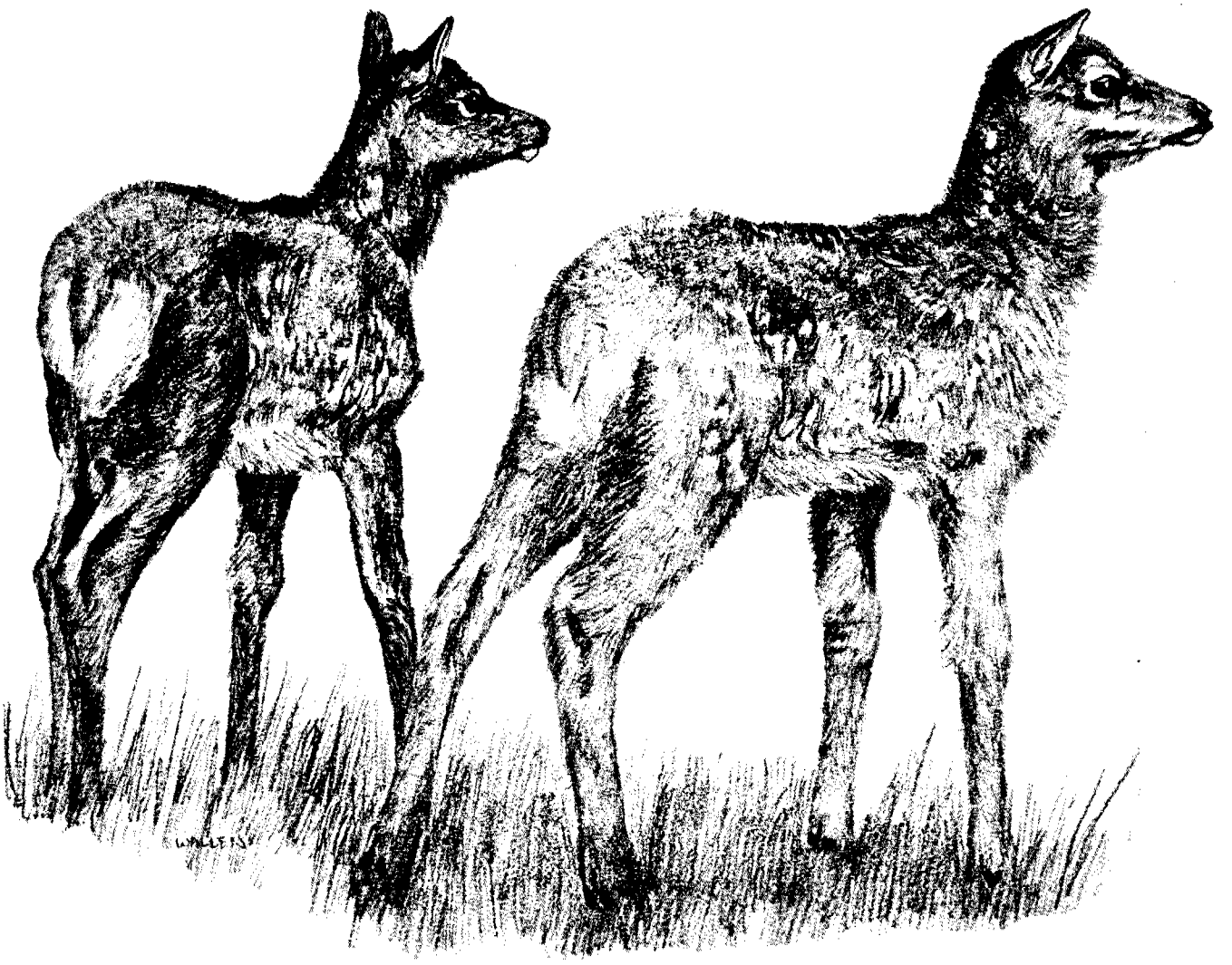
THE ROOSEVELT ELK IN ALASKA



ITS ECOLOGY AND MANAGEMENT

ALASKA DEPARTMENT OF FISH & GAME
Juneau, Alaska

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by

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INTRODUCTION

Interest in big game stocking in Alaska, and especially in the Kodiak Island area, became apparent early in the 1920's. Prior to 1925 transplants into and within the Territory of Alaska were sponsored by the territorial legislature, the governor's office and a few interested sportsmen's organizations. With the creation of the Alaska Game Commission in 1925 game introductions became an integral part of the federal wildlife management program in Alaska prior to statehood.

In 1926 and 1927, the Alaska Game Commission, endeavoring to establish a new big game species in the territory, introduced Roosevelt elk (Cervus canadensis roosevelti) to Kruzof and Revillagigedo Islands in southeast Alaska. However, these transplants were unsuccessful due, in part, to poaching and the release of too few animals to insure the establishment of a population.

In 1928 the Alaska Game Commission transplanted eight elk calves, secured from the Olympic Peninsula in the state of Washington, to Kodiak Island. The calves, three males and five females, were held at Kalsin Bay in a semi-domestic state throughout their first winter. To avert a possible conflict with the Kodiak livestock industry all eight calves were shipped to Afognak Island and released at Litnik Bay the following spring.

By the early 1940's, with an estimated population of 147 animals, it was evident that the Roosevelt elk was well established on Afognak Island and that the introduction was successful. The present population, ranging over most of the island and numbering about 1,200 animals, originated from this single introduction.

DESCRIPTION OF THE AREA

Afognak Island lies within the Gulf of Alaska some 50 miles below the southern tip of the Kenai Peninsula and three miles northeast of Kodiak Island. Nearly 40 miles long and averaging 25 miles wide, with 780 square miles it is the second largest

island in the Kodiak Archipelago. Only Kodiak Island is larger. Several smaller islands, including Raspberry Island, belong to the Afognak group. Afognak is the western most portion of the Chugach National Forest.

Most of Afognak is undulating or mountainous with elevations ranging to over 2,500 feet at the summit of Crown Mountain in the southwestern corner of the island. The coastline is irregular, with many steep-walled bays. The principal streams are generally less than six miles long, flowing through fairly narrow, well-drained valleys bordered by rolling hills. Many of these valleys have been deeply glaciated and are separated by steep ridges or peaks.

Geologically, Afognak Island is an extension of the Kenai Peninsula to the north and exhibits little resemblance to the volcanic Alaska Peninsula some 40 miles to the west. Most of the island was covered by ice during the glacial period and the many steep-walled, flat bottomed valleys bisecting the island are largely the result of glacial erosion and deposition.

The vegetation of Afognak Island is similar to that on the Kenai Peninsula to the north, and also contains elements common to southeast Alaska. Two distinct vegetative formations occur on the island: a Spruce shrubland area in the northern, central and southeastern regions, and a grassland-forb-shrub formation on the western side. The Sitka Spruce (Picea sitchensis) climax area which dominates the former is interspersed with extensive shrublands of alder (Alnus crispa) and elderberry (Sambucus racemosa). Understory vegetation here contains many species indigenous to southeast Alaska, principally devil's club (Oplopanax horridus), blueberry (Vaccinium ovalifolium), salmonberry (Rubus spectabilis) trailing bramble (R. pedatus), nagoon berry (R. stellatus), and highbush cranberry (Viburnum edule). Extensive forestation by Sitka spruce (a recent arrival to Afognak) is occurring throughout the island and it remains only a matter of time before this species will occupy the whole of the Afognak Group. The vegetation that typifies western Afognak becomes evident northwest of Litnik Lake where a vast grassland-forb-shrub complex dominates the landscape. The formation consists of estensive shrublands of alder, willow (Salix spp.) and salmonberry interspersed with a matrix of grasses and perennial forbs, which include blue joint (Calamagrostis canadensis), hairgrass (Deschampsia

caespitosa), fireweed (Epilobium angustifolium), geranium (Geranium erianthum), lupine(Lupinus nootkatensis), burnet (Sanguisorba sitchensis), cow parsnip (Heracleum lanatum), and angelica (Angelica lucida). Sedge meadows occupy poorly drained sites, and a riparian shrubland of alder and willows is found along most water courses. Above 1,800 feet elevation the grassland-forb-shrub formation is replaced by an alpine vegetation dominated by extensive heath mats of crowberry (Empetrum nigrum), alpine azalea (Loiseleuria procumbens), Diapensia (Diapensia lapponica), Kamchatka rhododendron (Rhododendron kamtschaticum), purple heather (Phyllodoce empetriformis), Alaska heather (Cassiope lycopodioides), alpine bearberry (Arctostaphylos alpina), mountain cranberry (Vaccinium vitis-idea), bog blueberry (V. uliginosum), and dwarf willow (Salix spp.). In this western portion of the island, spruce is found only in isolated stands in the lowlands.

Unlike much of Alaska, Afognak Island experiences a relatively mild climate throughout the year. Nearby seas tend to prevent extreme temperature variations: seldom does it fall below 5 degrees in winter or go above 75 degrees in summer. Precipitation is abundant, especially in the spring and fall, averaging about 60 inches annually. Winter precipitation consists of rain and snow with an average maximun snow depth of about 10 inches on the ground at sea level.

LIFE HISTORY OF THE ROOSEVELT ELK ON AFOGNAK ISLAND

Growth of the Population

By 1941, twelve years after the release at Litnik Bay, the Roosevelt elk was well established on Afognak. Jack Benson, Wildlife Agent stationed at Kodiak prior to World War II, estimated the population at 147 animals that year. At this time Benson believed that the main herd summered in the Litnik Lake-Raspberry Strait region of southwestern Afognak and in late fall migrated northeastward to Blue Fox and Perenosa Bays, where it remained throughout the winter, to return southward in the spring.

By 1947 a few elk were sighted in the vicinity of Danger Bay and the following summer Mack Meyer, fisheries agent, reported seeing several on Raspberry Island. As early as 1946 Frank

Beals, manager of the Kodiak National Wildlife Refuge, received reports of elk tracks on the northeast shore of Kodiak Island and in June of the same year a single elk carcass was located on Kodiak, giving evidence that at least one animal had left Afognak.

The first comprehensive census of Afognak elk was conducted by Nelson and party in 1948: they counted 116 animals and estimated the total population at 212 (Nelson, 1949). Nelson's party was unable to secure any information that might confirm Benson's earlier report that the main herd had chosen to winter in the low, heavily timbered region in the vicinity of Blue Fox and Perenosa Bays. Observations of tracks indicated that few elk strayed from the southwestern part of the island. The aerial census covered the entire island, and Nelson and his colleagues believed that no herds were missed; however, they assumed that individuals and a few small bands may not have been detected. Beals reported sighting numerous elk tracks in new snow between Izhut and Danger Bays, and a herd of 41 on Raspberry Strait near Muskomee Bay during a flight over Afognak in Mid-January, 1949. Nelson believed these observations to be the first reliable report of elk wintering between Izhut and Danger Bays in the eastern portion of the island.

Reviewing the 1948 census and the later survey by Beals, Nelson concluded that most of the elk were sedentary and spent the greater part of the year in the southwest quarter of Afognak, on Raspberry Island, and, to a lesser extent, at the head of Izhut Bay.

From 1951 through 1958 the U. S. Fish and Wildlife Service conducted an annual aerial elk census during the summer or early fall months when the elk occupy the high open ridges of southwestern Afognak (Troyer, 1960). Throughout this period elk spread over much of Afognak and the herd increased from 264 in 1951 to a population estimated at 800 in 1958. Troyer in 1960 reported approximately 160 elk on Tonki Cape in the northeastern sector of the island and 640 along Raspberry Strait and on Raspberry Island. He stated that "only occassional stragglers get into the central portion of the island."

With the advent of statehood the management of Afognak elk became the responsibility of the Alaska Department of Fish and Game in 1960. The Department initiated a study of the Roosevelt

Figure 1. Dispersal of Afognak Island Elk since the 1929 introduction.

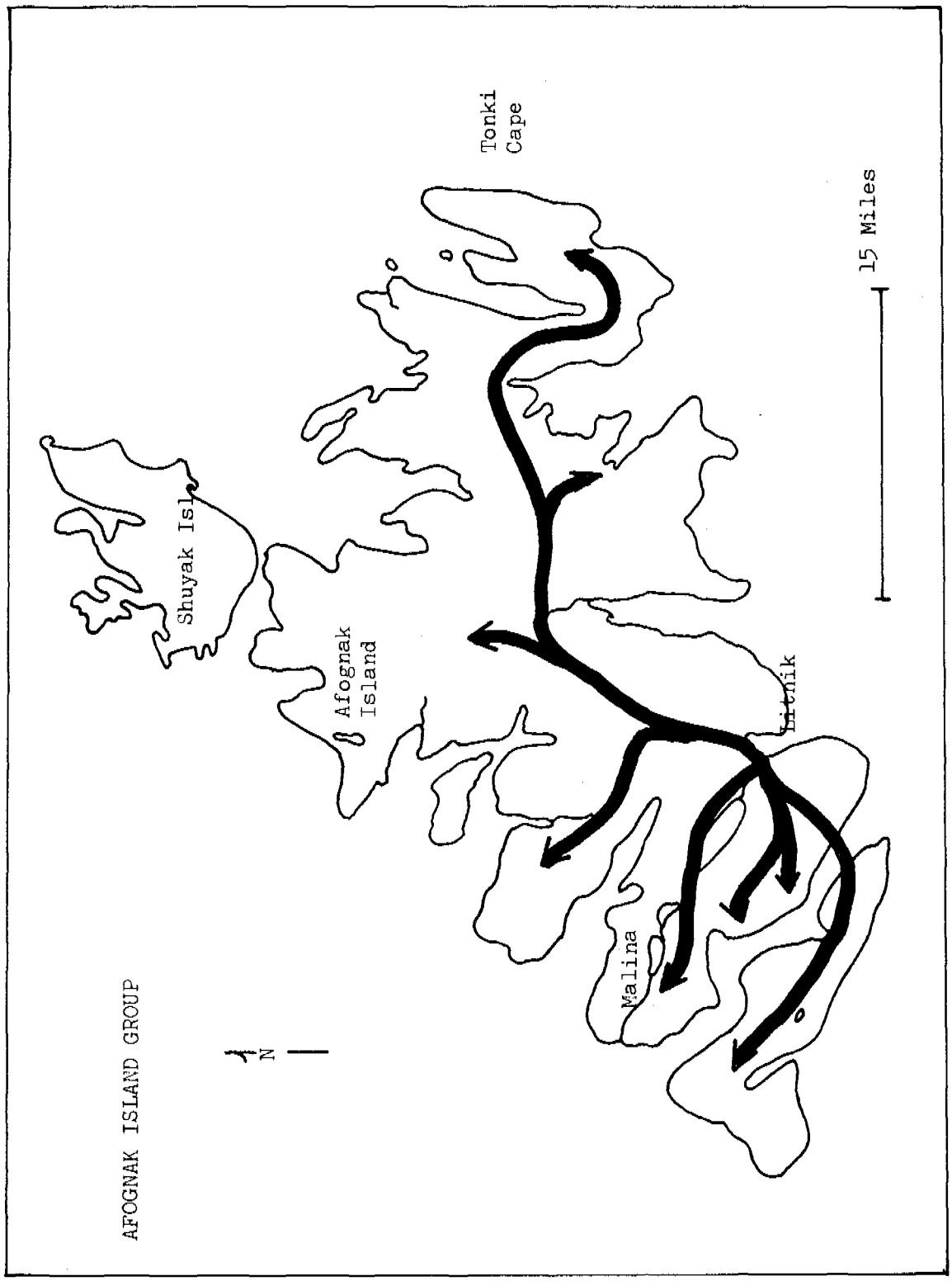

Table 1, Distribution of Afognak Elk, February 1961.

AREA	NUMBER COUNTED	PER CENT OF TOTAL COUNTED
Raspberry Island	115	15.9
Muskomee Bay	22	3.1
Northwest end Afognak Lake	41	5.7
Afognak Mountain	192	26.7
Hatchery Peak	35	4.9
Afognak River	48	6.7
Waterfowl Lake	25	3.5
Little Waterfowl Bay	15	2.1
Head Izhut Bay	3	0.5
Saposa Bay	53	7.4
Tonki Cape	171	23.8
TOTAL	720	

Table 2. Elk Population as Determined by Surveys and Estimates on Afognak Island[1]

Year	Actual Count	Estimated Population
1929	8	8
1941	64	147
1948	116	212
1949	161	-
1951	264	-
1952	345	-
1953	152*	-
1954	408	-
1955	273	450
1956	345	450
1957	456	600
1958	599	800
1960	294	-
1961	720	1,100
1962	452*	1,200

1-Taken in part from Troyer, 1960
*-Incomplete count

elk as part of its Federal Aid in Wildlife Restoration Program in July, 1959. The first effort by the Department to assess elk numbers on Afognak was in the spring of 1960, when Arthur Sheets, Jr., striving to determine the size, distinctness and distribution of Afognak herds, flew an aerial survey of Afognak and Raspberry Islands, (Sheets, 1960). Sheets anticipated obtaining a total population estimate and a sex and age composition count at the time of his flights, but inclement weather during this period forced most of the elk into the dense timber and only 294 animals were seen. Nevertheless, Sheets was able to recognize seven distinct herds during this survey.

The following March, a second and more successful survey was flown, accounting for 720 animals and an estimated population of 1,100 elk (Table 1.) Nearly 50 per cent of the 720 animals observed were found wintering in the Litnik Lake watershed; and additional 171 elk were found on Tonki Cape, while 115 head were sighted on Raspberry Island. Throughout central interior Afognak 93 animals in scattered bands of from 15 to 53 head were observed. Since this portion of the island supports a dense vegetation of spruce the number of animals recorded only suggested the possible status of elk in this region. The estimated population in 1963 was 1200 elk (Table 2.).

Sex and Age Ratios

The first comprehensive composition count of Afognak elk was conducted during August, 1961, when 610 animals were classified by sex and age. Of 1,384 elk classified since that time, 820 (59%) were cows, 156 (11%) were spike bulls, 147 (11%) were branched-antlered bulls, and 261 (19%) were claves of the year. These observations, summarized by range, are presented in Table 3.

The total yearling population was derived by doubling the number of yearling males, counted. This is based on the premise that the sexes are equally represented in this age class, thus giving 22 per cent as the total yearling segment. The adult cow population is then calculated as 48 per cent of the total herd. Counts made of all cows and calves observed during the summers of 1961, 1962 and 1963 yielded a total of 820 cows and 261 calves. These figures indicate that at least 32 per cent of

Figure 2. Size and distribution of identifiable elk herds on Afognak Island August, 1961.

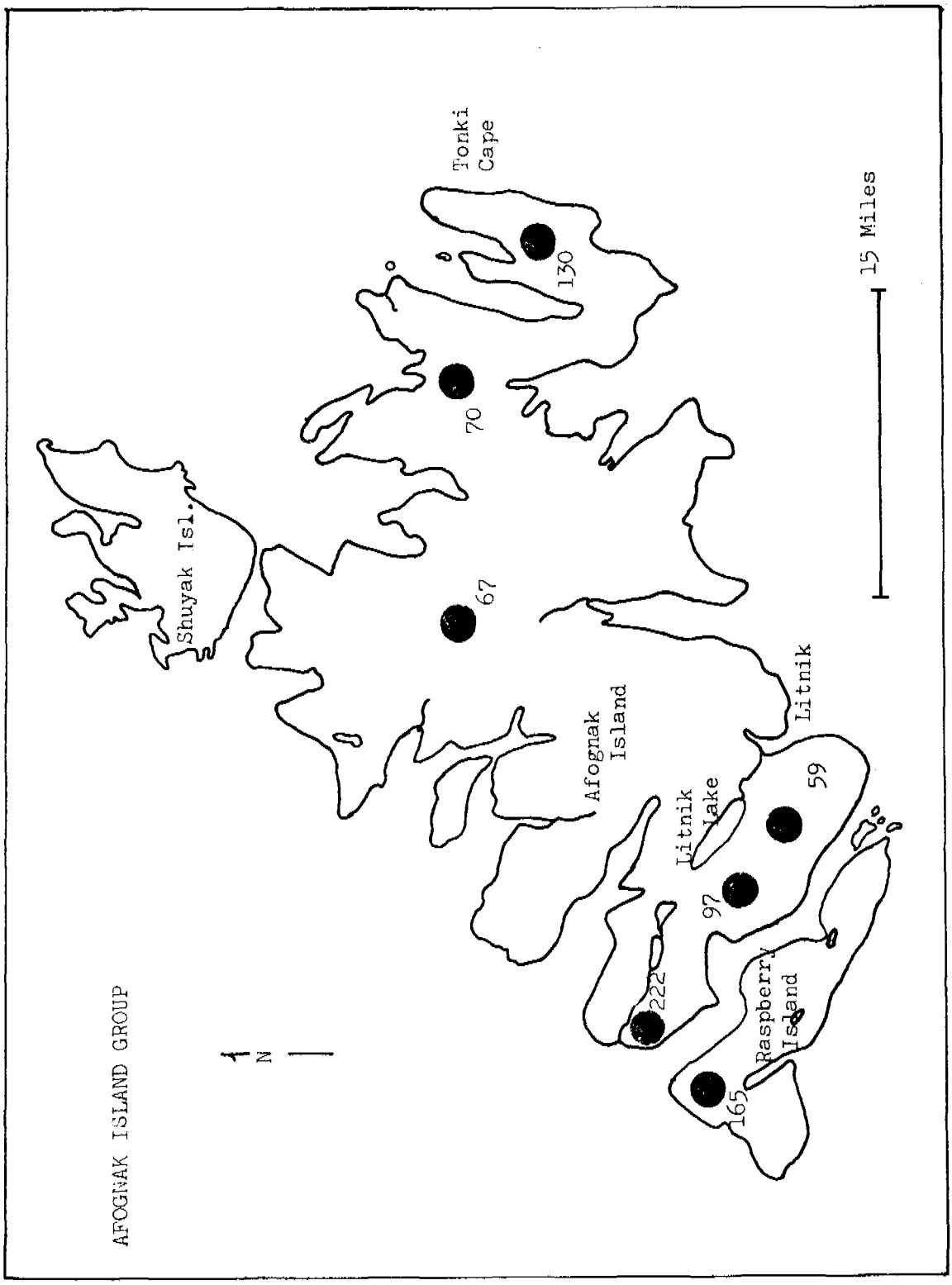

Table 3. Summary of Elk Population Composition Counts, Afognak and Raspberry Islands, 1961 - 1963

Area	Total Elk Classified	Spikes No.	Spikes %	Branched Antlered Bulls No.	Branched Antlered Bulls %	Total Bulls No.	Total Bulls %	Cows No.	Cows %	Calves No.	Calves %	Bulls/ 100 cows	Calves/ 100 cows
Malina	522	49	9	30	6	79	15	350	67	93	18	23	27
Interior Afognak	115	14	12	31	47	45	39	48	42	22	19	94	56
Raspberry Strait	156	22	14	10	7	32	21	97	62	27	17	33	36
Raspberry Island	481	50	10	59	12	109	22	273	57	99	21	40	36
Tonki Cape	110	21	19	17	16	38	35	52	47	20	18	73	38
Total	1384	156	11	147	11	303	22	820	59	261	19	37	32

all cows (including yearlings) produced calves. Allowing for a reasonable degree of postnatal mortality among the calf crop prior to August counts, it would seem safe to suggest that this percent age might even have been higher. Therefore, if it is accepted that 48 per cent of all elk were adult females (exclusive of yearlings) and 41 per cent of these were parturient, the breeding segment would then average 32 per cent in a typical Afognak herd. This figure is much below the 43 per cent reported by Schwartz and Mitchell (1945) for Roosevelt elk on the Olympic Peninsula. Reasons for this seemingly low percentage of parturient cows can only be speculated on at this time; whether this rate was reflected by a known overaged female component of the population, discussed below, or a combination of factors is not known. The ratio of 37 bulls per 100 cows was considerably above the average of 16:100 reported for this species in Oregon for the years 1956-1961 (Oregon Game Commission, 1960) or 14:100 recorded by Schwartz and Mitchell on the Olympic Peninsula during 1936-1938.

Age composition data collected from hunter harvested elk revealed that 47 per cent of the females sampled were 4.5 years old or older in 1960; the proportion was 35 per cent in 1961 and 28 per cent in 1962. These data indicate that prior to and during these years the female component consisted of a significant percentage of old animals. Liberal either-sex seasons since 1960 have removed a significant number of old animals from the population.

Elk composition counts made in most of the western states are generally conducted during the winter months when animals concentrate on their winter ranges. The elk of Afognak, however, frequently inhabit densely timbered areas during this period making reliable air or ground counts all but impossible at this time of year. All composition counts on Afognak are thus conducted during the summer months when the elk spend the greater portion of their time at the higher elevations. The Roosevelt elk on Afognak Island are quite gregarious and often remain in large herds numbering up to 250 animals throughout most of the year.

Reproduction

The reproductive cycle commences with the rut in the fall, the first signs being the polishing of antlers by the bulls. Bugling begins in late August, continuing through mid-October. During this period elk of both sexes band together to form the largest herds

observed throughout the year. Unlike the Roosevelt elk of the Olympic Peninsula, no herd breakup or harem formation has been observed on Afognak; 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 observed. At the peak of the rut, which usually occurs between September 25 and October 1 on Afognak, bulls can be found scattered throughout the herds and breeding is frequently noted.

On September 26, 1957, from a distance of 400 yards, Troyer reports observing a herd of 121 elk composed of 76 cows, 20 calves and 25 bulls. He states that the bulls were fairly evenly distributed throughout the band and goes on to say that "a few larger bulls attempted to keep some of the smaller bulls at a distance by short threatening runs and prods, but they did not appear to be entirely successful. During this activity almost constant bugling could be heard. Two cows were bred while the herd was being observed."

On September 16 and 17, 1958, a band of elk numbering 150 animals was observed by Troyer for several hours each day. He states that "because of scattered spruce they could not all be seen at the same time. Bugling was almost constant and sparing activities between bulls, scattered throughout the band, could readily be observed. While under observation 10-12 cows were bred."

In September, 1961, the Malina herd, numbering 220 animals at the time, was under observation by the writer for several days during the last week of the months. During this period, bulls of all ages, including yearlings, were noted to mount and breed cows. In the course of these observations no fighting between bulls was recorded.

As the breeding season progresses rutting activity becomes more intense, and by the last week of September bugling can be heard throughout the day. Observations indicate that breeding activity is apparently at its greatest intensity at dusk and in the pre-dawn hours. Yearling bulls, physically capable of breeding, frequently take an active part in the rut. This has been especially true of the Malina herd where a significant proportion of cows are bred each year by yearling bulls. Cows, not normally capable of successfully breeding as yearlings, are usually bred

for the first time early in their third year, when approximately 28 months old. However, on September 3, 1961, during a routine collection of reproductive tracts from hunter harvested female elk, a male fetus approximately 200 days old was collected from a 2 year 3 month old cow which had been killed two days previous in the Malina Lakes area of western Afognak Island. Using Morrison's (1959) figure of 247 days for a term Rocky Mountain Elk calf (Cervus canadensis nelsoni) would place the time of conception somewhere between February 12 - 18, or some 4 months past the normal rutting season for the Roosevelt elk in Alaska.

This late conception is believed attributable to one of three factors: (1) the cow, apparently 20 months old at the 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. An examination of the udder of a 2 year 3 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 (Batchelor, 1963).

Although the literature mentions the occurrence of pregnancies in yearling Rocky Mountain Elk (Buechner and Swanson, 1955 and Coffin and Remington, 1953) data pertinent to the breeding biology of the Roosevelt elk are scant and suggest the cow first breeds in the third rutting season after birth, at an age of 2 years 4 months. The significance of these two occurrences of yearling pregnancy in the ecology of the Roosevelt elk in Alaska is not presently known.

Most of the cows are believed bred by the 27th of September and the majority of parturitions occur by the last week of May, after a gestation period of approximately 244 days. Calving extends from approximately May 20 to June 12. The earliest date recorded was May 23, when calf tracks were noted. The first calf sighted in 1961 was spotted running with the Malina herd on June 12, while the first calf seen in 1962 was spotted on June 14. The earliest calf sighted by the writer was on June 6, 1964.

On June 14, 1961, 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 quite 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 given good indication of its age; however, comparing its size and conformation with other captured calves it was believed to be no more than a week old.

In his treatise on North American elk Murie (1951) states that at birth the calf elk weighs between 30 and 40 pounds. The average weight of 8 calves captured and tagged in mid-June, 1961 on Afognak was 84 pounds, with the range being 54 to 106 pounds. These weights indicate that calves on Afognak ranges experience a rapid weight gain during their first month of life.

By early July many calves have been observed freely feeding on a variety of succulent forbs which are abundant throughout the summer ranges. Sixteen calves captured in mid-June 1963, and held for a later transplant, consumed large quantities of fireweed within a week of their capture.

Knowledge of basic productivity is vital in the formation of an intensive management plan for any species. The method selected for determining the rate of production of Afognak elk involved analysis of sex ratios and age classes which were based on incidence of occurrence. Taken from field observations during the summers of 1961-1963, cumulative sex and age classifications are believed to represent productivity of the Roosevelt elk on Afognak with a fair degree of accuracy.

Productivity, expressed as the number of calves per 100 cows in the summer population, varied between herds with a three year average of 32:100 and a range of from 27 to 56 calves per 100 cows for all herds classified during the period 1961 through 1963. This figure is well below a 3 year average of 39 calves per 100 cows reported for this species by the Oregon Game Commission (1960). The annual rate of increase for Afognak elk, based on the percentage of calves in the summer population, averaged 19 per cent for the three years of study. This figure compares favorably with elk populations elsewhere.

Physical Characteristics

The Roosevelt elk is the Kodiak Island groups' largest hoofed mammal and is second only to the moose as the largest member of the deer family found in Alaska

Size and weights of elk, especially mature bulls, are most generally over rated. Unfortunately, few reliable weights are available to compare the relative size of the Roosevelt elk throughout its range. Murie (1951) states that "the Roosevelt elk is often referred to as a larger animal than the Rocky Mountain elk, but figures are not available for comparison". Graf (1955) in 1938 estimated live weights of 1,000 to 1,200 pounds for each of three Roosevelt elk bulls weighed from the coast range of Oregon, Between 1956 and 1958 Troyer obtained field-dressed weights for 16 bulls and total weights from 9 male elk from Afognak Island. Of the 9 animals from which total weights were securred, 4 were classed as mature adults (4 years old or older) weighing in excess of 1,000 pounds each, the largest of these weighing 1,155 pounds. With the exception of one young male weighed in October, all Troyer's weights were obtained between September 1st and 15th. Troyer reports that three adult bulls field dressed at over 1,000 pounds and felt it safe to assume the largest of the three might well have had a live weight close to 1,300 pounds.

Comparing the few known weights of Roosevelt elk obtained by Troyer on Afognak and Graf in western Oregon with those reported by Murie and Quimby (1951) for the Rocky Mountain elk, it is believed safe to say the Roosevelt form may be a larger animal than its Rocky Mountain counterpart. The average of 631 pounds for 30 adult bulls weighed in Jackson Hole and Yellowstone reported by Murie certainly suggests this.

Food Habits

The food habits of the Roosevelt elk on Afognak Island have been determined by four methods: 1) direct observation of feeding animals, 2) inspection of areas immediately after grazing and/or browsing, 3) browse utilization transect analysis and 4) analysis of a limited number of rumen samples.

Food preferences of Afognak elk have been found to be quite diverse. It appears that Afognak elk, while restricted in food preference to a certain degree, do have a wide range of selectivity, and the greater the variety of species comprising their environment the greater is the number of species utilized. The Roosevelt elk is frequently referred to as a browser while the Rocky Mountain elk is often considered a grazer by many; however, the food preference of either race appears to be more a function of availability than of habit. When available, Roosevelt elk feed freely on a variety of grasses and forbs while the Rocky Mountain elk will often utilize a diversity of browse species during the winter months. Because of the great abundance of vascular plants on Afognak the diet of the Afognak elk includes a great variety of succulent and woody plant species.

Summer feeding observations conducted in southwestern Afognak revealed the following plants to have been utilized by grazing elk: fireweed (Epilobium angustifolium), lupine (Lupinus nootkatensis), burnet (Sanguisorba sitchensis), cow parsnip (Heracleum lanatum), sea lovage (Ligusticum hultenii), hellebore (Veratrum eschscholtzii), and water chickweed (Montia sp.).

With the arrival of fall consumption of grasses and forbs decreases when these become dry and apparently less palatable, and these species give way to a diet that includes a few perennial forbs, notably fireweed, and an abundance of browse species with elderberry (Sambucus racemosa) and highbush cranberry (Viburnum edule) as the most important constituents. Troyer, analyzing 9 stomach samples collected from hunter harvested elk in September, found that elderberry occurred in all nine samples, accounting for 58 per cent of the total volume, while fireweed, also occurring in all samples, accounted for 33 per cent of the volume.

Findings of the writer closely parallel those of Troyer, when the analysis of 16 rumen samples collected in September and October are compared. Analysis of the 16 rumen samples is given on the following page.

Species	Frequency of Occurrence	Per cent of total volume
Elderberry (Sambucus racemosa)	16	41
Fireweed (Epilobium angustifolium)	16	38
Willow (Salix spp.)	9	8
Highbush cranberry (Viburnum edule)	6	5
Grass (Gramineae)	11	3
Miscellaneous unidentified forbs	16	5

During the winter months Afognak elk feed almost exclusively on browse, with elderberry and willow as the most important species. It is interesting to note that in late winter elk have been observed to utilize heavily the cured tops of hairgrass (Deschampsia caespitosa) which occurs in scattered stands in a few of the lowland valleys; however, grasses are not generally regarded as a major item in the winter diet of Afognak elk. Blueberry (Vaccinium ovalifolium) and salmon berry, considered important species on the Olympic Peninsula, have been observed by Troyer and the writer to be seldom utilized on Afognak ranges. Troyer reports that willow, followed by elderberry, constituted the most important browse species during his investigation of the food habits of Afognak elk. Considering the overall distribution of these two species, I believe elderberry to be the single most important browse species utilized by elk. During snow-free winters elk often feed on trailing bramble (Rubus pedatus) which is found under the forest canopy.

By spring food habits undergo rapid changes. These changes are apparently a matter of availability. The consumption of grasses, grass-like plants and perennial forbs increases with the development of new growth. Such plants as the sedges (Carex spp.),

horsetail (Equisetum spp.), Angelica (Angelica lucida), bluejoint (Calamagrostis canadensis) and cow parsnip (Heracleum lanatum), are heavily utilized as are the buds of fern (Anthyrum cyclosorum) and the terminal buds of devil's club (Oplopanax horridus).

Mortalities-Natural and Hunter Harvest

Since the initiation of the elk study by the Department of Fish and Game no measurable mortality, save hunter harvest, has been noted for Afognak Island elk. The nature of the terrain and denseness of vegetation on Afognak is such that carcasses of winter killed animals can not be readily located, even through extensive search. Observations during this period have led me to conclude that any mortality occurring at this time, or in the recent past, is of little significance to the well being of Afognak elk. The occurrance of large terrestial carnivores in the Kodiak Archipelago is limited to the Alaska brown bear (Ursus arctos) which, with but the taking of an occassional calf, exerts little or no influence on the population performance of the elk.

Before 1950, federal game regulations prohibited the hunting of elk on Afognak and Raspberry Islands. Hunting by permit-only was initiated in 1950, with the issuance of 50 permits and a harvest of 27 animals. Special permit hunts were again held in 1952 and 1953. Since 1955, general season, varying in length, have been held each fall. From 1950 through 1957, only bull elk with forked antlers or larger could legally be harvested. However since 1958 spike bulls have been included in the legal take. The first either-sex season was held on Tonki Cape in 1959, lasting 25 days. The following year, the first under Department of Fish and Game administration, saw the opening of a 5 day either-sex season throughout the Island, followed by a 15 day season extension during which time animals of either-sex could be taken. Since 1961, elk of either-sex have been included in the harvest, which increased from 27 animals in 1950 to 127 in 1960. The kill has remained relatively stable the past six years, fluctuating between 100 and 127 animals.

Hunting pressure on Afognak Island the past 13 years increased to where 345 hunters were afield in 1958. This level was maintained through 1960 and thereafter declined to where only 175 sportsmen hunted elk in 1963. The decline in hunting effort the past few years may be attributable in part to the rigorous hunt usually required to successfully bag an Afognak elk, as well as the expenses incurred traveling to and from the island by

charter aircraft.

During the years preceeding 1960 most hunting was done from small boats crusing the shores of Afognak and Raspberry Islands. However, since this time the pattern has changed, and now most hunting pressure is centered within the interior of Afognak, in the vicinity of Malina and Litnik Lakes. Accessibility, lack of adequate hunting pressure and poor hunter distribution continue to be the major problems in the management of the elk. Sizable elk herds occupying Tonki Cape, Raspberry Island, and northcentral Afognak remain relatively unharvested in spite of extremely liberal seasons in these areas.

To increase hunter interest in Afognak elk hunting and to provide greater access to herds the U. S. Forest Service is presently engaged in a long term program of shelter cabin construction and trail building throughout southwestern Afognak.

Table 4. Afognak Elk Kills, 1950 - 1963

Year	Kill	No of Hunters	Per cent Success	Hunting Season Dates
1950*	27	50	54	Oct. 1 - 15
1951	0	0	0	
1952*	15	35	43	Oct. 1 - 15
1953*	19	40	46	Nov. 1 - 15
1954	0	0	0	
1955	26	105	25	Sept. 1 - 15
1956	40	135	27	Sept. 1 - 20
1957	70	250	28	Sept. 1 - 20
1958	110	345	32	Sept. 5 - 15; Oct. 20-Nov.5
1959	120	330	36	Oct. 1 - 25
1960	127	345	37	Aug. 20 - Oct. 15
1961	120	260	46	Aug. 20 - Nov. 31**
1962	110	186	59	Aug. 1 - Dec. 15**
1963	100	175	55	Aug. 1 - Dec. 31

* Hunting by permit only
** Includes special season

Table 5. Composition of Elk Harvests in Alaska, 1960-1963.

Year	Bulls		Cows		Calves		Unidentified		Total
	Number	%	Number	%	Number	%	Number	%	Kill
1960	68	53	43	34	2	2	14	11	127
1961	69	58	46	38	4	3	1	1	120
1962	53	48	40	37	9	8	8	7	110
1963	60	60	21	21	4	4	15	15	100

Table 6. Distribution of Elk Harvest by Area for the Years 1958 - 1963

Area	1958 No. Harvested	%	1959 No. Harvested	%	1960 No. Harvested	%	1961 No. Harvested	%	1962 No. Harvested	%	1963 No. Harvested	%
Raspberry Island	44	45	17	14	23	18	15	13	28	25	11	13
Afognak Island												
Malina	14	14	38	32	24	19	32	26	38	35	29	34
Raspberry Strait-Afognak Lake	31	31	32	26	62	49	59	49	33	31	11	13
Interior Afognak							3	3	5	4	15	18
Tonki Cape	10	10	33	28	18	14	11	9	6	5	19	22
	99*		120		127		120		110		85*	

* Figure does not include unidentifies animals

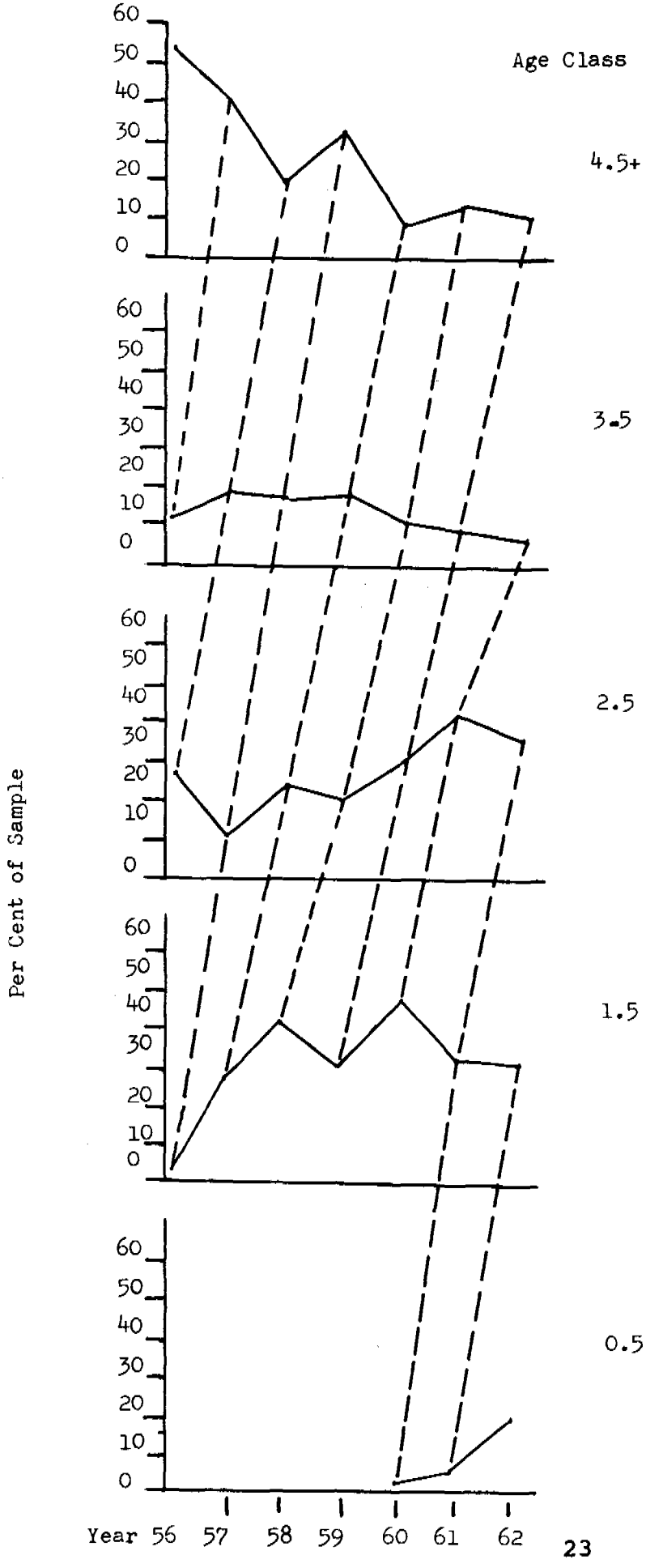

Figure 3.

Trends in age classes of male elk harvested 1956 - 1962

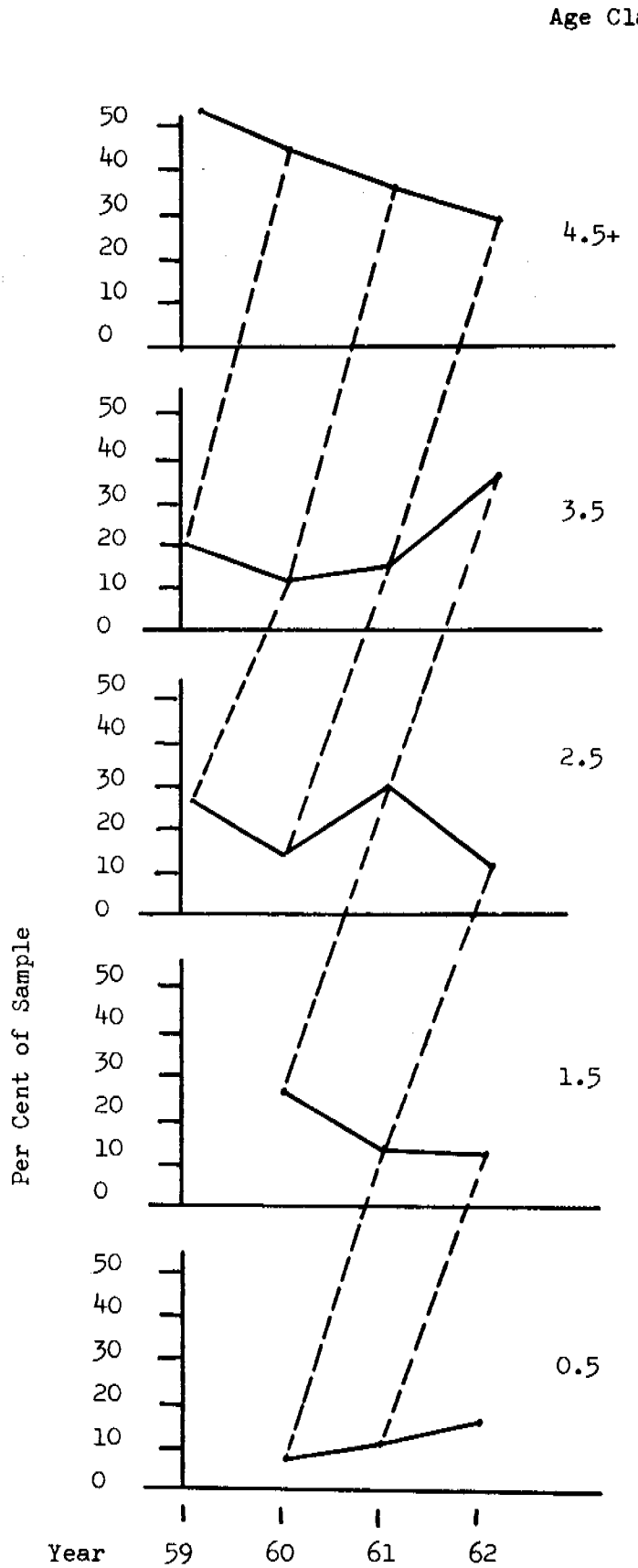

Figure 4.

Trends in age classes of female elk harvested 1959 - 1962

Movements

Since the introduction of 5 animals to Litnik Bay in 1929, elk have spread over much of Afognak island, and today they can be found in all regions of the island with the exception of the northwest corner. The lack of an established herd in this region appears to be due to the reluctance of animals on nearby ranges to move into unoccupied habitat as well as a lack of suitable winter range.

Owing to the relatively small size of the Afognak Island group, elk inhabiting it are not regarded as migratory, for no great distance is covered between summer and winter ranges. Throughout the summer and fall months herds inhabiting the southwestern region of the island may be found on either the open alpine slopes above timberline seeking refuge from insect harassment or feeding in the lowland valleys of the interior. By early winter, the exact time depending on the severity of the weather, a gradual drift between summer and winter ranges commences, the distance rarely exceeding 10 miles. Elk summering along Raspberry Strait and on the Malina Peninsula move into the Litnik Lake watershed where they ordinarily remain throughout the winter and early spring. Animals on Tonki Cape, when forced by deep snows, winter along a narrow bench adjacent to Marmot Strait. At about the same time there is a movement of animals from the open exposed summer range on Paramanoff Peninsula, adjacent to Shelikof Strait, to the heavily timbered interior.

The importance of the spruce climax in the ecology of Afognak elk has been demonstrated throughout this study. All of the major winter ranges on Afognak are characterized by dense stands of Sitka spruce interspersed with extensive shrublands of alder, elderberry and willow. It is these shrublands which produce the bulk of the winter forage and the spruce forest that provides protection from sever winter weather. Throughout periods of inclement weather elk are found almost entirely within the forest canopy, venturing into the shrubland to feed for short periods of time only. The role of the spruce forest in the well-being of Afognak elk is such that it is doubtful a population of any size will ever become established outside the forested region of the Kodiak Archipelago.

To provide information on herd movements an elk calf tagging program was undertaken in 1961 in the treeless portions of southwestern Afognak and western Raspberry Islands. The operation, in which the Department of Fish and Game was assisted by the U. S. Coast Guard, was undertaken not only as a means of providing information on herd movement, interchange, and calf survival, but to evaluate the feasibility of capturing elk calves on Afognak Island ranges by use of a helicopter.

Although the peak in calving on Afognak Island occurs the last week of May, few calves have been found earlier than June 10. Observations made annually throughout the latterhalf of May and early June indicate that prior to calving parturient cows seek areas of dense timber or brush to drop their calves and, once born, the calves remain hidden until sufficiently strong to travel with a herd. This period was found to last three weeks or more. All calves were tagged between June 14 and June 19 using a Bell HUL three place helicopter and crew provided by the Coast Guard Air Detachment, Kodiak, Alaska.

An aerial survey using a Piper 150 Super Cub was flown each morning during tagging between the hours of 3:30 am and 5:00 am to determine the location and number of calves in each herd. Once the herds were reconnoitered the aircraft returned to the base of operations and the helicopter with a two man tagging crew was deployed to the herd containing the greatest number of calves.

The technique employed to capture calves involved using the noise and downdraft produced by the helicopter rotor blades to separate calves from the cows. This method usually succeeded, but there were occassions when a cow could not be driven from her calf. Calves, easily spotted from the air, often proved difficult for the tagging crew to locate on the ground. After a chase, often lasting 30 minutes or more, the calf being pursued by the helicopter would tire and seek rest in whatever cover it could find, generally tall grass or a clump of alder or willow. At this point the pilot would hover the helicopter above the calf while the tagging crew, already on the ground, approached the calf from behind, taking care so as not to be observed, and when close enough, would leap onto the calf and restrain it. After it was caught, the calf was sexed, weighed, measured and tagged with numbered metal and plastic cattle tags - one in each ear. The entire tagging operation required about 5 minutes. As soon as the calf was released the

Figure 5. Capture and release sites of tagged Roosevelt Elk calves, June 1961.

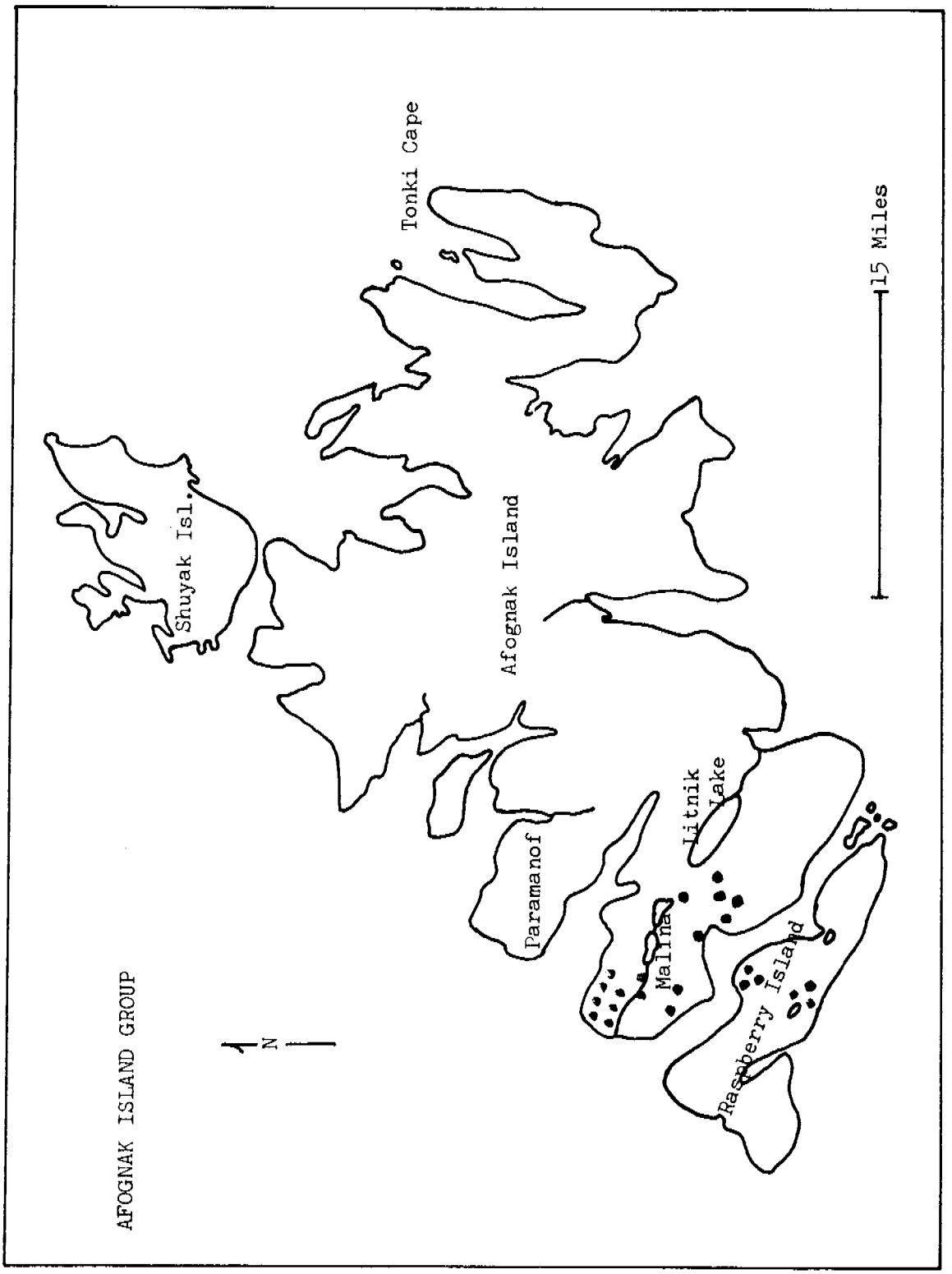

Table 7. Elk Calf Tagging Record Afognak Island, Alaska, 1961-1964.

Date Tagged	Area Tagged	Plastic Tag Number	Metal Tag Number	Sex
6/14/61	Malina	1	1001	♂
6/14/61	Malina	2	1002	♂
6/15/61	Malina	3	1003	♂
6/15/61	Malina	4	1004	♀
6/15/61	Malina	5	1005	♂
6/16/61	Malina	6	1006	♀
6/16/61	Malina	7	1007	♀
6/16/61	Malina	8	1008	♀
6/17/61	Malina	9	1009	♂
6/17/61	Malina	10	1010	♂
6/17/61	Malina	11	1011	♀
6/17/61	Malina	12	1012	♂
6/18/61	Raspberry Strait	13	1013	♀
6/18/61	Raspberry Strait	14	1014	♀
6/18/61	Raspberry Strait	15	1015	♀
6/18/61	Raspberry Strait	16	1016	♂
6/18/61	Raspberry Island	17	1017	♂
6/18/61	Raspberry Island	18	1018	♂
6/18/61	Raspberry Island	19	1019	♂
6/18/61	Muskomee Bay	20	1020	?
6/19/61	Raspberry Island	21	1021	♂
6/19/61	Raspberry Island	22	1022	♂
6/19/61	Raspberry Island	23	1023	♂
6/22/62	Malina	none	1024	♂
6/20/64	Raspberry Island	streamer	1062-1061	♂
6/20/64	Raspberry Island	streamer	1064	♂
6/21/64	Raspberry Island	streamer	1066-1065	♂
6/21/64	Malina	streamer	1068-1067	♂
6/21/64	Malina	streamer	1070-1069	♂
6/23/64	Raspberry Island	streamer	1071-1072	♂
6/23/64	Raspberry Island	streamer	1028-1027	♂
6/23/64	Malina	streamer	1026-1025	♂
6/23/64	Litnik Mtn.	streamer	1078-1077	♂
6/23/64	Litnik Mtn.	streamer	1084-1083	♂
6/23/64	Litnik Mtn.	streamer	1031-1030	♂
6/23/64	Litnik Mtn.	streamer	1035-1032	♂
6/23/64	Litnik Mtn.	streamer	1036-1034	♂
6/24/64	Litnik Mtn.	streamer	1029	♂

helicopter was summoned to pick up the tagging crew and the search for another elk was resumed. Calf capture proved extremely difficult throughout the operation due to the size and vigor of young animals three weeks old and older. To save time and effort calves that would not lie down within a 30 minutes chase were by-passes for other animals.

At the conclusion of the operation 23 calves had been captured, tagged and released during 47 hours of flight time for an average of one calf for each 2 hours flown. The greatest single factor contribution to this low return per hour flown was the inability of pilot and tagging crew to locate a sufficient number of calves to work with. Since 1961, 79 elk calves have been captured on Afognak and Raspberry Island ranges. Of these, 38 animals were tagged and released and 41 calves were held for transplant purposes.

Winter Range Survey

Elk ranges on southwestern Afognak Island conform to the usual situation found in Alaska where quantity, quality and availability of winter forage govern the number of animals that a range will support. The condition of the soil and vegetation, and trends exhibited by the range as a whole, are measures for determining the total game population which the range can properly support.

With these thoughts in mind an extensive winter range survey was begun in 1962. Objectives of the survey were to develop a rapid method for determining, on an annual basis, the relative state of health of key browse species utilized by elk on Afognak Island winter ranges, and to assess changes in plant vigor and trend as influenced by the existing elk herds. Selection of a range survey method for use on winter ranges was influenced by a desire not only to furnish a basis for present management, but to establish a foundation for the accumulation of accurate data.

Techniques used in Afognak elk range studies had to be suited to situations where range-use data were obtained on an annual basis, over large expanses of range with limited funds and personnel. The method employed was a modification of the Key Browse Survey Method developed by G. F. Cole (1959) of the Montana Department of

Fish and Game. Certain additions, alterations and omissions with respect to this method were made to comply with the objectives and circumstances of this study. Furthermore, criteria for evaluating soil and vegetation condition and trend were developed for the specific ranges upon which the method was applied. The problem of developing a range method to fit Afognak range conditions was a comparatively simple task as only two species, elderberry and willow, constitute the principal browse plants used by elk throughout the winter months.

The alder/elderberry association, together with lesser understory species, not only comprises the dominant shrub community of the southwestern region, it also constitutes the most important browse producing community throughout the island. In many of the lowland valleys, along beaches and water courses, stands of willow also serve as important browse producers.

Together, elderberry and willow make up the principal browse species supporting elk throughout the year and especially during the winter months. In fact, these two species have been found so palatable that elk rely almost entirely upon them for winter-spring browse, which has led to severe over-use of these two plants in certain areas of the island. 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.

As the willow and alder/elderberry assocations on Afognak are seral, they accordingly are relatively short lived; changes are rapid and can be observed over a period of a few years. In several key elderberry stands in the Litnik Lake watershed, plant succession has been advanced through excessive cropping to a point where this species is expected to be eliminated from the community althogether within a few years. Interspecific relationships between members of the alder/elderberry association are not fully understood, although it appears that alder is asserting dominance as the overstory species by forming a closed canopy, while elderberry, a shade intolerant species, suffers from poor vigor and may eventually be eliminated.

Plant vigor, trend and utilization studies of key browse species were begun in 1962 with the installation of 46 range transects in the Litnik Lake watershed. Utilization figures compiled from 27 willow transects averaged 25 per cent for the winter of 1961-62, well within the allowable use factor for this species. Assessment of browse removal prior to 1961, how, ever, indicated that nearly 50 per cent of 810 willow plants sampled rated in the severe to heavy use classes. Excessive cropping by elk in the years prior to 1961 has altered the growth and conformation of almost all willow stands within the Litnik Lake range. A significant percentage of plants examined rated as either decadent, closely hedged or mostly unavailable. An analysis of plant vigor revealed that 50 per cent of the willow examined rated in the poor and very poor vigor classes.

Elderberry, seemingly more adversely influenced by excessive herbage removal and plant competition than most woody species, apparently is unable to maintain itself in a vigorous state under conditions as they now exist on the Litnik Lake range. Analysis of trend data gathered from 19 transects indicated that 95 per cent of 570 elderberry plants examined in 1962 suffered from either excessive cropping or competition with other species to where plant vigor and herbage production can no longer be maintained under present conditions.

Many range technicians suggest that herbage removal of most browse species should not exceed 60 per cent of the annual growth it plants are to remain healthy. Using this criterion, it is clear that winter ranges on Afognak Island have received excessive use. Conformation and age classes of important browse species are over-balanced in favor of decadent and heavily hedge individuals. Reproduction of willow and elderberry is almost nil and

large segments of these species are dying out. A significant percentage of these two species received use in excess of 60 per cent of their annual growth in past years. Observations of this study suggest that continued utilization at this level is decidedly deterimental to the maintenance of willow and elderberry stands in the Litnik Lake watershed. Since 1962 marked the first range work of its kind on Afognak Island the degree and effect of elk utilization on key browse species should continue to be analyzed on an annual basis to develop a background of knowledge to be used as a source of information upon which to base the management of Afognak Island elk populations.

SUMMARY

In an attempt to establish the Roosevelt elk in Alaska, five female and three male yearlings were introduced to Afognak Island of the Kodiak Archipelago in 1929. Finding the Afognak environment favorable, these eight animals increased to a population of approximately 1,200 animals within 35 years and now occupy nearly all of the Island.

Vegetation of Afognak Island resembles many of the formations occuring on the Kenai Peninsula as well in Southeast Alaska. Two distinct vegetative types are found on Afognak. In the northern, central and southeastern region the vegetation is dominated by a dense spruce climax while the western region is typified by a vast grassland-forb-shrub complex.

The first comprehensive composition count of elk on Afognak was conducted in the summer of 1961. Since then a total of 1,384 animals have been categorized by sex and age. The annual rate of increase averaged 19 per cent for the years 1961-63 while an average of 37 bulls per 100 cows prevailed during the same period.

A peak in the successful breeding season occurs by the 27th of September and the majority of partuitions occur the last week of May, after a gestation period of approximately 244 days. Calf development on Afognak ranges is rapid and by early July calves are observed consuming large quantities of forbs.

Food perferences of Afognak elk are quite diverse, fireweed and other forbs constitute the greater portion of the summer diet while elderberry, willow and a few perennial grasses and sedges make up a major segment of the winter-spring diet.

Elk on Afognak Island were first legally hunted in 1950 when 50 special permits were issued. Permit hunts were again held in 1952 and 1953. Since 1955, general seasons of varying length have been held each fall with the first either-sex season conducted in 1959. Since that time animals of either sex have been hunted, and the harvest increased from 27 animals in 1950 to a high of 127 in 1960.

A range study begun in 1962 indicated that the conformation and age classes of important browse species occuring in the Litnik Lake watershed are overbalanced in favor of decadent and heavily hedged plants while reproduction of willow and elderberry, key species, is presently almost nonexistent.

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