-sex season (Aug. 20-Nov. 5) was in effect. At the conclusion of the general season, a 26 day special season (Nov. 6-31) was established in an attempt to increase the harvest.

Age Distribution of the Kill

The age distribution of a segment of the 1961 elk harvest is

Table 1. Distribution of the 1960-1961 harvest.

Year	Bulls Number	Bulls %	Cows Number	Cows %	Calves Number	Calves %	Unidentified Number	Unidentified %	Total Kill
1960	68	53	43	34	2	2	14	11	127
1961	69	58	46	38	4	3	1	1	120

Table 2. Comparison of the age distribution of samples of female elk harvested, 1959*-1961.

Age (Year)	1959 %	1959 No. of Jaws Represented	1960 %	1960 No. of Jaws Represented	1961 %	1961 No. of Jaws Represented
0.5			5	1	9	3
1.5			26	5	9	3
2.5	27	3	11	2	31	10
3.5	18	2	11	2	16	5
4.5+	55	6	47	9	35	11
		11		19		32

*Tonki Cape area only.

presented in Tables 2 and 3. This distribution is based on a sample of 65 elk jaws collected throughout the season and represents 54 per cent of the total legal harvest. Of the total, 33 jaws were collected from bulls and 32 from cows.

Female Age Distribution

The sample of 32 jaws collected from females harvested during the season represents 74 per cent of the total cows harvested in 1961. The age ratios for this sample are shown in Table 2. Trends in the female age class distribution are shown in Figure 1.

Female age ratios for the 1961 sample were found to be similar to those of 1960, where 47 per cent of the female jaws aged represented animals in the 4.5 year and older age classes. In 1961, these same age classes accounted for 35 per cent of the total sample. A greater similarity is evident when all 3.5 age classes and above are grouped. In 1960, these age classes made up 58 per cent of the total sample while in 1961, they represented 50 per cent of the sample. These data suggest the female segment of the population is presently overbalanced with old aged animals, presumably resulting from under harvest, high survival and decreased production. Information concerning calf production collected during the summer of 1961 indicated an average calf-cow ratio of 26:100 which, when compared to a calf-cow ratio of better than 36:100 for the Roosevelt elk in Oregon, suggests a current state of relative low production.

On fully stocked ranges, there is an inverse relationship between survival of breeding adults and the production of young, due presumably to competition for food between young and adults and/or through increased density of adults resulting in lowered production. The phenomenon of long-life expectancy and low proportional production apparently is occurring within the Afognak elk herd at this time. Survival is known to be high and the population is virtually free of interspecific competition. Predation, with the exception of the brown bear, which apparently exerts little or no influence upon survival, is nonexistent. Further data are needed to substantiate or refute this phenomenon.

Male Age Distribution

The age distribution of bull elk harvested in 1961 is presented in Table 3 and is shown in comparison with age distribution data for the years 1956-1960. Trends in the male age class distribution are shown in Figure 2.

Table 3. Comparison of the age distribution of samples of male elk harvested, 1956-1961.

Age (Year)	1956 %	1956 No. of Jaws Represented	1957 %	1957 No. of Jaws Represented	1958 %	1958 No. of Jaws Represented
0.5						
1.5	3	1	27	10	43	19
2.5	28	8	11	4	23	10
3.5	14	4	19	7	16	7
4.5+	55	16	43	16	18	8
		29		37		44

Age (Year)	1959 %	1959 No. of Jaws Represented	1960 %	1960 No. of Jaws Represented	1961 %	1961 No. of Jaws Represented
0.5			4	1	3	1
1.5	30	14	48	13	31	10
2.5	19	9	29	8	42	14
3.5	17	8	11	3	9	3
4.5+	34	16	8	2	15	5
		47		17		33

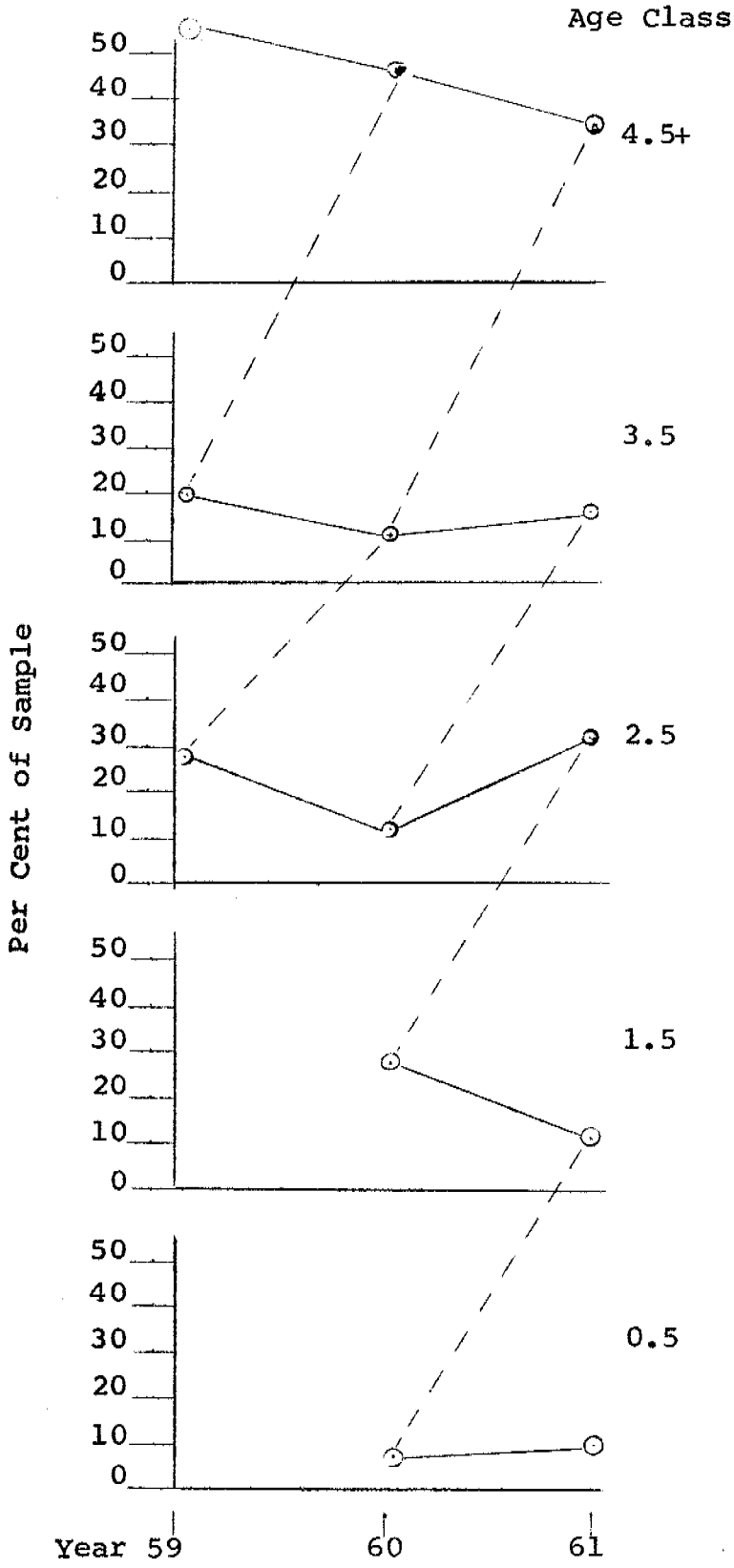

Figure 1.

Trends in age classes of female elk harvested 1959 - 1961.

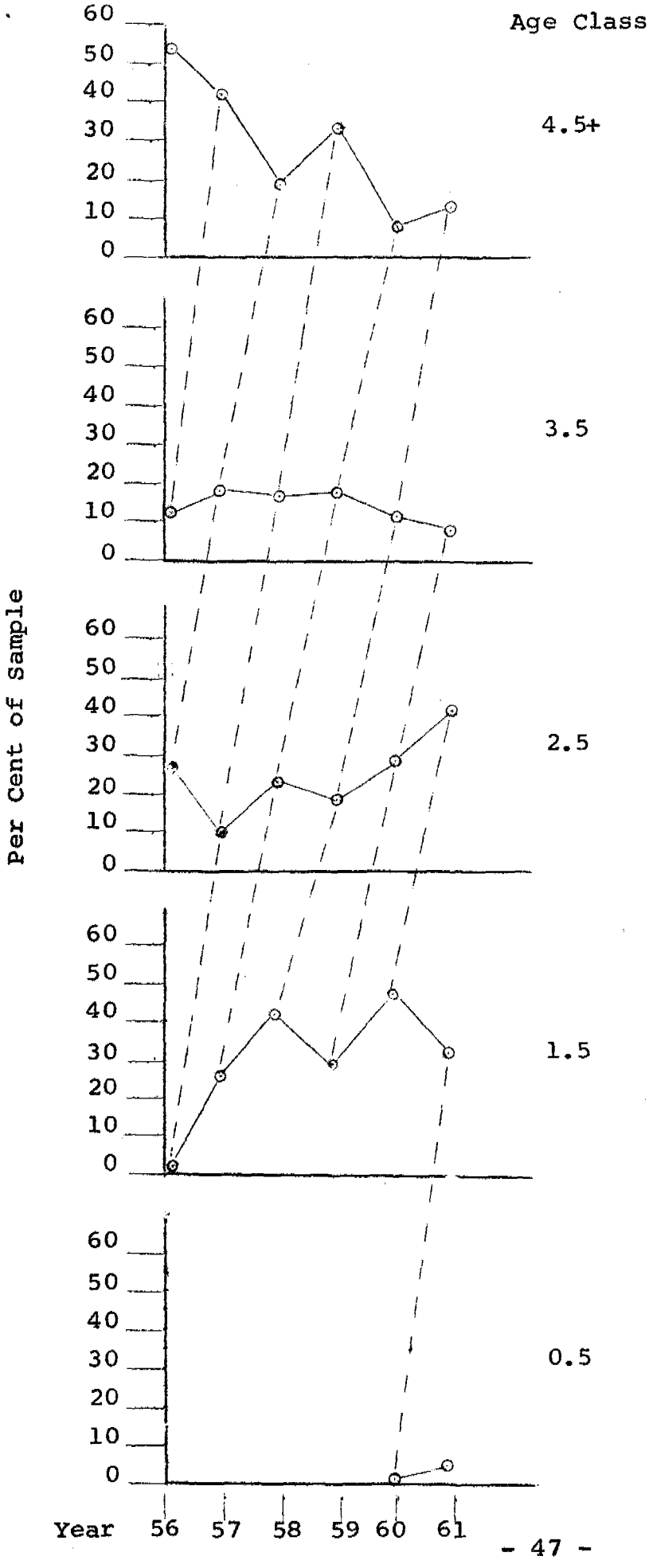

Figure 2.

Trends in age classes of male elk harvested 1956 - 1961.

Males representing the 1.5 year class (34 per cent) have shown a marked decrease from the 48 per cent figure for 1960. Conversely, the percentage of 2.5 year class animals has increased to 42 per cent in 1961. It is believed this increase reflects high survival of the 1960 yearling class coupled with lowered productivity during the same year. Although data collected to date suggest relatively low productivity, the continuing high occurrence of young males in the harvest indicates a great amount of selectivity for young males on the part of local hunters. Since this phase of the elk investigation was undertaken, it has been demonstrated on several occasions that hunters prefer to select young males. As most successful hunters seek and select their elk for the dinner table rather than the trophy room, almost all prefer to bag a spike or small branched antlered bull.

Spike bulls (1.5 year class), under good production and survival, should out-number any other single age class, with the exception of calves, and thus represent the most available year class to the harvest. Assuming that spike bulls constitute the most available year class and that the majority of hunters prefer spikes, they should account for the greatest percentage of any single age class in the harvest. This was not so in 1961, when 26 per cent fewer yearlings than 2.5 year olds were harvested. The lowered take of 1.5 age class males suggests a reduction in productivity over a previous level.

The high percentage of old-aged cows in the harvest indicates that hunters are unable to differentiate between young and old aged females and that this segment of the population is overbalanced with old-aged animals.

Distribution of the Kill by Area

The distribution of the 1961 harvest by area is presented in Table 4. The Raspberry Strait (Afognak Island side), Malina and Afognak Lake areas again sustained the heaviest kill, accounting for 75 per cent of the total harvest. Raspberry Island, supporting a herd of more than 165 animals, accounted for only 13 per cent of the total legal kill. Likewise, the Tonki Cape region continues to be under-harvested with only 9 per cent of the kill coming from this area which is known to support more than 225 animals. The inadequate harvesting of elk from interior Afognak Island and Tonki Cape presents a problem not easily solved as neither area is readily accessible to the hunting public.

Table 4. Distribution of elk harvest by area for the years 1958-1961.

Area	1958		1959		1960		1961	
	No. Harvested	%	No. Harvested	%	No. Harvested	%	No. Harvested	%
Raspberry Island	44	45	17	14	23	18	15	13
Afognak Island								
Malina	14	14	38	32	24	19	32	26
Raspberry Strait	31	31	32	26	34	27	27	23
Afognak Lake					28	22	32	26
Interior Afognak							3	3
Tonki Cape	10	10	33	28	18	14	11	9
Totals	99		120		127		120	

Table 5. Roosevelt elk kills, 1950-1961.

Year	Kill	No. of Hunters	% Hunter Success
1950*	27	50	54
1951	0	0	0
1952*	15	35	43
1953*	19	40	46
1954	0	0	0
1955	26	105	25
1956	40	135	27
1957	70	250	28
1958	111	345	32
1959	120	330	36
1960	127	345	37
1961	120	260	46

* Hunting by permit only.

Chronological Distribution of the Harvest

The distribution of the harvest by ten-day periods is presented in Figure 3. In previous years, with the exception of 1960, the heaviest harvest occurred during the early portion of the season and then tapered off. The 1961 harvest was well distributed throughout the season and this was attributed to the any-sex option. The peak of the 1960 harvest occurred the last five days of the season at which time animals of either sex could be legally harvested.

The 26 day special season occurring during November accounted for only 4 elk harvested and did not serve to materially increase the 1961 kill.

Hunter Harvest - 1961

The 1961 elk season in Alaska was from August 20 through November 5 in that portion of Afognak Island known as Tonki Cape. For the remainder of Afognak and all of Raspberry Island, the season was from September 1 through 20, and October 14 through November 5. A special season of 26 days (November 6-31) was initiated to harvest additional animals. The bag limit for all areas was one animal of either sex. Elk taken during the general season did not prevent the taking of an additional animal during the special season.

Two hundred and sixty hunters, 25 per cent fewer than in 1960, were in the field and harvested 120 elk for a success of 46 per cent. Although hunter success was increased by 8 per cent over that of 1960, the total legal take decreased by seven animals. This decrease in the harvest can be attributed, in part, to fewer hunters in the field. Many local sportsmen who normally hunt elk were discouraged to do so because of frequent periods of inclement weather which occurred throughout the latter half of the general season and the entire special season. As in previous years, a number of military and civilian hunters journeyed from Anchorage and Fairbanks to participate in hunts.

As shown in Table 5, the number of elk hunters, generally stabilized between 1958 and 1960, decreased by 25 per cent in 1961. If the number of hunters in the field does not again increase,it will be difficult to attain an adequate harvest. It is doubtful at this time that hunter success can be increased much beyond the 46 per cent attained in 1961.

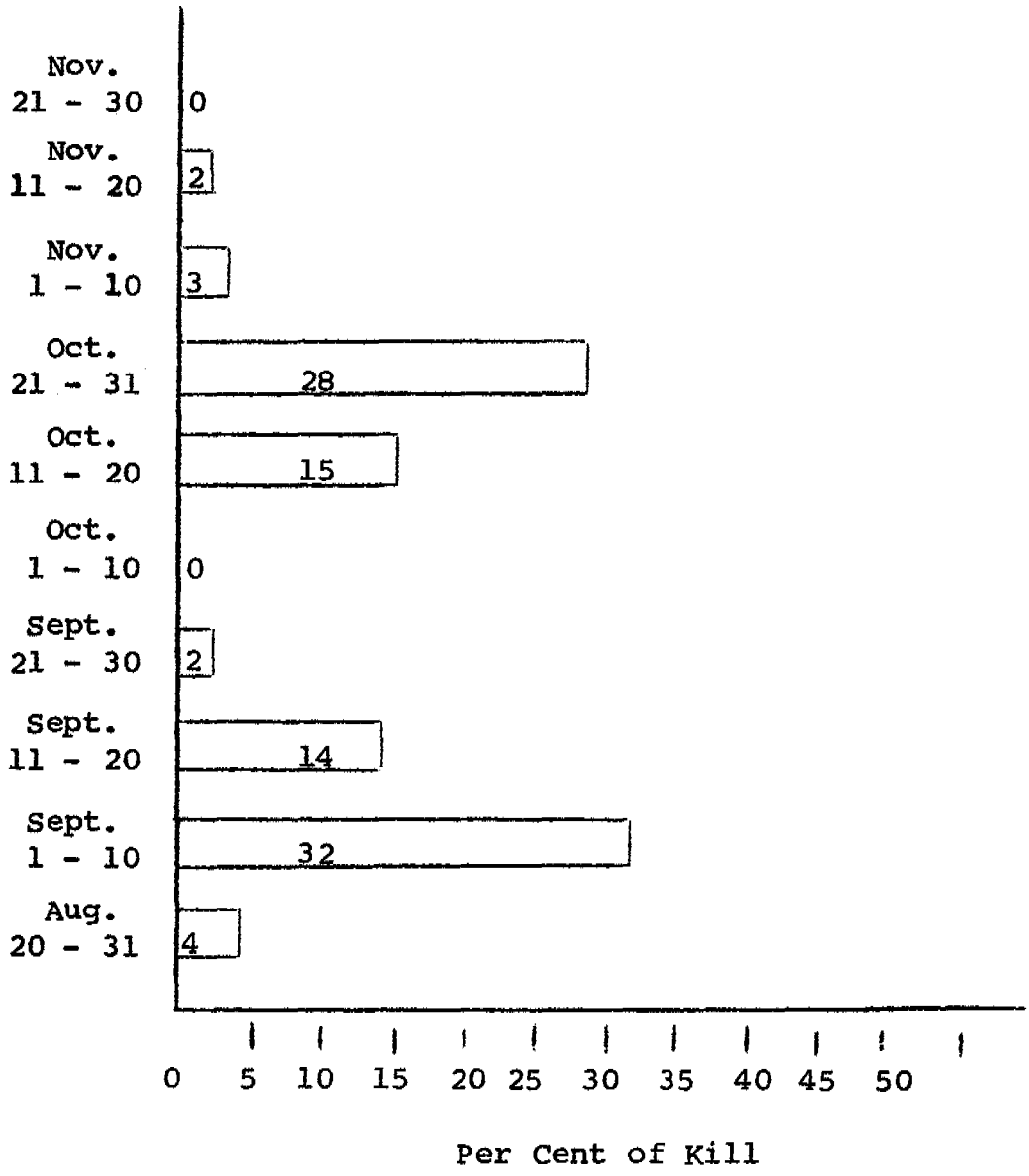

Figure 3. Chronological distribution of elk kill for 1961.

Weather conditions from year to year continue to be the major factor governing the success of the elk harvest in the Afognak Island group.

The ineffectiveness of special post-season hunts was demonstrated in 1960 and again in 1961 when only four animals were harvested. Most sportsmen have lost interest in hunting by the time special seasons are opened and poor weather at this time further dampens their enthusiasm for going afield.

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: L Title: Wildlife Data Collection

Job No: 1 Title: Wildlife Reconnaissance, Alaska

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

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; and to identify specific wildlife management problems, if such exist, in the previously little studied regions of Alaska.

FINDINGS

The only work undertaken on this job was the mailing of a hunter harvest questionnaire to a sample of Alaskan hunters. This questionnaire was, primarily, a testing of this means of obtaining harvest data, as the method had never been tried in Alaska.

Returns were still being received by the end of the reporting period: a report on results will, therefore, be combined with the report for Work Plan L, Job No. 3, W-6-R-4, which is now being prepared.

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JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: L Title: Wildlife Data Collection

Job No: 2 Title: Population Characteristics, Distribution and Movements, Big Delta and Nabesna (Upper River) Bison Herds

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

ABSTRACT

The Big Delta bison herd was estimated at 367 animals and the Nabesna herd was estimated at 100 animals as of July 1, 1962.

The 1962 initial calf production was 31 or 8.4 per cent for the Delta herd. Initial calf production was 15 per cent in 1961. Initial calf production for the Nabesna herd was 13 or 13 per cent.

No significant changes were noted in the distribution or movements of the Big Delta bison herd except that few bison occurred in the Delta Junction or Clearwater agricultural areas before or during the harvest of crops. The distribution and movements were mapped for the Nabesna herd. The Nabesna herd does not reside in the Nabesna area and should hereafter be referred to as the Copper River herd.

A permit hunt was initiated on the Big Delta herd and 53 bison were removed. Sixteen bison were weighed and many were examined for parasites.

Bison depredations in the Delta area were confined to crops left unharvested, and unprotected hay stacks.

RECOMMENDATIONS

An annual hunt should be conducted and the number of animals harvested should be adjusted to reduce the herd size to approximately 250 animals. At this level the herd will be more prolific and able to support a substantial annual harvest.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

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

Work Plan: L Title: Wildlife Data Collection

Job No: 2 Title: Population Characteristics, Distribution and Movements, Big Delta and Nabesna (Upper River) Bison Herds

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

OBJECTIVES

To determine the current size and population structure of the Big Delta and Nabesna bison herds; to determine herd distribution and movements throughout the year; and to implement management of the Delta herd through sport hunting.

TECHNIQUES

Surveys of the Big Delta and Nabesna herds were made to determine herd distribution, composition, size and movements. Most observations were made with the aid of an aircraft. Flights were made in June, July and August, and additional observations were made while conducting other projects and by Department cooperators.

The size of the Big Delta herd was computed by subtracting the known mortality from the known natality and applying the difference to the 1960 total count information.

A permit hunt which provided for the removal of 50 bison from the Big Delta herd was held in August and September. Specimens useful in determining age composition, reproductive performance, incidence of parasitism and growth were collected from most of the animals killed by hunters.

FINDINGS

Herd Size

Delta Herd

The herd estimate of 367 animals as of July 1, 1962, is derived by subtracting the known mortality for 1961 and 1962 from the known natality for the same period and adding the difference to the 1960 population estimate (Table 1). The estimate assumes that the unknown mortality equals unknown natality, the validity of this assumption is unknown. Another measure of herd status and initial production of calves was provided by aerial surveys of the calving grounds (Table 2).

Although these surveys reveal a slightly lower production of calves in 1962, 31 as compared to 49 in 1961, the total population segment using the alluvial bars of the Delta River for calving and for summer range was essentially the same - 258 in 1962 and 268 in 1961. The counts made on the summer range may prove a useful index to total population as well as to initial production of calves. Most of the mature males are not represented in the summer counts due to their tendency to segregate from the remainder of the herd during the early summer months. Thus only the females with calves, "barren" females, and young animals of both sexes are believed to be represented in their true proportions when the counts are made. The mature males are apparently scattered throughout the range. A constant population segment, useful for making annual comparisons, is obtained by extracting the adult males sighted from the totals. Such manipulation of the data provides for comparison of the important or "reproductive" segments of the herd and should be sufficiently sensitive for present management needs.

Copper River Herd

The herd is estimated at 100 animals. Attempts to obtain a total count of the herd were made in February, June and late June - early July. The first two attempts were unsuccessful but on the last effort 74 animals were located. Only 8 of the 74 were large males. The tendency for adult males to segregate from the rest of the herd during early summer probably accounts for this seemingly unbalanced sex ratio. When the estimate for the herd was prepared, the sex ratio of the adult animals was assumed to be even.

Table 1. Population estimate, Delta bison herd.

Date	Estimated Total Population	Mortality	Natality	Source
11/20/60	352			Delta bison census
5/23/61		7		Observed winter mortality
5/27/61			49*	Observed calf crop
8/26/61 to 9/17/61		53		Permit hunt
4/30/62		5		Observed mortality
5/26/62			31	Observed calf crop
	352 -	65 +	80	
6/30/62	367			Above observations and computations

* Three albino calves observed May 27, 1961, did not survive and are not included in the number listed.

Table 2. Initial calf survival, Delta and Copper River herds.

DELTA HERD

Date	Total No. Bison Observed	No. of Adults	No. of Calves	% Calves in Total Observed	% Calves in Total Estimated Herd
5/27/61	268	216	52	19	15
6/26/62	258	227	31	12	8.4
		COPPER RIVER HERD			
July 1962	74	61	13	21	13

Calf Production

Delta Herd

Three aerial surveys were conducted in June to obtain an appraisal of initial production of calves. On June 26, 1962, 258 bison were counted of which 31 (12 per cent) were calves. The surveys for 1961 and 1962 are compared in Table 2.

Copper River Herd

Thirteen of 74 animals counted in July 1962, were calves. The herd is estimated at 100 animals; thus calves are estimated to comprise 13 per cent of the total herd.

Movements and Distribution

Delta Herd

Movements and distribution were similar to the information reported in W-6-R-2, Job L-2 with two exceptions. A group of approximately 30 animals wintered on the Delta River dry bar. This represents the first time in recent years that bison have wintered on or west of the Delta River.

A major segment of the herd wintered in the vicinity of Healy Lake, north of the Tanana River and somewhat east of their usual routes. A portion of their group reportedly calved in the vicinity of Healy Lake. Aerial surveys on June 6 and 26, 1962, failed to confirm the report. There is no reason, however, to doubt the report because one band of bison apparently has calved in the Healy Lake area for a number of years. The size of the group is not known.

Copper River Herd

Prior to 1962, few observations of this transplanted herd were recorded. Observations in February and early June of 1962 showed a wintering and calving area in the Copper River Valley between the Dadina and Tonsina Rivers.

Further information was obtained from a resident of the area, Sam Snyder. He reports two calving segments, one near the mouth of the Chetaslina River and one near the mouth of the Dadina River. After calving, the herds move up the respective streams with the

group calving at the mouth of the Chetaslina moving across drainages and joining the Dadina group. Both groups spend the summer on the Dadina; drifting to the Copper River during the fall, breeding and repeating the cycle the following spring (Figure 1).

Bison have been reported from various drainages within the Copper River system. The observations, largely unverified, probably represent dispersal of adult males.

Management

Delta herd

A total of 3,256 permit applications were processed, 50 permittees were selected by lottery and an additional 150 permit applicants were designated alternates.

The regulations promulgated for the hunt specified that 10 permits would be validated each day following the opening of the season until 50 permits were validated. Permit validation was staggered in an attempt to maintain a relatively constant pressure on the bison herds, thereby forcing them away from the agricultural areas and reducing depredations to barley and forage crops which were ready for harvest. In addition, the system prevented hunters from concentrating within a relatively small and populated area where most of the bison were located. Further benefits were realized by the Department for most of the kills could be visited and specimens collected.

The hunt lasted 23 days although 90 per cent of the animals were taken during the first 10 days of the hunt. The 50 permittees were all successful, taking 38 males and 12 females (Table 3 & Fig.2). Three bison were accidentally killed; two by hunters shooting into closely grouped bands of animals or by bullets passing through one animal and lodging in another; the third was wounded fatally by a hunter who failed to recover it.

Carcasses of 16 animals were weighed (Table 4). All carcasses were eviscerated, skinned and the heads and legs were removed. A yearling male that weighed 625 pounds, minus a small amount of blood, produced a dressed carcass of 375 pounds or 60 per cent of the total weight.

Specimens collected for disease and parasite studies were

Figure 1. Annual movements of Copper River bison herd.

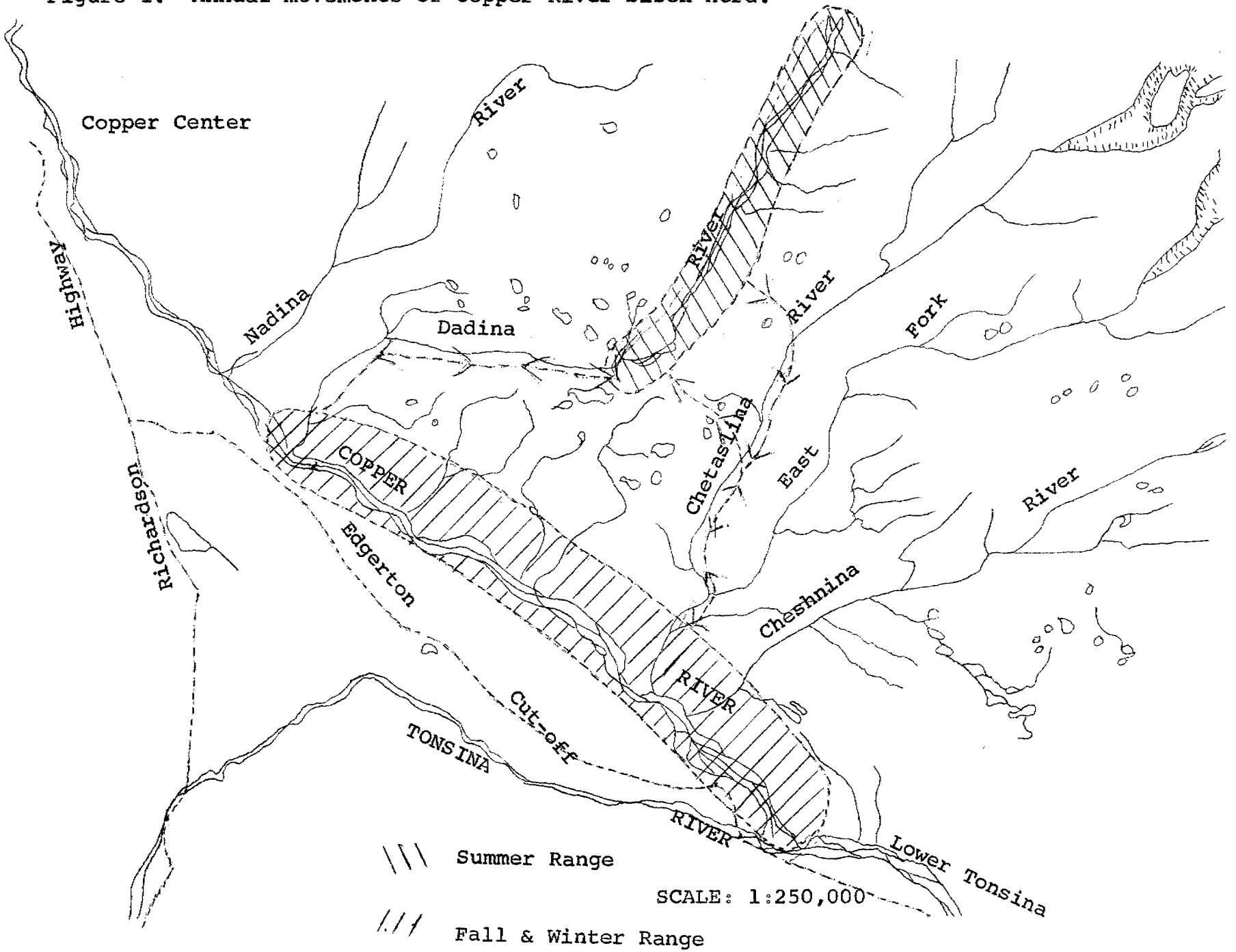
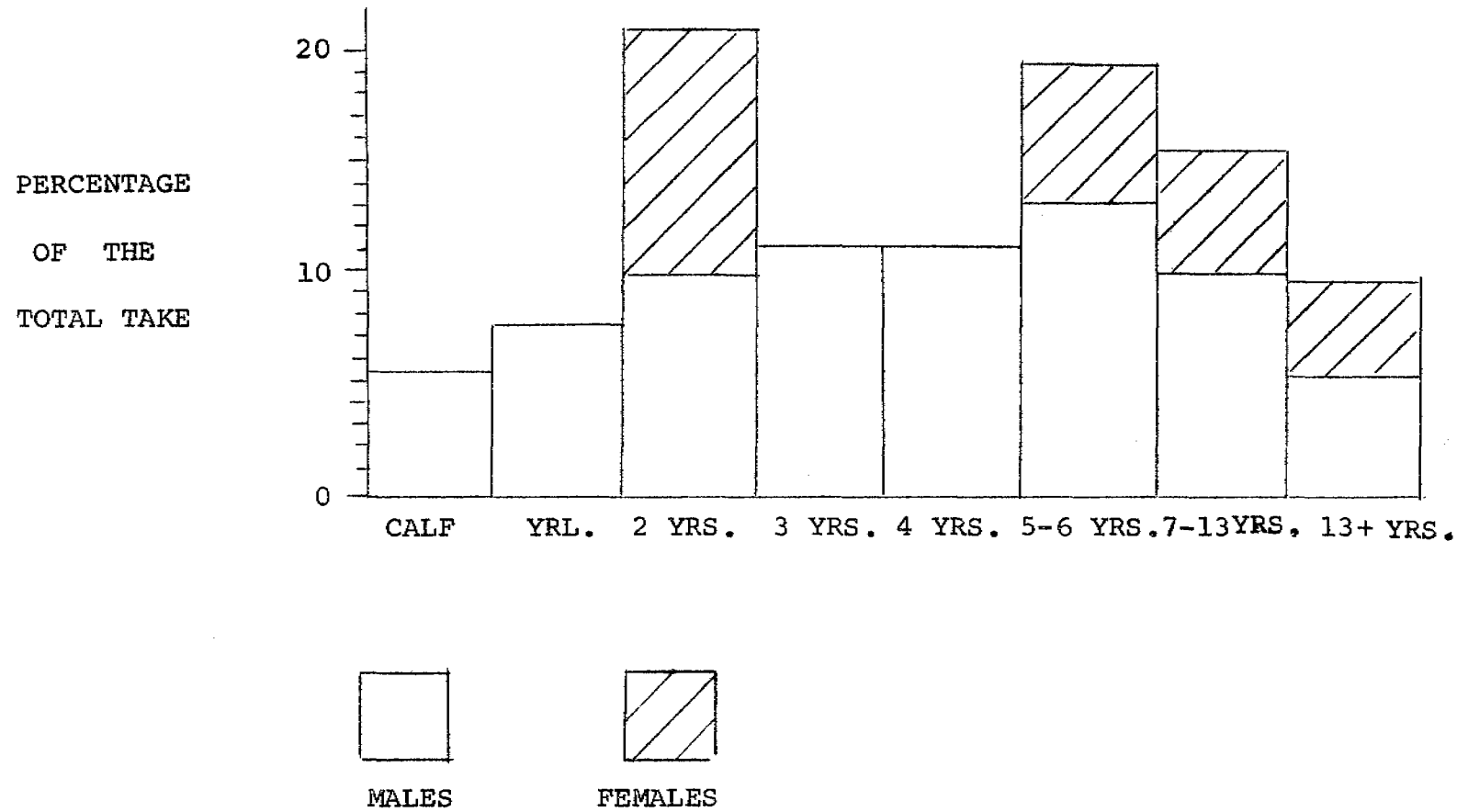


Table 3. Ages of bison taken during 1961 permit hunt.*

Age Class	Females	Males	Females and Males
Calf		3	3
Yearling		3	3
Two years	5	5	10
Three years		6	6
Four years		6	6
Five-six years	3	7	10
Seven-thirteen years	2	6	8
Thirteen + years	2	3	5
TOTAL	12	39	51

* Age determinations based on technique described by Fuller, 1959, Journal Wildlife Management 23 (3): 342-344.



* Age determinations based on technique described by Fuller, 1959, J. Wildlife Management

Figure 2. Ages * of bison taken during 1961 permit hunt.

Table 4. Bison carcass weights, August 26-31, 1961.*

Weight	Sex	Age
195	Male	Calf
375	Male	Yearling
460	Female	Young adult
485	Male	Young adult
525	Male	Two year
545	Male	Two year
565	Male	Two year
570	Male	Two year
640	Male	Three year
665	Male	Three year
760	Male	Young adult
826**	Male	Four year
975	Male	Aged
1010	Male	Adult
1056**	Male	Young adult
1425**	Male	Young adult
692	Mean weight	

* Bison carcass with skin, feet, head and viscera removed.

** Carcass not weighed by Department personnel.

processed by parasitologist Kenneth Neiland and were reported in Parasite and Disease Investigations, W-6-R-2, Volume II, No. 11.

Depredations

Delta herd

The permit hunt was scheduled for late August in an attempt to intercept and delay the bison when they were making their annual trek to the agricultural areas near Delta Junction. Although factors other than hunting may have influenced the movement of bison, nevertheless depredations to farm crops were confined to those crops not harvested and to unprotected hay stacks. No damage was observed by Department employees nor did any of the farmers report depredations during the harvest period.

Copper River herd

No management practices were initiated. At least one farmer reported some depredations caused by bison.

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