

JOB PROGRESS REPORT (SURVEY & INVENTORY)

State: Alaska

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Influence of Hunting on the
Nelchina Caribou Herd

Period Covered: January 1, 1972 to June 30, 1974.

SUMMARY

A photo-extrapolation census conducted in 1973 resulted in an October 1973 Nelchina caribou population estimate of 8,136 caribou. A preliminary study on the calving grounds in 1973 revealed light mortality on neonate calves. By July 1, 1973 the calf:cow ratio was 53.1:100 indicating a calf mortality rate of 11.5 percent. Survival of 1972 calves to April 1973 was estimated at 42 percent. Survival of 1973 calves to April 1974 was 69 percent. The 1972 harvest was reported as 555 caribou of which 72 percent were males. Reported hunter success was 34 percent. The distribution and movements of the Nelchina herd were recorded throughout the year.

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BACKGROUND

Considerable research and management effort has been expended on the Nelchina caribou (*Rangifer tarandus*) herd in the past two decades. During this period the herd increased rapidly to an estimated 71,000 in 1962 (Siniff and Skoog 1964) and then declined dramatically to an estimated 8,100 in 1972 (Bos 1973). Management emphasis has shifted from the problem of limiting the growth of the herd to one of encouraging population increase.

Annual field evaluations of herd welfare are now an established part of the management effort on this important sport-hunted herd. Such evaluations basically provide information on yearling recruitment levels which, when used with harvest statistics, form a basis for season and bag limit recommendations.

Two field projects were conducted on the Nelchina herd in 1973 to supplement information from standard herd evaluation surveys: a photo-census and a preliminary calving ground study.

A photo-census was completed in 1973 for the second successive year. The estimate of 8,100 obtained during the 1972 census was below expected values and an unusually late spring migration in 1972 raised that question of whether or not most caribou had been accounted for in that census. The census was repeated in 1973 to provide a check on the 1972 results.

Ample yearling recruitment rates would provide for controlled population growth and allow for a harvest. However, poor recruitment levels since 1968 were indicated from an analysis of aged tooth samples (Bos, in press). Data from sex and age composition counts conducted in October 1971 and in March, July and October 1972, when compared to data from previous years, suggested the possibility of low parturition rates and/or high mortality on newborn calves during the first month of life in both 1971 and 1972. Possible changes in calving characteristics or neonate mortality levels from those described in previous calving ground studies (1955-57) indicated the need for an assessment of the current calving situation.

A preliminary calving ground study was conducted in 1973 to: 1) determine what problems would likely be encountered during subsequent calving ground field studies, 2) establish the location and progression of calving and the comparison of such with findings of earlier studies and 3) monitor the causes and extent of calf mortality.

OBJECTIVES

To provide information for an annual status evaluation of the Nelchina caribou herd in terms of total numbers, productivity, mortality, sex and age structure and condition of the animals and their environment.

PROCEDURES

Population Estimate

The general census procedure in use has been described previously (Bos 1973). In 1973, reconnaissance flights were conducted throughout the Nelchina range prior to calving to determine distribution of animals. Aircraft utilized in the surveys were Cessna 180s, 185s and PA-18 "Supercubs." Movements and distribution of caribou were followed through the calving period into the postcalving aggregation period. The frequency of flights was increased, as caribou aggregations and distribution approached conditions suitable for photo-censusing, until daily reconnaissance was used the last few days prior to photography.

Aerial photography was done by North Pacific Aerial Surveys, Inc., (NPAS) using a Cessna 320 and a Zeiss RMKA 15-23 camera with Kodak Aerographic XX film. Photography was at 1,500 ft. above terrain resulting in a scale of 1"=250'. Peripheral groups of caribou, not in areas photo-graphed by NPAS Inc., were photographed with hand-held 35 mm SLR cameras from a "Supercub" or helicopter.

Following the photographic survey, composition counts were conducted to determine sex and age proportions of animals known to have been within the area of photographic coverage. Composition counts were made with the aid of a Bell 206A helicopter. Small groups of animals were sexed and aged (calves, cows, and bulls) from the air. On larger groups, generally numbering over 50 caribou, observers were positioned on the ground and the helicopter was used to move the animals past the observers. Calves were aged on the basis of body size. Sex of all animals older than calves was determined on the basis of external genitalia.

Counts of caribou on the aerial photos were made with the aid of a mirror stereoscope with 4X binocular attachment.

Productivity

Calving ground field studies were conducted in the Kosina Creek Valley and on uplands adjacent to Clarence Lake to the south (Figs. 1 and 2). A base camp was set up at Clarence Lake. Due to the condition of the lake ice and absence of snow on surrounding tundra, fixed-wing aircraft could not land on or near the lake. A helicopter (Bell 206A) was used to ferry personnel, supplies and fuel in from the Denali Highway and for transportation and observation in the calving area. A "Supercub" on wheels was used to exchange personnel by rendezvousing with the helicopter at the Goose Creek air strip approximately 10 miles southeast of Clarence Lake. A caribou distribution reconnaissance flight with the "Supercub" was made on May 28.

Four biologists spent 10 days in the study area with 8 days (May 23-30) utilized for extensive ground observations in Kosina Valley. Initial attempts at aerial classification on May 23 resulted in excessive disturbance of calving caribou, with resultant abandonment of newborn calves. Thereafter biologists were dropped off in the morning each day at various locations within Kosina Valley and were picked up in the afternoon. This allowed each man to cover several miles on the ground in areas selected for maximum observation opportunity, as well as to obtain general coverage of the whole valley (Fig. 2). Each man used a spotting scope to facilitate observation. Data recorded by each observer included sex and age composition (bulls, cows, yearlings, calves), the proportion of cows with antlers, the proportion of cows with visible udders, the incidence of retained placentas, dead calves, crippled caribou, presence of predators, notes of births in progress, observed abandonment of calves and intraspecific strife.

Maximum and minimum daily temperatures at Clarence Lake were recorded daily from a Taylor maximum-minimum thermometer.

Mortality

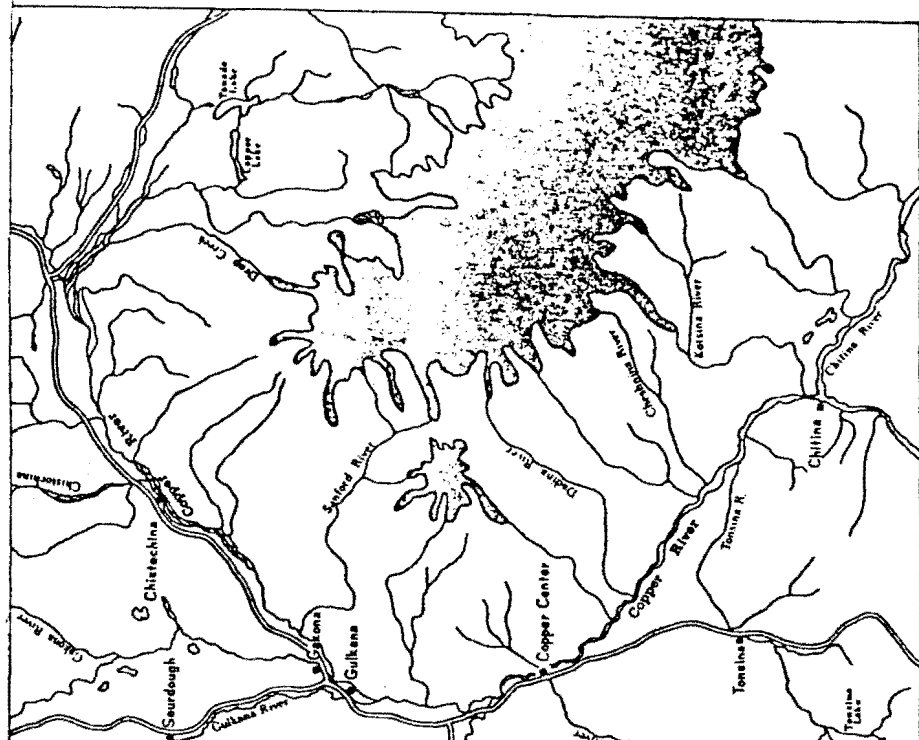
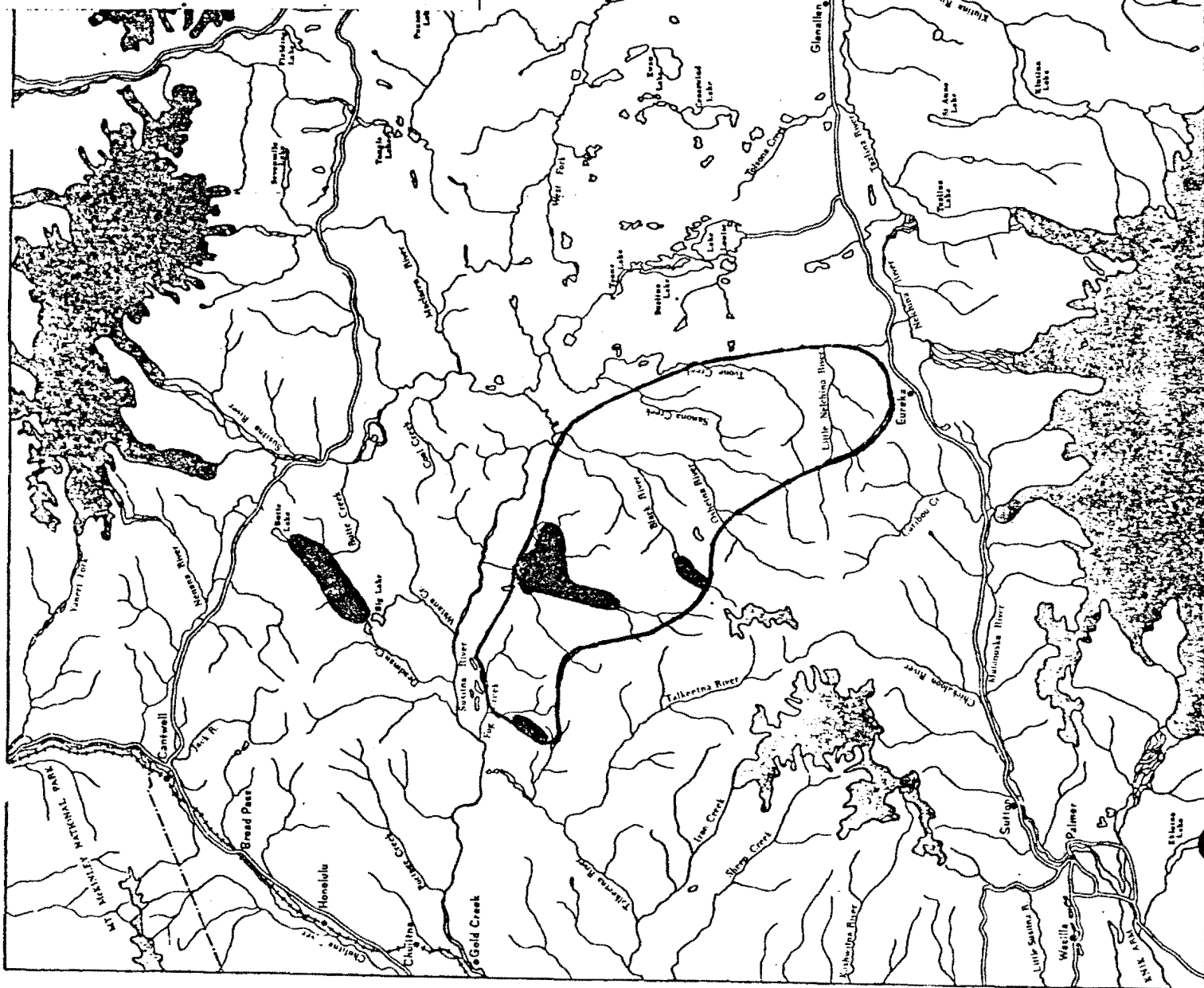
Natural mortality of adults (older than one year) was recorded when observed.

Natural mortality and hunter harvest of calves through the first year were determined by using the difference between natality rates and

Fig. 1. Nelchina caribou calving grounds.

Traditional calving area 1955-1973.

Calving area 1973:



early spring calf-cow proportions when the calves of the previous year were approximately 10 months old.

Hunter harvest of adults was determined from returns of caribou hunter reports. The sex and age structure of the kill was determined from age data acquired from the teeth of collected hunter-killed specimens of known sex, by cementum aging techniques and from caribou hunter reports.

Annual Increment

Yearly increments to, or losses from, the total population were determined by subtracting total computed losses from the computed yearling addition to the population in the spring.

Sex and Age Structure

Information on sex and age composition was obtained from composition counts conducted June 29-30, and Oct. 15-16, 1973, and March 27-28, 1974. The method used was as described above under Population Estimate. During the October and March counts, many of the animals were in timber, which necessitated classification from the helicopter at low flight level. During the October and March counts the sex of all animals was determined and they were recorded as either calves or adults. The age distribution sample of known-sex caribou killed by hunters was determined by the use of fluorescence microscopy on cross sections of incisor teeth.

Movements and Distribution

Seasonal movements and distribution patterns of caribou were recorded from periodic reconnaissance flights. Such flights were made bimonthly. In addition, information on movements and distribution was obtained on flights associated with census or composition counts. Cessna 180, 185 or PA-18 "Supercub" aircraft were utilized at altitudes of 300-500 feet above terrain. Caribou locations were recorded on maps and filed in the Department's Big Game Data Index File system.

FINDINGS

Population Estimate

An October population estimate of 8,136 caribou resulted from the 1973 photo-extrapolation census.

Postcalving aggregations of caribou occurred adjacent to the areas used for calving in 1973. The major concentration areas which were photographed by NPAS were located on or near Watana Mountain and along Kosina Creek in the vicinity of Terrace and John Creeks (Fig. 2). Peripheral aggregations near Black Lake, on upper Tsisi Creek and in the Butte Lake-Deadman Lake area were photographed with a hand-held 35 mm camera. All photos were taken on June 28 and 29.

Composition counts were conducted on June 29 and 30. Table 1 presents the postcalving sex and age composition data for 1973 and comparative data for 1972. Of 4,555 caribou classified, 56.1 percent were females older than calves and 29.8 percent were calves. The resulting ratio of 53.1 calves:100 females was well above the 38.5:100 value observed in 1972. The bull:cow ratio in 1973 was below that observed in 1972. The higher 1972 bull proportion may have been due to the delayed spring migration and heavier snowpack which could have served to contain the bulls with the herd. In 1973 a normal movement to the calving grounds and a light snowpack probably allowed greater separation and dispersal of bulls from the cow segment of the herd. As in 1972, bull:cow ratios were higher in peripheral aggregations. In contrast to 1972, when the calf:cow ratio for the Deadman Lake area was the lowest of the three areas surveyed (Bos 1973), the 1973 calf:cow ratio for this area was the highest observed.

A count of caribou on the developed 9" x 9" black and white prints yielded 6,168 caribou. Counts of caribou in peripheral areas added 2,589 animals for a total postcalving estimate of 8,757 caribou. By applying the value of 56.1 percent females obtained during postcalving composition counts to the estimate of 8,757 caribou, a cow base of 4,913 cows was derived for the extrapolation. This estimate is quite similar to the value of 4,954 cows obtained in 1972.

Sex and age composition counts were carried out during the rut on October 15-16, 1973 to obtain representative sex and age proportions for extrapolation of a population estimate from the July cow base. As in October 1972, most of the Nelchina herd was located in the Little Nelchina River-Horn Mountains area near Eureka on the Glenn Highway. Adult bulls were well represented in most aggregations of caribou observed.

The counts yielded a bull:cow ratio of 27.3:100 and a calf:cow ratio of 38.3:100 (Table 2). These ratios were used to extrapolate an October population estimate as follows:

Postcalving estimate =	8,757 x 56.1 percent cows =	4,913 cows
	4,913 x 27.3 =	1,341 bulls
	4,913 x 38.3 =	1,882 calves
		<u>4,913 cows</u>
Total October population estimate =		8,136 caribou.

This estimate was remarkably close to the estimate of 8,094 in 1972. Whether the similarity is fortuitous or corroborative depends on the thoroughness of the field work and the validity of the assumptions underlying the extrapolations. At the least, the total postcalving estimates, based for the most part on photography, represent minimum estimates. These estimates for 1972 and 1973 were relatively close (8,342 and 8,757, respectively). More importantly, assuming the postcalving composition counts were representative in both years, the close similarity in estimated postcalving cow segments is significant because it is the cow segment of the population which is most constant in its presence on the calving grounds and in the postcalving aggregations.

Table 1. Nelchina caribou postcalving sex and age composition counts, 1973.

Area and Date	MM per 100 FF*	Calves per 100 FF*		Calves		Cows*		Bulls*		Total
				N	%	N	%	N	%	
Black Lake, June 29	35.8	43.2		82	(24.1)	190	(55.9)	68	(20.0)	340
Deadman Lake-Butte Lake June 29	100.0	61.9		104	(23.6)	168	(38.2)	168	(38.2)	440
Watana Mtn. Kosina Creek Area - June 30	18.5	53.3		1171	(31.0)	2197	(58.2)	407	(10.8)	3775
1973 totals	25.2	53.1		1357	(29.8)	2555	(56.1)	643	(14.1)	4555
1972 totals	30.0	38.5		970	(22.8)	2522	(59.4)	757	(17.8)	4249

* excluding calves

Table 2. Nelchina caribou fall sex and age composition counts, 1973.

Area and Date	MM per* 100 FF	Calves per 100 FF	Calves		Cows		Bulls		Total
			N	%	N	%	N	%	
Slide Mountain October 15	33.6	57.0	163	29.9	286	52.5	96	17.6	545
Little Nelchina River-Crooked Creek October 15	27.0	25.8	176	16.9	682	65.5	184	17.7	1042
Syncline Mountain October 16	25.9	41.0	485	24.5	1184	59.9	307	15.5	1976
1973 Total	27.3	38.3	824	23.1	2152	60.4	587	16.5	3563
1972 Total	33.8	29.6	431	18.1	1457	61.2	493	20.7	2381
1971 Total	33.7	30.2	652	18.4	2160	61.0	728	20.6	3540

* excluding calves

Representation of the bull segment, particularly large bulls, during composition counts is known to be variable between seasons and between years. The representativeness of the bull segment in the composition count samples is believed to be most accurate in the October counts due to the mixing of animals in the rut. However, even in October, estimates of bull:cow ratios in the population are less reliable than those of calf:cow ratios. The direction of error is probably to underestimate proportions of bulls. It is unlikely that an overestimation of the bull proportion would occur with large sample sizes. Whether or not the reduction in the bull:cow ratio for 1973 from that observed in 1972 was real is unknown. If the reduction was a result of segregation of bulls, then the October 1973 population estimate would be somewhat low. Harvest report returns for the 1973 season were not available as of this writing, however, preliminary estimates of the kill (400-500) would not effect the observed reduction in the bull:cow ratio, even with a predominance of males in the kill.

Productivity

The Calving Area

The Nelchina caribou have utilized the northern foothills of the Talkeetna Mountains as a calving area at least since calving studies of the herd were first conducted in the mid-1950's (Scott 1955, Skoog 1958). The major calving activity has usually occurred above timberline in the drainages of Tsisik Creek, Kosina Creek, Goose Creek, Black River and the Oshetna River, although occasionally some calving has taken place as far south as the Little Nelchina River and as far west as Fog Lakes (Fig. 1).

During the 1950's and early 1960's, the Oshetna River was central to the calving distribution. In more recent years the central calving area has shifted slightly westward to the Kosina Creek Valley and the mountains adjacent to Fog Lakes. Also, in recent years, a relatively small number of caribou have calved further to the north in the area between Deadman Lake and Butte Lake. Calving in this location has not been previously reported as a normal occurrence.

In years when the population was large, calving groups were spread out over several drainages. During 1972 and 1973 the relatively small population calved primarily in Kosina Creek Valley and the uplands south of and adjacent to Clarence Lake.

The area utilized is generally above 2,600 feet elevation and below 4,600 feet. The terrain is gentle in character with shallow U-shaped valleys, moraines and outwash deposits attesting to past glacial activity. Vegetative cover falls primarily into the shrub birch, the meadow and the heath types described by Hanson (1958) as reviewed by Pegau (1972). The shrub birch type is by far the most extensive vegetation type in the calving area, covering the bottoms and lower slopes of the valleys and the uplands generally below 4,000 feet in elevation. The heath type is found above the shrub birch. Wet sedge meadows occur in areas of poor drainage throughout the calving grounds.

The presence of a rainshadow in the calving area probably results in reduced snow accumulations in comparison to the southwestern and western portions of the Talkeetna Mountains and the southern slopes of the Alaska Range. Reconnaissance flights conducted during late winter-early spring in 1972 and 1973 showed the calving area to have considerably less snowpack retention in relation to areas of comparable elevation to the south, west and north. Snow was largely absent from the lower Kosina Valley bottom when caribou began arriving there on May 20, 1973, and by the end of May most of the calving area was snow-free. Maximum and minimum temperatures recorded at Clarence Lake during the period ranged from +15°C. to -5°C. The average maximum temperature was +13°C. and the average minimum was -3°C (Table 3).

Spring Migration

The caribou have traditionally arrived at the calving grounds in mid-May. Their fidelity to these calving grounds has been remarkable. Only in a few years have heavy snowpacks retarded the spring migration to the extent that some cows were forced to calve enroute, but even in those years the caribou that calved enroute continued their movement to the traditional calving grounds after calving (Skoog 1963, Lentfer 1965, Bos 1973).

Since winter ranges have varied in distance from the calving grounds over the years, dates of commencement and rates of movement for the spring migration have differed between years to effect a relatively constant arrival date. In 1972-73 most of the Nelchina herd wintered in the Eureka area, within 50 miles of the calving grounds. Consequently the 1973 spring migration was more of a leisurely drift north and then west. Only on the last few days prior to arrival did the movement assume the character of deliberateness and urgency. On May 19 long files of caribou were observed on the uplands south of Clarence Lake just prior to arrival at the Kosina Valley. The well-marked trails indicated the major approach to the Kosina Valley was made from the area near Big Bones Ridge and along Goose Creek.

Calving Distribution and Progression

The Kosina Valley was the central calving area for the duration of the calving period in 1973. The adjacent uplands south of Clarence Lake were also utilized but to a lesser extent (Fig. 2). In addition, small pockets of calving caribou were found in the Black Lake vicinity, in the area south of Fog Lakes and in the Deadman-Butte Lakes area to the north (Fig. 1).

At the time of their arrival at the Kosina Valley on May 20, the upper Kosina drainages still retained some snowpack but that was melting rapidly. Upon reaching the Kosina, the caribou generally dispersed over the lower portions of the drainage near the junction of Tsisli and Kosina Creeks. At the commencement of our groundwork on May 23, caribou could be found up-valley to Terrace Creek. Caribou were most commonly observed

Table 3. Maximum and minimum daily temperatures recorded at Clarence Lake,
May 23-30.

<u>Date</u>	<u>Maximum Temperature °C</u>	<u>Minimum Temperature °C</u>
May 23	12	- 2
May 24	12	0
May 25	12	- 1
May 26	15	- 5
May 27	14	- 4
May 28	11	- 4
May 29	13	- 4
May 30	12	- 2
	Ave. 13	Ave. - 3

in portions of the valley that were largely snowfree, but a noticeable shift following the receding "snowline" was evident. By the peak of calving on May 28, calving groups were distributed along the Kosina Valley from Tsisik Creek upstream for about 20 miles. By this time, however, the higher uplands south of Clarence Lake became free of snow and were occupied by calving caribou.

During most of the study period (May 23-30) the primary movements of calving groups were up and down the valley. These movements involved groups of various sizes and were generally at a leisurely pace. For any given day most caribou that were in movement were moving in the same direction. At the end of the study period progressive movements up and out of the valley to the adjacent uplands were observed. These were probably a result of increased availability of snowfree areas.

Calving began soon after arrival of caribou at Kosina Creek on May 20. A few calves were observed May 23; some of these were estimated to be two days old using criteria described by Lent (1966). The progression of calving was found to vary, depending on the location within Kosina Valley. During the first few days of observations, a definite gradient in the stage of calving progression existed up and down the valley, with greater numbers of calves present in the lower portion of the valley. As late as May 28, casual observations obtained during a survey of the calving area with a "Supercub" indicated that several hundred caribou distributed farthest up-valley were just beginning to drop calves, and were considerably behind the calving progression for the herd as a whole. This difference resulted in varying calf percentages obtained by observers located in different parts of the valley. On the first day of ground observations (May 23) all observers were located in the lower reaches of the valley and a relatively large percentage of calves (14.3 :100 females) was tallied. Thereafter observers were positioned to cover different portions of the valley insofar as possible and still make observations on maximum numbers of caribou. The data obtained by various observers from May 23-30 were pooled and are presented in Table 4 and Figs. 3 and 4. Calf:cow ratios increased steadily through the period May 24-30. Data for May 23 are not considered representative for the calving area. As in past studies, once calving began it progressed quite rapidly. The peak of calving occurred on May 28, slightly later than in 1955-1957 when observed peaks occurred on May 24-27, May 26 and May 25, respectively.

Calf Mortality

Data on calf mortality from previous Nelchina calving studies are limited. In 1955, 12 dead calves were located from the air but were not checked on the ground. A golden eagle (*Aquila chrysaetos*) was seen feeding on one of the calves (Scott 1955). In 1957, 16 dead calves were found. The cause of death of 10 was undetermined. Three calves had sustained internal injuries and intraspecific strife was suggested as a possible cause (Skoog 1958). No accidental deaths were found. There was no mention of abandonment.

Table 4. Sex and age proportions of Nelchina caribou classified May 23 - May 30, 1973.

Date	Calves	Percentage	Yearlings	Yearlings		Bulls	Total	Calves per 100 FF*	Yearlings per 100 FF*	Bulls per 100 FF*
				Percentage	MM					
May 23	32	10.3	50			6	312	14.3	22.3	.3
May 24	42	4.1	211			10	1023	5.5	27.8	1.3
May 25	43	5.1	160	21.9		5	842	6.8	25.2	.8
May 26	118	11.1	137	22.6		6	1066	14.7	17.0	.7
May 27	108	15.6	111	24.3		18	691	23.8	24.4	4.0
May 28	142	24.2	83	26.5		5	586	39.9	23.3	1.4
May 29	248	27.9	105	26.7		11	888	47.3	20.0	2.1
May 30	375	29.4	135	32.6		13	1276	49.8	17.9	1.7

* Per 100 FF older than 1 year.

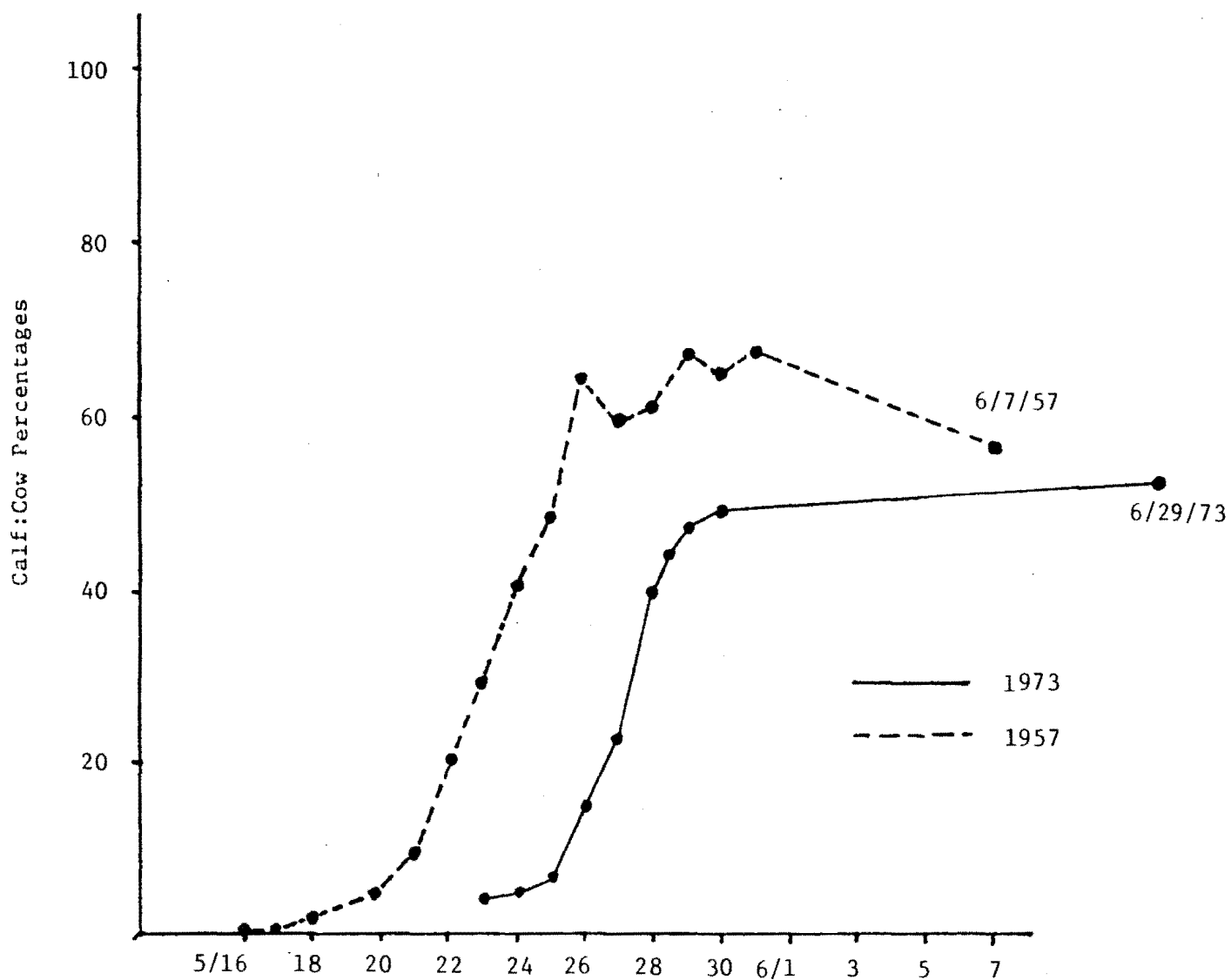


Fig. 3. Curves depicting progression of calving for the years 1957 and 1973. Data for 1957 based on calf:adult percentages from aerial surveys.

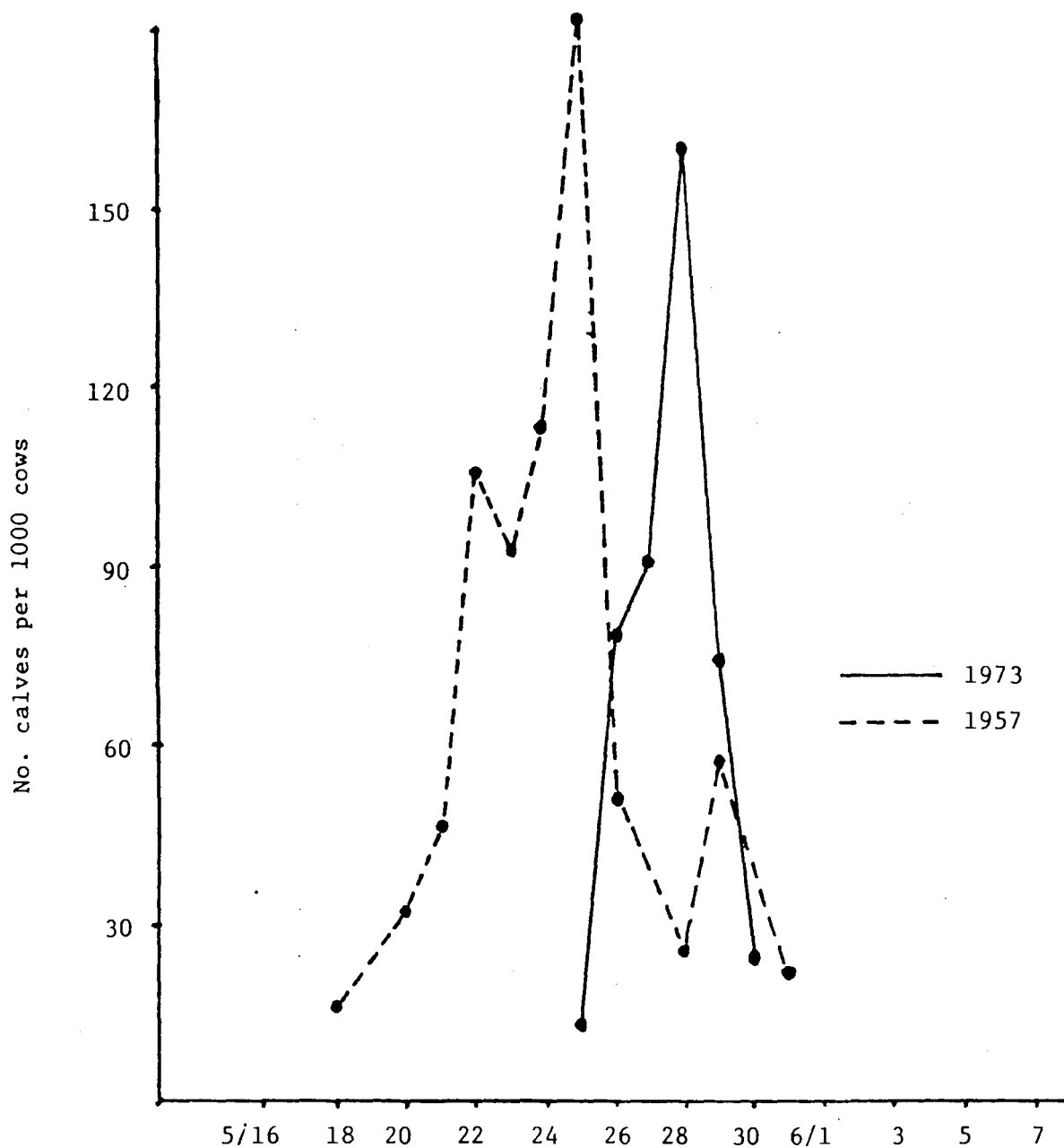


Fig. 4. Daily increment of calves per 1000 cows during the calving period for years 1957 and 1973. Data for 1957 based on calf:adult percentages from aerial surveys.

Observed mortality of calves in 1973 was slight. Various calf mortality factors are discussed below.

Weather

Weather conditions were quite favorable. Temperatures during the study ranged from freezing at night to a comfortable 13°C during the day (Table 3). The sun shown every day and the snow showers that occurred were limited in extent and short in duration. Inclement weather has been mentioned as a possible cause of extensive mortality of newborn calves in Canada (Kelsall 1968). No evidence of calf mortality due to weather was found in the Nelchina study.

The melting snowpack was inconsequential in the calving area. A few observations were made of the difficulty which newborn calves had following their cows across remnant snowbanks, however. Should newborn calves have to traverse large areas of deep, soft snow, the likelihood of calf mortality would become very real.

Accidents

No instances of observed calf mortality were attributed to accidents. Most calving caribou were located in gentle terrain. Streams were at low flow levels and calves were observed to cross streams with little difficulty.

Abandonment

Abandonment of calves by their mothers was considered an indirect cause of calf mortality during the study. Several instances of calf-cow separation due to disturbance by the observers occurred. In the majority of such instances, subsequent observation of the cow from a distance showed that she was unable to locate her calf, even after considerable searching. In most cases the search was abandoned after 1/2 hour and the cow moved away, often joining another group of caribou. The homogeneity of the terrain and the often dense shrub birch growth may have affected the success of searching by such cows. During the first day of study, aerial classifications were attempted but the disturbance to calving groups and consequent separation of cows and newborn calves were too great and aerial classification was discontinued. The experience pointed out the high vulnerability of newborn calves to separation and possible abandonment under conditions of disturbance by low flying aircraft. The probability of similar separation and subsequent abandonment caused by disturbance by large predators is high.

Several cases of cows losing their calves while traveling as members of larger groups were observed where active disturbance was not a factor. In two such situations, the cow was apparently unable to locate her calf and subsequently moved off and joined the rest of the group. Many times during the study large groups of cows and calves were observed to have one or more cows apparently searching for calves.

Two motherless calves were found. In one case, the calf was collected and autopsied. Its right rear leg was found to be badly bruised with internal hemorrhaging. Such an injury may have prevented the calf from keeping up with the mother, or it may have been the result of agonistic behavior by a strange cow after separation. The other lone calf was left alone, as it appeared healthy in all respects.

Intraspecific Strife

All observers recorded instances of rejection of strange calves by cows. Rejection was by agonistic behavior, sometimes violently so. One calf, observed trying to join a small band of caribou, was rejected by a cow with a calf. Subsequent collection and autopsy of the rejected calf revealed a badly bruised rear leg. Another case was observed where a cow with a calf struck down a strange calf with her hooves when it approached too closely. After the calf was down, the cow continued to strike at it until it managed to get up and move away. Many instances were observed where cows advanced on strange calves and the calves scampered away. The incidence of mortality or serious injury attributable to this cause is considered small.

Disease

Particular emphasis was placed on observing cases of retained placentas. Five possible instances of cows with retained placentas were observed. Two of these cows were not accompanied by calves; however, one was a cow with a fresh placenta in a group of caribou put to flight by the helicopter on May 23. The calf in this case was probably abandoned. The other three cows with retained placentas were accompanied by healthy calves. No adult caribou were collected. One limping caribou was observed but the nature of the injury was not determined. No other crippled or debilitated caribou were seen.

Predation

Predation was the single most important cause of mortality to newborn calves observed. Grizzly bears (*Ursus arctos*) and bald (*Haliaeetus leucocephalus*) and golden eagles were the only significant predators observed on the calving grounds. No wolves (*Canis lupus*) or wolf tracks were observed.

The remains of five calves were found during the study. All had been fed upon by various carnivores and scavengers. In one case an eagle was flushed from a freshly dead calf upon which it was feeding. The cause of death was attributed to the eagle. In another case, a grizzly bear was observed with a calf in its mouth. The cause of death of the other calves could not be determined.

Eagles were common on the calving grounds. I observed one eagle stooping on a calf but the protective actions of the cow aborted the attack. From the abundance of eagles on the calving grounds and the observations above, I believe predation by eagles on calves occurs, but its importance is unknown.

A sow grizzly with two yearling cubs and three additional single bears were seen in the calving area during the study. The opportunities for bears to catch newborn calves were numerous through the calving period, and I believe bear predation was an important component of the calf mortality that occurred.

The effect of predation on newborn calves on the Nelchina population in 1973 was probably relatively slight. The overall mortality rate was low while the calf crop was relatively large. However, at current population levels, the predation rate could become important if calf production were to drop or other mortality factors (for example, inclement weather) increase.

Udder Counts

An attempt was made to judge the feasibility of using udder counts as a measure of calf mortality as described by Bergerud (1961). Observers classified all cows over 2 years of age with respect to presence or absence of visible udders and presence or absence of calves. Table 5 summarizes the udder count data. It was soon apparent that increasing numbers of visible udders on pregnant cows during the calving study period did not permit estimations of calf mortality. Udder counts should be conducted after the completion of calving, but before regression of the udder takes place on those cows that have lost their calves. On the Nelchina herd the counts should be made during the first 2 weeks of June. Counts of cows with visible udders were made during postcalving composition counts June 29-30, 1973 (Table 1). These counts were used to estimate calf mortality occurring before July 1, 1973.

Estimate of Calf Mortality

Calving was not completed by May 30. The calf:cow ratio of 49.8 calves:100 cows 2-years-old or older obtained on May 30 cannot then be used to estimate neonate mortality. However, composition counts conducted on June 29 and 30 as part of the census operation do provide a means of estimating calf mortality in the first month of life. These counts yielded an overall ratio of 53.1 calves:100 cows. If parturition rates were known calf mortality could be calculated. Skoog (1968) estimated an overall parturition rate of 60.4 percent based on the proportions of pregnant females in a sample of 436, weighted by estimated age ratios of females in the population. This value of 60 percent has been used in the past on Nelchina caribou as an approximate base natality rate to estimate calf mortality from calf:cow ratios obtained in the fall and spring (Skoog 1964 and 1968, Bos 1973). Using the value of 53.1 calves:100 cows an estimate of 11.5 percent May-June calf mortality was obtained for 1973.

Of the 4,555 caribou classified during June 29-30, 3,601 were in groups classified by an observer on the ground where presence or absence of a visible udder on cows was recorded (Table 6). If the difference in the number of cows with visible udders and the number of calves is used

Table 5. Proportions of Nelchina caribou cows observed with visible udders,
May 25 - 30, 1973.

<u>Date</u>	<u>Calves</u>	<u>Cows</u>			
		<u>W/Udder</u>	<u>Percentage</u>	<u>W/O Udder</u>	<u>Percentage</u>
May 25	43	571	90.1	63	9.9
May 26	118	670	83.2	135	16.8
May 27	108	390	85.9	64	14.1
May 28	142	301	84.6	55	15.4
May 29	248	424	80.9	100	19.1
May 30	375	676	89.8	77	10.2

Table 6. Comparison of ground counts between observers during 1973

Nelchina caribou postcalving sex and age composition counts.

<u>Area and Date</u>		<u>Cows</u> <u>No Udder</u>		<u>Cows</u> <u>With Udder</u>		<u>Calves</u>		<u>Bulls</u>		<u>Total</u>
<u>Black Lake</u>										
June 29										
	Bos	66		67		62		34		229
	McIlroy	49		52		49		19		169
<u>Deadman Lake- Butte Lake</u>										
June 29										
	Bos	6		14		11		7		38
	McIlroy	4		15		14		8		41
<u>Watana Mountain- Kosina Creek</u>										
June 30										
	Bos	781		1182		1044		327		3334
	McIlroy	434		755		661		228		2078
<hr/>										
TOTALS	Bos	853	23.7%	1263	35.1%	1117	31.0%	368	10.2%	3601
	McIlroy	487	21.3%	822	35.9%	724	31.6%	255	11.1%	2288

as an estimator of calf mortality, the 146 calves apparently lost represents 11.6 percent mortality of calves, a value close to that estimated above using Skoog's calculated parturition rate. Loss of calves prior to July 1, 1973 was considered approximately 12 percent.

Sampling Problems

There were difficulties encountered by the observers in classifying caribou according to various categories called for by the objectives. These problems were as follow:

Representative Samples

Caribou were somewhat segregated with regard to advancement in calving progression within Kosina Valley. Those animals furthest up-valley were generally in an earlier stage of calving progression than animals lower in the valley. Thus calf percentages varied depending on the location of the observers. Counts made on the first day of the study (May 23) resulted in a higher calf percentage than those obtained the following two days because all observers were at the lower portion of the valley on May 23, whereas observers were more widely spaced up the valley on subsequent days.

In addition to the segregation mentioned above, movements of caribou up and down the valley may have resulted in duplication of counts of some observers for succeeding days.

Classifications of caribou were made within the area of highest concentration where the majority of the herd was calving. Peripheral groups were not sampled but could be expected to contain relatively fewer parturient cows. Also, the calving study of 1957 (Skoog 1958) suggested animals in peripheral calving areas had a slightly delayed calving peak in comparison to animals in major calving concentration areas.

Observer Abilities

Observers participating in the study varied in the amount of experience each had in classifying caribou as to sex and age categories and presence or absence of udders. An informal attempt was made to standardize criteria among observers. After a day or two in the field, each observer expressed a general confidence in the accuracy of his data. Nevertheless, I suspect that variation in observer abilities with respect to some of the various criteria was substantial. Movements and segregation of calving caribou negated analysis of variation between observers. For the purposes of this report, the data were pooled and considered representative.

Problems with Criteria

An attempt was made to determine the sex and age of all caribou observed. With the aid of 15-60 X variable power spotting scopes, some

animals could be classified at considerable distances. Sex was determined by the presence or absence of a vulva. Animals were aged as either calves, yearlings or adults, based on body size and conformation and antler characteristics.

Determination of sex of adults was usually easy. All pregnant and parturient cows showed a prominent vulva. Nonparturient cows had a vulva which was readily identifiable, although not as evident as those of parturient cows.

Yearlings were difficult to age and sex. While some yearlings were easily separable from adults on the basis of size and body conformation, others approached 2-year-olds in size and were difficult to distinguish. The presence of spike antlers was not, in all cases, felt adequate to distinguish yearlings from older animals since some adult cows had similar antlers and some yearlings (as well as many adults) were antlerless. Sex identification of yearlings was also quite difficult. Yearlings characteristically had large fluffy tails which often obscured the perineum and made verification of the presence or absence of a vulva difficult. Also when it was visible, the vulva was not readily discerned, often appearing as only a thin, light gray line below the anus. Most observers doubted the accuracy of their yearling sex classifications.

Calves were, of course, easily identified when they could be seen. No attempt was made to sex calves. Dense shrub birch growth throughout the calving area often made it difficult to see calves. Some of the caribou classified were resting or feeding, and many of the young calves in such groups were lying down and were not visible to observers from a distance. Since sex identification of adults required a rear-end view, most caribou classified were in movement away from the observer, and under such conditions, most calves in such groups were tallied. However some calves were undoubtedly missed, especially in counts involving stationary groups.

Another problem in classifying caribou occurred in counts of large maternity bands. Because of the limited field of view of the spotting scope and the time sometimes spent waiting for individual caribou to face about for identification, it was difficult to keep track of moving animals already counted, but outside the field of view. Some duplication of animals may have resulted. In addition, since counts of large groups were often made as they were moving away, providing limited time for classification, sometimes at relatively long distances (200-500 yds.), a bias existed in favor of cows with calves or animals easily identified (adult cows). Yearlings or young males which could not be rapidly classified were sometimes passed over.

Classification of cows on the basis of the presence or absence of a visible udder also was a problem. Initially, only the presence or absence of a distended udder was to be noted. The range of sizes and shapes of udders under observation soon necessitated abandonment of the distended criterion in favor of simple presence or absence of a visible

udder. Cows with and without calves were found to have udders of all sizes. As mentioned previously, pregnant cows with developing udders negated an attempt to quantify calf mortality by use of udder counts prior to May 31.

Sex and Age Structure

Composition count data for spring 1973 and 1974 and for summer and fall 1973, plus comparable data for the two previous years, where available, are presented in Tables 7, 1 and 2, respectively.

Spring calf survival counts were conducted on March 20-21, 1973 and on March 27-28, 1974 in the Horn Mountains-Little Nelchina River area of Game Management Unit 13. Sex and age classes were not randomly mixed throughout the count area. For example, in March 1973 four separate subsamples had the following proportions:

81 bulls:	43 calves:	100 cows	N = 343
17 bulls:	23 calves:	100 cows	N = 902
8 bulls:	27 calves:	100 cows	N = 425
3 bulls:	13 calves:	100 cows	N = 333

For all subsamples in the 1973 counts the differences were significant ($P < .001$).

As many caribou as possible were counted throughout the occupied Little Nelchina River winter range area in 1973 and 1974. The 25.1 calves:100 cows ratio obtained in 1973 was a considerable improvement over the 15.5 calves:100 cows observed in 1972. In 1974 the ratio further improved to 41.6 calves:100 cows (Table 8).

Postcalving composition counts in 1973 were conducted in the same general areas as in 1972. The proportion of bulls was lower in 1973 (14%) than in 1972 (18%). This may have resulted from a possible greater dispersion of bulls in 1973 following the mild winter and early breakup. The calf:cow ratio was high in 1973 (53.1:100) representing a large calf crop with good early survival of calves.

The postcalving classifications that were conducted on the ground were made independently by two observers to provide a measure of variability in results attributable to observers. The results (Table 6) indicated no significant difference between the classifications of the two observers involved ($P > .1$).

Both the 1972 and 1973 fall sex and age composition counts were carried out in the Horn Mountains-Little Nelchina River area. Reconnaissance flights prior to classification traced the major movement of the Nelchina herd from the vicinity of Clarence and Butte Lakes to the Little Nelchina River in early October. Although the count area included the majority of the herd, some bands were still straggling into the area from the north at the time of the counts. Within the count area the largest concentrations of caribou were located on Syncline Mountain. A total of 3,563 caribou were classified. Sex and age proportions differed from 1972 counts with fewer bulls and more calves present in 1973 (Table 2).

Table 7. Nelchina caribou reported harvest characteristics 1971 - 1972.

Year	Hunters Reporting	Successful (%) Hunters	Successful hunter residency		Method of Transportation* for successful hunters (expressed as % of total)							% MM in Kill (N)
			Res. (%)	Nonres. (%)	A	H	B	M	S	O	F	
1972	1586	546 (34.4)	301 (55.9)	237 (44.1)	44.2	3.0	5.2	1.9	.9	31.1	13.7	71.7 (541)
1971	6967	3931 (56.5)	3246 (84.7)	588 (15.3)	15.0	.4	2.0	.6	37.0	9.5	35.5	46.6 (6743)

* A - Aircraft
H - Horse
B - Boat
M - Motorbike
S - Snowmachine
O - Off-road vehicle
F - Highway vehicle ("afoot")

Table 8. Nelchina caribou spring calf survival composition counts, 1973 and 1974.

Area and Date	MM per* 100 FF	Calves per 100 FF	calves		cows*		Bulls*		Total
			N	%	N	%	N	%	
Horn Mountains- Little Nelchina River March 27-28, 1974	17.5	41.6	616	26.2	1479	62.8	259	11.0	2354
Horn Mountains- Little Nelchina River March 20-21, 1973	25.9	25.1	575	16.6	2289	66.2	592	17.1	3456
1972 Total	22.0	15.5	199	11.3	1280	72.7	282	16.0	1761
1971 Total	32.9	33.6	696	20.2	2069	60.0	681	19.8	3446

* excluding calves

During fall and spring composition counts calves were also sexed. The percentage of calves that were males and the number of calves sexed for the three counts conducted were: March 1973-50.3% (497), October 1973-46.6% (824), March 1974-46.3% (616).

Mortality

Natural Mortality of Adults

Excepting calving ground studies, instances of natural mortality were observed only during composition counts conducted in March 1973 and 1974. During March 1973, 4 caribou carcasses were found but causes of death were not determined. In March 1974, 5 dead caribou were found and examined. One of these, a calf, was definitely killed by wolves. Two adult caribou were probably wolf-killed. The causes of death of the remaining two caribou were not determined.

There was no reported or observed incidence of diseases or parasites. Hunter-killed caribou specimen collections did not yield any usable blood specimens. Possible cases of retained placentas were reported under Productivity, in this report.

Calf Mortality

Mortality of calves during 1972 and 1973 is presented in Table 9. Calf mortality in 1972 was relatively heavy (58%), with most of the losses occurring prior to July 1. During 1973 losses of calves were relatively light throughout the year. Errors in classification of calves during October 1973 or March 1974 resulted in a reduced mortality value between October 1973 and March 1974. The error most likely was that of omission of calves in large groups of caribou in October 1973. I consider the calf:cow ratio obtained in March 1974 more accurate, indicating mortality of 1973 calves at approximately 31 percent by April 1, 1974.

Harvest

The 1972 Nelchina caribou season was the first since 1963 that did not extend to March 31 or allow at least a three-caribou bag limit. The restriction to an August 10 - Sept. 20 season and a one-caribou bag limit resulted from substantiation of a reduced caribou population by the 1972 census.

The 1972 IBM reported harvest was 555 caribou. No extrapolation to estimate kill by nonrespondents was made because IBM programs were inadequate for extrapolation purposes. For the most part, caribou were available only to fly-in hunters or those using all-terrain vehicles. Seventy-five percent of successful hunters who reported on method of transportation utilized aircraft or off-road vehicles. As expected, restrictions in season and bag limit and reduced caribou availability

Table 9. Estimated Nelchina caribou calf mortality

June 1, 1972 - April 1, 1973 and June 1, 1973 - April 1, 1974.

Date	calf:cow ratio	% loss from previous ratio	% loss from June 1 base
June 1, 1972	60:100*	--	--
July 1-4, 1972	38.5:100	35.8	35.8
October 7-8, 1972	29.6:100	23.1	50.7
March 20-21, 1973	25.1:100	15.2	58.2
June 1, 1973	60:100*	--	--
June 29-30, 1973	53.1:100	11.5	11.5
October 15-16, 1973	38.3:100	27.9	36.2
March 27-28, 1974	41.6:100	--	30.7

* Assumed, data from Skoog (1968)

sharply lowered the number of hunters in the field. Only 1,586 hunters reported hunting caribou in the Nelchina caribou range, down from 6,967 in 1971. The percentage of nonresidents among successful hunters climbed to 44 percent in 1972 from 15 percent in 1971 as a consequence of their greater use of transportation services.

The age distribution by sex for a sample of the kill was reported last year (Bos 1973). Characteristics of the 1972 harvest are presented in Table 7; data for 1971 are included for comparison.

The selectivity of hunters for large-antlered animals was evident in 1972 when male caribou were antlered through the short early season. Of 541 caribou of reported sex, 72 percent were males. This value contrasts with 47 percent males reported in 1971 when an extended season made caribou available to hunters after males had shed their antlers but females still retained theirs.

IBM harvest statistics for 1973 were not available at time of writing. Preliminary estimates place the kill at 400-500 caribou. Caribou distribution, availability and hunting pressure were similar in 1973 to the pattern in 1972.

Annual Increment

It is desirable to know the annual increment which provides a basis for establishing an allowable harvest. Determining losses to hunting during the year is necessary for computing net increment from yearling recruitment values. Unfortunately, data from harvest reports are not presently available until after regulations affecting the subsequent hunting season are adopted.

The computation of the annual increment is not difficult, but it depends on a number of tenuous assumptions and crude estimates which, at best, provide a rough guide for harvest decisions.

For 1973, a positive increment of 194 yearlings was calculated as follows: In July 1972 there were an estimated minimum of 4,954 cows in the population. During the Aug.-Sept. hunting season 555 caribou were reported harvested. Assuming 7 percent of the kill were calves (Bos, in press) and applying the reported sex ratio of the kill to the adult fraction, yielded $555 \times .93 \times .28 = 145$ cows lost to harvest. Sex and age ratios obtained during October composition counts after the hunting season thus yield an adjusted October 1972 population estimate of

4,954	- 145	= 4,809 cows
4,809	$\times 29.6$	= 1,423 calves
4,809	$\times 33.8$	= <u>1,625</u> bulls
		7,857 caribou

Natural mortality of adult Nelchina caribou has been estimated at about 6 percent annually (Skoog 1968). Of the 7,857 caribou in October, 6,434 were older than calves and subject to the assumed 6 percent mortality rate. Thus natural mortality equalled $6,434 \times .06 = 386$, and total losses to adults equalled $386 + 555 = 941$.

Of the natural losses, $4,809 \times .06 = 288$ were cows (assuming proportional mortality), leaving 4,521 cows as a base for applying calf:cow ratios obtained in March, 1973. The 1973 spring composition counts yielded a ratio of 25.1 calves:100 cows. Thus yearling recruitment in 1973 was approximately 1,135 yearlings.

The annual increment for 1973 is then equal to $1,135 - 941 = 194$ caribou, more-or-less. Consideration of the variables involved might include the following, with the relative adjustment for each adding to or subtracting from the calculated increments: 1) Increasing the assumed natural mortality rate to 9 percent or more (in this case) results in a negative increment, 2) Reported harvest is known to be less than the actual kill by hunters, 3) Reported sex ratio in the kill is suspect, 4) Natural mortality takes place throughout the year, not just from October to March and it is probably not sex-proportional and 5) The cow base established during July is considered a minimal figure.

Despite the qualifications, I believe the estimated increment value is useful, provided its input occurs prior to harvest recommendations.

Although harvest data are not yet available for 1973, the size of the kill and characteristics of the harvest are believed to be very similar to 1972 values. Using 1972 harvest figures and 1973 census and composition data a preliminary estimate of net increment for 1974 was computed at 945 yearlings.

Movements and Distribution

Movements and distribution of Nelchina caribou were followed with less frequency in 1973 than in 1972. Emphasis of survey flights centered more on migration periods and on reconnaissance for composition counts. The general patterns of distribution and movements in 1973 and early 1974 are shown in Figs. 5 and 6.

Nelchina caribou wintered primarily in the vicinity of the Little Nelchina River during the winter of 1972-73. Additional small groups were scattered across the Lake Louise flats and some animals were found in the Oshetna River drainage and near Butte Lake. By April caribou were well dispersed on the flats west of Lake Louise.

Movement toward the calving grounds began in early May, with most of the cow segment of the herd occupying calving areas by May 20. The major calving area centered around Kosina Creek. In addition the hills above Fog Creek were used by several hundred calving caribou, and the Deadman Mountain area was utilized for calving by the caribou which wintered near Butte Lake.

Postcalving concentrations of caribou occurred in late June in Fog Creek Valley, Watana Mountain, Kosina Creek, Black Lake and Deadman Creek. In July the caribou dispersed to upland summer ranges in the Talkeetna Mountains and the Chulitna and Chuniilna Hills.

Fig. 5

1973 NELCHINA CARIBOU
DISTRIBUTION AND MOVEMENTS

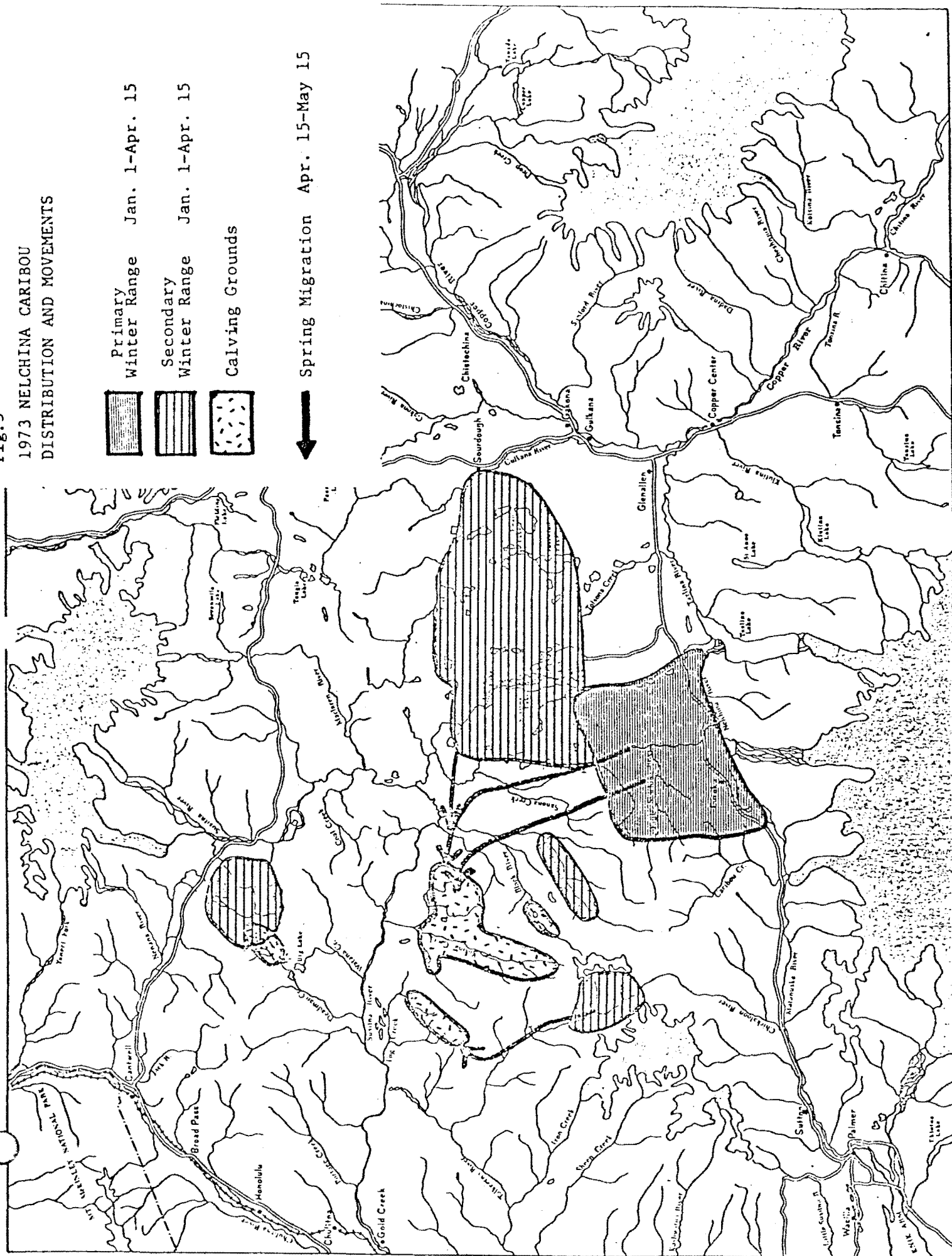
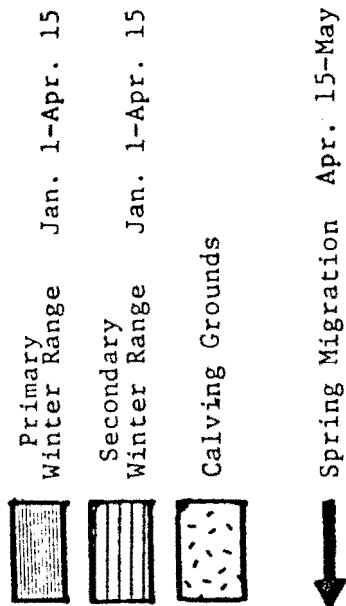
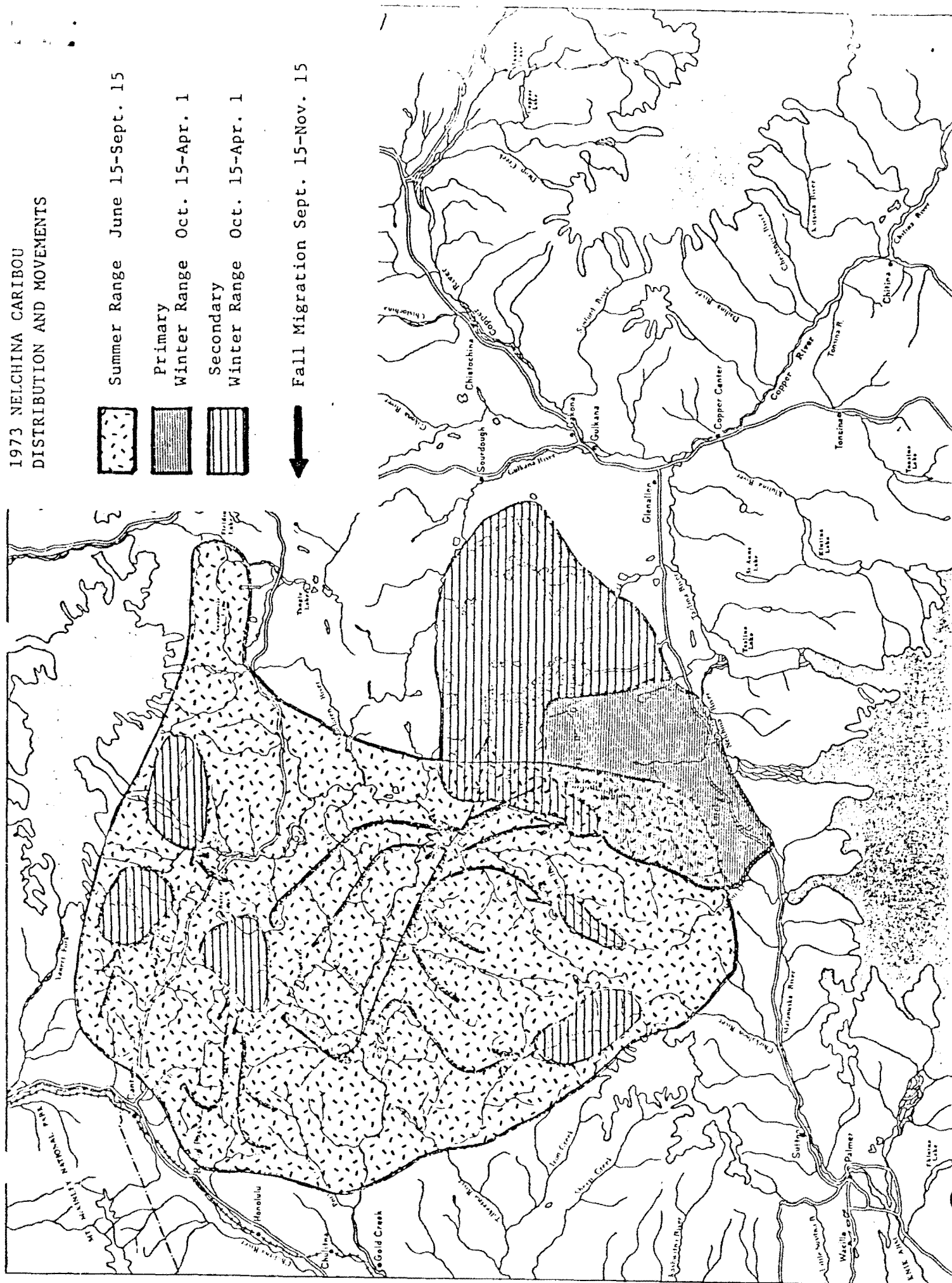


Fig. 6

1973 NELCHINA CARIBOU
DISTRIBUTION AND MOVEMENTS

Fall aggregations of caribou were observed in early September in the country south of Butte Lake. By early October a definite movement south and east across the Susitna River took place involving the major part of the herd. From the Clarence Lake - Goose Mountain area the caribou moved rapidly east to the Oshetna River and Tyone Creek and then south to the Little Nelchina River. Some animals scattered over the Lake Louise Flats. Other caribou that did not take part in the southward movement remained widely dispersed from Big Lake north to the East Fork of the Susitna River and east to the McLaren River. One group of about 400 caribou moved south along the Talkeetna River to its headwaters. A small group has wintered in the headwaters of the Talkeetna River for several years.

No major movements of Nelchina caribou were observed after October 1973. The distribution established, following the October movements, remained relatively static through the winter although wide dispersal within the various wintering areas was observed by January 1974. Some of the caribou in the Little Nelchina River area drifted to the west, reaching Sheep Creek (drains into Caribou Creek) in January. Previously, in recent years, caribou had not extended west of Alfred Creek during the winter. A relatively light snow cover was probably responsible in part for the scattered distribution observed.

RECOMMENDATIONS

Herd status evaluation surveys should be continued on an annual basis. Minimally, spring calf survival counts must be conducted. Fall sex and age composition counts should be conducted if information on adult sex ratios and summer calf survival is desired. In addition, "Supercub" surveys of postcalving aggregations of caribou can yield estimates of population size of sufficient accuracy to indicate the general population trend.

The caribou IBM harvest report program should be designed to give as accurate a determination of the caribou kill characteristics as possible. Data must be amenable for use in the kill extrapolation formula.

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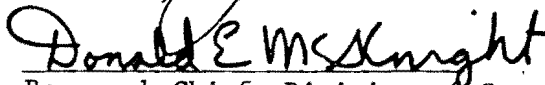
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