ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

STATE OF ALASKA
Walter J. Hickel, Governor

DEPARTMENT OF FISH AND GAME
Augie F. Reetz, Commissioner

DIVISION OF GAME
Loren W. Croxton, Director
Don H. Strode, Federal Aid Coordinator

CARIBOU REPORT

by

James E. Hemming
Leland P. Glenn

Volume IX
Annual Project Segment Report
Federal Aid in Wildlife Restoration
Project W-15-R-2 and 3, Work Plan L

(Printed April 1968)

TABLE OF CONTENTS

CONTENTS PAGE NO.

WORK PLAN SEGMENT REPORT

FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO: W-15-R-2 and 3 TITLE: Big Game Investigations

WORK PLAN: L TITLE: Caribou Studies

JOBS:

1 (both segments) TITLE: Populations

2 (both segments) TITLE: Distribution and Movements

3 (both segments) TITLE: Productivity

4 (both segments) TITLE: Mortality

5 (W-15-R-2 only) TITLE: Snow Machine vs. Caribou
(completed during first six months of segment and reported under 1966 report)

6 (both segments) TITLE: Analyses of Range

7 (W-15-R-3 only) TITLE: Aging Techniques and Age Composition

PERIOD COVERED: January 1, 1967 to December 31, 1967

ABSTRACT

Nelchina Herd

A census of the Nelchina herd revealed an estimated fall population of 61,000 caribou.

During the winter of 1967 three major and six minor concentrations were found. The three large groups were in the Lake Louise-Tazlina Lake area, Mentasta-Wrangell Mountain area, and the Cantwell-Broad Pass area. Smaller groups were observed near Yanert Fork, upper Nenana River, upper Susitna River, Tangle Lakes, upper Talkeetna River, and Stephan Lake. Movement to the calving grounds began in late March. Major calving activity

occurred in the Watana Lake-Goose Creek area. Caribou were widely dispersed during the summer. Active directional migration did not begin until late November when animals began to move south and east to their winter ranges.

Composition counts during the period of post calving concentration revealed a calf/cow ratio of 58:100. Short yearling counts taken prior to calving were too few to provide data on the annual increment.

The total harvest of caribou during the 1966-67 hunting season was estimated to be 5,500 animals. During the first half of the 1967-68 hunting season harvest was quite low, due to the relative inaccessibility of caribou adjacent to the road system. Checking station tallies from the Denali Highway area show a 40% drop in harvest since 1965. Natural mortality of calves during the summer appears to be extremely low.

A review of data from range exclosures over a ten-year period revealed that many sites have been drying out somewhat and the number of cover shrubs is increasing. These changes appear to be mainly successional but some disturbance by moose and/or caribou was indicated.

Arctic Herd

During the winter of 1966-67 the Arctic caribou herd ranged south of the Brooks Range and along the coast of the Chukchi Sea. Migration to the calving grounds began in mid-April. The calving grounds were located along the headwaters of the Awuna, Meade, Kaksu and Ketik Rivers. No calving was reported south of the Brooks Range as observed in previous years. After calving caribou concentrated into two large groups which gradually dispersed during July. Fall migration was first noted at Wainwright on 9 August 1967 when 50,000+ caribou, of mixed composition, were observed moving to the southwest. Fall weather conditions were mild which may have contributed to the late arrival of caribou near some villages south of the Brooks Range. A reconnaissance flight in mid-November indicated that the Arctic herd was still in migration.

The 1967 Arctic caribou harvest is estimated to be 26,000 animals. With the exception of Anaktuvuk Pass caribou were available throughout the winter to villages along the coast of the Chukchi Sea and the drainages of the Kobuk, Selawik and Noatak Rivers. Subsistence hunters reported caribou to be in

better condition this winter than in previous years. Blood samples were collected from the Arctic caribou herd and tested for brucellosis. Results of those tests will be reported in the Disease-Parasite Annual Segment Report (1967).

From October 1966 through May 1967 three thousand caribou mandibles were collected from ten western Arctic villages. The sample is large enough to allow comparison of sex and age composition by village. The age structure of 1,912 mandibles, revealed a higher percentage of calves and yearlings and a lower percentage of prime (3-5 years) animals as compared to previous years. The sex composition is 38.8% males to 61.2% females.

Steese-Fortymile Herd

During the winter of 1966-67, the Steese-Fortymile caribou herd wintered in spruce forests near the Fortymile River and eastward into Canada. Two small groups wintered north of the Steese Highway near the headwaters of Preacher Creek and Victoria Creek. Calving occurred between Mt. Harper and headwaters of Charley River. During the summer the bulk of the herd utilized the area between Mt. Harper and that portion of the Taylor Highway between Dome Creek and Eagle. Caribou moved east across the Taylor Highway from mid-October through early November. In December animals were scattered from the headwaters of the Fortymile River to the Tanana River.

The estimated hunter harvest in the Steese-Fortymile area during the first half of the 1967-68 hunting season is 500 caribou.

Adak Herd

The introduced caribou herd on Adak Island is increasing steadily. This winter (1968) there are 163 caribou on the island.

Caribou have expanded their range to include the entire island. Calving occurred near Split Top Mountain. The animals were widely dispersed during the summer. This winter most of the herd is utilizing the Teardrop Lake-Hidden Bay area. They spent the winter of 1966-67 on Cape Yakyak and the Caribou Peninsula.

Sixty-two calves were produced this year. Since natural mortality, excluding hunter harvest, is almost non-existent, the above figure should be equivalent to the 1968 annual increment. Total mortality for the 1967 calendar year is 25. The

sex composition of animals dying on Adak revealed higher mortality among males than females which is probably due to the tendency of hunters to select bulls.

Alaska Peninsula Herd

Limited reconnaissance work in this area revealed a normal pattern of movement. The population is divided into two segments, a northern and southern group. The northern group winters in the Becharof-Naknek Lakes area and calves in an area just north of Port Moller. The southern group ranges between the southern tip of the Peninsula and the area just south of Port Moller. Calving is thought to occur between Caribou River and Herendeen Bay.

The 1966-67 hunter harvest is estimated to be 450 caribou.

Mulchatna Herd

Several reconnaissance flights were made in the Mulchatna area this year. Evidence of calving was noted in the Twin Lakes-Lake Clark area and near the west end of Iliamna Lake. Caribou were widely scattered in summer. This winter (1968) there are three groups: one in the Bonanza Hills, one in the Stuyahok Hills, and one near the junction of the Nushagak and King Salmon Rivers.

A survey of native villages in the area revealed that only the villages of Igiugig, New Stuyahok, and Koliganek take caribou regularly for food. Other villages rely on moose as the main source of protein.

The Mulchatna area supports dense climax stands of lichen above timberline and spruce with lichen understory in river valleys. Sedge and Dryas fell-field types are also common. Disturbance by fire appears to be minimal.

RECOMMENDATIONS FOR MANAGEMENT

Census data from Unit 13 indicate that the area is supporting a large population of caribou. Therefore the existing seasons and bag limit should remain the same or perhaps be more liberal.

The Adak Island caribou herd must not be allowed to increase above 200 animals. Current hunting pressure is too low to remove the annual increment from a larger population.

We desperately need a harvest ticket or equivalent means for determination of hunter harvest in Units 9, 11, 12, 13, 14, and 20.

We need better sport hunter-biologist cooperation for obtaining caribou specimens (mandible, blood samples, etc.) from caribou killed by sportsmen.

WORK PLAN SEGMENT REPORT

FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO: W-15-R-2 and 3 TITLE: Big Game Investigations

WORK PLAN: L TITLE: Caribou Studies

JOBS:

1 (both segments) TITLE: Populations

2 (both segments) TITLE: Distribution and Movements

3 (both segments) TITLE: Productivity

4 (both segments) TITLE: Mortality

5 (W-15-R-2 only) TITLE: Snow Machine vs. Caribou
(completed during first six months of segment and reported under 1966 report)

6 (both segments) TITLE: Analyses of Range

7 (W-15-R-3 only) TITLE: Aging Techniques and Age Composition

PERIOD COVERED: January 1, 1967 to December 31, 1967

OBJECTIVES

To evaluate annually Alaska's caribou population in terms of numbers, productivity, mortality and general condition of the animals and range. To determine, as time permits, the relative status of herds not yet inventoried.

To determine the seasonal distribution patterns of caribou throughout Alaska. To monitor population shifts and range use and to define summer, winter, and calving areas.

To obtain information concerning sexual cycles, fertility and natality rates and factors affecting intra and interherd productivity, in relation to population size, body condition and range quality.

To identify and evaluate the various mortality factors affecting caribou populations and to determine the magnitude and composition of the hunter-kill.

To measure the condition and trend of range forage as influenced by caribou utilization with emphasis on the Nelchina and Adak areas.

To determine the age structure of the various caribou herds in Alaska with emphasis on the Nelchina and Arctic herds.

To review, compile, analyze, and prepare for publication the biological data obtained from studies of caribou in Alaska.

TECHNIQUES

Observations from fixed-wing aircraft by Department biologists and by biologists of cooperating agencies (U. S. Bureau of Land Management, U. S. Fish and Wildlife Service, and U. S. Navy) provided information on distribution and movements.

Census techniques required aerial photography, direct counts from helicopters, and composition counts from the ground.

Range exclosures were photographed with color, black and white and infrared. Samples of meat, bone, marrow and rumen contents were collected from Arctic, Nelchina, and Alaska Peninsula caribou for radiation analysis. Standard measurements, weights, productivity data, and incidence of disease and parasitic infections was also recorded for each animal.

Three field trips conducted in 1966 and 1967 by work plan personnel furnished data on the Arctic caribou herd. Supplemental information was gathered from other members of the game staff and from pilots in the northwest Arctic. Important caribou distribution and movement data was recorded by selected Eskimo residents in the villages of Ambler, Kiana, Kivalina, Kobuk, Noatak, Noorvik, Pt. Hope, Selawik, Shungnak, and Wainwright. Each village council was asked to select a capable and reliable man to collect designated caribou specimens and to keep a diary of caribou activities. The persons selected were instructed to record exact dates of spring and fall caribou movements in their respective areas, length of time caribou were available to village

hunters, distance and direction hunters traveled to hunt caribou and the approximate number of naimals harvested. Most diaries were of acceptable quality and this new venture in hunter cooperation should be considered a success. Detailed information of this type could not have been obtained otherwise since there are no Department personnel now stationed in the northwest Arctic. Collectors were paid $1.00 each for caribou blood samples and jaws. All mandible collections were made from October 1966 through March 1967 at a time when 80% to 90% of the annual Arctic harvest is achieved. Of 3,000 caribou mandibles collected, only data from those collected from the villages of Kiana, Kobuk and Noorvik will be included in the 1968 segment report. Data from the other village collections will be reported at a later date.

ACKNOWLEDGEMENTS

We should like to express our sincere thanks to the U. S. Bureau of Land Management, U. S. Fish and Wildlife Service, and U. S. Navy for their cooperation with the Caribou Work Plan in various portions of our research. Jim Evans, BLM, Theron Smith, USFWS, and Lt.j.g. Rudd Thabes, USN, have been particularly helpful with aerial reconnaissance, and field projects this year. To members of our staff and others not individually named we express our sincere thanks.

FINDINGS

Nelchina Herd

Population

Census

A census of the Nelchina herd was started on 21 June 1967. The initial phase of the census was conducted with cooperation from the U. S. Bureau of Land Management.

Phase 1 was designed to obtain a direct count of adult females in the population and an estimate of the 1967 calf crop, during the period of post calving concentration. The BLM took aerial photographs of major areas of concentration and ADF&G biologists made direct counts from a helicopter in peripheral areas. Immediately following the census, ground composition counts, with the aid of a helicopter, were made to determine the calf/cow ratio and the percentage of bulls and yearlings in the post calving segment.

A total of 15,953 caribou, excluding calves, were counted on the photographs. Ground composition counts of 3,083 caribou revealed a total of 0.8% or 128 bulls, and 3.9% or 622 yearlings. Therefore the total number of adult females on the photographs is 15,203. A total of 11,851 adult females were counted by helicopter in adjacent areas for a combined total of 27,054 adult females in the herd in June.

It is assumed that all cow-calf groups were located and counted during the census. Since total cows represents the base for extrapolation by this technique, if any cows were missed during the census the final population estimate would be low. Therefore all estimates derived from the technique yield minimum population estimates.

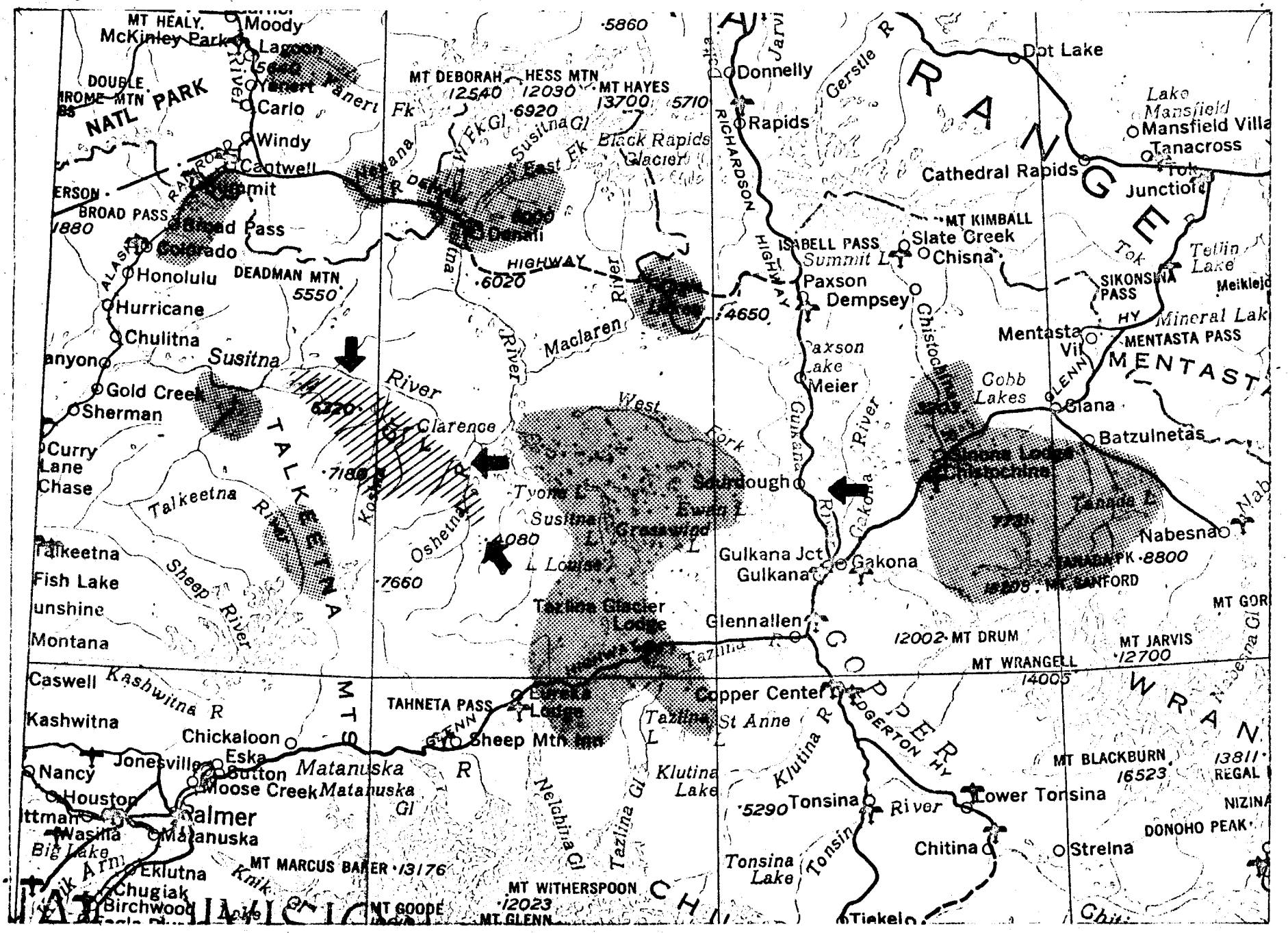
Phase 2 involved additional ground composition counts during the rut to obtain accurate calf/cow, yearling/cow, and bull/cow ratios. During the rutting period both sexes and all age classes are most randomly distributed (Skoog, 1964). The above ratios, plus a known population of adult cows, can be used to compute the total number of calves, yearlings, and bulls.

Fall composition counts of 4,219 caribou revealed a calf/cow ratio of 57:100, a yearling/cow ratio of 22:100, and a bull/cow ratio of 47:100. Bad weather delayed the composition counts until 25 October, after the peak of rut, therefore it is possible that the estimated bull/cow ratio is somewhat low due to post rut dispersal of bulls.

By multiplying the respective proportion of calves, yearlings, and bulls by 27,054 (adult cows) the total number of each was determined. These computations provided estimates of 15,421 calves, 5,952 yearlings, and 12,715 bulls for an estimated fall population of 61,142 caribou.

The 1967 sex-ratio appears disproportionately low in view of previous data. Skoog (1963) reported a sex-ratio in the Nelchina herd of 65 bulls:100 cows based on a sample of 2,057 taken on 1-2 October 1962. If we used Skoog's 1962 ratio the total bull population this year would be 17,585, an increase of 4,870 animals. Therefore the estimated minimum fall population for 1967 could be as high as 66,000.

The above estimates are of a preliminary nature and are subject to modification. An identical census of the Nelchina herd will be conducted in 1968 which will allow us to fully evaluate the census technique. Therefore discussion of sources of error in the direct count-aerial photo extrapolation census will not be



Winter Range 1966-67

Calving Area 1967

* Arrows indicate movements to calving area.

FIGURE 1. WINTERING AND CALVING AREAS AREAS OF THE NELCHINA CARIBOU HERD.

presented until next year.

A comparative cost study of the 1962 and 1967 census, using stratified random sampling, and aerial photo-direct count techniques respectively, revealed that the latter census cost slightly less than half of the former, i.e., $14,660 in 1962 and $7,234 in 1967.

Distribution and Movements

Winter 1967

From January through March 1967 major concentrations were located in the Lake Louise-Tazlina Lakes area, Mentasta-Wrangell Mountains area, and the Cantwell-Broad Pass area with smaller groups near Yanert Fork, upper Nenana River, upper Susitna River, Tangle Lakes, upper Talkeetna River and Stephan Lake (Fig. 1). The above wintering areas ranged from high alpine to low spruce forest.

Spring 1967

Migration to the calving area began in late March in the Mentasta-Wrangell Mountains area and by 12 May migrating caribou were stretched from Chistochina to Clarence Lake. Migration from the Broad Pass area began in early April and many of these animals were approaching the calving area by the first week in May. Major calving activity occurred in the Watana Lake-Goose Creek area (Fig. 2). This area is more extensive than the one used in 1966 i.e., it extends much farther east. Extensive reconnaissance flights failed to reveal any other calving segments.

Early Summer 1967

Post calving concentration occurred in the upper Black-Oshetna Rivers area. In early July part of this group moved north across the Susitna River into the Chulitna Mountains.

In spring and early summer the usual distribution of the bull-yearling segment was noted i.e., they appeared to be randomly scattered throughout alpine areas of the Nelchina range.

Fall and Winter 1967

When the caribou hunting season opened on 10 August most animals were still in alpine areas of the Talkeetna and Chulitna

Mountains, but by early September there was a slight shift to the east and a few caribou were scattered along the Denali Highway and in the Tyone-Susitna Lakes area.

From September through mid-November movements appeared quite random, except for the usual reunion of the bulls and cows during the rut in October. In the latter part of November many animals began to move east and south. Several thousand caribou, in small scattered groups, moved east through the Alphabet Hills and across the Richardson Highway between Paxson Lake and Sourdough while a second larger group moved south and spread out in the Tyone Lake-Eureka area. Movements east and south continued through December. By January 1968 it appeared as if winter ranges had been established (Fig. 3). The major areas of winter concentration are the Sourdough-Tyone Lake-Sheep Mountain area and the Chulitna Mountain-Monahan Flats area with smaller groups near Yanert Fork, Broad Pass, upper Talkeetna River, and Mentasta-Wrangell Mountains. There are conspicuously fewer caribou in the Mentasta-Wrangell Mountains area than have been recorded there the last three winters.

Productivity

In May and early June regular reconnaissance flights were made to delineate calving areas and monitor calving activity. The peak of calving appeared to be several days later than last year.

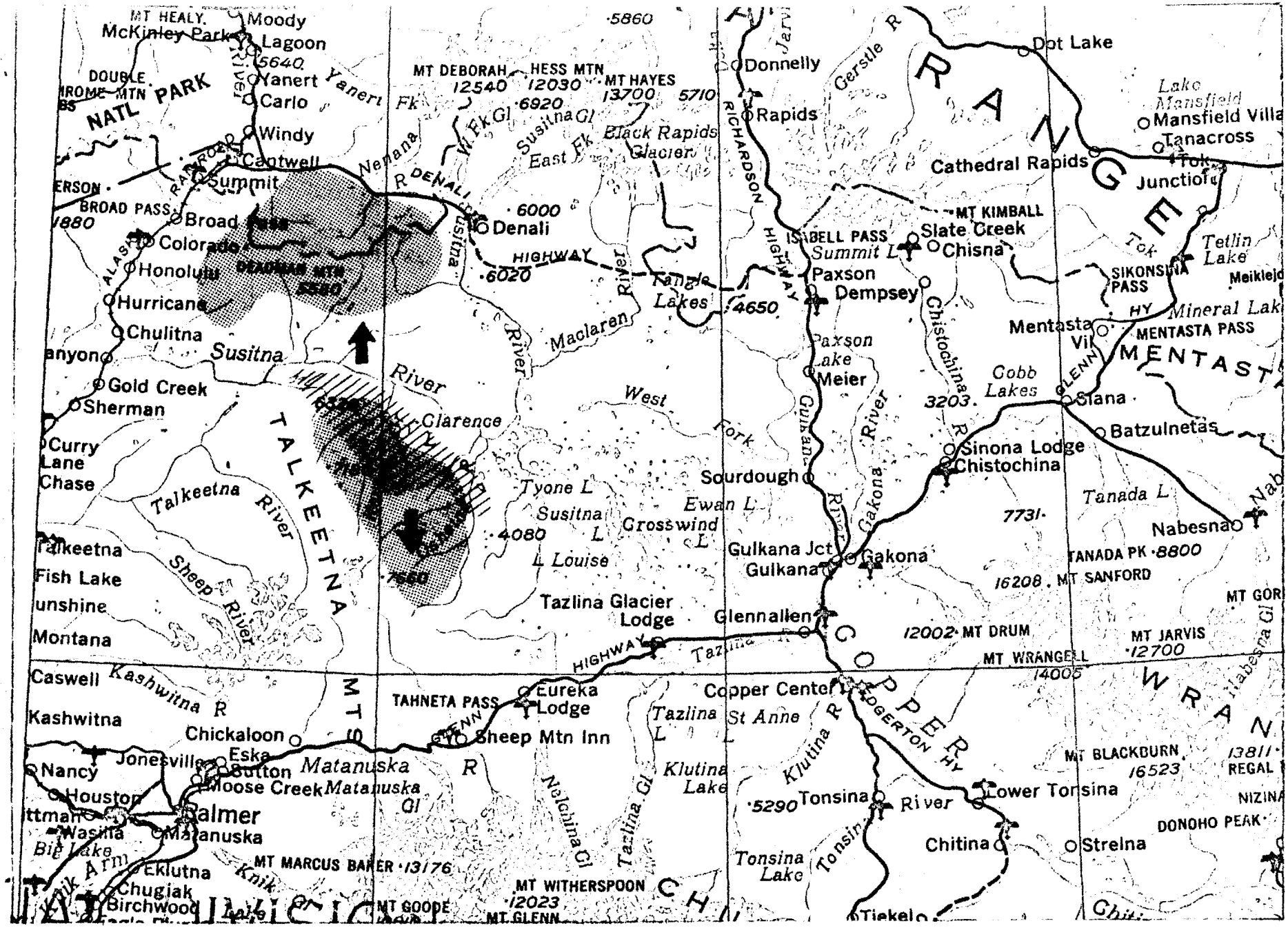
Ground composition counts were made on 22, 23 and 24 June. Optimum ground positions were reached by helicopter. When necessary the helicopter pilot was directed to make a low pass over the animals in order to get them on their feet and moving so that calves would not be missed during the counts. All observations were made with a stock-mounted 20X spotting scope. A total of 3,083 caribou were counted in this manner. The calf/cow ratio was 58:100 indicating a calf crop somewhat higher than last year. In June 1966 the calf/cow ratio was 55:100.

Short-yearling counts taken prior to calving were too few to provide significant data on the increment of yearlings.

Mortality

Hunter Harvest

During the latter half of the 1966-67 hunting season the



Summer Range 1967

Calving Area 1967

* Arrows indicate post calving movements.

FIGURE 2. CALVING AREAS AND SUMMER RANGE OF THE NELCHINA CARIBOU HERD.

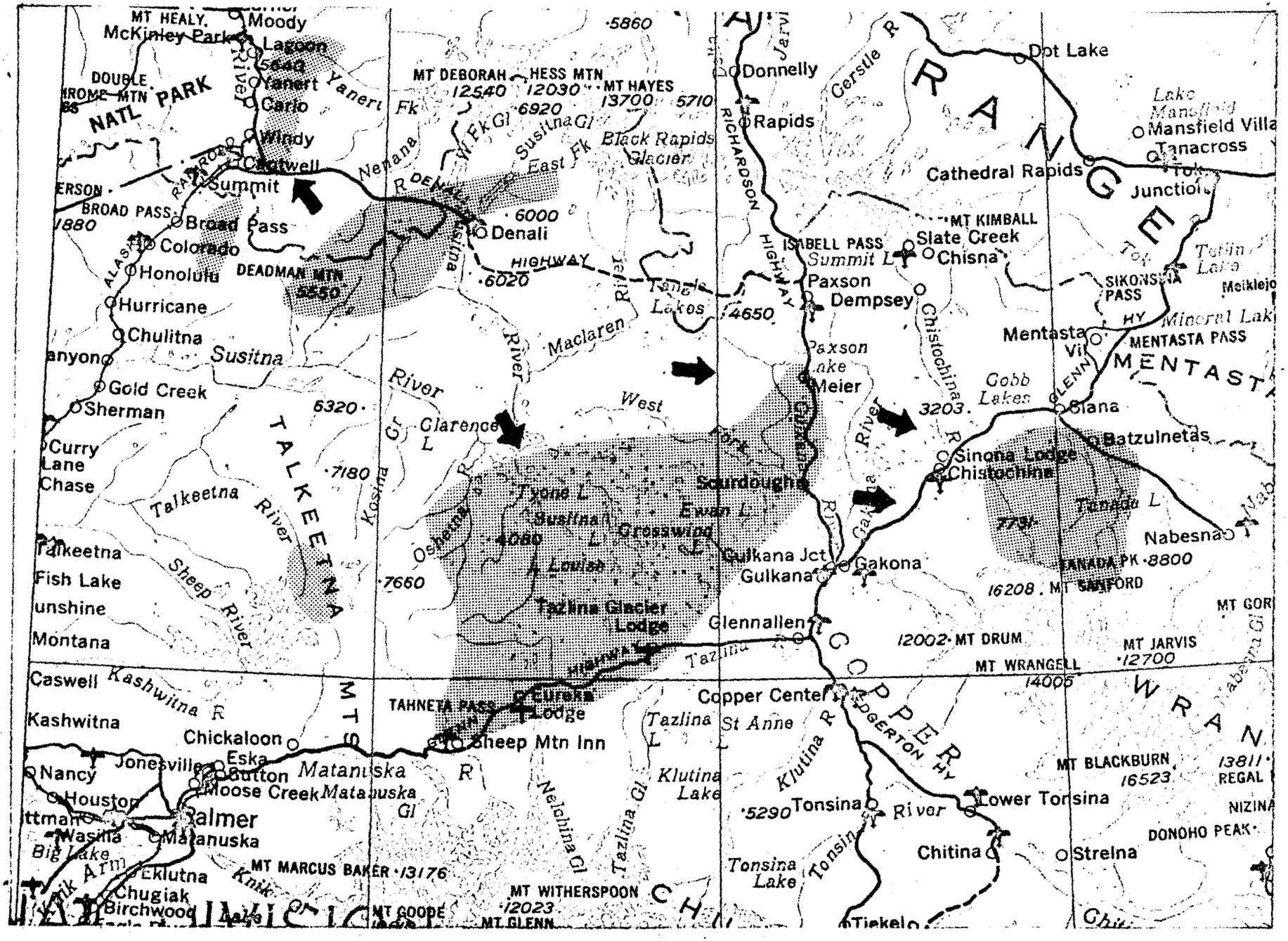


FIGURE 3. WINTER RANGES OF THE NELCHINA CARIBOU HERD 1967-68 (thru January).

* Arrows indicate movements to winter range.

harvest of caribou was generally low. However, hunter activity picked up in March when caribou were moving west across the Slana-Tok Highway. The final crude harvest estimate for the 1966-67 hunting season is 5,500 caribou.

The inaccessibility of the Nelchina herd during the August-September portion of the 1967-68 hunting season was reflected on kill tallies from the Denali Checking Station. The Denali Checking Station was operated from 14 August to 9 October 1967. A total of 2,977 hunters harvested 740 caribou, including 65% bulls, in the vicinity of the Denali Highway. This is a 40% drop in harvest for that area since 1965. The Denali Checking Station serves only a small portion of the area occupied by the Nelchina caribou herd and the data from this station serves to reflect only harvest trends, never total harvest.

During October, November and December low densities of accessible caribou and inhibiting influences of winter weather combined to restrict hunter effort and kill. The projected crude estimate of harvest for the 1967-68 hunting season is 4,000 caribou.

Since travel into the Nelchina area involves not only the automobile but aircraft and various off-the-road vehicles which scatter hunting activity over much of the 22,000 square mile area, it has been impossible, with our small staff, to adequately monitor the harvest of caribou. As a result it has been necessary to make very rough estimates of harvest.

This year a proposal has been made to initiate a program providing for the issue of harvest tickets and harvest report forms to caribou hunters. If implemented, this system should provide excellent harvest data in coming years.

Natural Mortality

Animals continue to remain in good condition with no significant number of diseased animals reported by hunters. The incidence of brucellosis this year is minimal (see Disease-Parasite Annual Segment Report, 1967).

Mortality in the calf segment appears to be extremely low. The calf/cow ratio was 58:100 in June 1967 and 57:100 in October 1967. Grizzly bears were relatively common in the calving area and probably took some calves in addition to utilizing calves which died from other causes. No wolves were observed on the calving grounds.

Range Analysis

In late July permanent range exclosures 1, 2, 4, 5, 11, 12, 13, 32 and 33 were visited. Each plot was photographed in black and white, 35 mm color and 35 mm infrared color. This is the first time we have tried infrared photography as part of our range studies. The infrared photos were very interesting e.g., lichens (Cladonia sp. and Stereocaulon sp.) appeared grey, black spruce (Picea mariana) pink, salmon berry (Rubus spectabillis) scarlet, and blueberry (Vaccinium sp.) red. The value of infrared photography for range analysis cannot be determined until we understand how individual variation, stage of maturity, etc. affects the colors produced on the photos.

Most exclosure fences were in good condition, but several showed signs of bear, moose and human damage. Next summer all exclosure fences must be reinforced.

Permanent quadrats 32 and 33 were examined and vegetation on each was analyzed by the Hult-Sernander scale for estimating vegetation cover. Time did not permit analysis of stations 16-30 and 34-39.

Ronald Skoog examined the data from permanent range exclosures for the past ten years and found that some interesting changes have occurred. Many sites have been drying out somewhat as indicated by the decrease or loss of such species as bog rosemary (Andromeda sp.), wintergreen (Pyrola sp.), and sphagnum mosses. Stations 1, 5-8, 12, 13 and 15 seem to have been so affected; on the others, no moisture change is evident. The most obvious change occurring at all stations and both plots has been the rather substantial increase in cover shrubs. An increase in shrubs in the area is quite in line with Hanson's (1958) ideas regarding succession in that area, and it fits well with the suggestion of a decrease in moisture at these sites. Thus, the main changes during the past ten years would appear to be successional. Four stations, however, show the effect of caribou and/or moose -- stations 4, 8, 13 and 15. The last is a particularly good example of caribou disturbance.

Regular reconnaissance flights have been conducted throughout the year. Detailed information derived from these flights are used to determine pattern of utilization by caribou on different range types.

Quantitative analysis of all range data gathered since 1956 is pending until a qualified range specialist can be employed to analyze the data.

Age Composition

Incisform tooth rows were collected from hunter kills in 1967 for use in determination of age. Analysis of sectioned incisors is pending due to a delay in the purchase of specialized equipment. This information will be included in the 1968 report.

Arctic Herd

Distribution and Movements

Winter 1967

By late January little migratory movement existed in the Arctic caribou herd. Animals that had migrated several hundred miles during the previous fall now remained semi-sedentary on selected feeding areas. The following locations (Fig. 4) represent winter range used during late January, February, March and early April: 1) Arctic coast from Cape Lisburne to Cape Seppings; 2) Wulik River south to the Igichuk Hills and from the coast of the Chukchi Sea east to the lower Noatak Valley; 3) south of the Kobuk River to the headwaters of the Selawik and Tagagawik Rivers; 4) Bettles Valley as far south as the village of Alakaket, including a small herd between Wiseman and Chandalar Lake. Other areas may have contained minor groups of caribou; however, limited time and money prevented a detailed aerial survey. Reports from Wainwright indicate that some caribou wintered north of the Brooks Range.

Spring 1967

The spring migration to the calving grounds progressed normally. Mild temperatures and relatively light snow cover allowed normal movement. Caribou which wintered between Cape Lisburne and Cape Seppings were observed moving eastward about 20 March. While flying about 30 miles east of Cape Lisburne on 19 April a Point Hope pilot saw a large herd of caribou moving inland. The cows moved inland first while the bulls remained along the coast until late May. Point Hope hunters harvested a substantial number of male caribou in the coastal hills during May, thus substantiating earlier observations.

By the first week of April caribou which had wintered between the Mulgrave and Igichuk Hills had moved up the Wulik and Noatak Rivers. Further information on spring caribou movements to the

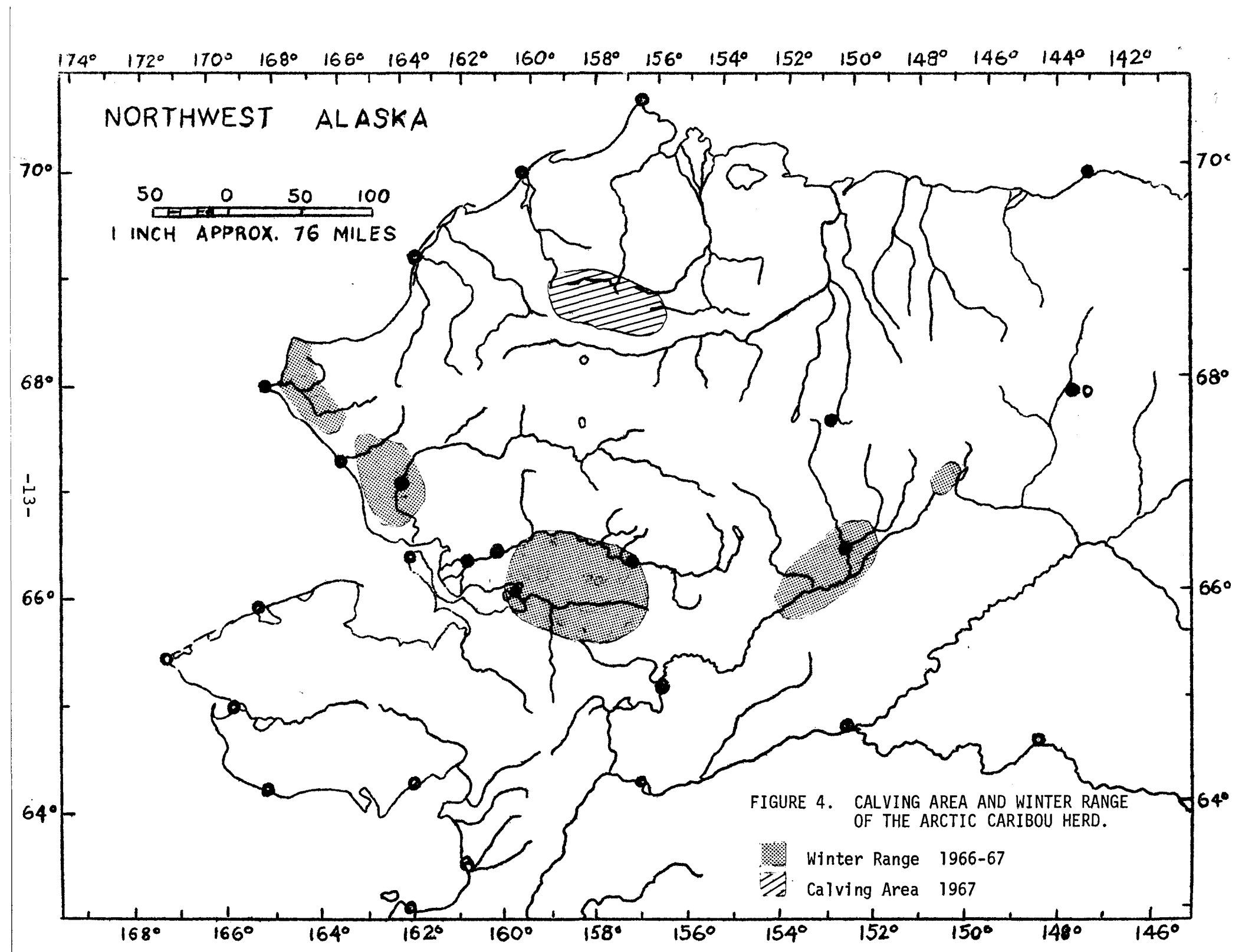


FIGURE 4. CALVING AREA AND WINTER RANGE OF THE ARCTIC CARIBOU HERD.

Arctic Slope is lacking; however, it is probable that former migration routes through the DeLong Mountains were used.

By 15 April, caribou which had wintered south of the Kobuk River and in the Bettles area were seen migrating to the calving grounds. The migration proceeded north through the Baird, Schwatka and Endicott Mountains. Large numbers were observed crossing the upper Noatak River Valley on the first of May. Hunters at the village of Anaktuvuk Pass began harvesting caribou on 5 May. By the end of May most of the adult females had reached the Arctic Slope. The calving grounds were located on the headwaters of the Awuna, Meade and Ketik Rivers, (Fig. 4).

Summer 1967

Specific information regarding summer movements are not available. Cows and calves usually congregate into large groups in mid-June, after which they drift westward into the western portion of the DeLong Mountains (Lent, 1966). During July and August the animals disperse and many of them move north toward the Arctic coast.

Caribou were available to Wainwright hunters until April, after which time they moved inland to calve. No caribou were seen in May or June. On 10 July, caribou were again available at Wainwright. This herd was composed almost entirely of cows with newborn calves. A Department biologist studying calf mortality on the Arctic calving grounds observed two large concentrations of cows and calves in June. One group was located on the upper Meade and upper Awana Rivers and consisted of "tens of thousands of animals". A larger group near the middle reaches of the Ketik River contained an estimated 100,000+ animals. The Ketik group was spread over approximately a thousand square miles. Each group contained bands of 50 to 2,000 caribou and was moving in a southwesterly direction. By 9 August, a large migration of caribou estimated at more than 50,000 animals was seen within three miles of Wainwright. The direction of movement was northeast to southwest. The herd now was composed of bulls, cows, calves and yearlings. By 26 August, a majority of the caribou moving past Wainwright were bulls. By early September only a few caribou remained.

Observations this year are similar to those made earlier by Skoog (1964) and Lent (1966) i.e., the post calving segment concentrated in June as the animals drifted westward. Some cows and calves moved onto the Coastal Plain and were available near Wainwright in early July. The main concentration, however, moved along the north slopes of the Brooks Range, picking up

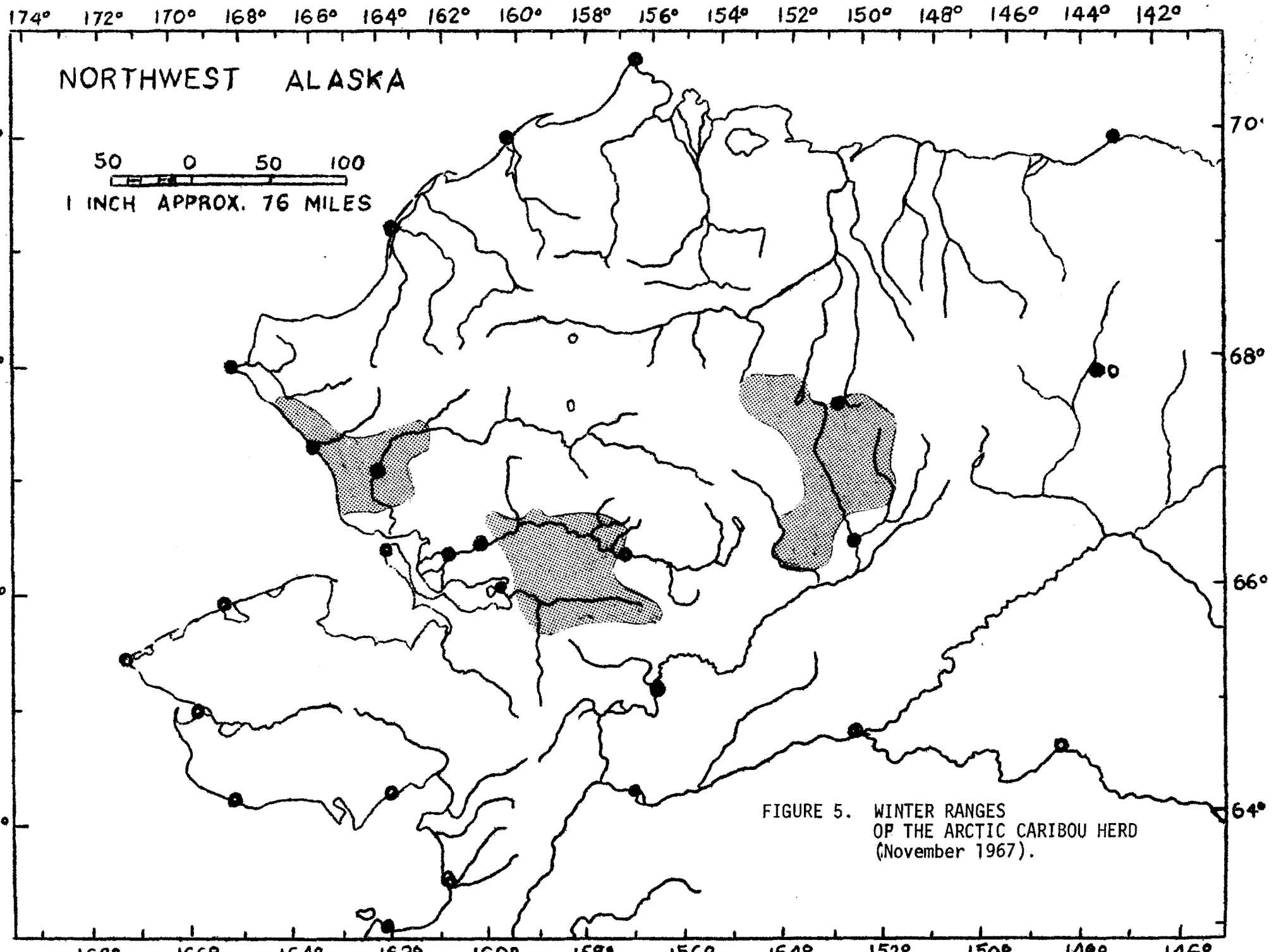


FIGURE 5. WINTER RANGES OF THE ARCTIC CARIBOU HERD (November 1967).

bulls and other non-calving animals which were still drifting northward from the wintering grounds. Caribou (mostly bulls) were still crossing the Kobuk River by 1 June. During July and early August a large portion of the Arctic herd was scattered over the coastal tundra.

Fall 1967

The fall caribou migration began in mid-August. Autumn weather was mild and caribou moved slowly to the south side of the Brooks Range. The ice on rivers and lakes remained thin and prevented hunters from traveling by dog team until mid-November.

Various environmental factors may affect the rate of caribou movement. Table 1 is a comparison of 1965-67 data on autumn caribou movements near some western Arctic villages.

Table 1

Times of Arrival of Caribou Near Arctic Villages During the Fall Migration

	1965	1966	1967
Anaktuvuk Pass	Sept. 15	--	Oct. 15
Ambler	Oct. 1	Sept. 1	Oct. 20
Kiana	--	--	Nov. 12
Kivalina	Oct. 10	Oct. 27	Oct. 16
Kobuk	Oct. 25	Oct. 20	Oct. 25
Noatak	Oct. 30	Sept. 1	Nov. 10
Noorvik	--	--	Nov. 8
Pt. Hope	Oct. 5-10	Nov. 22	Nov. 1
Selawik	Oct. 15	Oct. 18	Nov. 15
Wainwright	--	--	Aug. 10

Considering the unusually mild fall weather conditions the prolonged southward movement of 1967 was not unexpected. Lent (1966) reported that in 1961 the large scale movement started about 20 August, stopped during warm periods around the end of the month, then began again in early September. Adverse weather conditions no doubt act as an added stimulus to speed up the fall migration. In 1965 I observed the Arctic caribou herd moving 30 to 35 miles per day after a severe storm in late September. In 1965 caribou were available to most villages by mid-October.

Reconnaissance flights in the Brooks Range from 6-16 November provided information on the distribution of caribou and routes used for travel to winter range (Fig. 5). Caribou were observed along the Arctic Coast from the Kukpuk River south to the Mulgrave Hills and east across the Noatak Valley to the Agashok River. Old trails were seen on the Kelly and Kugururok Rivers indicating caribou had entered the Noatak Valley by that route. Caribou were also located between the lower Salmon and Shungnak Rivers, and as far south as the Selawik River. Within this area the majority of caribou were in the lower tributaries of the Ambler, Redstone and Hunt Rivers. The third area of major caribou activity was located on the south side of the Endicott Mountains between the Alatna and the South Fork of the Koyukuk Rivers. Caribou were moving throughout this area and traveling in both southerly and easterly directions. In mid-November a few caribou were still present on the north slope of the Brooks Range and were moving into the passes between Anaktuvuk and the Killik Rivers.

Productivity

Little information was obtained on Arctic calving success since caribou work plan personnel were involved in a spring census of the Nelchina caribou herd. A Department biologist studying calf mortality on the calving grounds in June indicated that climatic conditions were ideal for calving, with no snow, low water and good weather. These factors probably were responsible for high calf survival during the spring period.

The calving grounds were located west of Birthday Pass along the headwaters of the Awuna, Meade, Kaksu and Ketik Rivers. No calving was observed south of the Brooks Range as reported last year (Glenn, 1966).

Mortality

Hunter Harvest

At present there is no closed season or bag limit on caribou in the Arctic. The only restrictions prohibit the commercial sale of caribou outside Game Management Units 22, 23 and 26. For the past five years the winter distribution of caribou has allowed a high level of utilization by most villages south of the Brooks Range and north of the middle Koyukuk and Selawik Rivers. Table 2 shows the extent to which Northwest Alaska Eskimos utilize the caribou resource:

Table 2

Comparative Caribou Harvest 1963-67

Year	N. W. Arctic Harvest	Statewide Harvest
1963	20,000	27,000
1964	25,000	32,000
1965	29,000	39,000
1966	24,000	33,000
1967	26,000	31,000

While the subsistence harvest has increased in recent years it is relatively low when we consider that the average annual harvest since 1963 represents only 8.3% of the estimated caribou population of 300,000 animals.

With the exception of Anaktuvuk Pass caribou were available throughout the winter to villages along the Chukchi Sea Coast and the Kobuk, Selawik and Noatak Rivers. From late December 1966 through February 1967 Point Hope hunters were most successful in two areas: 10 to 20 miles southeast and 20 miles northeast of the village. Occasionally caribou were observed at the Point Hope airstrip and on nearby beaches. People from Kivalina and Noatak hunted together in the Mulgrave Hills; Kotzebue hunters had good success in the Igichuk Hills. From December 1966 through January 1967 Selawik hunters reported the best hunting 15 to 20 miles north to northeast of the village; February and March found heaviest hunting pressure 20 to 40 miles east to

southeast of Selawik. Caribou were widely scattered in the Bettles area with the largest numbers south and east of that location. Few caribou were killed by the villagers of Anaktuvuk Pass during the previous fall and winter period (October 1966 - March 1967), causing hardship among village residents. As a result, sled dogs were in such poor physical condition that hunting by team was limited to short distances. Ptarmigan and ground squirrel provided the main source of protein for man and dogs in spring. Caribou were first observed in the Pass on 3 May and by 5 May villagers were again harvesting caribou.

Natural Mortality

Three caribou were autopsied near Ambler in November 1967 and were found in excellent condition. Subsistence hunters in the Arctic indicate that the body condition of caribou has improved over the previous winter. Blood samples were collected from the Arctic herd and tested for brucellosis; results indicate a low incidence of infection and are reported on in the Disease and Parasite Annual Segment Report, 1967.

Population Structure

Table 3 represents the sex and age structure of 1,912 caribou mandibles which were collected from October 1966 through May 1967 by villagers of Ambler, Anaktuvuk Pass, Kivalina, Noatak, Point Hope, Selawik and Shungnak. Table 4 is a comparison of the total average kill with the kill by village. Table 5 through 8 show the sex and age structure of the harvest by village. Figures 6 and 7 show the sex composition by month of caribou killed by hunters at the villages of Selawik, Ambler, Noatak and Point Hope.

The age structure of the 1966-67 Arctic harvest (Table 3) shows a higher percentage of caribou in the calf and yearling age class and a lower percentage in the prime (3-5 years) age class as compared to the kills of previous years. In the 1964-65 harvest data, calves represented 2.4%, yearlings 5.5% and prime 68.1% of the harvest. The 1965-66 age structure is almost identical to that of 1964-65. Harvest of mature (6-9 years), old (10+ years) and two-year-old animals has remained about the same since 1964.

The age composition of caribou killed by Ambler, Kivalina, Noatak, Point Hope and Selawik hunters (Table 4) is about the same. The prime (3-5 years) age class which represents about 64%

of the total caribou harvest varies less than 4% (60.4% to 64.3%) among the first five villages. The age composition of caribou killed at Shungnak and Anaktuvuk Pass is believed biased due to the small sample size, 99 and 80 mandibles, respectively.

The jaw collection from Ambler, which consists of 478 mandibles was judged superior to all other village collections. Most jaws were collected and labeled by one person, which eliminates a source of error in sex identification, especially in the juvenile age class. For this reason, the sex composition of the Ambler harvest (38.8% males to 61.2% females) is believed to be more representative than the overall sex composition (30.3% males to 69.7% females). All villages show a high percentage of females in the calf and yearling age class; the reason for this is not known since hunter selectivity for sex in that age class would be extremely difficult. The sex ratio presented here (38.8% males to 61.2% females) differs from that found by Skoog (1964) who reported a ratio of 49% males to 51% females from 553 mandibles collected. This sample was also taken during the winter and considered valid by Skoog.

Steese-Fortymile Herd

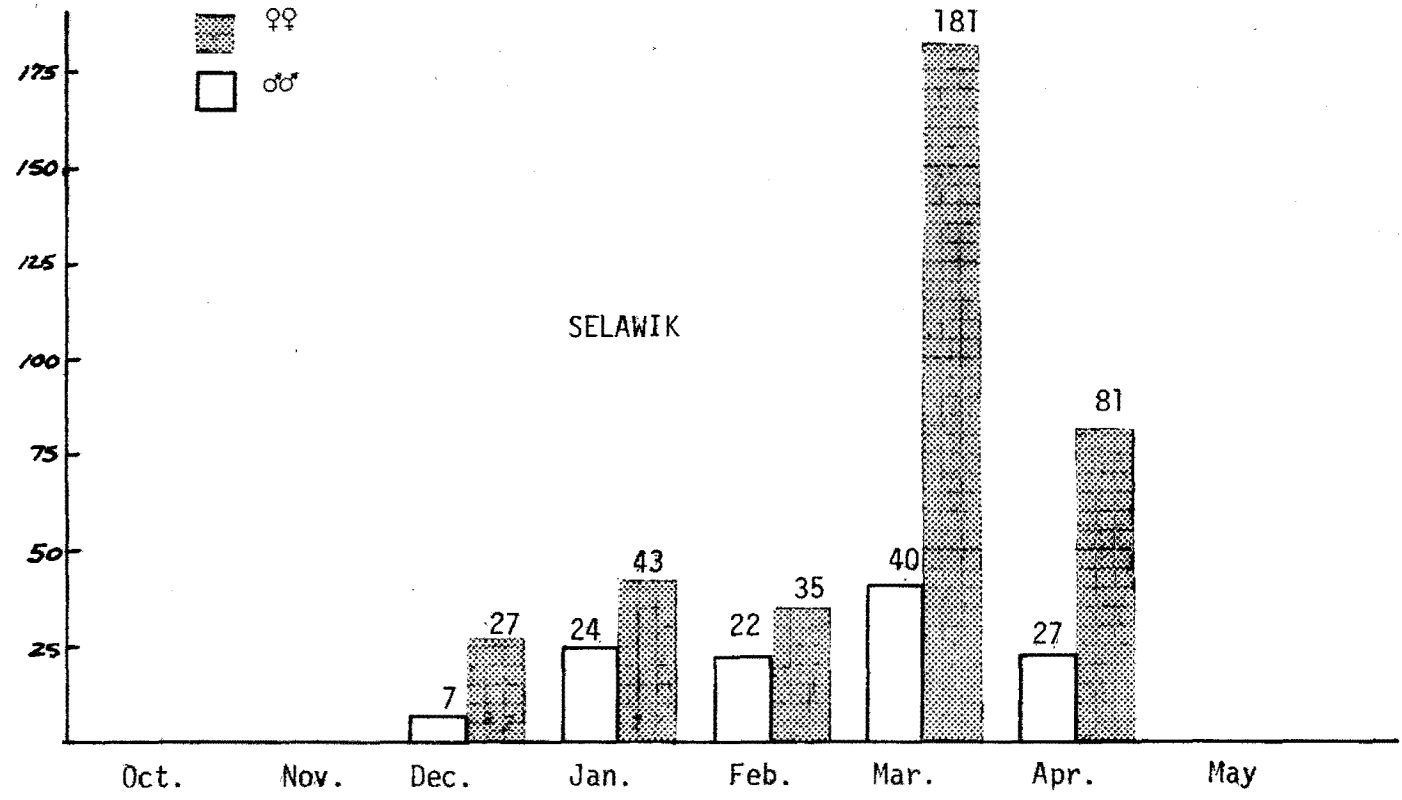
Distribution and Movements

During the winter of 1966-67 major caribou concentrations were found in spruce-lichen forests of the Fortymile River and eastward into Canada. Two small groups were observed north of the Steese Highway near the headwaters of Preacher Creek and Victoria Creek.

Calving took place between Mt. Harper and the headwaters of Charley River. Since only limited aerial reconnaissance was possible before and during the calving period it was not possible to delineate spring migration patterns or the exact boundary of the calving area.

After calving the usual summer dispersal occurred; however, most of the herd remained in the area between Mt. Harper and that portion of the Taylor Highway between Dome Creek and Eagle. When the hunting season opened on 10 August 1967 there were a few caribou east of the Taylor Highway between miles 90 and 145. From

FIGURE 6. SEX COMPOSITION OF THE HARVEST BY MONTH



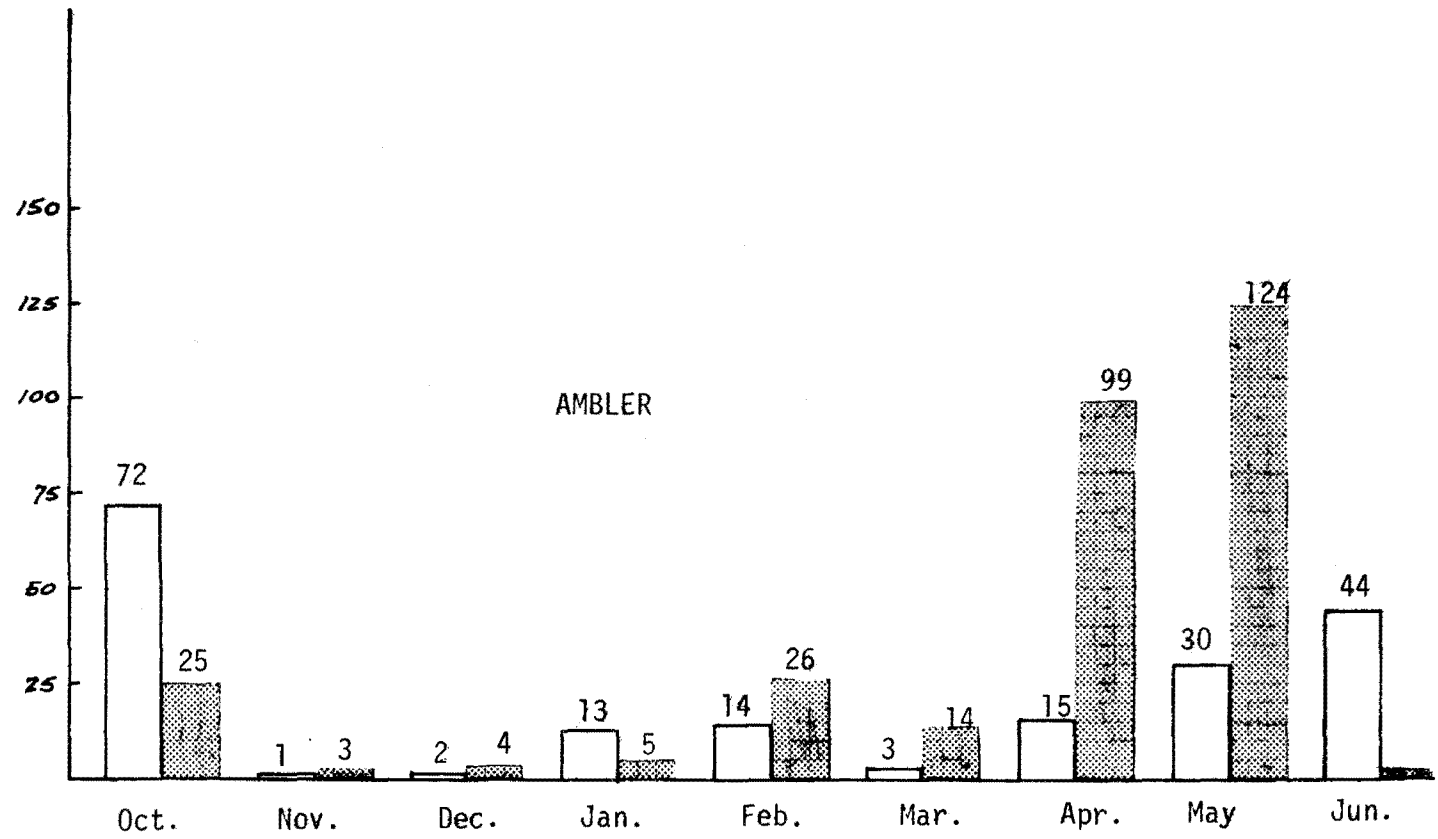


FIGURE 7. SEX COMPOSITION OF CARIBOU HARVEST BY MONTH

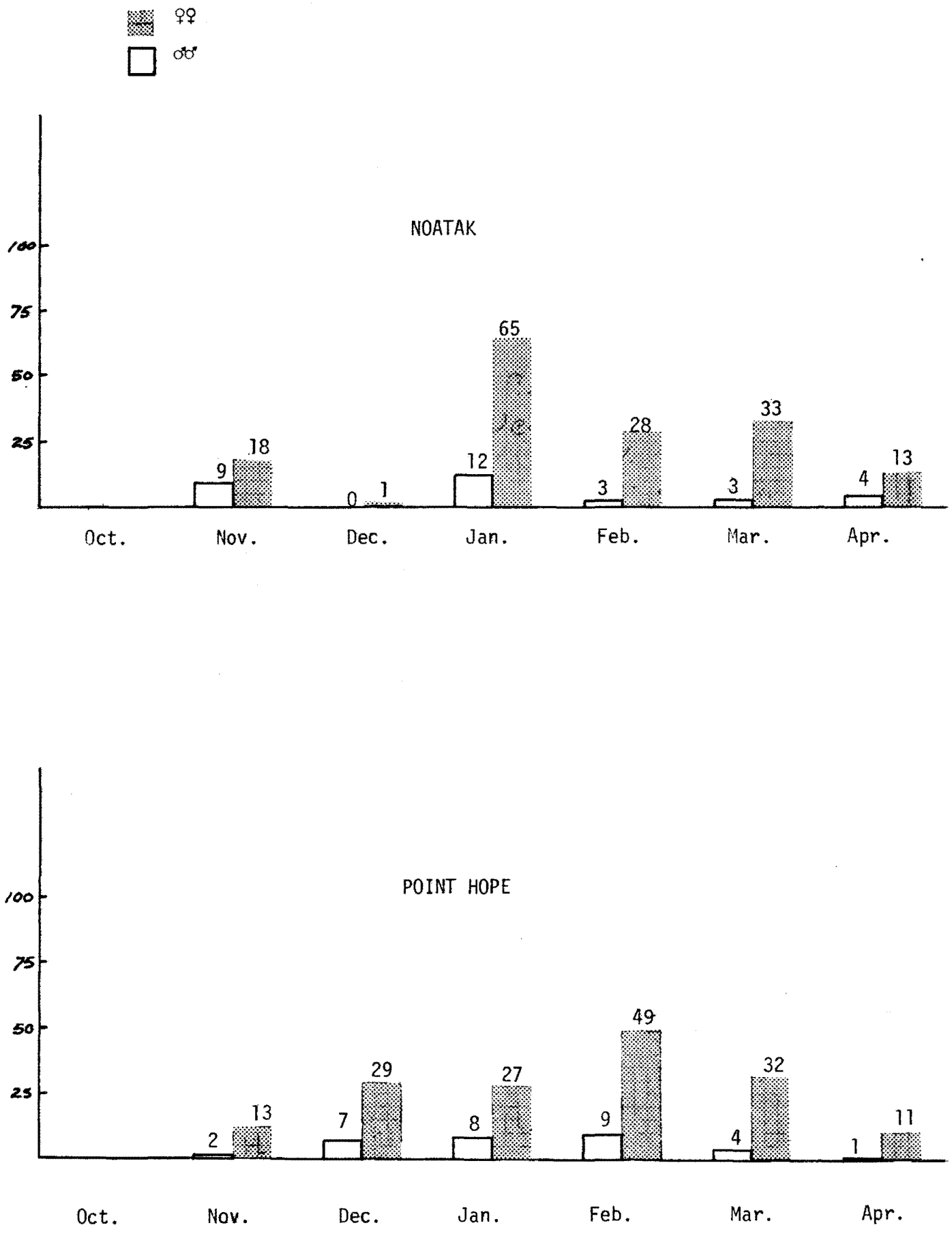


TABLE 3

SEX AND AGE STRUCTURE OF THE ARCTIC CARIBOU HERD*
Fall, Winter, Spring 1966-67

Age Class	♂♂	♀♀	Sex Unk.	Total No.	%
Juvenile:					
Calf	46	58	--	104	5.4
1 Yr.	29	134	1	164	8.6
2 Yrs.	24	159	2	185	9.7
Total	99	351	3	453	23.7
Prime:					
3 Yrs.	144	335	7	486	25.4
4 Yrs.	177	309	15	501	26.2
5 Yrs.	87	148	9	244	12.8
Total	408	792	31	1231	64.4
Mature:					
6-9 Yrs.	47	126	1	174	9.1
Old,10+ Yrs.	13	38	3	54	2.8
Total	60	164	4	228	11.9
TOTAL NUMBERS	567	1307	38	1912	100.0

* Data from caribou mandibles obtained from the villages of Ambler, Anaktuvuk Pass, Kivalina, Noatak, Point Hope, Selawik and Shungnak. Determination of age made by tooth succession and wear.

TABLE 4

SEX AND AGE* STRUCTURE OF THE 1966-67 ARCTIC CARIBOU HERD BY VILLAGE**

	Juvenile	Prime	Mature	Old	Male	Female	Sample Size
Average All Villages	23.7%	64.4%	9.1%	2.8%	30.3%	69.7%	1912
Ambler	23.4%	63.8%	11.1%	1.7%	38.8%	61.2%	478
Kivalina	24.9%	60.4%	10.2%	4.6%	43.7%	56.3%	197
Noatak	22.8%	64.3%	6.8%	6.1%	17.5%	82.5%	263
Point Hope	21.5%	62.5%	11.0%	5.0%	18.2%	81.8%	181
Selawik	28.8%	63.7%	5.9%	1.6%	26.5%	75.5%	614
Anaktuvuk Pass	12.5%	73.8%	13.7%	0.0%	61.2%	38.8%	80
Shungnak	6.0%	75.7%	16.2%	2.2%	12.1%	87.9%	99

*Age determined from tooth wear.

**Sample of 1912 mandibles.

TABLE 5

SEX AND AGE STRUCTURE OF THE ARCTIC CARIBOU HERD, FALL, WINTER, SPRING 1966-67

	Noatak					Kivalina				
Age Class	♂♂	♀♀	Sex Unk.	Total No.	Total %	♂♂	♀♀	Sex Unk.	Total No.	Total %
Juvenile										
Calf	0	12	--	12	4.6	10	13	--	23	11.7
1 Yr.	0	25	--	25	9.5	10	6	--	16	8.1
2 Yrs.	1	21	1	23	8.7	2	8	--	10	5.1
Total	1	58	1	60	22.8	22	27	--	49	24.9
Prime:										
3 Yrs.	15	47	7	69	26.2	24	27	--	51	25.9
4 Yrs.	9	39	15	63	24.0	12	29	--	41	20.8
5 Yrs.	7	22	8	37	14.1	15	12	--	27	13.7
Total	31	108	30	169	64.3	51	68	--	119	60.4
Mature:										
6-9 Yrs.	5	12	1	18	6.8	10	10	--	20	10.2
Old, 10+Yrs.	3	10	3	16	6.1	3	6	--	9	4.6
Total	8	22	4	34	12.9	13	16	--	29	14.8
TOTAL NUMBERS	40	188	35	263	100.0	86	111	--	197	100.0

TABLE 6

SEX AND AGE STRUCTURE OF THE ARCTIC CARIBOU HERD, FALL, WINTER, SPRING 1966-67

	Selawik					Ambler				
Age Class	♂♂	♀♀	Sex Unk.	Total No.	%	♂♂	♀♀	Sex Unk.	Total No.	%
Juvenile:										
Calf	31	17	--	48	7.8	1	3	--	4	0.8
1 Yr.	5	58	1	64	10.4	10	29	--	39	8.2
2 Yrs.	1	64	--	65	10.6	16	52	1	69	14.4
Total	37	139	1	177	28.8	27	84	1	112	23.4
Prime:										
3 Yrs.	44	133	--	177	28.8	44	64	--	108	22.6
4 Yrs.	45	94	--	139	22.6	75	68	--	143	29.9
5 Yrs.	21	53	1	75	12.2	25	29	--	54	11.3
Total	110	280	1	391	63.7	144	161	--	305	63.8
Mature:										
6-9 Yrs.	12	24	--	36	5.9	12	41	--	53	11.1
Old, 10+ Yrs.	3	7	--	10	1.6	2	6	--	8	1.7
Total	15	31	--	46	7.5	14	47	--	61	12.8
TOTAL NUMBERS	162	450	2	614	100.0	185	292	1	478	100.0

TABLE 7

SEX AND AGE STRUCTURE OF THE ARCTIC CARIBOU HERD, FALL, WINTER, SPRING 1966-67

	Point Hope					Anaktuvuk Pass				
Age Class	♂♂	♀♀	Sex Unk.	Total No.	%	♂♂	♀♀	Sex Unk.	Total No.	%
Juvenile:										
Calf	3	9	--	12	6.6	1	3	--	4	5.0
1 Yr.	3	14	--	17	9.4	1	1	--	2	2.5
2 Yrs.	2	8	--	10	5.5	2	2	--	4	5.0
Total	8	31	--	39	21.5	4	6	--	10	12.5
Prime:										
3 Yrs.	9	42	--	51	28.2	5	5	--	10	12.5
4 Yrs.	10	33	--	43	23.8	21	10	--	31	38.8
5 Yrs.	3	16	--	19	10.5	13	5	--	18	22.5
Total	22	91	--	113	62.5	39	20	--	59	73.8
Mature:										
6-9 Yrs.	1	19	--	20	11.0	6	5	--	11	13.7
Old,10+Yrs.	2	7	--	9	5.0	--	--	--	--	--
Total	3	26	--	29	16.0	6	5	--	11	13.7
TOTAL NUMBERS	33	148	--	181	100.0	49	31	--	80	100.0

TABLE 8

SEX AND AGE STRUCTURE OF THE ARCTIC CARIBOU HERD, FALL, WINTER, SPRING 1966-67

Shungnak

Age Class	♂♂	♀♀	Sex Unk.	Total No.	%
Juvenile:					
Calf	--	1	--	1	1.0
1 Yr.	--	1	--	1	1.0
2 Yrs.	--	4	--	4	4.0
Total	--	6	--	6	6.0
Prime:					
3 Yrs.	3	17	--	20	20.2
4 Yrs.	5	36	--	41	41.4
5 Yrs.	3	11	--	14	14.1
Total	11	64	--	75	75.7
Mature:					
6-9 Yrs.	1	15	--	16	16.2
Old,10+ Yrs.	--	2	--	2	2.0
Total	1	17	--	18	18.2
TOTAL NUMBERS	12	87	--	99	100.0

mid-October through early November caribou moved east across the Taylor Highway. Directional movement to the winter range began in November and the animals in the triangle bounded by the Fortymile River, Yukon River and the Taylor Highway, fanned out and moved southward. In December caribou were scattered through the area from the headwaters of the Fortymile River to the Tanana River. The east-west boundaries have not been defined.

Mortality

Most of the hunter harvest during the first half of the 1967-68 hunting season occurred between miles 90 and 146 of the Taylor Highway. Approximately 500 caribou were taken in this area before snow closed the road. On the Steese Highway hunter success was extremely low with only five animals tallied at the checking station. This was to be expected since most of the herd remained in the eastern portion of their range during summer and fall.

Adak Herd

Population

Since caribou were introduced on Adak Island in 1958 the herd has increased rapidly. Figure 8 shows the annual increase in the population based on winter census data (this graph replaces the graph in Alaska Department of Fish and Game Monthly Report, December 1967 which was in error). This winter there are 163 caribou on the island.

The goal is to maintain a summer herd of approximately 200. At the present level of production (70 calves per 100 cows) there should be 55 calves produced this spring (1968) for a summer population of about 218 caribou.

At the present time there is not enough hunting pressure to harvest more than 50 animals per year. Since hunter harvest is approximately the same as the current annual increment of yearlings it should not be difficult to control the size of the herd. Excess animals can be harvested efficiently by Department biologists and the specimens collected from each will provide valuable information on reproduction, growth, body condition, food habits, etc. However, if the population is not kept at the desired level ($\pm$200) control may become extremely difficult.

On 17 January 1967 a census by helicopter revealed 126 caribou in the Adak herd. The herd was censused again on 8 June 1967 and 127 caribou were present, excluding new calves. There were 62 new calves. Therefore the total June population was 189 animals. On 12 January 1968 the entire herd was counted again and photographed with the aid of a helicopter. The counts from the helicopter and counts from the photographs were exactly the same i.e., 163 animals. By adding known mortality of 25 caribou since June to the above total we come up with 188 animals, leaving only one caribou unaccounted for in 1967.

Distribution and Movements

Caribou on Adak have now expanded their range to include the entire island. On 4 June 1967 four adult caribou were observed on Mt. Moffett (see Fig. 9). This is the first time caribou have been seen north of the Adak Naval Station.

It was not possible to delineate the exact distribution of the female segment of the population during the calving period. However, a census on 8 June 1967, just after calving, revealed a large group of cows and calves on the east slope of Split Top Mountain (Fig. 9). A cow and calf were seen on Cape Yakyak during the last week of May and the first week of June. This cow must have given birth on Cape Yakyak.

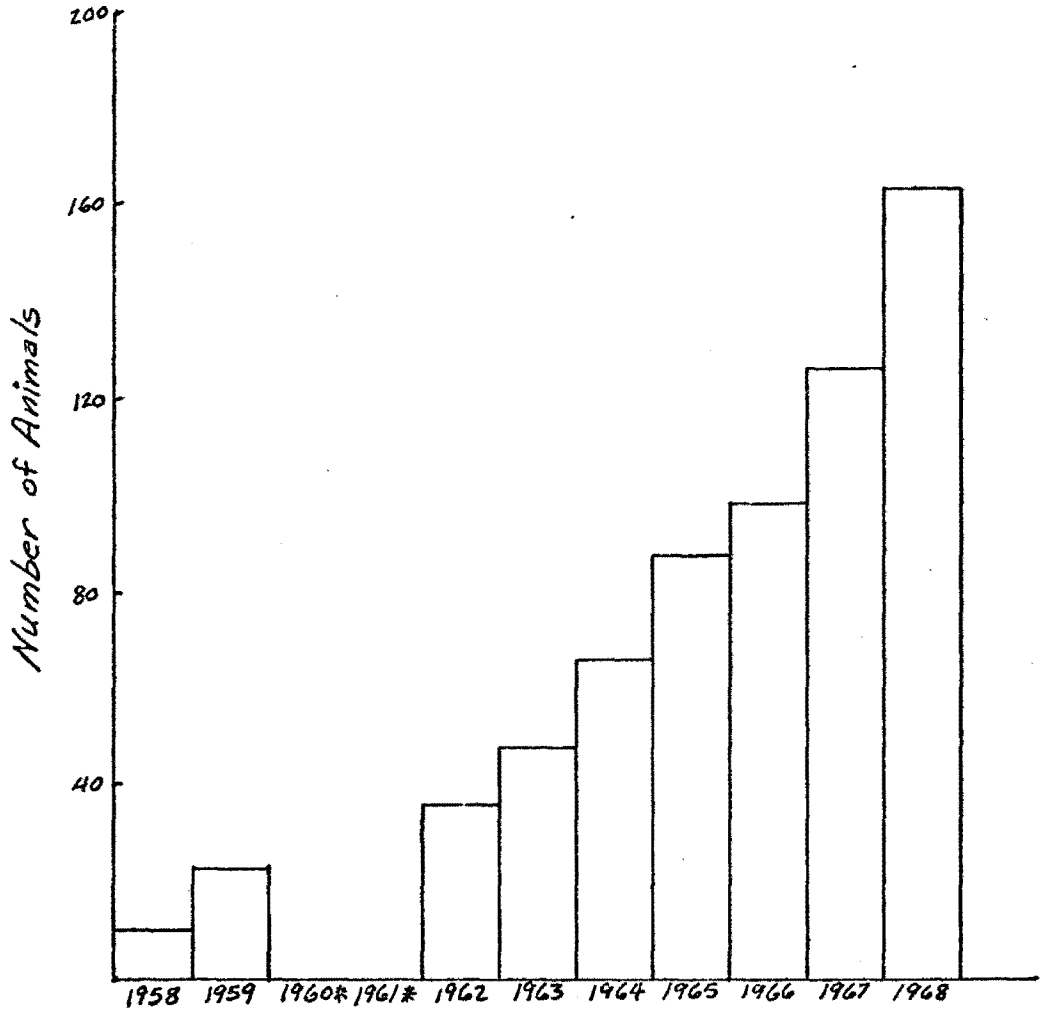
This year the caribou have expanded their winter range eastward (Fig. 9). Glenn (1967) reported that the herd used Cape Yakyak and the Caribou Peninsula during the winter of 1966-67. However, this winter most of the herd is using the Teardrop Lake-Hidden Bay area which is approximately the same elevation as Cape Yakyak and the Caribou Peninsula, but is more protected.

Productivity

One aerial composition count was made by Navy personnel using a helicopter on 8 June 1967. A total of 189 animals were observed including an estimated 11 bulls, 114 cows, 62 calves and 2 sex unknown. Most partutient cows were antlerless, but but bulls and barren cows had well developed antlers (in velvet). Since counts were made from the air there is a possibility that some of the animals classified as barren cows were actually yearlings or two-year-old bulls.

FIGURE 8. **ADAK IS. CARIBOU POPULATION**

Winter Census Data



* No Census taken

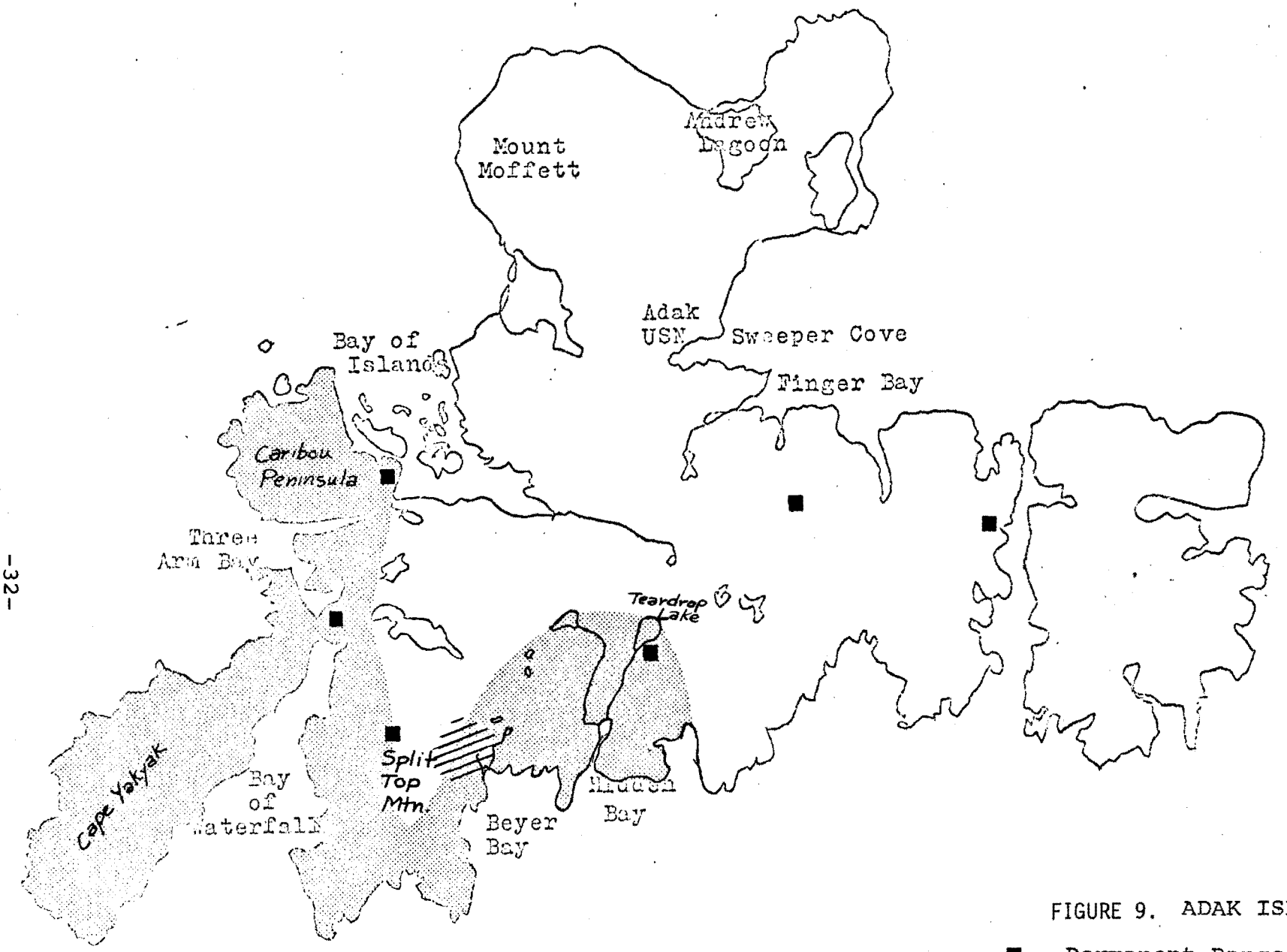


FIGURE 9. ADAK ISLAND

■ Permanent Range Exclosures

Approximate Calving Area 1967

Winter Range 1967-68

The increment of yearlings this year is approximately 39%, compared to 35% last year.

Mortality

Hunters took 24 caribou in 1967, one animal died when it became entangled in old communications wire, and one animal is unaccounted for. Data from previous years suggests that natural mortality, excluding animals lost by entanglement in wire, is extremely low.

The sex composition of animals dying on Adak shown in Table 9 suggests higher mortality among males than females. It has been reported that hunters select males when they are available and our data on caribou killed by entanglement in wire also indicates higher male mortality.

Analysis of Range

No activity.

Age Composition

Specimens have been collected, but anlaysis is pending.

Alaska Peninsula Herd

Distribution and Movements

The Peninsula herd consists of two segments, one occupying the area north of Port Moller and the other, to the south where animals are divided between the mainland and Unimak Island. Skoog (1964) has estimated the northern segment to contain approximately 11,200 animals while the segment south of Port Moller contains a minimum of 1,000 animals. A reconnaissance flight on 5 October 1967 (Fig. 10) located the northern segment. These caribou were scattered throughout the foothills between Becharof Lake and Naknek Lake and consisted mainly of cows and calves. A second group was located between Port Moller and Port Heiden from the coast to the foothills and contained a large number of bulls. These animals were moving northward and it is expected that most of them will winter with the northern group. Charlie Franz, pilot and

TABLE 9

SEX COMPOSITION OF CARIBOU DYING ON ADAK ISLAND

Year	Males	Females	Unknown Sex	Total
1958	--	--	1	1
1959	--	--	1	1
1960	--	--	--	--
1961	--	--	--	--
1962	--	--	--	--
1963	--	--	--	--
1964	3	1	1	5
1965	7	3	--	10
1966	7	11	3	21
1967	11	7	6	25
Total	28	22	12	63

lifetime resident of Port Moller, reported that several thousand caribou winter between Port Moller and Port Heiden, moving towards the coast during winters of deep snow. Skoog (1964) indicated that the main wintering grounds are located in the Becharof Lake region, in the northwest portion of this herd's range. Observations made in October tend to verify these findings.

Mortality

The 1966-67 caribou harvest on the Alaska Peninsula including animals taken on guided and unguided hunts is estimated to be 450 animals. In recent years the Peninsula herd has become increasingly important for recreational hunting. Record-size trophy animals have been taken including a large male caribou killed in October 1966 which measured 481 1/8 points and now holds the number one position in the Boone and Crocket record book.

Alaska Peninsula caribou collections were made in April and October for radiation analysis. All animals autopsied were in good condition.

Mulchatna Herd

Distribution and Movements

Repeated reconnaissance flights were made with cooperation of the U. S. Bureau of Land Management and ADF&G (Lands and Caribou Work Plans) in an attempt to delineate the area occupied by the Mulchatna caribou herd and to monitor seasonal movements. Figure 11 shows the approximate boundaries of the calving and wintering areas.

Evidence of calving activity was observed in two areas. Several hundred cows and calves were seen in the Twin Lakes-Lake Clark area on 27 and 28 June 1967 and local residents reported that a small group of cows and calves were present near the west end of Iliamna Lake in early June.

In early October caribou were scattered widely from Lake Clark to the Nushagak River, north as far as the Hoholitna River and south to the Stuyahok Hills. By 18 October the animals began to concentrate. Two groups were found, one in the headwaters of the Nushagak River which was moving southwest, and another larger

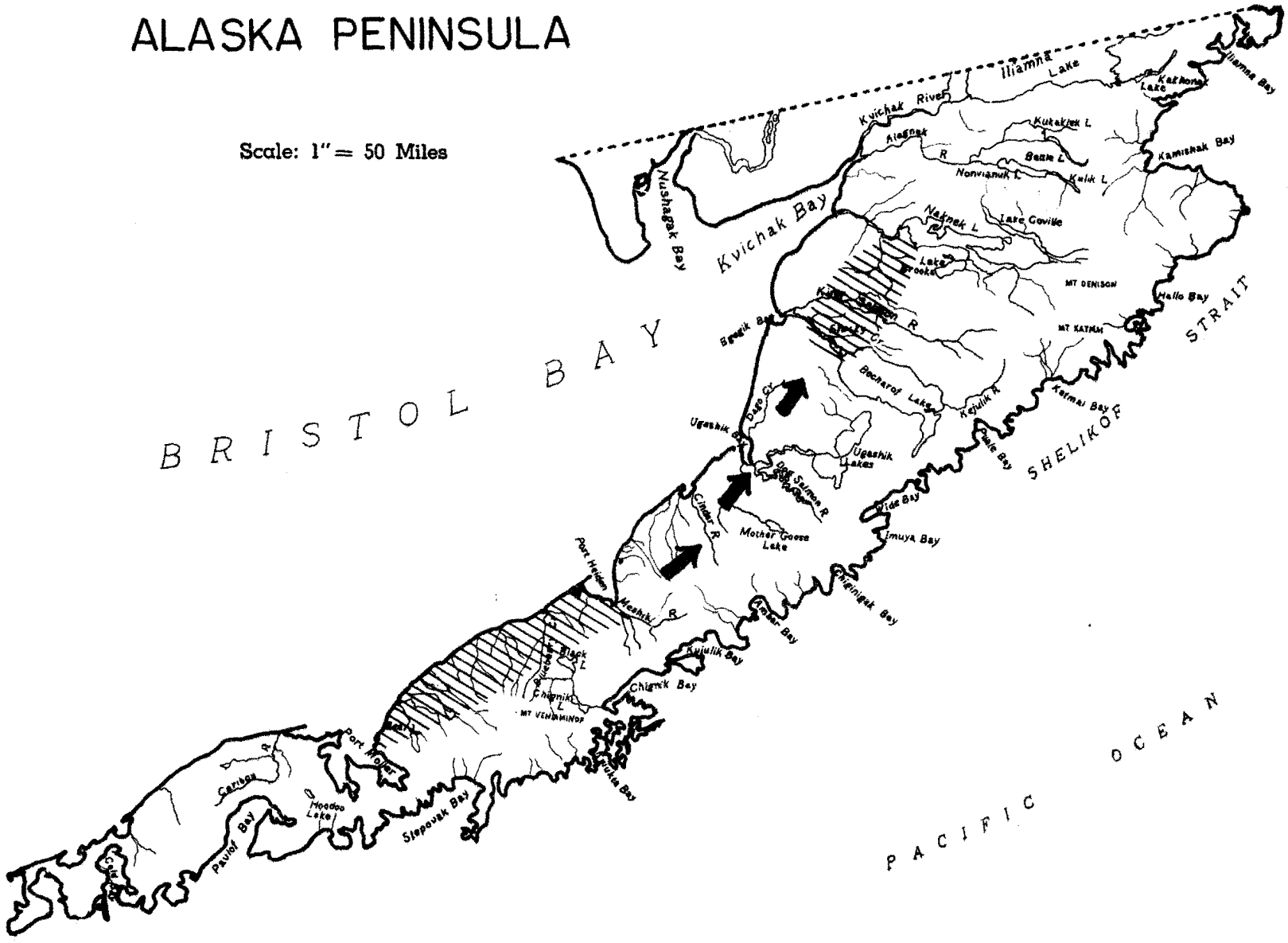


FIGURE 10. PRE-RUT CARIBOU DISTRIBUTION

* Arrows indicate direction of movement.

group in the Bonanza Hills. More caribou may have been present in the Stuyahok Hills but little flying was done in that area.

Flights in late December revealed three winter groups. Approximately 500 animals were seen in the Bonanza Hills, 500 northwest of Igiugig and 300 along the Nushagak River above the junction of the King Salmon River. Bad weather prevented reconnaissance in the Holitna-Taylor Mountain area.

Human Utilization

A survey of native villages in the area by mail in addition to personal contact with a few local residents revealed that only the villages of Igiugig, New Stuyahok and Koliganek have caribou close enough during the open season to be readily harvested for food. Most villages rely on moose meat supplemented by beaver, fish and ptarmigan. Of course the villages which take caribou regularly usually share the meat with other villages.

According to local guides sport hunting for Dall sheep appears to be increasing in the Lake Clark-Turquoise Lake area which usually results in trophy hunting for caribou as well. The size of the harvest of caribou by sport hunters is not known.

Range

Vegetation in the Mulchatna area appears to be strikingly different from that of the adjacent Alaska Peninsula. Aerial observation in October revealed spruce with lichen understory in river bottoms, sedge on lake margins, pure lichen types on many of the rolling hills, and Dryas fell-field in dry rocky areas. Each of these vegetation types was photographed.

This appears to be a good quality caribou range with relatively little disturbance by fire. There were, however, a few small burns between Tutna Lake and Telaquana Lake.

Kenai Herd

Reports from residents of the Kenai Peninsula this year indicate that the introduced herd is doing very well. The current distribution of this herd is shown in Figure 12. In April and May 1967 a total of 34 caribou were seen by biologists, local residents, tourists, etc. During the summer 13 calves were seen

at widely separated locations, indicating the animals are reproducing normally. The numbers reported above were compiled from casual observations and are not intended to reflect total population size. The caribou have been so widely scattered this year that it was impossible to estimate the size of the herd.

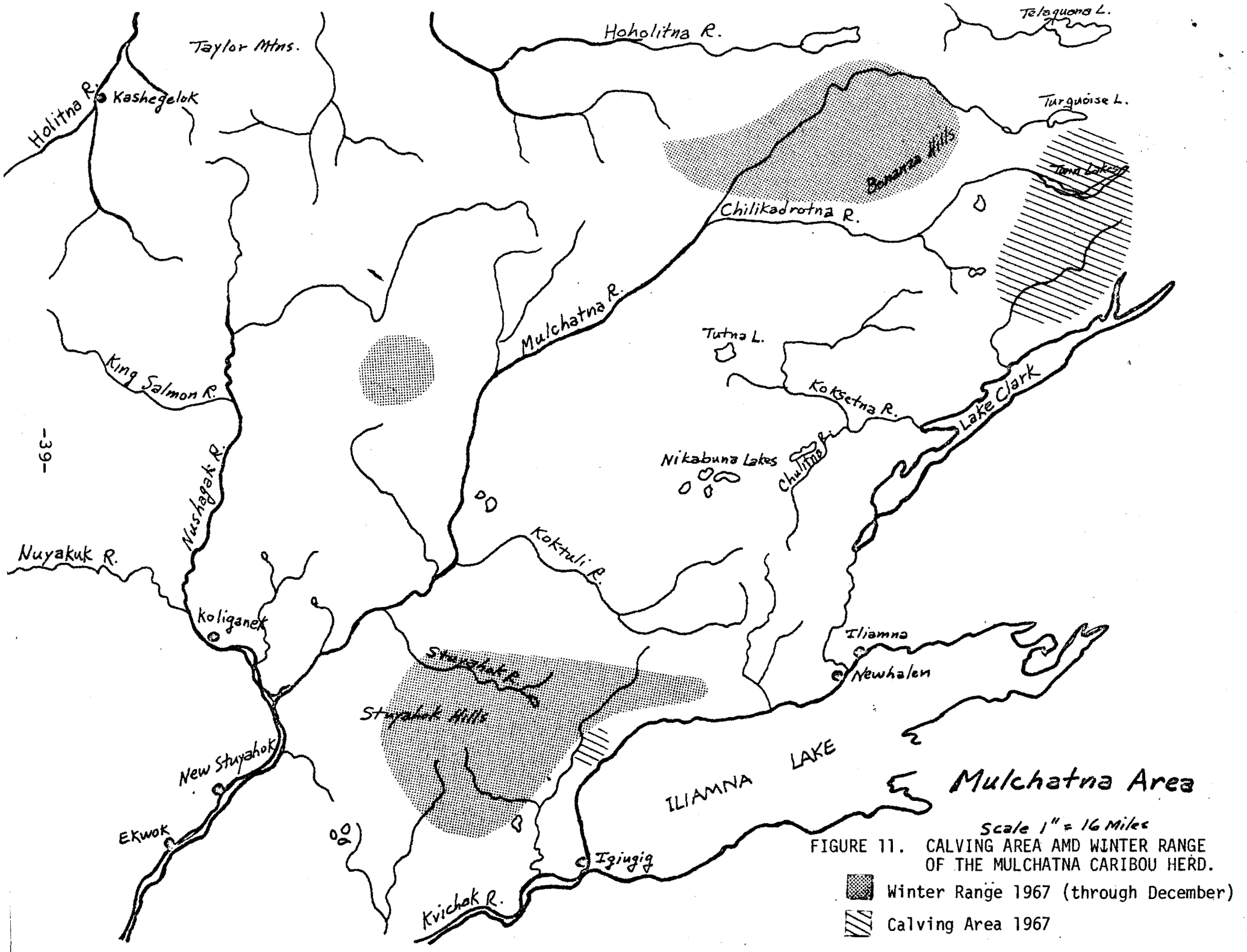


FIGURE 11. CALVING AREA AMD WINTER RANGE OF THE MULCHATNA CARIBOU HERD.

Winter Range 1967 (through December)

Calving Area 1967

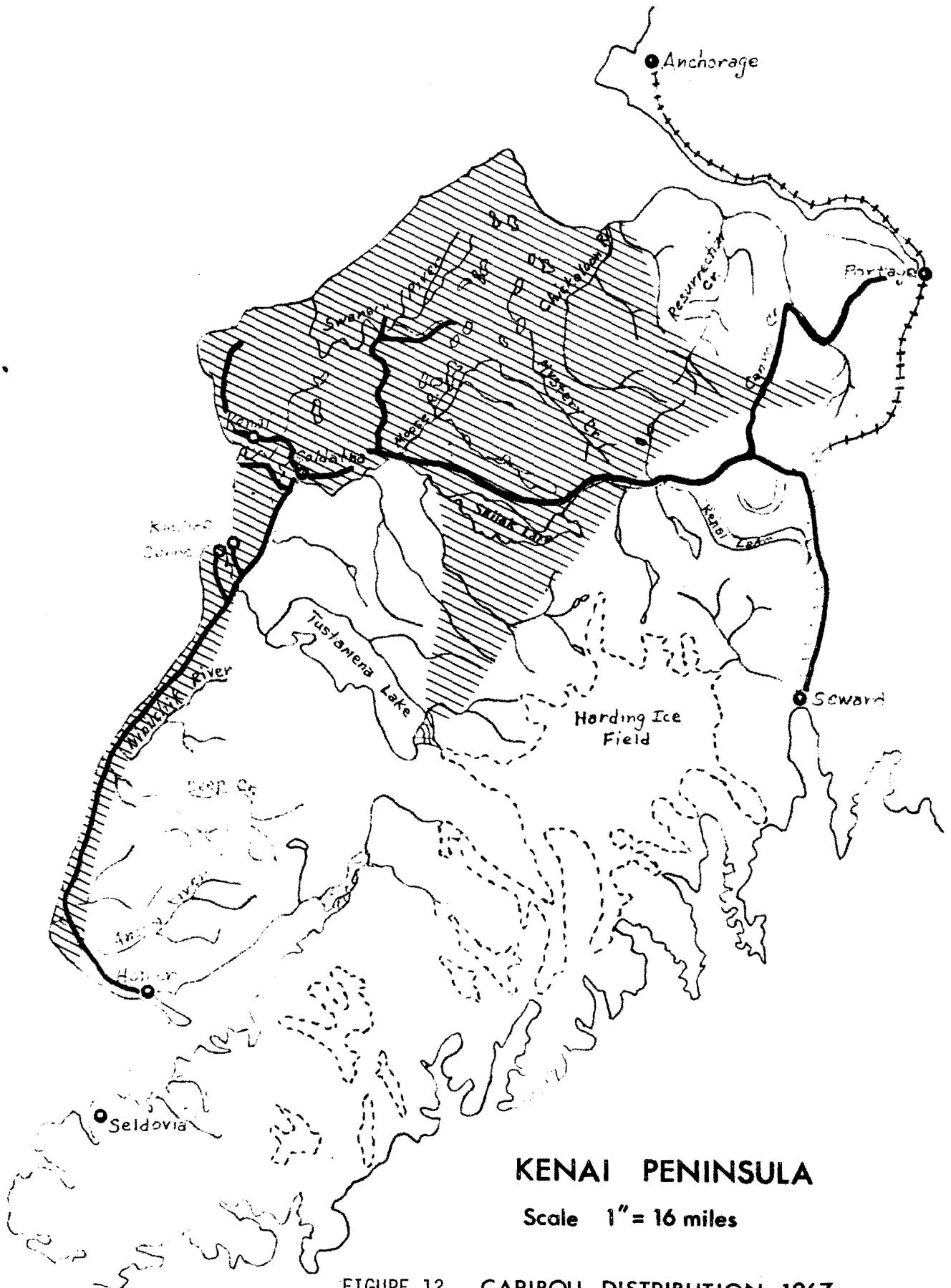


FIGURE 12. CARIBOU DISTRIBUTION 1967

LITERATURE CITED

Glenn, L. P. 1967. Caribou project annual segment report. Alaska Department of Fish and Game, Fed. Aid Wildl. Rpt., W-15-R-1 and 2, Juneau, Alaska, 36 pp.

Hanson, H. C. 1952. Importance and development of the reindeer industry in Alaska. J. Range Mgmt. 5(4):243-251.

_____ 1958. Analysis of caribou range. U. S. Fish and Wildlife Service, Fed. Aid Wildl. Job Completion Rpt., W-3-R-12,4, Juneau, Alaska, 68 pp.

Jones, R. D. 1966. Raising caribou for an Aleutian introduction. J. Wildl. Mgmt. 30(3):453-460.

Lent, P. C. 1966. The caribou in northwestern Alaska. In Wilimovsky, N. J. (Editor), Environment of the Cape Thompson Region, Alaska. U. S. Atomic Energy Commission, Washington, D. C. 1250 pp.

Skoog, R. O. 1963. Caribou project annual segment report. Alaska Department of Fish and Game, Fed. Aid Wildl. Rpt., W-6-R-4, Juneau, Alaska 31 pp.

_____ 1964 The caribou in Alaska. Unpublished Comprehensive Report (incomplete), Alaska Department of Fish and Game, Juneau, Alaska

PREPARED BY:

James E. Hemming
Study Leader

APPROVED BY:

Don H Strode
Federal Aid Coordinator

SUBMITTED BY:

Robert A. Rausch
Project Leader

Lowell W Crapton
Director, Division of Game