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Interrelationships of Dall Sheep and Predators in the Central Alaska Range

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RESEARCH PERFORMANCE REPORT

STATE: Alaska **STUDY:** 6.13

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TITLE: Interrelationships of Dall Sheep and Predators in the Central Alaska Range

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PERIOD: 1 July 1999–30 June 2000

SUMMARY

Dall sheep (*Ovis dalli*) populations in much of the Alaska Range declined during the early 1990s, mainly because of poor lamb production during 1990–1993. Scotton (1997) reported that coyotes (*Canis latrans*) are a major predator of Dall sheep lambs in the central Alaska Range (CAR), yet little is known about coyote ecology in Alaska. Furthermore, recent studies in Canada indicated that coyote predation on Dall sheep may be influenced by fluctuations in populations of snowshoe hares (*Lepus americanus*), which are the main prey of coyotes at northern latitudes (Todd et al. 1981; O'Donoghue et al. 1997). Currently, the snowshoe hare population in the CAR is high, and a decline is expected during the next few years. This study was designed to give managers a better understanding of the importance of coyote predation to sheep populations and ways that predation may be affected by changes in populations of alternate prey. In particular, I assess reproduction and cause-specific mortality rates of Dall sheep lambs and ewes. I examine populations and movements of coyotes in the study area and changes in these parameters that may occur in response to changing hare populations. During FY00 (FY00 = fiscal year 1 Jul 1999–30 Jun 2000), we captured and radiocollared 7 coyotes, 24 Dall sheep ewes, and 23 lambs. We used aerial radiotracking to assess movements and survival of radiocollared animals. Remains of animals that died were examined to determine the cause of death. Wolves (*Canis lupus*) killed 1 coyote during February. One ewe died from wolf predation during March. Survival of lambs was high from August to December 1999 (1 of 11 monitored died), but declined following heavy snowfall in mid-January 2000 (6 killed by coyotes, wolves, or wolverines [*Gulo gulo*] in late Jan–Feb). Nine of 23 radiocollared lambs died during May and June 2000. In contrast to 1999, when more lambs were killed by golden eagles (*Aquila chrysaetos*), the most common cause of mortality during 2000 was coyote predation (4 lambs). Other causes of death included wolf and eagle predation (1 lamb each), 1 lamb killed by either coyotes or wolves, 1 lamb that evidently starved to death due to

abandonment or inability to nurse, and 1 that either shed its collar or died of unknown causes. The study is planned to continue through 30 June 2001.

Key words: *Canis latrans*, coyote, Dall sheep, mortality, *Ovis dalli*, population ecology, predator-prey relationships, reproduction, survival.

CONTENTS

BACKGROUND

Dall sheep (*Ovis dalli*) are widespread throughout most mountain ranges in Alaska. Sheep populations have been surveyed at irregular intervals in many parts of the state for several decades, although precise estimates of population size are not available for most areas. However, surveys during the 1990s indicated that sheep populations in much of the Alaska Range and Brooks Range were below levels that occurred during the 1970s and 1980s (Whitten 1997).

Spring or summer surveys to assess lamb production and survival were conducted annually from 1993–1997 in the central Alaska Range (CAR). Lamb survival and recruitment in this area were very low during the recent sheep decline, but causes of lamb mortality are largely unknown. A recent study indicated that coyote (*Canis latrans*) predation was an important source of mortality for lambs (Scotton 1997). Previous authors (e.g., Murie 1944; Heimer and Stephenson 1982) indicated that wolf (*Canis lupus*) predation on adult sheep might be important to some sheep populations. A control program reduced wolf numbers in the CAR during 1993 and 1994. Greatly varying opinions have been published regarding the effects of predator control on sheep populations. Heimer and Stephenson (1982) suggested sheep populations responded positively to predator reductions in the late 1970s, while Gasaway et al. (1983) concluded that sheep did not respond to predator reduction.

Little is known about the occurrence or behavior of coyotes in Alaska. Studies elsewhere have indicated that coyotes avoid wolves, and in some cases the presence of wolves may restrict coyote movements and populations (Thurber et al. 1992). Populations of coyotes at northern latitudes fluctuate in response to changes in populations of hares (*Lepus americanus*) (Todd et al. 1981; O'Donoghue et al. 1997) and coyotes may increase their use of larger prey when hares are scarce (Todd et al. 1981). O'Donoghue et al. (1997) suggested that coyote predation on Dall sheep might increase during the low phase of the hare cycle, but no data are available to test this hypothesis.

OBJECTIVES

Job 1: Estimate annual pregnancy and birthrates for adult ewes.

Job 2: Estimate lamb survival to yearling age class and determine causes of mortality.

Job 3: Estimate annual survival and determine causes of mortality of adult ewes.

Job 4: Monitor movements of coyotes in relation to sheep distribution to determine proportion of coyotes that forage in sheep habitat.

Job 5: Assess spatial and temporal variability in coyote predation on lambs.

Job 6: Assess trends in sheep population and reproductive success over time.

Job 7: Analyze and publish results.

STUDY AREA

The CAR study area encompasses approximately 500 km^2 and is bounded by the West Fork Little Delta River, Wood River, Virginia Creek, and the northern foothills of the Alaska Range. Elevations range from 700–2500 m. The terrain consists of rugged mountains, divided by narrow valleys and streams. Vegetation includes spruce (*Picea glauca* and *P. mariana*) and birch (*Betula papyrifera*) trees at lower elevations, dwarf birch (*B. nana*) and willow (*Salix* spp.) shrubs at middle elevations, and grasses, sedges, and forbs at higher elevations. Nonvegetated areas, including rock slopes, cliffs, ridges, and gravel bars, are common throughout the area. Human activity in the area includes sport hunting for caribou (*Rangifer tarandus)*, moose (*Alces alces)*, and Dall sheep during late summer and fall; several private hunting camps and airstrips are present. The area is roadless, and access is by air, horseback, snowmachine, or ATV. During recent years mineral exploration has increased, with access primarily by helicopter.

METHODS

Job 1: Approximately 20 adult ewes will be captured each year during late March or early April, using a net-gun fired from a low-flying helicopter. Ewes will be weighed and a blood sample obtained for pregnancy determination by analysis of serum progesterone levels (Ramsey and Sadleir 1979; Goodrowe et al. 1996). All ewes captured during 1999 will be radiocollared. During 2000, additional radio collars will be deployed to maintain at least 20 radiocollared ewes in the study population. During May, radiocollared ewes will be located daily (weather permitting) to determine the proportion that give birth.

Job 2: Lambs of radiocollared ewes and other ewes will be captured by hand and radiocollared using techniques described by Scotton (1997). We plan to capture 20–30 lambs each year. Survival will be determined by daily radiotracking flights during May, weekly flights during June, and biweekly flights during the remainder of the

year (Scotton 1997). We will determine causes of mortality by examining remains of dead lambs.

Job 3: Radiocollared ewes will be located by aerial radiotracking at 2-week intervals throughout the year. Carcasses of ewes that die will be examined to determine probable causes of death.

Job 4: We will attempt to capture and radiocollar 10 coyotes each year; from helicopters, we will use darting to capture coyotes. Radiocollared coyotes will be located during the tracking flights used to assess survival of collared sheep. Additional radiotracking will be in conjunction with other ongoing studies in the area. Movements of radiocollared coyotes will be analyzed to determine the proportion of coyotes that forage in sheep habitat. If sufficient data on wolf movements in the area are available, home ranges of coyotes and wolves will be compared to determine interspecies relationships. Movements of coyotes during spring will be monitored to locate dens and determine reproductive success.

Job 5: Losses of lambs to coyote predation will be compared across the study area and among years to determine if loss rates vary spatially or temporally. Losses will also be compared to distributions of coyote family groups to determine if coyote predation on sheep varies among individuals.

Job 6: Sheep populations in the study area will be assessed each June using aerial surveys. All potential sheep habitat will be searched by helicopter (Scotton 1997; Whitten 1997), and observers will record the number, age, and sex of all sheep observed.

Job 7: Progress reports will be prepared annually and a final report will be prepared when the work is completed. Final results will be submitted for publication in 1 or more scientific journals.

RESULTS

Job 1: Sixteen ewes radiocollared during March 1999 were monitored during FY00. Three of these were killed by predators, probably all by wolves. Deaths occurred during August, September, and February (1 each). Ten additional ewes were captured and radiocollared during 3–6 March 2000. In addition, the 13 remaining ewes radiocollared during 1999 were recaptured during 2000. Blood samples were obtained and sent to the University of Alaska Fairbanks for progesterone analysis. Results of those tests are pending. One newly radiocollared ewe was killed by wolves during March. Thus, 22 collared ewes were alive at the start of lambing season. Of these, 15 (68%) produced lambs (some lambs might not have been observed because they died soon after birth). The first lamb was seen on 13 May. Radiotracking flights were conducted at intervals of 1–3 days during the remainder of May. We assumed lambs were born on the first day we observed them. Thirteen ewes produced lambs during May, 2 produced lambs between 1 and 7 June, and 7 ewes were never seen with lambs. Median and mean birth dates were 21 and 23 May, respectively.

Job 2: During FY00 (FY = fiscal year 1 Jul 1999–30 Jun 2000), we monitored 13 lambs that were radiocollared during May 1999. Three of these died during July, 1 died in October, and 5 died late January and February. Eight deaths were due to predators and 1 (during October) could not be determined because the collar was in steep terrain and could not be recovered. Eagles killed at least 2 and possibly 3 lambs during July (1 lamb was eaten by both eagle and wolverine [*Gulo gulo*]). Golden eagles (*Aquila chrysaetos*) are the only large raptors common in the area, so we assume golden eagles caused all deaths by raptors. Coyotes killed at least 2 and possibly 5 lambs during late January and February (1 lamb eaten by both coyote and wolverine, 1 killed by either coyotes or wolves, and 1 killed by an unknown predator). Of 24 lambs radiocollared during May 1999, 4 (17%) survived their first year. A more detailed analysis of survival data will be performed using the method of Pollock et al. (1989). During 16–28 May we captured and radiocollared 23 newborn lambs. Four lambs were from radiocollared ewes and 19 were from uncollared ewes. In contrast to 1999, when eagles killed more lambs than other predators, only 1 lamb mortality was caused by an eagle during May–June 2000. Coyotes killed 4 lambs, 1 was killed by wolves, 1 was killed by either coyotes or wolves, 1 lamb evidently starved to death due to abandonment or inability to nurse, and cause of death for 1 lamb could not be determined (only the collar was found).

Job 3: Wolves killed 1 ewe during March, approximately 2 weeks after she was captured. No additional deaths had occurred as of 30 June. Survival of the remaining ewes will be monitored during FY01.

Job 4: Five coyotes radiocollared during 1999 were monitored during FY00. These coyotes comprised 3 male-female pairs (including one male that was not collared). In addition, one coyote that had dispersed from the study area during spring 1999 was located near Mentasta Pass, about 240 km southeast of the study area. A hunter or trapper evidently had killed this coyote midwinter. Only 1 pair produced pups during 1999. One female from another pair was judged to be 10 months old in February 1999; thus, she may not have been fully mature during the mating season. The other female was aged >3 years, and it is not known why she did not produce a litter. The male from this pair died during January 2000, evidently killed by wolves. Seven additional coyotes (5 males, 2 females) were captured and radiocollared during February and March 2000. One male was estimated to be 10 months old; all other coyotes were adults (>2.5 years old). The young male remained in the study area until 25 April, when he was located about 35 km north of his capture area. The last location of this animal, on 10 June, was in the Yukon Flats, about 240 km north of the study area. Including 4 coyotes that were radiocollared during 1998 or 1999, the 10 adult radiocollared coyotes formed 5 male-female pairs. One of the newly collared males paired with the female whose mate had died during January. In addition, one of the new captures was paired with a collared female whose mate was not collared during 1999. Four of these pairs evidently produced pups during 2000. The only exception was the pair that had produced pups during 1999. This pair showed no indication of establishing a den, although at least 1 additional coyote, probably a pup from 1999, was seen accompanying this pair during May–June 2000.

Preliminary analyses of home ranges and habitat use by coyotes were completed and presented as a poster at the 10th Northern Furbearer Conference in Fairbanks on 17–18 April 2000. These analyses indicated that home ranges of 3 coyote pairs were 28.7–45.1 km^2, and that,

during April–December, coyotes used lower elevations and vegetation types associated with low elevations more frequently than would be expected if use were random. This suggests that during spring and summer, coyotes spent proportionally more time in habitats used by hares than areas used by sheep. However, increased predation on sheep during midwinter indicated that habitat use by coyotes may vary among seasons. This possibility will be investigated more thoroughly as more data are collected.

University of British Columbia graduate student Laura Prugh completed 1 summer and 1 winter field season as part of her work to assess coyote foraging ecology in relation to small mammal abundance. Populations of hares and small rodents were assessed using mark-recapture and counts of pellets and tracks. Coyote scats were collected along standard survey routes. We hope to secure additional funding to estimate coyote population size using genetic markers obtained from scats. In addition, Ms Prugh assisted with radiotracking coyotes and investigating sheep mortalities.

Job 5: Locations of lamb deaths due to coyote predation were recorded. Coyotes were located by aerial radiotracking, and home ranges will be compared to distributions of lamb mortalities.

Job 6: On 24–25 June, a sheep survey was conducted using an R-22 helicopter with both pilot and observer recording and classifying sheep. We surveyed a total of 253 mi^2 (Fig 1) during a period of 7.6 hours, for a survey intensity of 1.8 min/mi^2. This was slightly less than last year's effort of 2.25 min/mi^2. Results of the survey are shown in Tables 1 and 2. We saw a total of 615 sheep, with overall ratios of 30 lambs and 66 rams per 100 ewes (counts of ewes excluded yearlings but probably included some young rams). The June 1999 survey found a total of 777 sheep in units surveyed during both years, with ratios of 52 lambs and 69 rams per 100 ewes. Although the number of ewes seen in areas surveyed annually during 1994–1999 (sections 1–3) increased from 267 during 1999 to 279 during 2000, this year's counts of lambs, yearlings, and rams all declined (Table 2). Concurrent radiotracking flights indicated that 21 radiocollared ewes were present within surveyed units during the survey. We sighted 13 (62%) of the collared ewes. Locations of collared sheep indicated that at least 4 of the sheep that were not seen were with groups that were counted. The remaining sheep were in steep, rocky terrain and probably were hidden from view. Thus, it seems likely that most or all large groups were sighted and, although we failed to see some individual sheep, we actually counted >62% of the sheep population.

DISCUSSION

Winter 1999–2000 was relatively mild until mid-January, when a heavy snowfall occurred, followed by high winds that caused significant snow drifts. The dramatic increase in predator-caused mortality during midwinter seemed to be related to the presence of deep snowdrifts that inhibited movements of sheep. Although predation losses were high, this may be the result of a relatively small sample of radiocollared lambs. Ratios of lambs and yearlings in the population during the June surveys also indicated that mortality of young sheep was high during winter 1999–2000, but data from additional years are needed before we can assess effects of predation.

Although little significant snowfall occurred in the study area after January, snow cover persisted well into June. Weather during early May was cool and cloudy with frequent snow showers. These conditions may have contributed to the low parturition rate and lamb:ewe ratio observed this year.

As of June 2000, the hare population in the study area remained high, although Laura Prugh's surveys indicated some signs of decline. A primary objective of this study is to assess the effects of changes in hare populations on predation losses of sheep, and this will require data from years of differing hare abundance. Thus, it seems likely that it will be necessary to extend the current study by 1 year, through FY02, to obtain the required data.

Currently, 10 radiocollared coyotes are being monitored. These represent 5 pairs, and their combined home ranges include much of the area occupied by radiocollared sheep. This year all coyotes were captured at little additional cost during helicopter flights to investigate lamb mortalities. Snow-tracking surveys planned for this winter as part of Laura Prugh's graduate research may help to locate additional coyotes present in the study area.

In addition to the work reported above, possibilities for collaborative work with other researchers and agencies are being explored. Blood samples and feces collected from captured ewes were provided to investigators from the Idaho Department of Fish and Game and University of Saskatchewan for assessment of exposure to diseases and parasites. Discussions were held with representatives of the National Park Service regarding possibilities for cooperative surveys of eagle abundance and nesting success in the study area. Current plans are for the National Park Service to provide funding for an initial eagle nest survey during July 2000 and possibly again during 2001.

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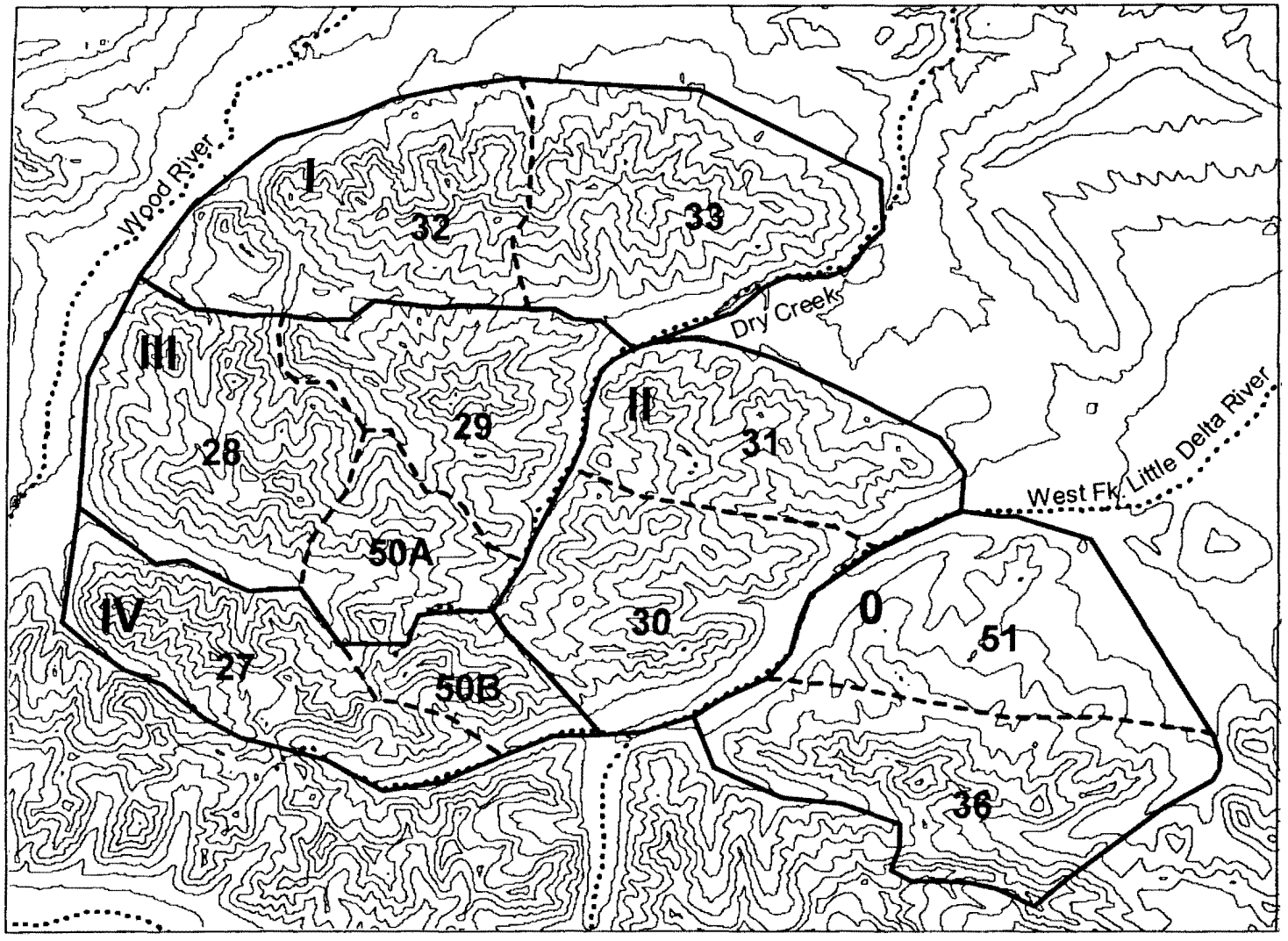


Figure 1 Area surveyed for Dall sheep during 24–25 June 2000. Dark lines and Roman numerals indicate sections surveyed during previous years; dashed lines and Arabic numerals indicate survey units (subdivisions surveyed with little or no interruption); dotted lines indicate streams.

Table 1 Results of helicopter sheep survey in the central Alaska Range, 24–25 June 2000

Unit[b]	Section[c]	Mi^2	Time	Min/Mi^2	Ewes[d]	Lambs	Yearling	Ram Class[a] 1	2	3	4	Rams	Total	Lambs:100 Ewes[d]	Rams:100 Ewes[d]
36	0	28.7	19	0.66	0	0	0	0	0	0	0	0	0		
51	0	26.2	11	0.42	0	0	0	0	0	0	0	0	0		
32	1	29.0	92	3.17	63	18	15	5	41	12	5	63	159	29	1
33	1	30.3	48	1.59	34	6	4	8	12	0	0	20	64	18	59
30	2	25.8	61	2.36	29	8	9	4	25	26	3	58	104	28	2
31	2	22.9	72	3.23	95	31	23	9	11	5	0	25	174	33	26
28	3	26.6	33	1.25	0	0	0	0	1	0	0	1	1	0	0
29	3	21.8	52	2.39	22	9	4	0	6	2	2	10	45	41	45
50A	3	11.6	17	0.81	0	0	0	0	5	1	2	8	8	0	0
27	4	21.5	43	1.99	29	12	8	0	0	0	0	0	49	41	0
50B	4	8.5	9	1.06	7	0	4	0	0	0	0	0	11	0	0
TOTAL		252.9	457	1.81	279	84	67	26	101	46	12	185	615	30	66

[a] Ram classes: 1 = <1/2 curl; 2 = 1/2–3/4; 3 = 3/4–7/8; 4 = full curl.
[b] Sample units designate areas that were surveyed continuously or with only brief interruptions (to refuel helicopter) during 1998–2000.
[c] Sections 1–3 were surveyed during 1994–2000; section 4 was surveyed during 1998–2000 and some years prior to 1994; section 0 was surveyed only during 1998–2000.
[d] Counts of ewes likely included some young rams.

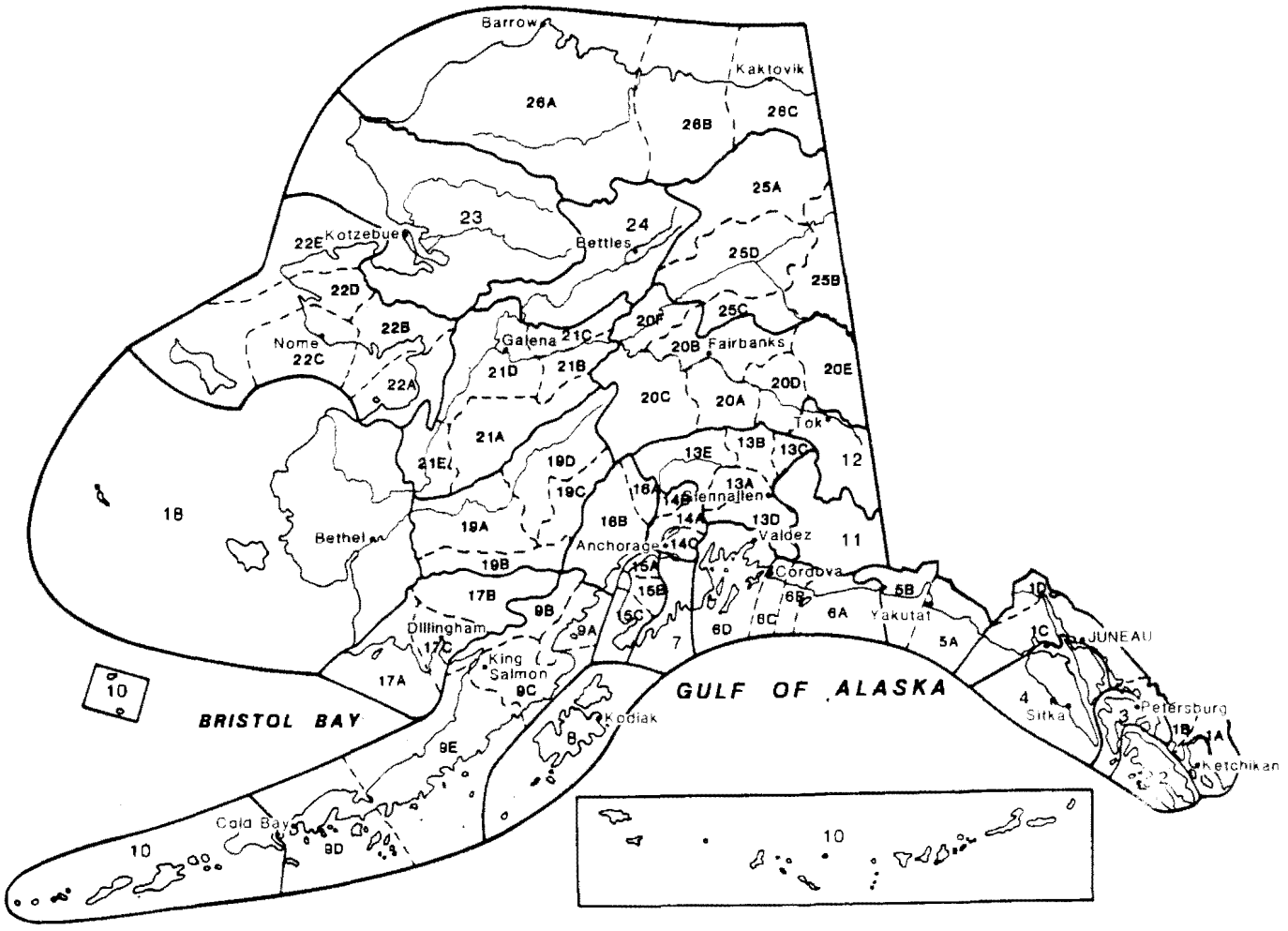
Table 2 Comparison of annual sheep surveys for the central Alaska Range sections 1–3

Year	Date	Ewes[a]	Lambs	Yearlings[a]	Rams	Total	Lambs:100 Ewes[a]	Rams:100 Ewes[a]	Hours	Min/Mi^2
1984	11–12 Jul	605	231		266	1102	38	44	10.3	
1991	22–25 Jul	374	68		195	639[b]	18	52	10.3	
1994	4 Jun	211	72		125	408	34	59	4.8	1.5
1995	7 Jun	249	109	61	167	586	44	67	5.8	1.8
1996	9 Jun	267	137	95	158	657	51	59	6.0	1.9
1997	17 Jun	212	85	93	177	567	40	83	7.3	2.3
1998	17 Jun	287	117	69	192	686[b]	41	67	6.2	2.2
1999	10–11 Jun	267	138	75	210	690	52	79	7.8	2.6
2000	24–25 Jun	279	84	67	185	615	30	66	6.3	2.2

[a] In 1984, 1991, and 1994, surveys were conducted using a Piper Super Cub; all yearlings were classified as ewes. All other surveys were conducted using an R-22 helicopter; yearlings were separated from ewes. During all years, counts of ewes likely included some young rams.

[b] Totals include unclassified sheep, 2 in 1991 and 21 in 1998.

Alaska's Game Management Units



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