

ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

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ANNUAL REPORT OF
SURVEY-INVENTORY ACTIVITIES

PART VIII. MOOSE

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STATEWIDE HARVEST AND POPULATION STATUS

The current status of moose, as well as the quantity and quality of data on them, is quite variable in the state. A series of generally favorable winters has allowed good survival in many areas, with the notable exception of much of interior Alaska. In those areas (all or parts of Units 12, 19, 20, 21, 24 and 25), moose populations are still low, critically so in portions of Units 20E, 25D and 19D. Heavy accumulation of snow during this winter (1984-85) in some portions of south-central Alaska, notably Unit 16, is thought to have resulted in significant losses.

Moose harvests were generally above those for recent years. Harvest data tends to be reasonably accurate for areas hunted by urban hunters, near road systems, or hunts conducted by permit. Harvest data from more remote, "bush" units is generally inaccurate due to lack of compliance with regulations and reporting requirements. The actual hunters' take may be several times that reported for areas such as Units 18, 19, 21, 24 and 25.

The reported harvest of moose in 1984-85 is as follows:

Unit	Reported harvest			Total
	Males	Females	Unk	
1A	7	0	0	7
1B	55	0	0	55
1C	24	13	0	37
1D	35	0	0	35
				<u>134</u>
5	63	3	4	70
6A	59	22	0	81
6B	22	28	0	50
6C	18	14	0	32
				<u>163</u>
7	75	2	0	77
9	176	8	5	189
11	41	0	0	41
12	84	0	0	84
13	839	0	0	839

Unit	Reported harvest			Total
	Males	Females	Unk	
14A	310	139	10	459
14B	258	271	5	534
14C	120	47	0	167
				<u>1,160</u>
15A	281	28	5	314
15B	107	2	1	110
15C	214	1	3	218
				<u>642</u>
16A	251	52	5	308
16B	436	173	7	616
				<u>924</u>
17	157	1	0	158
18	63	0	0	63
19A	161	17	7	185
19B	146	0	8	154
19C	95	0	0	95
19D	124	0	0	124
19 (unk)	9	0	0	9
20A	390	0	0	390
20B	307	0	0	307
20C	109	0	0	109
20D	104	0	0	104
20E	29	0	0	29
20F	15	0	0	15
				<u>954</u>
21A	135	0	1	136
21B	97	0	0	97
21C	18	0	0	18
21D	184	53	0	237
21E	133	0	0	133
				<u>621</u>
22	298	91	6	395
23	160	17	3	180
24	106	15	1	122
25	140	0	0	140

Unit	Reported harvest			Total
	Males	Females	Unk	
26A	42	7	1	50
26B	16	0	0	16
26C	7	0	0	7
				<u>73</u>
Statewide totals	6,520	1,004	12	7,596

Robert A. Hinman
Deputy Director

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1A, 1B, and 3

GEOGRAPHICAL DESCRIPTION: Southeast mainland from Cape
Fanshaw to Canadian border and
adjacent islands

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose occur along major drainages in Subunits 1A and 1B and on several of the major islands of Unit 3. Increased sightings of moose throughout Unit 3 indicate the population is increasing in the area. Hunted populations in Thomas Bay and the Stikine River appear to be stable. The future of moose on the islands of Unit 3 is uncertain. Although moose prefer the early seral stages of vegetation and concentrated logging of high volume old-growth timber has occurred, the successional vegetation created by clearcutting in this area is low in nutritive value (Doerr et al. 1980). Thus, predation and the severity of winters are likely to be the limiting factors on moose expansion in Unit 3.

A remnant herd is present in the drainages of the Chickamin River in Subunit 1A as a result of a 1963-64 transplant, by the Department of Fish and Game, of 14 moose from Cook Inlet and the Chickaloon Flats (Burris and McKnight 1973). Small native moose populations are present in the Unuk River drainage and some hunting occurs there.

The Thomas Bay moose herd in Subunit 1B supported a small harvest during 1970-81 and 1984 (Table 1). The season was closed in 1982 and 1983 because of poor calf production attributed to winter mortality. The season was reopened in 1984. The Stikine River herd appeared to be stable during the period. An estimated population of 300 moose uses the Stikine River drainage (Craighead et al. 1984).

Population Composition

The small kill in the Thomas Bay area (Table 1) does not justify extensive surveys, but limited aerial flights are made, when funds permit, to monitor sex and age composition of the herd. No flights were made in the Thomas Bay area in 1984. In lower Subunit 1B (south of LeConte Bay), a fixed-wing aircraft survey of the Stikine River was conducted on 22 August 1984. Based on this single survey, the pre-season 1984 sex ratio was 33 bulls:100 cows, compared with the 1983 ratio of 20:100. The calf count was 20 calves:100 cows, compared with 21:100 in 1983.

Mortality

Subunit 1A:

Seven bulls were killed in Subunit 1A during the 1984 season. All of the animals were taken in the Unuk River drainage.

Subunit 1B (south of LeConte Bay):

Biologists stationed at Kakwan Point regularly visited hunting camps in upper Subunit 1B throughout the season to interview hunters and to examine kills for age and antler characteristics. Based on information gathered in this effort, it was found that 41 bulls were taken on the Stikine during 1984. Two bulls were taken elsewhere in southern Subunit 1B, 1 at Aaron Creek and 1 at Virginia Lake. Sixty-three percent of the bulls taken in the southern portion were examined for age and antler characteristics. Of these, 69% were yearlings.

Approximately 200 people hunted the Stikine during 1984 compared with an estimated 130 hunters in 1983. An increase in the use of aircraft on the river for moose hunting was observed. In past years, no more than 2 aircraft have been in use by hunters on the Stikine River. In 1984, besides charter aircraft, at least 5 airplanes were in regular use during the season.

The success ratio in southern Subunit 1B, based on the check station data, was 22% ($\underline{n} = 43$). The hunting success reported through harvest tickets was 16% ($\underline{n} = 30$).

According to replies from 193 returned moose harvest tickets, unsuccessful hunters in southern Subunit 1B spent an average of 8 days in the field, compared with 7 days for successful hunters. Of the successful hunters in southern Subunit 1B, 97% used boats for transport and 3% used airplanes. Of the unsuccessful hunters, 98% used boats and 2% used aircraft.

According to harvest ticket reports, 57% of the bulls were taken during the 1st week, 20% during the 2nd week, 10% during the 3rd week, 10% during the 4th week, and 3% during the last week of the season.

Subunit 1B (north of LeConte Bay):

The northern portion of Subunit 1B (including the Thomas Bay and Farragut River areas) was opened to moose hunting for the 1st time since 1981. An antler restriction was implemented to control the harvest of bulls. In the northern portion of Subunit 1B, a legal bull was defined as having at least 3 tines on at least 1 antler.

The lower jaws of all bulls ($n = 12$) taken in northern Subunit 1B were examined to determine the occurrence of yearlings. In the northern portion of the subunit where the 3-tine antler restriction was in effect, only 9% of the legally taken bulls were yearlings. In the southern portion of Subunit 1B, with no antler restrictions, 69% of the bulls examined were yearlings. Two bulls that did not meet the minimum antler requirements were killed by hunters; both were yearlings. The known accidental kill was 17%, which may be considered normal for the 1st year of a new regulation.

In the northern area, 130 registration permits were issued and 70% ($n = 91$) of the permit holders participated in the 15-day season.

The success ratio for hunters in northern Subunit 1B was 13% ($n = 12$). The average number of hunter days reported by successful hunters was 13, while unsuccessful hunters reported hunting an average of 12 days. Ninety-three percent of the hunters utilized a boat to get to the hunting area; 7% used aircraft.

Management Summary and Recommendations

The Subunit 1A kill was 7 bulls, and the Subunit 1B harvest was 55 bulls. The Stikine harvest of 41 bulls was the same as in 1983, tying the 2nd highest recorded bull harvest. The 1957 kill of 42 bulls was the highest on record.

The continued hunting pressure on the male segment of the Stikine herd is cause for concern because a majority of the available breeding males are killed each year. While bulls are capable of breeding with many cows (Rausch and Bratlie 1965), we are concerned that the ratio may become low enough to affect successful reproduction.

In 1984, the definition of a legal bull in northern Subunit 1B was "a bull with at least 3 tines on at least 1 antler." Hopefully, this regulation protected a segment of the bull population and will result in increased productivity of the herd and increased hunting opportunity. The regulation will be in effect for at least 1 more year in the Thomas Bay area where calf survival has been poor during severe winters. A similar regulation will be considered for the Stikine if the Thomas Bay regulation is proven effective.

The 1984 moose kill in the Thomas Bay portion of Subunit 1B was 11 bulls. It appears that the antler regulation was effective in reducing the kill without restricting the number of hunters in 1984. An additional bull was taken in the Farragut River drainage where a small population of moose exists.

Continued logging and road construction in southeastern Alaska pose a problem in moose management. Logging has been shown to be involved in moose population explosions in Scandinavia (Lavsund 1981, Wilhelmson and Sylven 1979) where regrowth vegetation is used by moose. Peak moose numbers in British Columbia in the mid-50's and mid-60's were attributed to logging and land clearing for agriculture (MacGregor and Child 1981). However, a combination of clearcutting and logging roads in Ontario led to excessive moose harvest, declining populations, and closed hunting seasons in recently logged areas (Eason et al. 1981).

Recent calf declines in the heavily logged Thomas Bay area were not matched by similar losses in the unlogged Stikine-LeConte wilderness during the same winter. Predation in Thomas Bay may have increased if wolves utilized the road systems and preyed on moose concentrations in unlogged areas as described in Ontario (Bergerud 1981). It is also possible that poor nutrition in the Thomas Bay area (Doerr et al. 1980) contributed to calf loss during periods of deep snow. Deep snows do not seem to limit moose during most winters in the Stikine River watershed (Craighead et al. 1984).

While moose numbers in Game Management Units 1B and 3 may increase after logging in response to the increase in seral vegetation, the development of dense spruce second growth within 15 years will reduce moose carrying capacity and lead to a population decline. The techniques which could keep the habitat in the early seral stages of vegetation are either impractical (burning, chemical control) or prohibitively expensive (thinning, bulldozing).

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1C

GEOGRAPHICAL DESCRIPTION: Southeast mainland from Cape
Fanshaw to the latitude of Eldred
Rock

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

No significant changes were noted in the Chilkat Range moose population compared with the previous year.

Population information for the Berners Bay drainages indicated that the population declined, but the bull:cow ratio increased substantially. These results were expected under the current management plan for the area.

Moose have not established themselves in the Cowee and Davies creek drainages; however, a single moose was observed at the mouth of Cowee Creek in 1984. The moose has apparently remained in the area.

Population Composition

Sex and age composition counts were conducted by helicopter in the Berners Bay area on 28 November 1984. Surveys were not conducted in the Chilkat Range or the Taku River area during 1984. In Berners Bay, 101 moose were observed, including 22 bulls, 60 cows and 19 calves. Sex and age ratios were as follows: 37 bulls:100 cows, 32 calves:100 cows, and 19% calves in the herd.

Mortality

Beginning in the fall of 1984, a registration permit hunt was established for a portion of Subunit 1C, excluding the drainages of Berners Bay. Based on permit hunt report returns, the harvest for the Taku River and Taku Inlet area was 18 bulls. Eighty-three hunters spent 355 days afield.

The success rate was 22%. For the lower Chilkat Range, 40 hunters hunted and took 6 bull moose. One animal was taken in the Endicott River drainage and 5 were killed in the St. James Bay area. One hundred forty-two days were spent hunting in the Chilkat area. The success rate was 15%. One unsuccessful hunter hunted moose for 2 days in the Cape Fanshaw area and 1 unsuccessful hunter spent 2 days along the Juneau road system. In addition, 12 unsuccessful hunters hunted moose for 34 days in unspecified areas in Subunit 1C. For all of Registration Hunt 956, 137 hunters reported hunting, spending 535 days afield and taking 24 moose. The success rate was 18%.

Other mortality included the euthanasia of an adult cow and her bull calf that had been crippled by hunters in the Taku River area.

During the Berners Bay permit drawing hunt (Hunt 901), all 15 permittees hunted and 13 were successful in killing a cow moose, for a success rate of 87%. A bull was taken by mistake in the Antler River area. The mean cementum age of the 13 cows was 4.2 years with a range of 1 to 10 years. The bull was 2 years old.

Management Summary and Recommendations

An antlerless season conducted in the Berners Bay area for the past 2 years has sufficiently increased the bull:cow ratio to allow a limited either-sex hunt in 1985. The post-season sex and age composition surveys conducted in 1982, 1983, and 1984 indicated bull:cow ratios of 5, 14, and 37 bulls:100 cows, respectively. An either-sex bag limit was supported by the Fish and Game Advisory Committee and adopted by the Board of Game in the spring of 1985. Fifteen permits will be issued, and the desired harvest is tentatively set at 10 bulls and 5 cows.

The season was closed in the Berners River drainage on 25 September 1984 after 4 cows had been taken. A harvest of 5 cows was set prior to the season to distribute the harvest elsewhere in the hunt area. Local hunters cooperated in monitoring the harvest.

Several complaints were received involving U.S. citizens hunting illegally in Canada and also about the use of aircraft to spot moose and direct hunters to their locations.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1D

GEOGRAPHICAL DESCRIPTION: Upper Lynn Canal

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Although the Subunit 1D population size appeared stable at about 350 animals, the composition of the herd continued to change.

Population Composition

Sex and age composition of the Chilkat Valley moose population was determined by aerial survey on 28 November 1984 (Table 1). One hundred eighty-seven moose were enumerated (15 bulls, 135 cows, and 37 calves) in 5.2 hours of survey time. The ratio of bulls:100 cows (11:100) was the same as in 1983, while the calf segment of the population was down slightly (27 calves:100 cows; 20% calves in the sample). No late winter survival surveys were made during the reporting period.

Mortality

The 1984 permit registration moose hunt ran from 15 September through 27 September; it was closed 3 days early by emergency order. Thirty-five bulls (the quota established for this hunt) were reported taken (Table 2). In this 1st year of permit registration hunting in Subunit 1D, 555 permits were issued; 206 permittees did not hunt. The 314 unsuccessful hunters spent an average of 5 days in the field; the 35 successful hunters averaged 4 days afield. Sixty-six percent of the kill was taken by Haines residents, 20% by Juneau residents, 6% by residents of Sitka, and 3% each by nonresidents and residents of Skagway and Anchorage. Thirty-four animals from the fall hunt were analyzed for cementum age (Table 2). The mean age of 2.2 years is the lowest in recent years.

One cow moose was poached during the September bulls-only season. No natural mortality was documented during the report period.

Management Summary and Recommendations

The 1st permit registration moose hunt in Subunit 1D was an apparent success because of high hunter participation. The harvest quota was met and illegal activity was kept to a minimum. The fall sex and age composition survey, in conjunction with the age structure of harvested bulls, indicated that the bull:cow ratio would not improve if a harvest of 35 bulls was maintained. An analysis of the survey and harvest data resulted in a bag limit recommendation to the Board of Game of 25 bulls and 10 cows for the 1985 season. The cow hunt, to be conducted by permit drawing format, was denied by the Board because of Title 16 provisions that require Advisory Committee concurrence for a cow hunt. The bull quota was eventually set at 15, following further analyses of harvest and age statistics.

During an emergency session of the Game Board in June, the Subunit 1D moose hunt was included with those hunts defined as Tier II subsistence hunts for 1985. Permits will be issued to only 45 applicants (down from 555 in 1984) based on place of domicile, past participation in the hunt, and availability of alternate resources, including fish, wildlife, and finances.

Hopefully, the Upper Lynn Canal Fish and Game Advisory Committee will reconsider their long-standing opposition to the harvest of cow moose. The harvest level will undoubtedly remain at a low number under the current management strategy unless the harvest includes both sexes.

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Table 1. Game Management Subunit 1D moose survey data, 1962-84.

Year	No. bulls	No. cows	No. calves	Unid. sex and age	Total sample	No. bulls:100 cows	No. calves:100 cows	Percent calves in sample	Count time (hours)	Moose/ hour
1962	8	134	39	0	181	6	29	22	--	--
1963	0	0	36	157	193	--	--	19	--	--
1964	- ^a									
1965	--	--	--	--	349	41	49	21	--	116
1966	46	138	95	16	295	33	69	32	2.1	140
1967	50	173	75	0	298	29	43	25	2.8	106
1968	48	253	72	1	374	19	28	19	4.4	85
1969	23	91	31	0	145	25	34	21	2.1	69
1970	- ^a									
1971	27	170	34	0	231	16	20	15	4.9	47
1972	33	178	56	0	267	19	31	21	6.4	42
1973	30	189	45	0	264	16	24	17	4.4	60
1974	30	135	41	0	206	22	30	20	6.2	33
1975	--	--	30	151	181	17	--	17	4.2	43
1976	- ^a									
1977	30	186	71	0	287	16	38	25	5.8	49
1978	29	125	37	1	192	23	30	19	6.4	30
1979	15	149	36	18	218	10	24	17	4.5	48
1980	- ^a									
1981 ^b	--	--	38	173	211	--	--	18	4.3	49
1982 ^b	--	--	29	154	183	--	--	16	4.3	43
1982	34	115	51	0	200	30	44	26	4.8	42
1983 ^b	--	--	19	69	88	--	--	22	5.6	16
1983	16	148	47	0	211	11	32	22	5.8	36
1984 ^b	--	--	11	77	88	--	--	13	3.8	23
1984	15	135	37	0	187	11	27	20	5.2	36

^a No survey.^b Late winter surveys; sex composition not available.

Table 2. Game Management Subunit 1D moose harvest data, 1962-84.

Year	Season	Legal moose	Hunter success (%)	Harvest			Total	Comments
				M	F	?		
1962	9/1-10/15	M	--	66	0	0	66	
1963	9/1-10/15	M	--	81	0	0	81	
1964	9/1-10/15	M,F	54	79	65	2	146	
1965	9/1-10/15	M,F	--	66	34	1	101	
1966	9/1-10/15	M,F	58	92	60	0	152	
1967	9/1-10/15	M,F	--	80	47	0	137	
1968	9/1-10/15	M,F	--	82	61	2	145	
1969	9/1-10/15	M,F	--	52	24	2	78	
1970	9/1-10/15	M,F	--	48	48	0	96	
1971	9/1-10/15	M,F	31	67	30	0	97	
1972	9/1-10/15	M,F	28	46	45	1	92	Cow season 9/1-9/10
1973	9/1-10/15	M,F	23	69	46	0	115	Cow season 9/1-9/9
1974	9/15-9/19	M,F	13	21	37	0	58	
1975	9/15-9/18	M,F	9	25	0	1	26	Season closed by EO
1976	9/15-9/30	M	13	36	18	1	55	2-day antlerless hunt during season
1977	9/15-9/30	M	15	30	0	1	31	
1978	9/15-9/30	M	15	44	1	0	45	
1979	9/15-9/30	M	20	38	0	1	39	
1980	9/15-9/30	M	14	48	0	0	48	
1981	9/15-9/30	M	11	34	1	0	35	
1982	9/15-9/30	M	9	24	1	0	25	
1983	9/22-10/6	M	17	61	0	0	61	
1984	9/15-9/27	M	11	35	0	0	35	Registration hunt; closed by EO

Table 3. Ages of moose killed in Subunit 1D, 1982-84.

Age class	No. of moose in age class		
	1982	1983	1984
0.5	0	1	2
1.5	1	3	15
2.5	8	7	12
3.5	5	10	2
4.5	2	6	2
5.5	1	0	1
6.5	0	1	0
7.5	0	2	0
8.5	0	0	0
9.5	0	1	0

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5

GEOGRAPHICAL DESCRIPTION: Cape Fairweather to Icy Bay, Eastern Gulf Coast

PERIOD COVERED: 1 July, 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Yakutat Forelands:

Annual sex and age composition surveys of the Yakutat Forelands moose population, conducted between 26 November and 2 December 1984, resulted in a count of 379 moose in 12.1 hours of survey time (Table 1). The sample consisted of 90 bulls, 229 cows, and 60 calves (16%). A previous aerial survey during late winter 1984 counted 382 moose (22% calves) in 11.9 survey hours (Appendix A). The late winter survey included 30 animals observed between the Alsek and Doame Rivers, an area not surveyed during fall 1984. A winter 1984 count area identical to the fall count area contained 352 moose (22% calves); survey time was 10.2 hours. About 8% more moose were counted in the fall survey compared with the "adjusted" winter count, but it required 16% more survey time. Also, winter surveys were conducted in a Cessna C-180 aircraft while a Piper Super Cub was used in the fall. The Super Cub probably provided a more accurate moose count.

Fall 1984 survey results were similar to those of the most recent fall survey conducted in 1981. The 1984 ratios of bulls:100 cows, calves:100 cows, and the percentage of calves, were about the same as in 1981. The 1981 survey, which included the area east of the Alsek River, resulted in a count of 6% more moose but used 30% more survey time. Twenty-three percent of cows with calves had twins in fall 1984, while only 15% of the 1981 cows with calves had twins.

Late winter surveys were conducted on 28 March and 18 April 1985 because snowfall was over 30% higher than normal (Appendix B) and a large number of days with more than 30 inches of snow on the ground had occurred. In 5.9 survey

hours, 139 moose were counted; 19% of the moose were calves. Deep, hard-packed snow had concentrated most moose within 1 to 1.5 miles of the coast in areas with streambeds that provided walkways and spruce-hemlock habitat that provided cover and browse. The few animals that were farther from saltwater were all associated with stringers of timber along water courses.

Nunatak Bench:

Annual sex and age composition surveys of the Nunatak Bench portion of Subunit 5A were conducted on 26 December 1984 (Table 2). Gusty winds during the flight and the fact that several bulls observed had only 1 antler remaining indicated a poor bull:100 cows estimate. However, the number of animals seen, compared with previous surveys, indicated the population was stable or growing slightly.

Malaspina Forelands:

No surveys were conducted.

Mortality

Yakutat Forelands:

Forty-nine bull moose were killed during the 15 October-13 November permit registration hunt (Appendix C). Two hundred eighty-seven permits were issued, with 57 permittees not hunting and 181 hunting unsuccessfully. Thirty-seven percent of the kill was taken by Yakutat residents, 59% by other state residents, and 4% by nonresidents. The 49 successful hunters spent a total of 132 days hunting (mean = 3.7), while the 181 unsuccessful hunters were afield for 972 days (mean = 5.4). Thirty-eight (78%) moose were harvested in the 1st week of the season. Thirty-three moose (67%) were taken east of and including the Dangerous River; the remaining 16(33%) came from west of the Dangerous River.

Natural mortality was documented throughout the Yakutat Forelands area during the report period. One old bull in the Alsek River area succumbed to unknown causes in October, and 1 partially eaten carcass, probably a victim of wolf predation, was found along the Ahrnklin drainage in June. Reports of predator kills seemed to be higher during late winter/early spring compared with recent years, but the late retention of snow on the Forelands could have made kills easier to spot from the air.

Ages of 47 of the bull moose taken in 1984 were determined by reading tooth cementum layers (Table 3). Although the mean age of 3.2 was lower than in previous years, the range of ages included bulls to 7.5 years of age.

Nunatak Bench:

Three bulls and 3 cows were taken during the 15 November-15 February season. Twenty permits were issued for this hunt; 6 permittees did not hunt, 8 permittees hunted unsuccessfully for an average of 3 days. The 6 successful hunters averaged 4.5 days afield. Four of the 6 moose taken were killed during the last 2 weeks of the season.

Malaspina Forelands:

The 1 September-31 October season attracted 54 permittees, 4 of which did not hunt. Of the 50 hunters, 15 (30%) killed bull moose. Harvest chronology indicated that moose were taken throughout the season (up until the 3rd week of October) at a fairly constant rate. Seven moose were taken east of Point Manby, while the balance came from the western end of the subunit.

Management Summary and Recommendations

A quota of 50 bulls and 10 cows (the latter by permit drawing) was recommended to the Board of Game at the March meeting. Because of local opposition, a cow season was not adopted. An emergency Board of Game meeting held during June 1984 established the Yakutat Forelands as a Tier II subsistence hunt, with participation limited to 200 qualified applicants. Although the Tier II designation should have little effect upon the harvest, administration of the hunt will undoubtedly become more complex. Fall sex and age composition information should be collected for further analysis of limited cow harvests.

No changes in season or bag limit are recommended for the Nunatak Bench herd.

The Malaspina Forelands herd has not been surveyed adequately since 1981. While age structure remained spread over a range of ages and hunting pressure remained characteristically light, sex and age composition information should be obtained in 1985.

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Table 1. Moose sex and age composition, Game Management Subunit 5A, fall 1984.

Date	Location	No. of bulls	No. of cows	No. of calves	Total moose	Calves (%)	Survey time (hr)
26 Nov	Yakutat Bay- FH 10/Situk Lake	1	3	2	6	33	1.2
27 Nov	FH 10/Situk Lake- Situk River	0	11	5	16	31	1.5
30 Nov	Situk River- Dangerous River	34	91	27	152	18	3.4
1 Dec	Dangerous River- Italio River	24	67	10	101	10	2.7
2 Dec	Italio River- Alsek River	31	57	16	104	15	3.4
Total for area		90	229	60	379	16	12.2

Table 2. Moose sex and age composition for the Nunatak Bench portion of Game Management Unit 5, 1982-84.

Date	Total bulls	Total cows	Total adults	Total calves	Percent calves	Survey time (hrs)	Moose/ hr
11/22/82	8	14	22	0	0	0.6	37
11/28/83	5	10	15	10	40	0.8	50
12/26/84	10	13	23	4	15	0.5	54

Table 3. Ages of moose killed on the Yakutat Forelands portion of Subunit 5A, 1981-84.

Age class	No. of moose in age class			
	1981	1982	1983	1984
0.5	0	0	0	2
1.5	0	2	0	13
2.5	4	10	9	11
3.5	6	13	8	6
4.5	5	8	10	7
5.5	4	5	6	3
6.5	1	6	4	2
7.5	1	1	2	3
8.5	1	2	2	0
9.5	1	0	0	0
10.5	0	0	1	0
11.5	0	0	0	0
12.5	1	0	0	0
13.5	0	0	0	0
14.5	0	0	1	0

Appendix A. Moose aerial survey data for the Yakutat Forelands portion of Game Management Unit 5A, 1974-84.

Year	No. bulls	No. cows	No. calves	Unid. sex and age	Total sample	No. males: 100 females	No. calve: 100 females	Percent calves	Count time (hours)	Moose/ hour
1974	21	81	29	0	131	26	36	22	5.2	25
1975	43	183	32	30	288	23	17	11	10.9	26
1976 ^a	0	0	22	186	208	--	--	11	6.1	34
1977	82	198	44	10	334	41	22	13	11.1	30
1978	50	134	32	13	229	37	24	14	7.4	31
1979 ^a	0	0	25	95	120	--	--	21	2.8	43
1980 ^b	19	23	8	0	50	83	35	16	2.3	22
1981	93	243	65	1	402	38	27	16	15.7	26
1982										
1984 ^a	0	0	83	299	382	--	--	22	11.9	32
1984 ^c	90	229	60	0	379	39	26	16	12.1	31
1985 ^a	0	0	26	113	139	--	--	19	5.9	24

^a Late winter count, sex undetermined.

^b Situk River to Ahrnklin River only.

^c Yakutat Bay to Alsek River only.

Appendix B. Snowfall records for Yakutat, Alaska, 1949-85.

Year	No. days with "x" inches snow on ground					Total snowfall
	Trace-14	15-29	30-44	45-60	60+	
1948-49	--	--	--	--	--	241
1949-50	--	--	--	--	--	122
1950-51	--	--	--	--	--	193
1951-52	84	35	41	33	3	242
1952-53	138	0	0	0	0	139
1953-54	128	53	7	0	0	190
1954-55	63	70	34	32	6	338
1955-56	83	57	22	30	21	278
1956-57	143	9	0	0	0	181
1957-58	106	2	6	8	1	121
1958-59	111	51	5	4	13	286
1959-60	119	30	23	0	0	246
1960-61	109	14	22	9	0	238
1961-62	119	47	3	6	0	207
1962-63	124	7	6	1	0	129
1963-64	160	25	7	0	0	286
1964-65	120	24	15	5	0	253
1965-66	76	62	22	20	0	219
1966-67	85	48	59	2	5	293
1967-68	115	17	0	0	0	177
1968-69	43	53	70	10	0	237
1969-70	103	5	0	0	0	130
1970-71	98	40	55	0	0	313
1971-72	48	16	21	12	119	317
1972-73	61	44	42	22	0	239
1973-74	65	75	23	0	0	178
1974-75	69	58	35	4	0	327
1975-76	16	80	85	10	0	403
1976-77	83	26	0	0	0	168
1977-78	126	31	2	0	0	124
1978-79	67	55	43	0	0	139
1979-80	101	24	2	0	0	129
1980-81	71	3	0	0	0	71
1981-82	84	81	0	0	0	175
1982-83	100	8	2	0	0	86
1983-84	99	12	0	0	0	136
1984-85	81	30	49	0	0	275
Average	110	41	24	7	6	211

Appendix C. Game Management Subunit 5A (excluding Nunatak Bench) moose harvest, 1978-84.

Year	Season	Quota	No. permits issued	No. of hunters	Harvest	Hunter success (%)	Comments
1978	15 Oct-15 Nov	25 antlered moose	165	123	28	23	Includes Nunatak Bench
1979	15 Oct-15 Nov	25 bulls	185	167	20	12	
1980	15 Oct-18 Oct	NA ^a	NA	175	28	16	4-day, bull only season; harvest ticket system
1981	15 Oct-15 Nov	NA ^a	NA	180	27	15	4-day, bull only season; harvest ticket system
1982	15 Oct-15 Nov	50 bulls	226	199	49	25	
1983	15 Oct-15 Nov	50 bulls	282	235	47	20	
1984	15 Oct-13 Nov	50 bulls	287	230	49	21	

^a Not applicable; see comments section.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6A

GEOGRAPHICAL DESCRIPTION: Katalla to Icy Bay

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The Bering River/Controller Bay and Tsiu River moose herds number approximately 350-400 animals and are increasing.

Population Composition

Due to a lack of adequate snow cover, no moose composition surveys were flown.

Mortality

The 1984 moose harvest was 81 animals including 59 bulls and 22 cows. Hunters took 63 moose from the Bering River/Controller Bay herd (42 males and 21 females) and 18 from the Tsiu River herd (17 males and 1 cow). Actual hunting pressure was unknown, but 393 registration permits were issued for the 1 September-31 December season.

Successful Bering River/Controller Bay hunters used the following methods of transportation: airboat, 28; airplane, 28; boat, 5; off-road vehicles, 2. Transportation used by successful Tsiu River hunters was as follows: airplane, 14; boat, 3; and off-road vehicles, 1.

The winter of 1984-85 was mild and overwinter survival should be excellent.

Management Summary and Recommendations

The kill of 81 moose from the Bering River/Controller Bay and Tsiu herds was the highest on record. The Bering River/Controller Bay harvest increased substantially over the previous 4-year average of 36 but was within the harvest guidelines for this population.

Mild winter weather has continued in Subunit 6A since 1983. These conditions resulted in good overwinter survival and have permitted both herds to continue increasing in population size. For this reason, I recommend the registration permit hunt be deleted, and a general hunting season for either-sex moose be implemented.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6B

GEOGRAPHICAL DESCRIPTION: Martin River

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The Martin River moose herd appears to be stable but is slightly larger than the desired size of 150-175 animals.

Population Composition

One hundred eighty moose were counted during a sex and age composition survey flown on 27 November. Survey conditions were good. The bull:cow ratio was 64:100 with 20% of the population being yearling bulls. The calf:cow ratio was 32:100 with 16% of the population composed of calves.

Mortality

Fifty moose, including 22 bulls and 28 cows, were killed during the 1984 either-sex season. The season was closed by emergency order on 17 September after 10 days of hunting. Actual hunting pressure is unknown, but 371 permits were issued. Methods of transportation used by successful hunters were as follows: airboat, 37; airplane, 8; riverboat, 3; and highway vehicle, 2.

Management Summary and Recommendations

The 1984 moose season was designed to hold the Martin River moose herd between 150-175 animals. The harvest of 50 moose nearly accomplished this goal; however, 56% of the harvest was cows. The post-season composition count revealed a high bull:cow ratio with a large number of yearling bulls. Considering these factors, I recommend that a bulls-only harvest

occur in 1985 with a goal of maintaining the current herd size while lowering the bull:cow ratio to 30-35 bulls:100 cows.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6C

GEOGRAPHICAL DESCRIPTION: West Copper River Delta

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The West Copper River Delta moose herd is at the desired population level and is being held there by hunter harvest.

Population Composition

A moose sex and age composition survey was flown on 28 November. Survey conditions were good and 171 moose were observed. Survey data indicated 26 bulls:100 cows and 36 calves:100 cows, with calves making up 22% of the population.

Mortality

Hunters killed 32 moose, including 18 bulls and 14 cows from the West Copper River Delta. Thirty-five either-sex drawing permits were issued for the 11-day season. Thirty-two permittees hunted successfully, 1 hunted unsuccessfully, and 2 did not hunt. Six hundred one applications were received for the 35 available permits.

The winter of 1984-85 was relatively mild until March; therefore, overwinter survival is expected to be good.

Management Summary and Recommendations

The 1984 moose harvest was managed by a drawing permit system, the first since 1977. Distribution of the 35 permittees by residency of hunters, was as follows: Cordova, 30; Valdez, 3; Anchorage, 1; Petersburg, 1. The harvest of 32 moose was adequate, but the number of bulls killed (18) was slightly more than desired. Hunters tend to select more bulls, even during a short 11-day season; this trend suggests the need for

separate bull and cow moose drawing permit hunts. I recommend, therefore, a separate drawing permit hunt for each sex during the 1985 season.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 7

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula (except the Placer and Portage River drainages)

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose occur throughout the intermountain valleys of Unit 7; however, no survey data were available to assess their current status. Harvest data suggest the population is stable.

Population Composition

No current composition data are available.

Mortality

Hunters reported killing 77 moose, including 75 males and 2 females. The harvest has risen 108% since 1982. The success rate for 365 hunters was 21%. Antler spread of 71 bulls was as follows: 12 $\leq$ 29.9 inches, 31 between 30.0 and 39.9 inches, 20 between 40.0 and 49.9 inches, and 8 $\geq$ 50.0 inches. The methods of transportation used by hunters were as follows: highway vehicle, 63%; boat, 12%; airplane, 11%; horse, 11%; off-road vehicle, 2%; and three-wheeler, 1%.

Management Summary and Recommendations

Lack of adequate snow has prevented completion of moose composition counts since 1980. All empirical evidence suggests the moose population is stable. Although the moose kill has increased substantially since 1982, the number of hunters increased proportionally, and hunter success has remained relatively constant.

No changes in the season or bag limit are recommended.

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Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 9

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population in Unit 9 appears stable. In Subunit 9B, fewer moose were present in the Kijik-Miller Creek and Chekok Creek drainages during 1984 than during 1982, but numbers were higher in the Koksetna and Chulitna drainages during 1984.

Population Composition

Moose surveys during the fall were concentrated in Subunits 9B and 9C. Seven trend areas were flown in 9B and 693 moose were classified. Three trend areas were flown in 9C and 591 moose were classified. The bull:cow ratio in 9B was 57:100; in 9C the ratio was 42:100, well above the minimum management guideline. The calf:cow ratios were the same in 9B and 9C (25:100). Calves composed 15% of the samples classified in both subunits. Within Subunit 9B calf:cow ratios were lower in the Chekok Creek (17:100) and Big Mountain (10:100) areas of Lake Iliamna than elsewhere in the subunit.

Composition data collected from Subunit 9B were compared with data collected in 1982 (Kijik-Miller Creek, Lower Koksetna-Chulitna, Big Mountain, and Chekok Creek) and show no evidence of changes in population structure. Similar comparisons for Subunit 9C also indicate a stable sex and age structure. In the Katmai trend area, calf:cow ratios were higher (19:100) and bull:cow ratios were slightly lower in 1984 (42:100) than during the previous 2 years.

Mortality

Hunters reported killing 176 bulls, 8 cows, and 5 moose of unspecified sex during October and December seasons. These figures represent an 8% increase in total harvest and an 11%

increase in the bull harvest over 1983. Eighty percent of the total harvest occurred during the September season. Most of the December harvest occurred in Subunits 9B and 9C.

Moose hunting success was 34% for residents and 68% for non-resident hunters. Overall, 43% of 443 hunters reported they killed a moose, a decline from 1983 when 58% hunted successfully, but similar to 1981 and 1982 when 39% hunted successfully. The number of hunters increased 46% over the 1982 and 1983 levels.

Management Summary and Recommendations

The Unit 9 moose population appears stable in numbers and in sex and age structure. Bull harvest was 11% higher in 1984 than in 1983 and the numbers of moose hunters increased by 46%. Elimination of cow hunting in Subunit 9E and southern 9B in 1983, and reduction of the cow season in northern 9B in 1984 have reduced the cow harvest in recent years. The reported cow harvest in Unit 9 during 1984 was half that reported for 1983 (8 vs. 15). However, unreported harvest of cows in 9B may equal the reported harvest. Minimal cow harvests in Subunits 9B and 9E are necessary to provide maximum reproductive potential in the presence of chronic low calf recruitment.

The Becharof-Cinder River moose management plan calls for a minimum post-breeding population sex ratio of 30 to 40 bulls:100 cows. Because aerial surveys were not conducted in Subunit 9E during 1984, the impact of the 1984 harvest on sex ratios is unknown. Trend counts in Subunit 9E should, therefore, have 1st priority when surveys are conducted next year.

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Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 11

GEOGRAPHICAL DESCRIPTION: Chitina Valley and the eastern half
of the Copper River Basin

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose numbers are low throughout most of Unit 11. Trend counts were flown during the fall of 1982, 1983, and 1984 in the northwest portion of the unit; 23, 26, and 30.5 moose per hour, respectively, were observed. This slight increase in moose per hour suggests moose numbers are gradually increasing in that portion of Unit 11.

Population Composition

One hundred twenty-five moose were counted during a survey flown on 12 November in the Mt. Sanford/Mt. Drum area. The bull:cow ratio was 75:100 and the calf:cow ratio was 17:100.

Mortality

Hunters reported taking 41 bull moose, a slight decline from the previous year's harvest of 48. Two hundred twenty-four people reported hunting in Unit 11 (compared with 195 in 1984), yielding a success rate of 18.3%. Nonresident hunters killed 4 moose (9.8%). The most popular methods of transportation used by hunters were highway vehicles, 47%; all-terrain vehicles, 25.5%; and aircraft, 17%.

Management Summary and Recommendations

The moose kill declined slightly this year although hunting pressure increased. While moose numbers may be increasing in the Mt. Sanford/Mt. Drum count area, kill data suggest this is not the situation elsewhere in the unit. A count area should be established in the lower Chitina Valley to determine trends in the McCarthy area where substantial demand for moose hunting exists.

The low bull moose kill and high bull:cow ratios suggest that hunting has not restricted population growth. I believe poor range conditions and predation are limiting population size. No change in season dates or bag limits are recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 12

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White River drainages

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose numbers are low throughout much of Unit 12 with estimated fall densities ranging from 0.1 moose/mi² in the Tetlin-Northway Flats to 1.0 moose/mi² in the Tok River drainage. Approximately 2,500 moose inhabit this 8,500 mi² area.

Moose numbers in the Little Tok and Tetlin River drainages appear to be declining, but the number of migratory moose from Unit 13 that winter in the Tok River drainage appears to be increasing. Moose are probably stable at low densities in the remainder of the unit.

Population Composition

During the period 17 October-23 November 1984, 37 hours were spent surveying and classifying 1,271 moose in Unit 12 and immediately adjacent portions of Subunit 20D. Survey conditions were good to excellent, and the sample obtained was the largest to date.

Chronically low calf survival to 5 months of age (11 calves:100 cows) in the Little Tok and Tetlin River drainages may be expected to lead to further population declines. Calf survival in the Robertson River drainage was only 12 calves:100 cows compared with 55 calves:100 cows the previous year. Thus, moose inhabiting the Robertson River drainage are expected to decline.

The moose population in the Tok River and Dry Tok Creek drainages, consisting primarily of migratory moose from Unit 13, exhibited fair to good early calf survival of 29 calves:100 cows. Yearling recruitment (13%) and low adult

mortality are believed to be responsible for a slow population increase. Increased brown bear harvests and low numbers of wolves in Unit 13 are probably resulting in an increase in moose numbers.

Elsewhere in Unit 12, moderate rates of both yearling recruitment and adult mortality are believed to be resulting in stable but low populations.

Overall, the sex and age composition of moose inhabiting Unit 12 is 46 bulls:100 cows, 9 yearling bulls:100 cows, and 24 calves:100 cows.

Habitat Conditions

Observations indicate that browse use during winter 1984-85 was high in the moose wintering range along the Tok River. Browse use approached 100% of the current year's growth of felt-leaf and red-stem willow, and there was noticeable high use of poplar. Deep snows restricted moose movements to riparian browse stands, and moose did not leave the Tok River winter range until mid-May 1985.

Browse plots crushed in the Tok River drainage in 1982 and 1984 were heavily used. Additional crushed areas will be needed if this population continues to increase. Moose numbers are well below carrying capacity elsewhere in Unit 12.

Mortality

Predation by black bears, grizzly bears, and wolves is believed to be the limiting factor for moose in Unit 12. Continued poaching in the vicinity of villages contributes significantly to overall moose mortality and may be responsible for extremely low densities of lowland, resident moose.

Moose hunting pressure was somewhat higher in 1984 (415 hunters) than in 1983 (340 hunters) or 1982 (408 hunters). A total of 84 bulls was reported taken in 1984 compared with 73 bulls in 1983 and 86 bulls in 1982. Hunter success in 1984 was 20%.

The Tok River drainage contributed 33% of the harvest (28 moose), with the remainder of the harvest well distributed throughout the Tanana, Nabesna, Chisana, and White River drainages. The shortened season in the Little Tok River drainage resulted in a greatly reduced harvest. Consequently, a desired increase of the bull:cow ratio from 14 bulls:100 cows (1984) to 28 bulls:100 cows (1985) also occurred. Local area residents took 38 moose, which was 45% of the total reported harvest.

Of the 84 bulls taken, 23 (27%) were mature bulls with antler spreads equal to or exceeding 50 inches, 30 (36%) were sub-adult bulls with antler spreads from 35 through 49.9 inches, and 24 (29%) were yearling bulls with antler spreads of less than 35 inches.

Management Summary and Recommendations

Most moose populations in Unit 12 exist at low densities and appear stable. Moose numbers appear to be declining in the Little Tok and Tetlin River drainages due to low rates of yearling recruitment and relatively high rates of adult mortality attributable to wolf and bear predation.

Efforts to increase browse in the Tok drainage should continue to meet the needs of this increasing, migratory population. Crushing, logging, and prescribed fires are the recommended techniques.

Initiation of a wolf control program throughout Unit 12 is recommended to increase numbers of moose from 2,500 to 4,500. Browse-use surveys indicate that such a population increase could be sustained to provide for larger annual moose harvests by hunters. Management goals of providing for maximum opportunity to participate in moose hunting and of providing for optimum moose harvest are not being met because of low numbers of resident moose.

It is recommended that the 10-day moose season in the Little Tok River drainage be continued at least 1 more year to ensure that the number of bull moose continues to increase.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 13

GEOGRAPHICAL DESCRIPTION: Nelchina and Upper Susitna Rivers

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The Unit 13 moose population was estimated to be 27,000 animals. Density ranged from 0.4 to 3.3 moose/mi² within a 16,000 mi² area (below 4,000 ft elevation) of Subunits 13A and 13B. Estimates of population size and density were obtained from stratification and trend counts conducted during the fall.

Population Composition

Moose composition counts were conducted in 9 count areas. A comparison of trend count data since 1981 is shown in Table 1. Both the bull:cow and yearling bull:cow ratios increased slightly during 1984. Subunit 13A continues to have the lowest bull:cow ratio and the highest percent of yearling bulls in the unit. In the 2 count areas within Subunit 13A, bull:cow ratios were 15.4:100 and 19.5:100. Approximately 84% of the bulls were classified as yearlings. The Unit 13 calf:cow ratio was 28:100 and suggests an increase in calf production and/or survival.

Mortality

The total reported harvest was 839 moose, a decline of 7.2% from the previous year's kill of 904 moose. The success rate for 3,426 hunters was 24.5% compared with 28% for 3,243 hunters in 1983. Nonresident hunters took 7.7% of the total harvest (65 moose). The most popular methods of transportation used by nonsubsistence hunters were: highway vehicles, 36%; off-road vehicles, 26%; aircraft, 17%; boats, 12%; and three-wheelers, 9%. Nonsubsistence hunters spent an average of 6.1 days afield.

The subsistence moose hunt was a drawing permit hunt for any size antlered bull in Unit 13 except Subunit 13A. Only residents of the unit were eligible to apply and only 1 permit application per household was allowed. Three hundred seventy-two applications were submitted for 100 available permits. Eighty-two permittees reported hunting; 23 moose were killed (28% success ratio). The most popular methods of transportation used by subsistence hunters were highway vehicles, 55%; off-road vehicles, 21%; boats, 10%; aircraft, 7%; and three-wheelers, 7%. Subsistence hunters spent an average of 7.9 days hunting.

An experimental moose hunt for yearling bulls with spike or forked antlers was held in a portion of Subunits 13B and 13E. The purpose of this regulation was to direct hunting pressure to yearling bulls, thus providing for an increase in the survival of large bulls. The hunt area was located in the upper Susitna and Maclaren River drainages. The hunt was monitored by establishing voluntary check stations on the Denali Highway at Brushkana Creek and at the Maclaren River Bridge. The total reported harvest was 71 spike or forked-antler moose. This represents a 59% decline from the 1983 harvest of 175 bulls with antlers 36 inches or larger. Post-hunting season surveys were flown and observers found an increase in the proportion of adult bulls vs. yearling bulls in the experimental area compared with the remainder of the unit.

Additional sources of mortality include moose/vehicle collisions, poaching, and predation. Forty-one moose were reported killed by collisions with highway vehicles along the Glenn and Richardson Highways. The Alaska Railroad reported that 84 moose were killed by trains in Subunit 13E during late winter. The extent of poaching mortality is unknown.

Management Summary and Recommendations

A comparison of trend count information during the past 4 years suggests a gradual increase in the unitwide moose population. This increase is best explained by low winter mortality rates observed during recent mild winters, as well as a reduction in the harvest. Composition data also show an increase in overall bull and calf:cow ratios. However, the high percentage of yearling males observed suggests bulls are killed by hunters as soon as they reach the 36-inch minimum antler size requirement, leaving few large mature animals. In Subunit 13A, nearly the entire post-hunting season bull population was composed of yearling bulls and 2-year-old bulls with antler spreads less than 36 inches.

Harvest figures for 1984 show a decline in the total moose harvest, despite a slight increase in hunting pressure. This decline is directly attributable to the spike/fork regulation that decreased the total harvest by more than 100 bulls in the experimental area. Evaluation of the spike/fork hunt included analysis of 211 questionnaires returned by Unit 13 moose hunters. From monitoring the spike/fork hunt and from analyzing hunter questionnaires, the following conclusions concerning Unit 13 moose management were drawn: The majority of Unit 13 moose hunters favor the 36-inch-minimum antler spread regulation over the more restrictive spike/fork regulation; however, antler size requirements in general were strongly favored over drawing permit hunts. Hunters rated the quality of spike/fork hunting experience low compared with hunting for larger bulls. Hunter recognition was higher and enforcement problems were less for the 36-inch-minimum antler size regulation than for the spike/fork regulation.

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Table 1. Fall sex and age composition data for Unit 13 moose, 1981-84.

Year	Adult bulls	Yearling bulls	Cows	Bulls:100 cows	Calves	Calves:100 cows	Total moose	Moose/ hour
1981	455	294	3,508	21.4	1,054	30.0	5,311	56.4
1982	427	475	3,773	23.9	970	25.7	5,645	65.3
1983	417	437	3,557	24.0	887	24.9	5,298	56.0
1984	537	542	4,265	25.3	1,204	28.2	6,549	65.4

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14A

GEOGRAPHICAL DESCRIPTION: Matanuska Valley

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

No current data are available on moose in Subunit 14A.

Population Composition

No data are available. The lack of adequate snow cover forced cancellation of moose composition surveys.

Mortality

During the 1984 hunting season, hunters took 459 moose, including 310 bulls, 139 cows, and 10 of unknown sex. The 139 cow moose were taken by 400 hunters who were successful in drawing an antlerless moose permit. Analysis of permit data revealed that 97.8% of successful hunters were Alaskan residents, 1.3% were nonresidents, and 0.9% were of unspecified residency. Successful hunters spent an average of 5.1 days afield.

Climatic conditions during the winter varied in portions of Subunit 14A. Deep, persistent snows accumulated in early March in the eastern (upper Matanuska River) and western (Willow Creek) portions of the area. Some winter mortality was reported in areas of heavy snow, primarily among calves of the year. Most of Subunit 14A experienced only light snow accumulation with good wintering conditions and little known winter mortality. A review of moose/vehicle accident records, acquired from the Department of Public Safety, indicated 51 moose were reported killed during the winter. Ninety-four moose were reported killed by highway vehicles during the previous winter. The sex and age composition of highway-killed moose was not available.

Management Summary and Recommendations

Lack of adequate snow cover forced cancellation of moose composition surveys; however, the harvest of 459 moose was close to the 3-year harvest mean of 463 moose. We believe, therefore, that the moose population is stable.

Light snowfall in the central portion of Subunit 14A during the winter allowed moose to remain on summer range. The summer range is located in remote portions of the subunit away from areas of high human density. The lack of conflict with humans was evidenced by the reduction in moose/vehicle collisions.

No changes in seasons or bag limits are recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14B

GEOGRAPHICAL DESCRIPTION: Willow to Talkeetna

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Based on analysis of survey data, the moose population appears to be at a high density and stable.

Population Composition

Composition surveys were flown throughout the subunit in early December. Weather and snow conditions varied from fair to good, depending on the area surveyed. The majority of moose were located above timberline which made observation and classification easier. However, cow/calf groups were frequently located in brushy, more secluded habitat where observation and classification were difficult. This fact must be considered when evaluating the accuracy of calf:cow ratios.

During these surveys 1,771 moose were classified in 32.1 hours of flight time. The bull:cow and calf:cow ratios were 35:100 and 30:100, respectively. There were 6.4 cows with twin calves:100 cows with calves. These data are comparable to 1983 surveys in which 1,828 moose were classified in 38.6 hours of flight time. At that time the bull:cow and calf:cow ratios were 34:100 and 23:100, respectively. The twinning rate was 7 cows with twin calves:100 cows with calves.

Mortality

Hunters killed 534 moose including 258 bulls, 271 cows, and 5 of unknown sex. These totals include 490 moose killed during the fall season and 44 antlerless moose killed during a late winter (1-15 February) permit hunt. During the fall season, 2,528 hunters reported hunting moose; 21% were successful.

The mean age of moose killed during the late winter permit hunt (excluding calves) was 6.5 years for males ($\bar{n}$ = 24) and 7.5 years for females ($\bar{n}$ = 17). These ages are comparable to

7.6 and 7.5 years of age for males and females, respectively, killed during the previous year's hunt. Of 12 adult females checked for pregnancy, all were found to be pregnant with an in utero ratio of 1.6 calves:cow.

Deep, persistent snow conditions existed from mid-February to mid-May throughout the traditional wintering areas from the Susitna River to the foothills of the Talkeetna Mountains. Numerous reports of dead or dying moose were received from local residents. The extent of winter mortality is unknown at this time.

Personnel from the Alaska Railroad reported that 184 moose were killed by trains in Subunit 14B between 15 November 1984 and 28 March 1985. Representatives of the railroad, however, failed to respond to repeated requests for mortality information beyond 28 March 1985. It was estimated that approximately 250 moose were killed by trains in Subunit 14B during the winter of 1984-85. Meetings were held with personnel from the Alaska Railroad in an attempt to find ways to reduce train-caused moose mortality. A list of suggestions was developed and included 1) reducing the speed of trains through areas of high moose density; 2) attaching noise-emitting devices to the locomotive; 3) switching the headlight off when a moose was sighted; 4) plowing snow from a wider area along the tracks; and 5) covering trestles to prevent moose from walking on them. Some of these suggestions were tested by Alaska Railroad personnel.

Records obtained from the Department of Public Safety indicate that 77 moose were killed by highway vehicles and another 40 were killed in defense of life or property.

Management Summary and Recommendations

Mild temperatures and below-normal snow accumulations were recorded through the middle of February. These conditions allowed moose to remain at higher elevations on traditional summer range. Deep snow accumulated in late February, on traditional wintering areas from the Susitna River east to the foothills of the Talkeetna Mountains, and persisted until mid-May. The deep snow restricted moose movements, forcing them to use roads, trails, and railroad tracks that were kept clear of snow. Use of these areas resulted in twice the average number of moose/vehicle collisions on roadways and 12 times the average number of moose/train collisions between Willow and Talkeetna.

The Alaska Railroad tested several techniques which may reduce moose/train collisions. However, since they have not provided moose kill data after 28 March 1985, the effect of this testing is unknown. The railroad refused to reduce the speed of

locomotives since harmonic vibrations that may be damaging to railroad equipment develop at slower speeds. They also refused to deck the trestles, citing reasons relating to public safety and interference with "wheel slip" radar. Efforts to obtain more information on the extent of this type of moose mortality and to develop an effective technique to reduce train/moose collisions are continuing.

One thousand, seven hundred seventy-one moose were observed during the 1984 survey, which is 57 fewer than were classified in the previous year. However, 6.5 fewer survey hours were flown in 1984 and the number of moose counted per hour increased from 47 in 1983 to 55 in 1984. The calf:cow ratio also increased substantially between 1983 and 1984 (23 to 30 calves:100 cows). These composition surveys were conducted after the fall hunting season in which 490 moose were harvested. We believe these data indicate the moose population is at a high level and stable.

High moose hunting effort and success were attributed to favorable weather conditions which continued throughout the 30-day either-sex season. Kill locations, plotted on a map, show that the majority of harvest occurred along the Parks Highway and access trails. The remainder of the subunit lacks access and received only light hunting pressure. The moose population in Subunit 14B appears to be at or above maximum density for the available winter range.

Due to the high mortality of moose in the western portion of Subunit 14B, we recommend reducing the season and bag limit in that portion west of the powerline intertie. However, because of the high density of moose, limited winter range, and low harvest away from the road system, we recommend the either-sex bag limit remain in that portion of the subunit east of the intertie.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14C and 7

GEOGRAPHICAL DESCRIPTION: Anchorage area, within the Portage
and Placer River drainages

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population within the Anchorage and Ft. Richardson Management Areas declined 8-10%. A decrease in moose calf production and/or survival; moose killed on highways; and moose killed during the hunting season were the major contributors to this decline. The moose population in the remainder of the subunit was stable.

Population Composition

Nine hundred thirty-one moose were counted during aerial surveys flown in November and December. These surveys covered all but 1 of the major fall moose concentration areas within Subunit 14C. Snow cover was minimal and counting conditions were poor. A ratio of 51 bulls:100 cows was observed, which was similar to the previous year's mean of 49 bulls:100 cows. Thirty-nine calves:100 cows were observed, which is substantially less than the 1979-83 mean of 48 calves:100 cows.

Mortality

The total reported mortality (by hunting, poaching, vehicles, and trains) for the subunit was 276 moose. Hunters killed 167 moose, including 120 bulls and 47 cows. The cow moose were taken during several drawing or registration permit hunts throughout the subunit. Sixty-one bulls were taken in permit hunts, and 59 were taken during the general open season.

Eighty-seven moose, approximately 35 of which were calves, were killed by vehicles in Subunit 14C between 1 June 1984-31 May 1985. This compares with 130 moose killed on local highways during 1983-84 and 85 killed annually between 1977-83.

Twenty-two additional moose were killed by other means, such as poaching and collisions with trains.

The mean age of 88 cow moose killed by various means was 4.7 years of age while 67 bull moose averaged 2.5 years of age. Both figures were nearly identical to ages obtained during the past 4 years.

Management Summary and Recommendations

A decrease in calf production and/or survival was recorded in the Anchorage/Ft. Richardson portion of Subunit 14C. This decrease, when combined with other mortality factors, resulted in a moose population decline in that portion of the subunit. Changes in hunting regulations were recommended to reduce the moose kill in that area. No changes in season or bag limits were recommended for the remainder of the subunit.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15A

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose surveys were not conducted in Subunit 15A during 1984. A pattern of unseasonably warm weather and frequent rain continued through December, resulting in unacceptable survey conditions. However, the mild winter should have benefited the moose population by allowing moose to browse on plants that would normally be covered by snow.

The 1969 burn (85,000 acres) and other scattered areas of improved habitat are providing excellent browse for moose. I believe the moose populations in these areas are still increasing. However, these areas only make up about 12% of the total acreage in Subunit 15A. The remainder of the subunit is classified as an unproductive moose range and the populations in these areas are believed to be decreasing slightly.

Population Composition

No data are available.

Mortality

Hunters reported killing 314 moose during the 1-20 September season. Hunting occurred throughout Subunit 15A for bulls and within the 1969 burn for antlerless moose by permit. Twenty-nine permittees reported taking 23 antlerless moose (79% success). The mean age of these antlerless moose was 7 years and ranged from 1 to 18 years of age. Excluding the permit hunt, 1,943 hunters killed 281 bulls, 5 cows, and 5 moose of unknown sex. Ninety-nine percent of the hunters were Alaskan residents. The majority of the harvest came from the northern

portion of the 1969 burn and from the Swanson River area. Antler sizes of bulls taken were grouped as follows: 35% were <25 inches, 35% were 25 to 34.9 inches, 23% were 35 to 49.9 inches, and 7% were ≥ 50 inches.

Management Summary and Recommendations

Habitat improvement is needed in Subunit 15A to maintain the size of the present moose population and to distribute moose hunting pressure. The Department, assisted by the U. S. Fish and Wildlife Service, has conducted a habitat improvement program and mechanically manipulated 3,320 acres in the southeast corner of the subunit (Skilak Loop) during the past 2 years. Six hundred acres within this area were also burned to improve moose habitat. The primary objectives of this program were to improve moose winter range and, secondarily, to attract hunters to the Skilak Loop to reduce hunting pressure in the 1969 burn. As funds are available, similar habitat manipulation and prescribed burning should be conducted.

If the mild winter weather pattern continues and fall surveys indicate the moose population in the 1969 burn area is still increasing, I recommend the number of antlerless moose permits for that area be increased.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15B

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose surveys were not conducted in Subunit 15B due to lack of snow. However, incidental observations by State and Federal biologists and reports from hunters suggest the trend of high bull:cow and low calf:cow ratios is continuing. Since there has been little change in moose habitat in recent years and since densities of predators have remained high, I assume there was little change in the size of the moose population.

Population Composition

No data are available.

Mortality

Four hundred fifty-five hunters killed 80 moose including 77 bulls, 2 cows, and 1 of unknown sex in Subunit 15B West. Resident hunters took 99% of the harvest, and hunter success was 18%. Antler spread measurements were obtained from 69 of the bulls and can be grouped as follows: 34 $\leq$ 29.9 inches, 26 between 30.0-49.9 inches, and 9 $\geq$ 50.0 inches.

Seventy-four of 100 permittees reported hunting in Subunit 15B East. Thirty bulls were killed; 30% of the hunters were successful. Mean antler spread was 52 inches ($n = 19$), and the largest antler spread was 63 inches. The average age of bulls killed was 7 years. Horses were the primary means of transportation used by successful hunters.

The extent of weather-related mortality and predation by wolves and bears on moose in Subunit 15B is unknown.

Management Summary and Recommendations

The harvest of 80 moose in Subunit 15B West was the highest harvest since 1974 when 95 were reported killed. Mild weather during the hunting season is believed to be the primary reason for the high kill.

The trophy bull moose hunt in 15B East continues to provide excellent hunting opportunities and is popular among resident and nonresident sportsmen. The high bull:cow ratio in 15B East suggests the harvest of 30 bulls was an underutilization of the trophy bulls present. A limited annual harvest, however, is desirable to maintain a high portion of trophy bulls in the population. No changes in seasons or bag limits are recommended for either portion of the subunit.

Winter and summer moose ranges on the Kenai National Wildlife Refuge within Subunit 15B continue to deteriorate due to management policies which favor advanced forest succession for wilderness lands. Nonrefuge lands are so interspersed with private, borough, and native lands that significant habitat improvements are not feasible. The Department of Fish and Game and the U. S. Fish and Wildlife Service should cooperate on habitat projects to improve moose habitat in the Slikok Lake and Coal Creek Lake areas through mechanical manipulation and prescribed burning.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15C

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose are moderately abundant and probably near the ecological carrying capacity of the maturing forest habitats of the lower Kenai Peninsula. A minimum density of 2.9 moose/mi² was observed on 394 mi² of fall range in 1983. The overall minimum density for the entire subunit, however, was probably about 2.0 moose/mi².

Population Composition

No composition data are available.

Mortality

The reported harvest was 218 moose, including 214 bulls, 1 cow, and 3 moose of unspecified sex. The success rate for 1,265 hunters was 17% compared with 21% for 1,153 hunters in 1983. Antler size was obtained from 194 bulls and can be grouped as follows: 57 bulls <30.0 inches; 79 bulls 30-39.9 inches; 37 bulls 40-49.9 inches; and 21 bulls ≥50.0 inches. The most popular methods of transportation used by hunters were: highway vehicles, 44%; off-road vehicles and three-wheelers, 38%; boats, 9%; horses, 6%; and airplanes, 3%.

Management Summary and Recommendations

There is currently a need for more complete information about moose population size, recruitment rates, mortality, and late-summer/fall movement patterns. A census of moose in Subunit 15C is recommended. The census should be conducted during the fall since moose at that season are aggregated in open sub-alpine habitats where they are easily sighted and classified.

The Anchor River/Fritz Creek Critical Habitat Area was established by legislative act in May 1985. This act reserves 19,000 acres of river bottom and adjoining uplands along the South Fork of the Anchor River and Fritz Creek, primarily as moose winter range. A critical habitat area management plan will be developed for this area next year.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16

GEOGRAPHICAL DESCRIPTION: West side of Cook Inlet

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

With the exception of the Redoubt Bay drainages, the Unit 16 moose population has remained healthy and stable. Stratification surveys were conducted in most areas of the unit, including a portion of the area censused in 1984. Information from those surveys has indicated little change in population size. The population estimate was 10,340 moose at the 90% confidence level. In some areas, hunting or localized winter mortality has altered the population structure, but such changes are not of biological concern. The moose population in the Redoubt Bay drainages appears to be declining.

Population Composition

During November, trend counts were flown in Kroto Creek and the Peters-Dutch Hills in Subunit 16A; counts for Lone Ridge, Mt. Yenlo, Willow Mt., Beluga-Susitna Mts., Redoubt Creek, Alexander Creek and Sunflower Basin were flown in 16B. Survey results are shown in Table 1.

Mortality

In Subunit 16A, 308 moose including 251 males, 52 females, and 5 of unknown sex were reported killed by 1,216 hunters. Of these moose, 256 were killed during the general open season in September, 33 antlerless moose were killed by hunters with drawing permits in September, and 19 moose were taken along the Parks Highway by hunters with drawing permits in February. Most of the hunters were Alaskan residents (294 successful, 882 unsuccessful) with nonresidents (11 successful, 14 unsuccessful) and persons of unknown residency (3 successful, 12 unsuccessful) making up only 3% of the total.

Deep and persistent snow conditions existed from mid-February to mid-May and resulted in a substantial number of moose being killed by trains. Moose were attracted to railroad beds that were cleared of snow and refused to move off the railroad tracks, even when confronted with approaching locomotives. Two hundred fourteen moose were reported killed by trains between Willow and Talkeetna. This is a conservative number and does not include those moose that were hit and injured by trains and died later. The Alaska Railroad runs through the western portion of Subunit 14B, and lies within a major moose wintering area that includes western Subunit 15B and eastern Subunit 16A. It was estimated from data on radio-collared moose that 30% of the train-killed moose summered in Subunit 16A. An additional high number of moose were also killed by vehicles on roadways which pass through this winter moose range. The magnitude of natural mortality caused by deep snow cannot be quantified, but it appeared to affect the calf segment of the population primarily.

In Subunit 16B, 586 moose, including 424 males, 155 females, and 7 moose of unspecified sex were reported killed. This was the 3rd year that harvest from this subunit increased substantially (1983, 489 moose; and 1982, 362 moose). During the September season, 1,521 hunters reported taking 505 moose including 389 males, 109 females, and 7 of unknown sex. Alaska residents composed 92% of the September hunters (440 successful and 960 unsuccessful) with nonresidents (54 successful and 37 unsuccessful) and residency unspecified (11 successful and 19 unsuccessful) composing the remainder. During the 1-15 November season, 34 moose (17 males and 17 females) were taken by 96 hunters with drawing permits, and 16 moose (9 males and 7 females) were taken by 62 local resident hunters with registration permits. During the 10-24 January season, 53 local resident hunters reported taking 31 moose (5 males and 26 females). All hunters with permits were Alaskan residents.

Management Summary and Recommendations

Composition data obtained from both subunits were generally comparable to those collected in recent years. Annual variation in data frequently reflects bias introduced by movements of moose or by survey conditions, rather than changes in population status. The unit-wide ratio of 30 calves:100 cows indicates reproductive success was adequate to maintain existing harvest levels and a healthy population. The total harvest of 924 moose was the largest reported kill for the unit since 925 moose were reported killed in 1973. This harvest level represents only about 9% of the unit's estimated population. Winter mortality was confined to local areas primarily in northern Subunit 16A and losses occurred mainly

among calves. A substantial number of moose were also killed by trains and highway vehicles from mid-February through mid-May.

The moose population in the Redoubt Bay area appears to be in a steady decline due to natural causes. Hunting mortality has contributed to the decline and the record kill of 43 bulls and 15 cows was excessive. Since 1977, the bull:cow ratio has declined from 47:100 to only 16:100. The 1983 census placed this population at approximately 300 moose which is substantially below the 419 moose observed in 1977. The increase in harvest levels during the 1984-85 season was the result of favorable hunting weather during September and increased hunting opportunities through permit hunts. Although the 1984-85 harvest levels were not biologically harmful, further increases in the harvest level might be. Seasons and bag limits for the Redoubt Bay area should therefore be restricted.

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Table 1. Moose sex and age ratios in Game Management Unit 16, 1984.

Count area	Males: 100 females	Calves: 100 females	Twins: 100 females w/calves	Moose/ hour	Sample size	Count time (hours)
Subunit 16A						
Peters-Dutch Hills	31.2	35.8	9.4	67.9	760	11.2
Kroto Creek	26.1	37.3	14.3	70.6	219	3.1
Subunit 16A Totals					979	14.3
Means	30.0	36.2	10.5	68.5		
Subunit 16B						
Lone Ridge	51.8	31.4	16.7	55.8	251	4.5
Redoubt Bay	16.0	12.6	15.4	29.4	153	5.2
Sunflower Basin	38.7	18.7	5.3	77.0	354	4.6
Susitna D	41.4	42.4	5.1	65.0	182	2.8
Susitna B	67.2	33.6	7.5	69.0	269	3.9
Yenlo Mt.	45.9	23.9	2.9	151.7	273	1.8
Willow	22.2	38.1	20.0	112.2	101	0.9
N. Beluga	35.9	33.3	19.0	82.5	132	1.6
Alexander Cr.	11.1	40.7	10.0	21.6	41	1.9
Wolf Lake	40.4	24.3	17.9	97.4	224	2.3
Subunit 16B Totals					1,980	29.5
Means	40.9	27.1	10.7	67.1		
Unit 16 Mainland						
Totals					2,959	43.8
Means	37.3	30.1	10.6	67.6		

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16B

GEOGRAPHICAL DESCRIPTION: Kalgin Island

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population has been significantly reduced from its peak (estimated at 7 moose/mi²) through hunting. The present density is estimated at 2 moose/mi².

Population Composition

No data are available.

Mortality

Thirty moose (12 bulls and 18 cows) were killed during a 4-day season in September. Of the 30 moose, only 4 were older than 3 years of age and none were older than 6 years of age. Examination of incisor teeth indicated that few moose on Kalgin Island live beyond 6 years of age. Teeth from many adults had worn down to such a degree that it had apparently become difficult for them to obtain adequate food.

Management Summary and Recommendations

Two hundred twenty-seven moose have been taken from the Kalgin Island population during the past 4 hunting seasons. Although fall trend count data were not obtained in 1984, it was estimated that approximately 40 moose remained on the island following the hunting season. This estimate suggests an over-winter population of approximately 2 moose/mi². Without hunting to control population size, the herd could increase rapidly. There are no large predators on the island and weather conditions have continued to be mild. At this time the moose population is considered above carrying capacity and should be reduced to a winter population of 1 moose/mi².

Interest in hunting the Kalgin Island moose population has declined even though 1 hunter in 5 took a moose last year. In 1984, only 213 permits were issued with 149 hunters (70%) actually going afield. Spruce and alder vegetation on the island is generally dense and moose can readily avoid detection. However, if large numbers of hunters are present, the moose become more vulnerable. This aspect of hunter success is documented in 4 years of harvest chronology, which shows that most moose were killed during the 1st few days of the season when peak numbers of hunters were present. In 1984, no moose were reported taken on the 4th and final day of the season.

A moose survey on the northeastern portion of the island in mid-winter indicated that moose were obtaining adequate feed at that time. However, few if any of the traditional forage items were observed, and feeding was directed at fern rhizomes, alders, and lichens. Forage on such items probably accounts for accelerated tooth wear.

The existing number of moose remains too high to allow reasonable vegetation recovery. Some recovery of species like blueberries and salmonberries has been observed, but traditional forage like willow is absent and no regeneration of birch trees has been seen.

If a 1 moose/mi² objective is to be met, a large number of hunters will need to be encouraged to hunt. Because the population is significantly below its peak level, many hunters consider they have less chance of killing a moose on Kalgin Island compared with opportunities elsewhere in southcentral Alaska. For this reason, I recommend different opening dates of hunting seasons to minimize competition with other areas. I also recommend that season dates that open the area prior to other moose seasons be established. A registration hunt provides the best means of directing hunters to the island, monitoring the harvest level, and obtaining biological specimens from moose.

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Game Biologist III

SUBMITTED BY:

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 17

GEOGRAPHICAL DESCRIPTION: Northern Bristol Bay

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose populations in most areas of Unit 17 appear to have increased dramatically in recent years. These increases were attributable to very high calf survival in 1983 and 1984, mild weather conditions since 1974-75, and fewer incidences of illegal take of cow moose by Nushagak River villagers. In 1982, the Mulchatna Caribou Herd began wintering closer to these villages than they had in the past. Since 1982, caribou have replaced moose as the primary meat source for local residents.

Moose densities in Subunit 17A, however, remained extremely low. While immigration of moose into the Togiak drainage, particularly from the Wood River Mountains, is a common occurrence, the number of moose taken illegally was sufficient to keep this area practically devoid of moose. Seventeen illegal kills were reported from Togiak during December through March.

Moose stratification surveys were conducted in the upper portion of the Mulchatna River drainage during January 1985. The objectives were to delineate areas of high use and to provide a rough density estimate of moose for areas of Subunit 17B that had never been surveyed. Densities were estimated to range from 0.4 to 2.0 moose/mi². Highest densities were observed along tributaries of the Chilakadrotna River.

Population Composition

Record high numbers of moose were observed during all fall sex and age composition counts conducted in 1984. Snow conditions were excellent for a short period in late November and early

December and surveys were flown in Sunshine Valley, Iowithla and lower Nushagak Rivers in Subunit 17C, and Old Man Creek and Mosquito River in Subunit 17B.

Three hundred fifty-nine moose were observed in Subunit 17B during 5.4 hours of surveys. The following sex ratios were observed: 138 bulls:100 cows and 36 calves:100 cows, with 13% calves in the herd. In Subunit 17C, 257 moose were observed during 6.1 hours of surveys. Ratios were 98 bulls:100 cows and 53 calves:100 cows with 21% calves in the herd. Calf:cow ratios were at record high levels for fall composition counts in all survey areas.

Mortality

During the 1984 season, 361 hunters reported taking 158 moose, including 157 males and 1 female. Of these, 117 were taken by residents, 40 by nonresidents, and 1 by a hunter of unknown residency. Bristol Bay residents reported taking 96 moose. Forty moose were taken by 175 local resident hunters during the registration permit hunt held 20 August-4 September.

Harvest chronology indicated that the number of moose taken throughout the fall season in Subunit 17C was fairly uniform. Hunting pressure was concentrated along the Nushagak River between Angel Bay and Ekwok. Water levels in the Wood River Lakes were very low during the season, and boat access beyond the Agoulawok River was nearly impossible. In Subunit 17B, however, the peak of harvest occurred during the last week of the September season. Twenty-one moose were reported taken during the December season. Hunting pressure was well distributed.

In Subunit 17B, aircraft was the primary means of transportation for 80% of the successful hunters. In Subunit 17C, 56% of the successful hunters used boats, 30% used snowmachines, and only about 10% used aircraft as the primary means of transportation.

In addition to the legal harvest, 30 moose were taken illegally out of season according to the Department of Fish and Game and the Department of Public Safety, Division of Fish and Wildlife Protection. Of these, 17 occurred in the Togiak drainage, 7 near Manokotak, 3 near Ekwok, 2 near New Stuyahok and 1 at Queen's Cannery. Two citations were issued, resulting in 1 conviction and 1 case pending.

Management Summary and Recommendations

A succession of mild winters, high calf survival, and reduced mortality of cow moose during winter months have all contributed to increasing moose populations in Subunits 17B and 17C.

The Board of Game has increased the season length in that portion of Subunit 17B drained by the Mulchatna River upstream from the confluence of the Chilchitna River. No trend counts have been made in that portion of the subunit. The entire moose season is concurrent with the caribou season, and during the last 10 days, the brown bear season is open as well. Hunting pressure is expected to increase in this area through the 1985-86 season. A population estimate of this area should be made this fall to provide a data base for monitoring future changes in this population.

Extensive illegal harvest in Subunit 17A has left this area with almost no moose. Efforts by the U. S. Fish and Wildlife Service, the Department of Fish and Game, and the Division of Fish and Wildlife Protection to reduce the level of illegal take has had limited success. State and federal protection officers will need to maintain a high profile in the Togiak drainage from October through March if this population is ever to be viable.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

PERIOD COVERED: 1 July 1984-30 June 1985

Seasons and Bag Limits

See Alaska Hunting Regulations No. 25.

Population Status and Trend

The Unit 18 moose population is confined primarily to riparian willow habitat along the Yukon River above St. Marys, and the Kuskokwim River drainage upriver of Bethel. The density of moose in Unit 18 remained extremely depressed, particularly in the Kuskokwim drainage. Moose approach normal densities only in the Yukon drainage above Ohogamiut. In the remainder of the Yukon drainage and in the entire Kuskokwim drainage, moose densities are extremely low, even in the best habitat, and are generally less than 1 moose/10 mi². We believe the moose population in Unit 18 currently numbers approximately 500 in the Yukon drainage and 100 in the Kuskokwim drainage. Historically, the density of moose in Unit 18 has been extremely low, and most local residents are not alarmed by the low numbers. Although high-quality habitat is widely available in both drainages, heavy hunting pressure from resident subsistence hunters and sporadic brown/grizzly bear predation effectively limit growth of the moose population.

Population Composition

Fall composition counts were conducted during November and December along the Yukon River from Ohogamiut to Paimiut, and along the Gweek and Reindeer Rivers (Table 1). Survey conditions were marginal due to shallow snow depths and ceiling/visibility problems. No moose were observed in the Gweek River survey. Although more moose were observed in the Reindeer River survey than in previous years, densities are still extremely low. All moose were observed on ridges and upland areas adjacent to the river rather than on the riparian corridor. This is not surprising given the shallow snow depths encountered. Moose apparently had not begun their movement to the river and were still widely dispersed over their summer and fall ranges.

The lower number of moose observed during the fall 1984 Yukon River survey, compared with numbers in past years, also indicates that moose had not yet moved onto winter ranges (Table 2). As observed in the past, calf production was excellent; a calf:cow ratio of 97 calves:100 cows and a twinning rate of 31% among cows with calves indicate that productivity is high and should be sufficient to allow expansion of the population into suitable downriver habitat. The high bull:cow ratio observed (49 bulls:100 cows) is similar to ratios observed in past years and is probably more a result of local hunting practices than of low bull mortality. A heavy illegal harvest of cows probably increases the bull:cow ratio.

Late winter composition surveys were conducted in the Kisaralik, Tuluksak, and Ophir River drainages of the Kuskokwim and in the Chuilnak, and East and North Forks of the Andreafsky River in the Yukon drainage. Additional surveys were conducted along the Yukon River from Dogtooth Bend to Paimiut (Table 3). Survey conditions were excellent because snow cover was complete and moose were concentrated on winter ranges. Survey conditions were especially good along the Yukon River, and the most complete survey since 1981-82 was conducted over a 4-day period. Two hundred twenty moose were counted during 22.3 hours of survey flying (10 moose/hour) in both the Yukon and Kuskokwim drainages. Twenty-eight moose were counted in the 3 Kuskokwim drainages at a mean rate of 3 moose/hour; in the Yukon drainage, 192 moose were counted at a mean rate of 15 moose/hour. Densities varied from moderate to extremely low.

The number of moose observed along the Yukon River from Russian Mission to Paimiut was much higher than in past surveys (Table 4). Because snow was deep and moose were confined to the riparian corridor, this increase is not surprising. Calf percentages observed over a 5-year period do not differ statistically ($\chi^2 = 3.25$, $0.50 < P < 0.75$), and have remained remarkably stable at approximately 31%, indicating good recruitment each year (Table 4). Although winter conditions have varied greatly, from little or no snow to deep snow during the 5-year period, recruitment appears to have remained stable. Because moose numbers are low relative to suitable habitat, snow depth may not be as critical to overwinter calf survival as it is in other areas of Alaska.

Mortality

The most significant source of moose mortality in Unit 18 is hunting. During fall 1984, 236 hunters reported a harvest of 63 moose. Thirty-nine moose were reportedly harvested from the Yukon drainage, 20 from the Kuskokwim drainage, and 2 from the tundra lowland between the rivers. Fifty-three moose

(84%) were taken during the September season; the remainder were reportedly harvested during the November-December season. The 1984 harvest was similar to harvests reported in past years but substantially lower than the 1981 reported harvest of 82 moose. Moose are taken by hunters throughout the year, and the unreported, out-of-season harvest may equal or exceed the reported harvest. Snow conditions during winter and spring 1985 were excellent for hunters using snowmachines, and we believe the out-of-season harvest was substantial, particularly in the Kilbuck Mountains east of Bethel. We believe the total unitwide harvest exceeded 120 moose during this reporting period.

As reported in the past, most successful hunters (predominantly local residents) used boats as their primary mode of transportation (84%). Successful hunters using aircraft as their primary means of transportation accounted for 5% of the harvest. These hunters were typically guided, nonlocal people who hunted in the eastern Kilbuck Mountains, an area largely inaccessible to hunters using boats. ATV and snowmachine users took 11% of the reported harvest.

During the 1984 season, 84% of the reported harvest was taken by Unit 18 residents, a proportion nearly identical to those observed in past years (Table 5). Alaska residents from outside Unit 18 took 6% of the harvest; nonresidents took 3%. Although nonlocal hunters are the object of numerous complaints from local residents, harvest data indicate that nonlocal hunters continue to account for a relatively small percentage of the harvest.

Relatively little is known about the effect of predation on moose numbers in Unit 18. For the 1st time in 5 years, wolf sightings were reported in Unit 18 throughout the entire winter. Normally, wolves are sighted only sporadically in Unit 18 during fall, and such sightings are usually of animals passing through the unit. I suspect, however, that wolf predation is minimal, because moose densities are too low in most areas to support a resident wolf pack, and alternate prey are nonexistent. Brown/grizzly bear predation, however, is believed to be more substantial. Three instances of bear predation on adult moose were documented during spring 1985. Two instances occurred in the Andreafsky drainage north of St. Marys and 1 occurred in the Kilbuck Mountains east of Bethel. During April and May 1985 snow melted late and bears were apparently able to run down moose in the deep snow. Although I believe bear predation can be substantial in years of late snow melt, the effect of predation during normal years is poorly understood. Although bears undoubtedly take some calves, the low density of moose throughout the unit would prevent bears from keying in on moose as a food source during

spring. Significantly, areas of Unit 18 with the highest densities of brown/grizzly bears have low densities of moose. Additional information regarding moose/bear relationships is necessary if we are to adequately understand and manage both species.

Management Summary and Recommendations

Illegal harvest of moose during late winter and spring continues to be a highly significant management problem in Unit 18. We believe hunting mortality was unusually high this year, particularly in the Kilbuck Mountains east of Bethel. The problem is seriously aggravated by a lack of alternative game resources and a high density of people and villages. Due to cultural barriers, many hunters do not understand wildlife management or the need for game regulations. Our survey data indicate that Unit 18 moose populations are highly productive and could expand into suitable habitat given the opportunity. Additional public education and enforcement efforts are recommended.

Most hunters, particularly those residing in river villages, are aware of the harvest ticket requirement, and most comply during the legal season. Many hunters, however, still do not know that they must return their harvest reports after the season closes. We must continue public education efforts concerning the need for total compliance with the harvest ticket requirement.

The effect of brown/grizzly bear predation on low-density moose populations in Unit 18 should be studied. Although bears probably do not take many moose, the effect of predation may nevertheless be substantial, because bears are more numerous than moose in some portions of the unit. Combined mortality from hunting and bear predation may be sufficient to prevent the moose population from realizing its growth potential.

Distribution and seasonal movement patterns of moose in Unit 18 are still poorly understood. Because moose are heavily hunted throughout the entire year, seasonal movements probably differ from those observed elsewhere in Alaska. The population appears to be highly migratory and capable of moving long distances. A radiotelemetry study would greatly improve our understanding and management of moose in Unit 18.

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Table 1. Unit 18 moose composition counts, fall 1984.

Area	Adult bulls	Yrlg bulls	Cows	Calves	Percent calves	<u>n</u>
Yukon R. (Ohogamiut to Paimiut)	11	6	35	34	39	87 ^a
Reindeer R.	6	0	6	5	29	17

^a Includes 1 moose of unidentified sex and age.

Table 2. Fall Yukon River moose surveys, Ohogamiut to Paimiut, 1981-84.

Date	Bulls: 100 cows	Calves: 100 cows	Twins:100 cows with calves	Percent calves	Moose/hr	<u>n</u>
1981	55	88	50	36	28	102
1982	51	35	13	19	46	138
1983	24	68	22	35	21	83
1984	49	97	31	39	16	87

Table 3. Unit 18 late winter/spring composition counts, 1985.

Area	Adults	Calves	Percent calves	Moose/hr	<u>n</u>
Kisaralik R.	4	0	0	1	4
Tuluksak R.	6	1	14	2	7
Ophir R.	15	2	12	6	17
Andreafsky R. (North Fork)	1	1	50	1	2
Andreafsky R. (East Fork)	2	0	0	1	2
Chuilnak R.	11	6	35	11	17
Yukon R. (Dogtooth Bend to Devil's Elbow)	9	1	10	3	10
Yukon R. (Devil's Elbow to Russian Mission)	33	21	39	28	54
Yukon R. (Russian Mission to Devil's Elbow)	75	32	30	49	107

Table 4. Late winter Yukon River moose composition counts, Russian Mission to Paimiut, 1981-85.

Date	Adults	Calves	Percent calves	Moose/hr	<u>n</u>
1981	27	12	31	18	39
1982	22	15	41	19	37
1983	35	10	22	18	45
1984	43	20	32	29	63
1985	75	32	30	49	107

Table 5. Unit 18 moose harvest by residency status, 1981-84.

Residency status	1984		1983		1982		1981	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Unit 18 resident	53	(84)	53	(84)	45	(83)	67	(86)
State resident (nonlocal)	4	(6)	4	(6)	3	(6)	3	(4)
Nonresident	2	(3)	2	(3)	1	(2)	8	(10)
Unknown	4	(7)	4	(7)	5	(9)	0	(0)
Totals	63	(100)	63	(100)	54	(100)	78	(100)

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 19

GEOGRAPHICAL DESCRIPTION: Upper and middle Kuskokwim River drainages

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Calf production remained high on the Holitna and Hoholitna drainages in Subunit 19A. The scarcity of yearling bulls during fall surveys suggested that overwinter survival the previous year was poor. However, using yearling bulls as a measure of recruitment may be invalid in Subunits 19A and 19D where hunters regularly take nearly all yearling bulls occupying river habitat during the fall season. Calves composed a relatively high portion (26%) of the herd during late winter counts in 1984. Other population indicators for Subunit 19A, such as moose-per-hour, were similar to figures for 1983; this population was probably relatively stable or increasing slightly. In Subunit 19B, snow cover was inadequate to conduct meaningful surveys.

In Subunit 19C, surveys indicated the population may have increased slightly in the foothills of the Alaska Range and stabilized on the Farewell burn. Calf survival and yearling recruitment in 1984, which were low in the past, were the lowest observed.

In Subunit 19D, there was almost no snow cover during November, followed by record or near-record snow accumulations from January through May. Consequently, the distribution of moose during fall and late winter surveys was different than normal. Calf survival to November was one of the highest on record, but by early March the number of calves had declined to levels normally observed in late winter. Yearling bull recruitment was very low for the 2nd year in succession. Calves in very poor condition and winter-killed calves were observed in March and April over much of Subunit 19D. Losses of adults and calves to wolf predation were abnormally high

because moose were concentrated along main drainages and deep snow made moose vulnerable to wolf predation. Moose kills were regularly seen during a wolf census throughout most of Subunit 19D during March 1985. Most of the prime moose calving habitat flooded in late May and early June, and it is likely that many of the calves born in 1985 drowned. All indications are that the moose population in Subunit 19D suffered a substantial decline in spring 1985.

Population Composition

For the 2nd consecutive year most of Unit 19 (except Subunit 19C) had a mild fall with little snow. Consequently, only a limited number of composition surveys were attempted. Nevertheless, surveys indicated good survival of calves through November in Subunit 19A, but the number of cows with twins declined. In Subunit 19C, recruitment remained low with 20 calves:100 cows and 7 yearling bulls:100 cows during fall. In Subunit 19C, the number of yearling bulls probably provides a valid measure of recruitment as nearly all hunters take older bulls. However, the 41 bulls:100 cows is the lowest ratio recorded since the early 1970's. In Subunit 19D the calf:cow ratio increased, but the incidence of twins and yearlings remained very low.

Similar to last year, late winter surveys in Subunit 19A revealed moderate survival of calves. In Subunit 19D, calf survival was lower than in prior years.

Mortality

Twenty percent more hunters (1,019) reported taking 29% more moose (567) than last year's record harvest for Unit 19. All 4 subunits had record numbers of hunters and record high harvests except in Subunit 19C where only slightly more moose were taken last year.

Alien hunters were the only residency group that was not more numerous than in previous years. The number of hunters from Unit 18 (215) was more than double the prior 4-year average (97), while the number of Unit 19 residents increased 27%. Unreported moose harvest continued to be significant, but efforts by Department personnel and Fish and Wildlife Protection officers to improve harvest reporting appears to have brought compliance in McGrath to within 85% and to nearly 50% in Nikolai, Telida, and Sleetmute. In other villages, reporting compliance has ranged from 19% to 33%. It is estimated that the total harvest from Unit 19 was between 1,100 and 1,200 moose; approximately 850 of these animals were taken by residents of Units 18 and 19.

In Subunit 19A, 339 hunters reported taking 185 moose, an increase of 65% and 123%, respectively, over the prior 4-year average. The Holitna, Aniak, and lower Kuskokwim drainages were the most heavily hunted areas. Although nearly the same number of Subunit 19A residents (112) reported hunting in Subunit 19A as last year, their success increased 51%. The bulk of the increased hunting pressure (32%) came from Unit 18 residents. Boats were the principal means of transportation used by hunters in Subunit 19A (64%); 12% and 11% of the hunters used snowmachines and aircraft, respectively. Seventy-four percent of the take occurred during the September season. Hunters also took advantage of the February season, during which 23% of the take occurred. Sleetmute residents in particular took advantage of the February season. Only 5 moose were reported taken during November.

In Subunit 19B, 278 hunters reported taking 154 moose, up 69% and 59%, respectively, over the prior 4-year average. The increase stemmed principally from southcentral Alaska hunters and nonresidents. Despite increased hunter effort, the success rate (48%) was lower than in the previous year (55%). The number of aliens hunting in Subunit 19B dropped considerably. The upper Stony River and Whitefish and Telaquana Lakes were the most heavily hunted areas in Subunit 19B. Nearly all hunters used aircraft (95%) to get to their hunting area.

Subunit 19C had more hunters (169) than last year (137), but only 95 moose were taken compared with 102 the previous year. Hunting success dropped from 74% to 56%. Again the most heavily hunted area was near Farewell where 37 moose were taken. Other popular areas were the Hartman and Swift River drainages where harvests of 23 and 21 moose, respectively, were reported. Most hunters were from Southcentral (54%) or were nonresidents (31%). Aircraft was the most popular method of transportation (89%).

The number of hunters in Subunit 19D increased 6% from last year and the harvest increased 10%. The Takotna drainage, the Kuskokwim valley near McGrath, and the North Fork area were most heavily hunted. Most hunters (64%) were residents of Subunit 19D. Unit 18 and Southcentral Alaska residents composed 14% and 13% of the hunters, respectively. As in Subunit 19A, boats were the primary means of transportation (85%). Only 7 moose were reported taken from December through February in Subunit 19D.

Management Summary and Recommendations

Fall 1984 was mild with very limited snow until mid-December, after which several large snowstorms occurred in the upper Kuskokwim area. Temperatures dropped to record lows in

February, and February through May was marked by low temperatures and a heavy snowpack. Moose moved onto winter ranges along major rivers and remained there from late December until mid-April. The deep snow, coupled with moose herd concentrations on winter ranges, made moose vulnerable to predation by wolves. Wolf predation appeared heaviest along the Nixon, Takotna, and Kuskokwim Rivers near McGrath. Winter mortality was more notable than during the last few relatively mild years, but neither examination of wintering areas nor information from radio-collared moose suggested a large winter die-off. In addition to the winter being hard on moose, many principal calving areas flooded during breakup in late May and some loss of calves is suspected. Although moose were concentrated near willow stands along major rivers from mid-December through mid-April, browsing did not appear to have been extremely heavy or damaging.

Good weather during the 1984 fall season, combined with increased numbers of hunters, served to increase the moose harvest throughout the unit except in Subunit 19C. The moose population should be monitored carefully to determine the effects of the increased harvest, high predation, higher winter mortality, and possible reduced early calf survival, all of which occurred within the reporting period.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20A

GEOGRAPHICAL DESCRIPTION: Tanana Flats, central Alaska Range

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Subunit 20A contains a growing moose population of approximately 8,100 animals, according to population estimates made in 1982 and 1984. Moose numbers appear to be about evenly divided between the flats and the foothills, with approximately 90% of the population located west of the Little Delta River. Estimated density west of the Little Delta is 1.3 moose/mi² in the foothills and 1.6/mi² in the flats. Moose density is low in most areas east of the Little Delta River, due primarily to poor habitat.

Population Composition

Bull:cow ratios generally remained good except in a portion of the Yanert drainage and in the Central Tanana Flats, where November ratios tend to remain at approximately 22:100 (Table 1). The central Tanana Flats has shown a steady downward trend in the bull:cow ratio for the past several years. The Moody Creek area had a bull:cow ratio of 23:100.

This ratio has remained unchanged in recent years. Moose Creek in the Yanert River drainage had a bull:cow ratio of 20:100.

Recruitment was generally only fair in most of the subunit. Yearlings composed 10-14% of the population in most trend count areas, but in the Japan Hills yearlings made up only 4% of the population. This represented a decline from recent years. Calf:cow ratios were good throughout most of the subunit except for the Yanert River drainage and Moody Creek. The calf:cow ratios in these drainages were poor (15:100).

Mortality

Harvest reports indicate 390 moose were taken in Subunit 20A (Table 2), a slight decline from the 1983 harvest. This takes into account changes in the Game Management Unit boundary effective in 1984. The Wood River was the only drainage showing a harvest increase; harvests in all others declined slightly. The Tanana Flats, in particular, exhibited a significant harvest reduction. Eighty-four percent of the harvest occurred west of the Little Delta River and 32% occurred in the central Tanana Flats between the Little Delta and Wood Rivers. The proportion of the Subunit 20A harvest from the central Tanana Flats declined from 1983 levels, partly because of the elimination of the November season.

Assuming yearling moose possess antler spreads of 30 inches or less, yearlings composed 20% of the harvest, about the same as in 1983. The trend in recent years has been for an increasing harvest in the foothills and approximately half the harvest came from the foothills in 1984. Residents composed 91% of the 1,204 individuals that reported hunting in Subunit 20A; this was a 10% increase over 1983. Hunter numbers increased by nearly 200 compared with the previous year.

Although transportation patterns were similar to those of recent years, hunters using aircraft experienced a higher success rate than in previous years. They also harvested the most moose (Table 3).

Management Summary and Recommendations

Moose in Subunit 20A have experienced a population increase of approximately 180% since the last population estimate was made in 1978. Harvest levels increased along with the moose population until 1984, when the harvest on the Tanana Flats declined slightly. Trend count and sex and age data suggest the reduced harvest is not due to a smaller moose population. The lower harvest resulted from elimination of the November season, and a declining bull:cow ratio which effectively reduced the number of male moose available to hunters. In addition, the rut appeared to commence about a week later than usual, which tended to further reduce hunting success. It may be desirable to reduce the bull moose harvest through season restrictions to reverse the declining bull:cow ratio in portions of Subunit 20A.

Habitat limitations will eventually dictate the upper population levels attainable in Subunit 20A. If public needs and desires for moose cannot be met with existing habitat limitations, a program of habitat management and improvement should

be initiated to provide for a larger moose population. The area of 1st priority for habitat improvement should be the Tanana Flats.

Predator populations should continue to be monitored and control exerted only when warranted.

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Table 1. Subunit 20A sex and age composition by area, 1984.^a

Location	Bulls: 100 cows	Calves: 100 cows	Percent yearlings	Percent calves
Bear Creek (Tanana Flats)	22	51	12	30
Japan Hills	55	50	3	24
Moody Creek	23	15	14	11
Windy Creek	42	41	11	23
Yanert River	27	18	6	12

^a The Windy Creek survey area does not exactly correspond with the sample units counted in past years. The Yanert River survey area consists of Moose Creek and Dick Creek.

Table 2. Subunit 20A moose harvest by drainage, 1984.

Drainage	Harvest
Tanana River and unknown	12
Nenana River	82
Totatlanika River	47
Tatlanika River	5
Wood River	67
Tanana Flats	128
Little Delta River	23
Delta Creek	7
Delta River	19
Total	390

Table 3. Subunit 20A moose harvest by transportation mode, 1984.

Transportation	Successful	Unsuccessful	Total
Aircraft	136	181	317
Horse	24	21	45
Boat	112	295	407
3-wheeler	28	57	85
Off-road vehicle	40	50	90
Highway vehicle	34	118	152
Unknown	16	92	108

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20B

GEOGRAPHICAL DESCRIPTION: Fairbanks and central Tanana Valley

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose density in most of Subunit 20B appears to be increasing although the rate of increase may have slowed since the previous year.

Moose calf survival and yearling recruitment for the Minto Flats area were fair (Table 1). Department removal of 26 wolves from this area during winter 1984-85 should produce some increase in recruitment next year.

No trend counts were done in the Manley area, but the low number of yearlings in the harvest suggests that the moose population has stabilized at a low level or continued to decline.

The Chena River drainage continued to have good calf survival and yearling recruitment.

Trend counts were conducted in the Ninety-eight Creek area of the Salcha River drainage. Recruitment and survival were poor, probably due to the presence of a pack of 7 wolves in the survey area.

Population Composition

Fall sex and age composition surveys were flown in Minto Flats and in the Chena and Salcha River drainages (Table 1). Bull:cow ratios decreased as expected. Lengthened bulls-only seasons during the previous 2 years have increased the harvest of male moose.

Overall, calf survival in Subunit 20B was good with 39 calves per 100 adult cows. Calves composed 20% of the population. Surveys revealed 14 yearling bulls per 100 cows and yearling bulls composed 8% of the population.

Movements

To determine seasonal movements and mortality, radio collars were placed on 10 cow moose in the Minto Flats during 27-29 March 1984. Three collars were placed on cows along the lower Tolovana River in the southwestern portion of the Flats; 4 collars were put on cows in the southeastern portion of the Flats; and the remaining 3 were placed on cow moose near the Chatanika River in the northern portion of the Flats (Fig. 1a, 1b). Based on examination of cementum layers in extracted canine teeth, it was determined that 5 of the collared cows were adults between the ages of 2 and 11 years and one was a subadult 22 months of age. Teeth were not collected from the remaining 2 cow moose, but they were judged to be adults based on body size and general tooth wear. Five of the 9 adults were accompanied by single 10-month-old calves when captured. No twins were observed.

All 9 radio-collared adult cows produced offspring. On 17 May 1984 the 1st calf was observed and was already 1 or 2 days old. Additional newborn calves were observed during a relocation flight on 6 June 1984. Relocation flights were made at 4-day intervals during the calving period. We determined that 13 calves were produced, including 4 sets of twins. The subadult cow did not produce a calf.

Relocation flights were continued at less frequent intervals through the remainder of the 1-year study. The last relocation flight was conducted 8 March 1985. The 10 collared cows moved very little during the year they were observed and, for the most part, remained on the Flats (Fig. 1a, 1b). The average maximum distance the 9 cows traveled from their respective points of capture was 10.3 miles (range 4.5-18.6 miles). The subadult cow traveled 21.5 miles from the capture site, with most movement occurring during the 1st 6 weeks after collaring. Her movements became more localized after 17 May 1985, which was the onset of calving.

One of the 10 collared moose, an adult cow of unknown age, died during the year of study. She was killed by a wolf from the Tatalina pack during late February 1985. Twin calves were accompanying this cow in early February 1985, and it is not known if the calves were also killed by wolves.

Thirty-one percent of the calves produced by radio-collared cows were killed within 2 weeks after birth. Calf mortality totaled 54% (7 of 13) by November. This would equate to 60 calves:100 adult cows. Survey data from Minto Flats, with a sample size of 58 adult cows (compared with 9 in this study), suggest that this ratio actually is much lower (29:100) and

points out the shortcomings of studies with small sample sizes. However, it is noteworthy that early mortality was due to black bear predation. Cause of death could not be established for the later losses.

Calf losses during the winter months cannot be assessed from this study due to the small sample size and the onset of wolf control activities which removed 26 wolves from the Minto Flats area during November and early December 1984.

This study confirms 2 generally held beliefs: (1) a resident moose population exists in the Minto Flats area, and (2) black bears are preying on moose calves. The study does not, however, rule out the existence of a migratory moose population. Subjective observations of biologists involved in moose surveys and wolf control activities, and inferences from adjacent movement studies suggest that a segment of the population is migratory.

Mortality

Wolf predation remained the primary moose mortality factor during this reporting period. Black bears and grizzly bears also contributed to the overall moose mortality in portions of Subunit 20B. Mortality due to predation is thought to be substantial, and although hard to quantify directly, the effects of predation are at least partially reflected in the calf:cow and yearling:cow ratios. Wherever wolf control has not been conducted or effective, low yearling recruitment and continued adult mortality are sufficient to prevent herd growth.

Harvest ticket data for 1984 show that 307 bulls were legally taken. In addition, the Fish and Wildlife Protection Division reports that a minimum of 26 moose (both sexes) were illegally killed by poachers. Accidental road-kills accounted for an additional 52 moose.

The success rate for the 2,227 hunters who reported hunting in Subunit 20B in 1984 was 14.5%, compared with 16% in 1983. The harvest decreased 7% while the number of hunters increased 8% over 1983. Distribution of the harvest is shown in Table 2. These totals include 10 moose taken by bow and arrow in the Fairbanks Management Area and 7 moose taken in the Minto Flats Management Area.

Yearling bulls composed 37% of the reported harvest (bull moose with antler spreads of 30 inches or less were considered yearlings). An additional 45% of the antlers measured 31-49 inches and 18% measured 50 inches or greater.

Presently, management of this herd involves restricting the harvest to bulls and limiting the average annual harvest to no more than 8% of the estimated population. This approach is intended to minimize the impact of hunting on population recovery without precluding human use.

Deep snow during late winter 1984-85 concentrated moose on lowland winter ranges, especially in the Chena and Salcha drainages. Prevailing winds on exposed portions of Minto Flats kept snow depths from reaching depths as critical as elsewhere. At times moose were observed walking in snow up to their bellies, but no deaths that could be directly attributed to malnutrition due to immobility were noted.

Examination of marrow in leg bones from the wolf-killed cow in Minto Flats in March 1985 suggested the moose was in good condition. Thus, effects of the abnormally deep snows on the moose population were indirect. For example, the deep snow-pack probably increased susceptibility of moose to wolf predation, increased auto- and train-related deaths, and increased the likelihood of newborn calf mortality due to spring flooding in lowland calving areas. Residents of Minto reported that water levels were unusually high in Minto Flats during May 1985, and high water on the Chena River necessitated closing the flood control gates which backed water up into the Chena Flats.

Habitat

A large fire on the Minto Flats in 1981 has proven beneficial to moose and other species that thrive on early seral growth and habitat diversity. However, most of the habitat in the subunit is becoming unavailable or less productive for moose. Natural fires are frequent only during occasional hot, dry summers; in these conditions, managers are reluctant to let fires burn. Completion of the Tanana Basin Wildfire Management Plan was a positive step toward improved habitat management, but the presence of scattered private holdings, development, and commercial timber stands limits the use of wildfire for habitat improvement. Increasingly, other alternatives such as prescribed burning, mechanical treatments, and logging must be put to use.

Past observations have indicated that browse utilization by moose in Subunit 20B is generally light. As the moose density has increased in the central portion of the subunit following successful wolf control efforts during the period 1980-82, moderate browsing of preferred species on the winter range has been noted. Less-preferred species still show little use and extensive brooming and pull-down has not been noted. This

suggests that present moose densities are well below carrying capacity. However, with management geared to increasing the moose population to twice the present size, habitat must not be allowed to deteriorate further. To the extent possible, land managers should be persuaded to let wildfire recycle old-growth habitats and alternative methods of enhancement should be developed for areas that are unlikely to burn naturally and for areas where developments preclude use of wildfires.

Management Summary and Recommendations

The present moose population in Subunit 20B is estimated to be no more than one-third the size that present habitat conditions are capable of supporting. Management plans conservatively call for increasing the population to 10,000 moose by 1993. Moose density in much of Subunit 20B has been slowly increasing, but populations in the Manley and Salcha River areas continue to decline or have stabilized at low densities. Habitat manipulation will become increasingly important as the population grows.

Although bears are a factor, particularly with regard to calf mortality immediately following parturition, wolf predation is primarily responsible for calf and adult moose mortality in Subunit 20B. Wolf control should continue in the western portion of the subunit to further improve yearling recruitment into the moose population. Wolf control should be extended to the remainder of the subunit as funds and manpower permit, with the Salcha drainage being next in priority.

The minimum take of moose by people (legally, illegally, and accidentally) amounted to about 8% of the estimated moose population in Subunit 20B. It is doubtful that a higher take can be sustained given the present recruitment rates. Currently, hunting regulations appear sufficient to contain the harvest within acceptable limits. However, the effects of continued bulls-only harvest are becoming evident in lowered bull:cow ratios. If recruitment does not improve, measures to ensure that the bull:cow ratio does not drop below desired levels may be necessary.

Additional survey trend areas should be established in the Chatanika, Tolovana, and Salcha drainages to improve population status and trend assessments. In addition, a population estimate survey should be conducted in the western portion of the subunit to refine the current estimate of moose numbers. Similar data are needed for the remainder of the subunit, but the western portion is of highest priority.

More cow moose should be radio-collared in the western portion of Subunit 20B to determine if migratory moose occur in the population. The presence of a migratory segment would be cause for reassessment of both hunting regulations and wolf control. Radios should be placed on moose in the hills surrounding Minto Flats during late winter.

The following management actions are recommended:

1. Maintain an average ratio of 50 moose:wolf and maintain a 10% average growth rate of the moose population until the moose population objective is attained.

2. Control moose harvest rates to an average not to exceed 8% of the estimated population until the desired population level is attained, and limit the harvest to bulls only.

3. Adjust harvest levels as necessary to maintain an average post-rut bull:cow ratio of at least 20:100.

4. Encourage the harvest of bears and wolves by the public to lessen predation on moose.

5. Embark on a pilot program of prescribed burning and/or mechanical habitat manipulation to obtain public acceptance of habitat enhancement alternatives to wildfire where use of such fires is not feasible.

6. Obtain a more precise estimate of moose numbers.

7. Determine seasonal movements of moose in the subunit so hunting pressure can be distributed to segments of the population that are normally not accessible.

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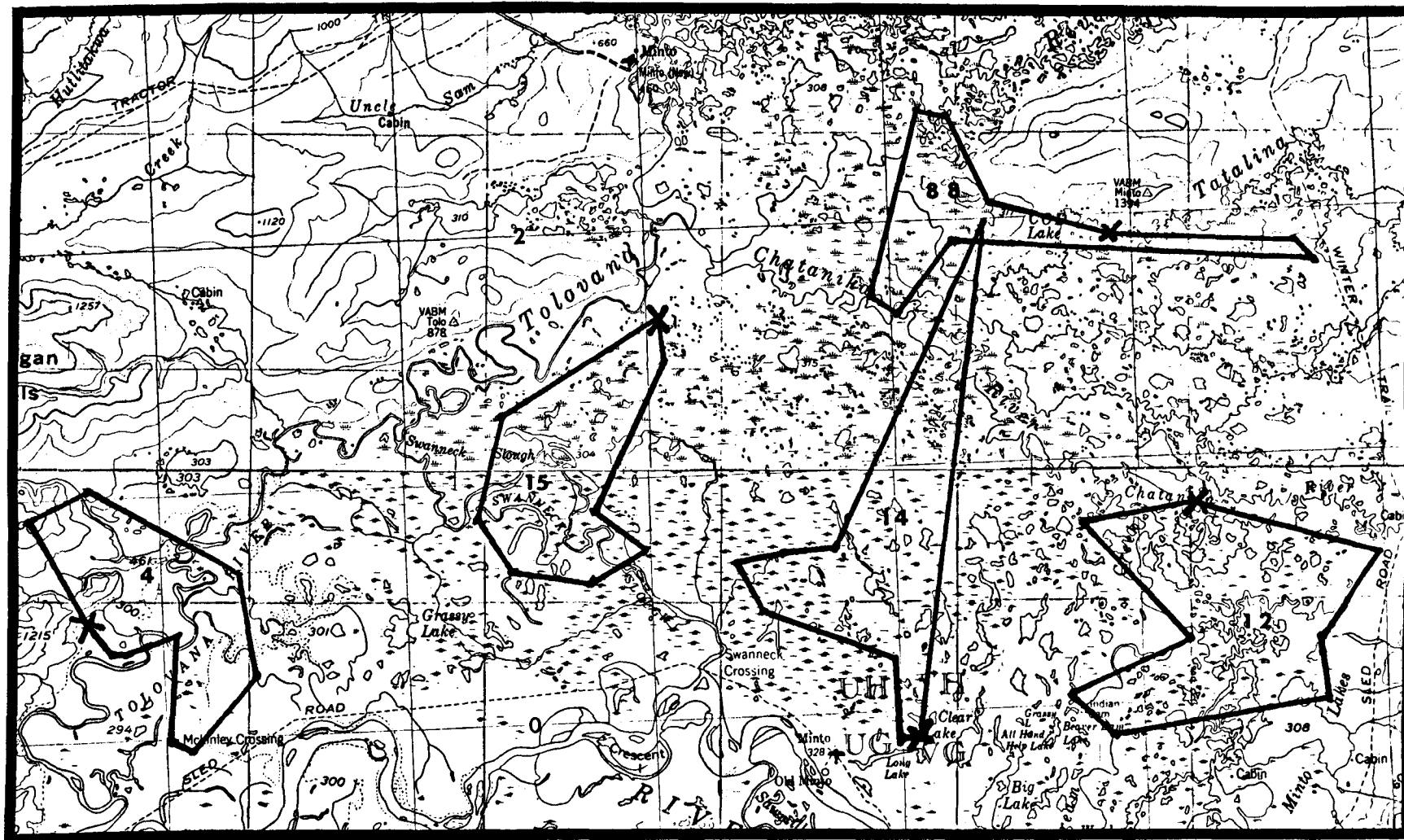


Fig. 1a. Polygons depicting the movement of collared moose on Minto Flats, Subunit 20B, 1984-85. (X indicates point of capture.)

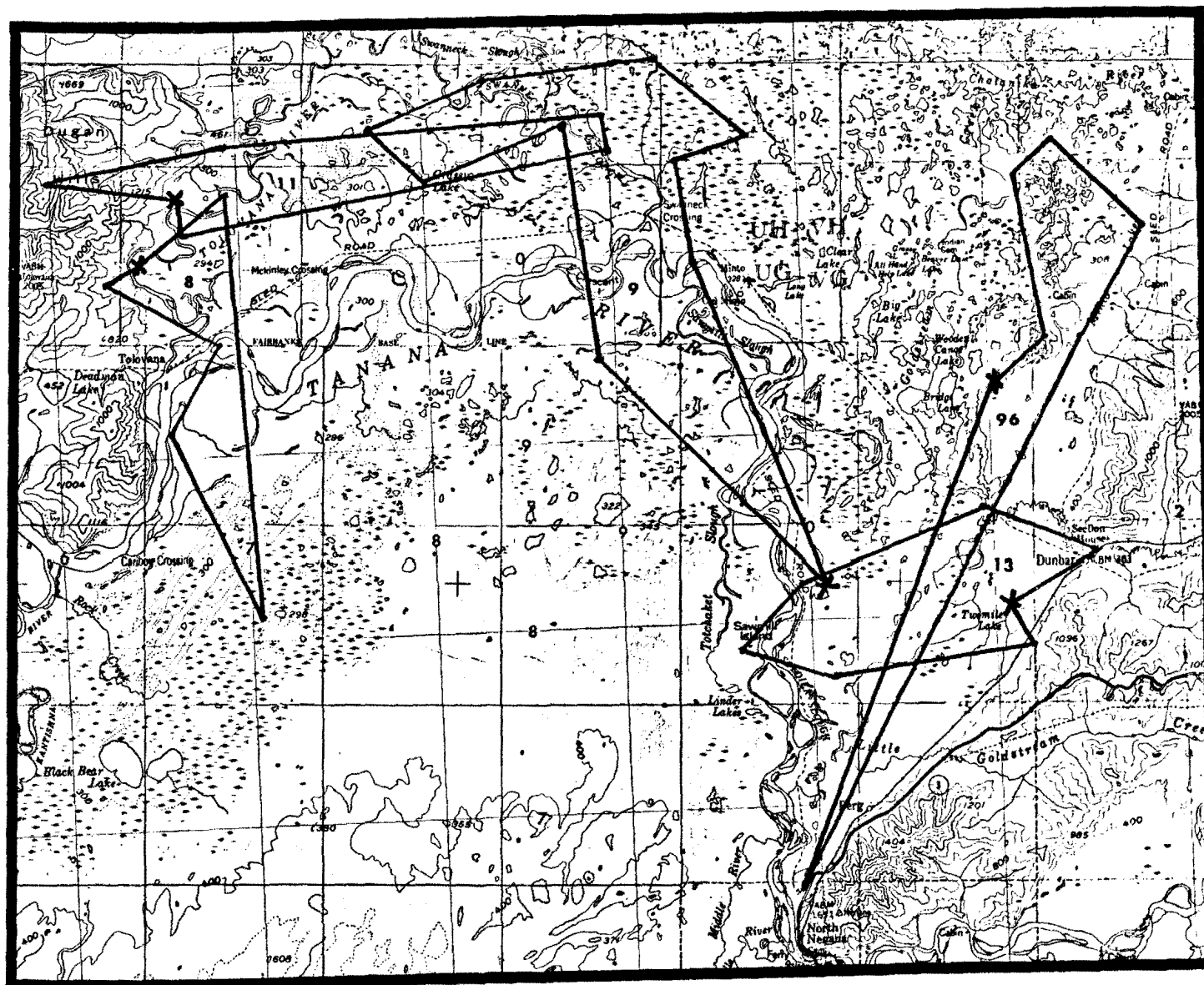


Fig. 1b. Polygons depicting the movement of collared moose on Minto Flats, Subunit 20B, 1984-85. (X indicates point of capture.)

Table 1. Moose survey data for Subunit 20B, fall 1984.

Area	Total bulls: 100 cows	Small bulls: 100 cows	Percent small bulls	Calves: 100 cows	Calves: 100 cows ≥2 yr	Percent calves	Sample size
Chena drainage	41	20	11	41	52	23	244
Minto Flats	34	9	6	27	29	17	103
Salcha drainage	27	5	4	23	25	15	84
Subunit 20B total	36	14	8	34	39	20	431

Table 2. Distribution of bull moose harvest in Subunit 20B during 1984.

Area	Number of moose
Chatanika River	47
Chena River	102
Eielson area	23
Goldstream Creek	26
Manley area	11
Rosie Creek	16
Salcha River	60
Tatalina River	2
Tolovana River	19
Unknown	1
Total	307

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20C

GEOGRAPHICAL DESCRIPTION: Kantishna, Cosna, and west side of
Nenana River

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Stratification flights were flown in 2 areas of Subunit 20C. The Lake Minchumina area included 2,308 mi² within Denali National Park and Preserve and 986 mi² outside the Preserve. Biologist Steve DuBois (memo dated 4 February 1985) summarized the stratification results as follows:

"Eighty percent of the area was stratified as low density and had an estimated mean density of only 0.06 moose/mi² (Table 1). Fourteen percent of the stratified area was classified as medium density and had an estimated mean of 0.6 moose/mi². Most of the medium density was found either in a large burn between Lake Minchumina and Wien Lake, or along the foothills of the Alaska Range. Areas with high densities of moose composed only 5% of the total area, had an estimated mean of 2.8 moose/mi², and were found almost exclusively along the foothills of the Alaska Range. Total estimated number of moose ranged from 795 to 1,177 in the stratified area."

A 2nd area of 654.5 mi² was stratified in the lower Kantishna River. DuBois (memo dated 1 March 1985) reported the following:

"The low density stratum was 500.9 mi² in size and had an estimated mean density of 0.01 moose/mi² (Table 2). Vegetation in the low density stratum was primarily mature black spruce. The medium density stratum was 153.7 mi² in size and had an estimated mean density of 0.3 moose/mi². Areas with medium densities of moose were almost entirely on the east side of the Kantishna River. The medium density area was characterized by large areas of low shrub near Black Bear Lake and within the flood plain of the Kantishna River."

Population Composition

Moose surveys were conducted in Denali National Park. Early winter calf and yearling bull survival rates were low (17 calves:100 cows, 10 yearling bulls:100 cows, $n = 737$). The number of bulls was high compared with cows (62 bulls:100 cows).

Mortality

According to harvest tickets, 299 hunters took 109 moose (Table 3). Hunter success was 36% with 50% of the harvest coming from the Kantishna drainage/Lake Minchumina area.

Assuming that yearlings have antler spreads of 30 inches or less, yearling bulls composed 22% of the harvest.

Poaching and predation are thought to be substantial mortality factors in Subunit 20C.

Management Summary and Recommendations

Stratification flights confirmed that moose density in Subunit 20C is very low. Count areas should be established to monitor trends in the moose population and provide a basis for harvest regulations.

Hunting season dates have been gradually liberalized since 1981. The 10-day 1980 season (5-15 Sep) was extended to 15 days in 1981 (1-15 Sep) and 20 days in 1983 (1-20 Sep). The addition of 5 days in early September probably did not affect the harvest. However, the addition of 5 days to the end of the season appears to have substantially increased the harvest. The harvest from the Kantishna drainage/Lake Minchumina area increased by approximately 170% (mean 1981-82 harvest compared within mean 1983-84 harvest).

A harvest of 54 bull moose was reported from the Kantishna drainage/Lake Minchumina area in fall 1984. The actual harvest is some unknown amount higher. The estimated size of the population supporting this harvest is 850-1,250 moose. Thus, the legal harvest probably represents 4.5-6.5% of the population. Because a large portion of the population is not accessible to hunters, the harvest is directed at a relatively small portion of the herd. In addition, not all moose taken are reported. Hence, the percentage of the population harvested is greater than reported here, and the biological impact is probably greater than would be expected for a take of 4.5-6.5%. Given that recruitment to the population is probably poor, the present harvest level may be as high or even higher than can be sustained.

More data on moose and wolf populations are needed to determine how large a harvest of moose can be sustained. Needed are (1) a better estimate of moose numbers, (2) a better estimate of wolf numbers, (3) a better estimate of the moose harvest, (4) knowledge of moose movements and accessibility to hunters, and (5) data on moose calf survival and yearling recruitment.

A short, bulls-only season should be maintained until herd size has increased substantially. Because an increase is not likely in the short-term without manipulating factors responsible for the present situation, it is recommended that those factors be identified and addressed. Based on similarity of the situation to adjacent areas for which more data are available, it is likely that a management program to increase the harvestable surplus of moose will necessitate some form of predation control.

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Table 1. Estimated densities of moose in the Lake Minchumina area, Subunit 20C, based on a stratification flight during November 1984.

	<u>In Denali National Park and Preserve</u>			<u>Out of Denali National Park and Preserve</u>			Total
	<u>Stratum</u>			<u>Stratum</u>			
	Low	Medium	High	Low	Medium	High	
Stratum area (mi ²)	1,948	193	167	694	279	13	3,294
No. moose seen	42	45	155	10	53	13	318
Est. $\bar{x}$ no. moose	126	135	465	30	159	39	954
Est. range no. moose	105-155	113-167	388-574	25-37	133-196	33-48	797-1,177
Est. $\bar{x}$ density (moose/mi ²)	0.06	0.7	2.8	0.04	0.6	3.0	0.3
Est. range densities (moose/mi ²)	0.05-0.08	0.6-0.9	2.3-3.4	0.04-0.05	0.5-0.7	2.5-3.7	0.2-0.4

Table 2. Estimated densities of moose along the lower Kantishna River, Subunit 20C, based on a stratification flight during November 1984.

	Stratum		Total
	Low	Medium	
Stratum area (mi ²)	500.9	153.7	654.5
No. moose seen	2	13	15
Estimated mean no. moose	6	41	47
Estimated range no. moose	5-7	33-48	38-55
Estimated mean density (moose/mi ²)	0.01	0.3	0.07
Estimated range density (moose/mi ²)	0.01-0.01	0.2-0.3	0.06-0.08

Table 3. Distribution of bull moose harvest in Subunit 20C during 1984.

Area	No. of moose
Lake Minchumina	22
Savage River	13
Kantishna River	32
Teklanika River	12
Cosna River area	5
Healy area	12
Nenana area	11
Unknown	2
Total	109

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20D

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Status of moose populations varies considerably in Subunit 20D. North of the Tanana River, limited data suggest very low resident populations. South of the Tanana and east of the Johnson River a low to medium density population appears to be stable or slowly increasing. West of Johnson River a medium to high density population appears to be increasing.

Population Composition

Moose composition surveys were conducted during October and November 1984. A total of 1,011 moose was classified in 12 separate count areas. In established trend count areas, surveys were flown at intensities of more than 4 minutes per square mile. In other survey areas, surveys were flown using intensities of 1-2 minutes per square mile (Table 1).

South of the Tanana River and west of the Johnson River, calf survival declined from the high recorded in 1983. Yearling survival increased slightly. The proportion of bulls in the population remained at a relatively high level. A similar trend in calf and yearling survival was observed east of the Johnson River. The proportion of bulls in this area remained high, but it was somewhat reduced from the previous 2 years.

North of the Tanana River, calf and yearling survival remained low. Yearling survival was the lowest ever recorded in this area. Bull:cow ratios were moderate in the more accessible western part of the subunit and high in the eastern part.

Movements and Distribution

Thirteen moose have been radio-collared in Subunit 20D since fall 1983. Collars were placed on cows, with 1 exception. Moose were captured and collared in the portion of Subunit 20D

south of the Tanana and west of the Gerstle River. Six were captured near Donnelly Dome, and 7 were captured east of Jarvis Creek (Fig. 1). Observations of collared moose suggest that the population comprises both resident and migratory moose. Migratory moose tended to move north toward the Tanana River. The resident moose tended to stay within a few miles of the capture locations.

A low-intensity search of the entire Goodpaster River drainage was conducted in late October 1984. The survey revealed very low densities (approximately 0.16 to 0.30 moose/mi²). These data, plus limited moose movement data from south of the Tanana, suggest that the moose densities in the Goodpaster drainage are relatively high during the summer when migratory moose move into the area. During winter, numbers are much lower when only resident moose occupy the area. The survey showed that the highest fall concentration of moose in the drainage was in a 1968 burn in the Central Creek drainage and along a portion of the North Fork. Very few moose were found in the South Fork drainage and on the Goodpaster flats.

Mortality

A total of 621 hunters reported harvesting 104 moose in Subunit 20D during the reporting period. This represents a 2% decline in success from the previous year when hunters reported a 19% success rate. A late August snowfall may have influenced moose movements and reduced hunter success. Approximately 75% of the harvest occurred in the portion of the subunit west of the Johnson River. Subunit 20D residents composed 54% of all hunters and 58% of the successful hunters in Subunit 20D during the 1984 moose season. Persons residing outside Alaska composed approximately 3% of all hunters.

North of the Tanana River, most successful hunters (65%) used boat transportation. South of the Tanana, approximately half of the successful hunters reported using highway vehicles for access to hunting areas. Where permitted, motorbikes, including three-wheelers, were a popular mode of transportation.

Measurements reported by hunters indicated that nearly 66% of the moose taken in the subunit had antler spreads less than 40 inches. Most moose of this size are yearling and 2-year-olds. In that part of the subunit south of the Tanana and east of the Johnson River, the situation was nearly reversed. This aberration may be due to a small sample size ($n = 11$).

Other recorded mortalities totaled 49 moose (Table 2).

Habitat

Browse utilization transects were conducted in the Central Creek and Gerstle burns. Limited data suggest that the Central Creek burn is producing considerable browse in riparian areas and in some locations where good deciduous seed sources exist. Utilization along the riparian zone was relatively heavy, but this is believed to be a result of deep snows forcing moose to leave the subalpine zone. Transects in the Gerstle burn indicated extremely high (93%) utilization of desirable browse species in a disturbed area where browse is still available to moose. Elsewhere in the Gerstle burn, transects and visual observation indicate little browse of value to moose.

Management Summary and Recommendations

The dynamics of the moose population in the southwest part of Subunit 20D are becoming increasingly understood. The population appears to be on the increase. Survey effort could probably be reduced in this area. Conversely, recent information collected from the other parts of the subunit suggests that because populations appear to be at very low densities and declining, improved data on distribution, movements, and population status are needed.

In light of human use patterns and moose population status, the following should be priorities for moose management work in Subunit 20D in the next 2 years:

1. Conduct a low-intensity survey stratification of Subunit 20D north of the Tanana River (except the Goodpaster River drainage) to develop an estimate of population density and density strata.
2. Increase the number of moose survey areas in the northern and eastern parts of the subunit to improve understanding of population dynamics and predator-prey relationships.
3. Advance for public review a draft plan for the management of moose and their predators in the portion of the subunit north of the Tanana River.
4. Continue population identity studies using radio-collared cow moose.
5. Complete and seek Board of Game approval of a moose management plan for the 20D Southwest moose population.

6. Complete a population estimate survey for the above population.

7. Continue a reduced number of trend surveys of the above population.

8. Continue and expand spring browse utilization surveys in the range of the above population.

9. Recommend to the Board of Game very limited cow moose hunts in the above population to begin slowing its rate of increase.

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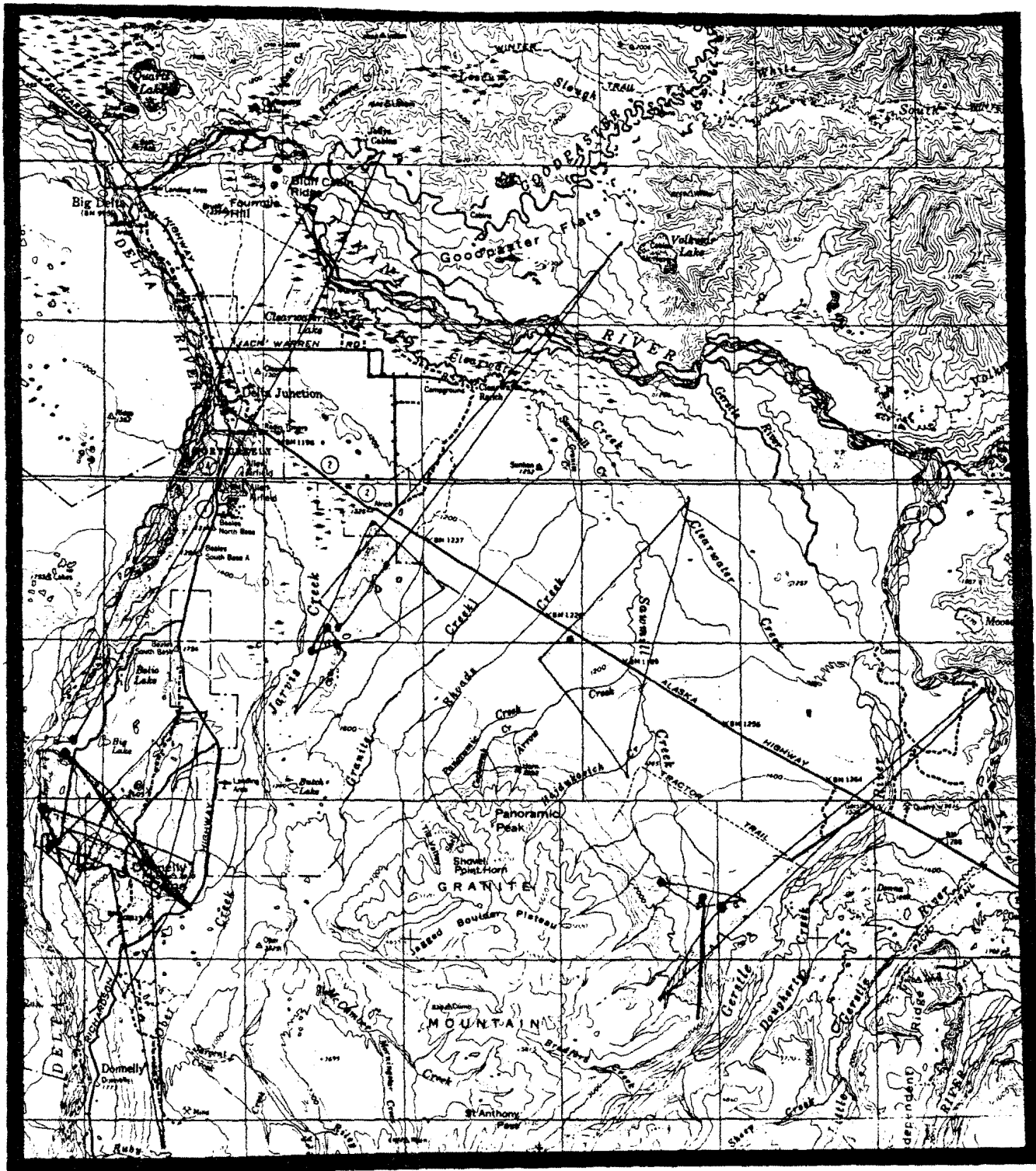


Fig. 1. Known home range of 12 moose radio-collared in Subunit 20D, 1983-85.

Table 1. Sex and age composition of the Subunit 20D moose population, 1984.

Area ^a	Bulls: 100 cows	Percent yearling bulls	Calves: 100 cows	Calves: 100 cows ≥2 yrs	Twins: 100 cows w/calves	Percent calves	Total sample
20D SW	37	8	36	42	6	21	480
20D SE	46	8	21	24	11	12	218
20D NW	37	2	12	12	0	8	89
20D NE	56	5	15	17	11	0	224
All areas combined	43	7	26	29	7	15	1,011

^a Subunit 20D is divided into north and south by the Tanana River; southeast and southwest by the Johnson River; northeast and northwest by the Goodpaster drainage.

Table 2. Known nonhunting moose mortality in Subunit 20D, 1 July 1984-30 June 1985.

Cause of death ^a	Cows				Bulls			Unknown sex			Total
	Calf	Yrlg	Adlt	Unk	Calf	Yrlg	Adlt	Calf	Adlt	Unk	
Road kill	1	1	8	0	3	2	0	2	0	1	8
Illegal kill	0	0	0	0	0	0	0	0	0	2	2
Wolf kill	0	0	1	0	0	0	0	2	1	12	16
Apparent winter-kill	1	0	2	1	0	0	0	0	0	0	4
Snare	0	0	0	0	0	0	1	2	0	0	3
Drowning	0	0	1	0	0	0	0	1	1	1	4
Unknown	0	0	0	0	0	0	0	0	0	2	2
Totals	2	1	12	1	3	2	1	7	2	18	49

^a Actual proportion of cause of death is unknown.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20E

GEOGRAPHICAL DESCRIPTION: Fortymile, Charley, and Ladue River drainages

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Subunit 20E is estimated to contain 1,400-2,000 moose based upon an intensive quadrat sampling effort in 1981. No clear population trend has been noticed since that time. Wolf population reductions during the period 1981-83 are believed to have halted a long-term moose population decline in a 3,000 mi² area in the southern portion of the subunit. Moose density in Subunit 20E is approximately 0.2 moose/mi² of moose habitat, one of the lowest densities in Alaska.

Population Composition

During the period 24 October-26 November 1984, 19.4 hours of aerial, contour-type surveys resulted in the classification of 464 moose, for an average of 24 moose per survey hour. Survey conditions were good to excellent.

Overall, the bull:cow ratio was very good at 74 bulls:100 cows; calf survival to 5 months was only fair at 22 calves:100 cows; and yearling recruitment was also only fair with 11 yearling bulls:100 cows. Calf survival and yearling recruitment were generally higher east of the Taylor Highway than west of the highway, presumably due to a lower density of grizzly bears and past reductions of the wolf population.

Mortality

Predation remained the primary mortality factor during this reporting period and wolves and grizzly bears were the main predators.

Hunting pressure in the subunit was similar to that in 1983 and 1984. Twenty-nine bull moose were reported taken in 1984 compared with 31 in 1983 and 17 in 1982. The reported harvest represents 1.4-2.0% of the population.

Of the 29 bulls taken, 12 (40%) were taken by local hunters. Eight successful hunters reported using off-road vehicles; 6 used aircraft; 5, highway vehicles; 2, boats; and 1, horses. Seven successful hunters failed to indicate mode of transportation.

The harvest was well distributed throughout the subunit. By drainage, the harvest was as follows: 7 bulls were taken in Mosquito Fork; 6 in the Dennison-West Fork drainages; 4 in the main Fortymile; 3 in the Middle Fork; 2 in the Ladue; and 1 each in the Charley, Yukon, South Fork, and North Fork.

Mature moose with antler spreads equal to or greater than 50 inches composed 62% (18 bulls) of the harvest, and 9 subadult bulls approximately 2-4 years old, with antler spreads from 35-49.9 inches, composed 31% of the harvest. One yearling bull with an antler spread of less than 35 inches composed 3% of the harvest. Only 1 successful hunter failed to report antler spread. The harvest reflected the old-age structure of this moose population as previously determined through aging of teeth from radio-collared cows.

Habitat Conditions

Moose exist at levels far below the range carrying capacity. This evaluation is based upon observed low rates of browse use. Also, much of eastern Subunit 20E is characterized by early seral vegetation, a result of large fires during the period 1966-69.

Management Summary and Recommendations

Moose densities remain low in Subunit 20E. No trend is evident, but moose populations are likely stable or declining slowly in most areas. Both wolf and grizzly bear numbers are high in relation to numbers of moose, and predation is the limiting factor for this population.

Observed low rates of browse use indicate that habitat is not limiting moose population growth in Subunit 20E. The implementation of the Fortymile Fire Management Plan in 1984 assures a near-natural fire regime in Subunit 20E, which is expected to maintain good habitat conditions for moose and other species dependent on habitat in successional stages.

Neither the primary management goal of providing the greatest opportunity to hunt moose, nor the secondary goal of providing optimum harvests of moose is currently being met with the short, bulls-only season. A larger, more productive moose population is required to meet these management goals.

To achieve management goals, the following actions are recommended:

1. Resume wolf control to achieve and maintain a ratio of 40-50 moose:wolf.

2. Further liberalize grizzly bear seasons to reduce neonate moose mortality.

3. Maintain short, bulls-only moose seasons to minimize human-caused moose mortality.

4. Continue trapper education efforts to encourage greater wolf harvests by the public.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20F

GEOGRAPHICAL DESCRIPTION: Central Yukon, Hess Creek, and
Tozitna River drainages

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Because surveys are not conducted routinely in Subunit 20F, few population data are available. Indices and casual observations suggest a low and probably static population. In general, habitat appears to be poor throughout most of the subunit, but habitat is unlikely to be the factor presently limiting population size. Other factors, including poaching and low recruitment, may be restricting population growth.

Mortality

Harvest report data indicate 15 moose were harvested by 98 hunters for a success rate of 15%. Only 1 moose was reported taken during the November season. The harvest declined substantially from 1983 when 25 were taken, but the hunter success rate remained similar to success rates of recent years.

The largest harvests occurred in the Hess Creek and Tanana drainages. The remaining harvest came from scattered locations throughout Subunit 20F. Assuming yearling moose have antler spreads of less than 30 inches, yearlings composed 47% of the harvest. Out-of-season hunting and unreported take are believed to be significant in Subunit 20F.

Management Summary and Recommendations

Moose density in Subunit 20F is low and probably stable. Although habitat appears to be generally poor, it is not believed to be responsible for present low moose numbers. Rather, predation is the factor that is likely limiting population growth. If recruitment improves and the moose population substantially increases, habitat will probably

become a major limiting factor in much of the subunit. Range rehabilitation, either through prescribed burning or reduced wildfire suppression, should be an ongoing management activity.

Virtually all hunting in Subunit 20F is done by Alaska residents, and the 15% hunter success rate is only average for Unit 20. The November season was popular, but the harvest was low.

Aside from a low-density moose population, reasons for the sharply reduced harvest in 1984 are unknown. The rut in other portions of Unit 20 appeared to commence several days later than normal, which could have reduced moose vulnerability to hunters.

Because few population data have been collected in Subunit 20F, systematic efforts should be made to obtain information on moose density, recruitment, population composition, and trend. The relative importance of various factors that are limiting moose population size should also be examined.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNITS: 21A and 21E

GEOGRAPHICAL DESCRIPTION: Upper Nowitna River, Innoko River
and Yukon Rivers Between Paimiut
and Blackburn Rivers

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

U. S. Fish and Wildlife Service surveys on the middle Innoko River in Subunit 21A during early December 1984 indicated calf survival continued to be low. The bull:cow ratio was also low and may reflect differential movement patterns of the sexes. The number of moose counted on survey quadrats in mid-March 1985 was more than twice the number normally counted during past late winter surveys. The high numbers of moose wintering on the main river systems were common throughout Subunits 21A and 21E as well as in Unit 19 due to record snow accumulations during the period January through May 1985.

Fall survey data showed that calf survival was considerably higher along the main Yukon in Subunit 21E than in the Innoko drainage. Bull:cow ratios were also higher along the Yukon than in the Innoko drainage but were lower than those recorded for 1982.

Population Composition

Moose distribution was probably affected by unusual weather patterns that occurred during winter 1984-85. Fall was mild with very little snow, followed by record snow accumulation and cold. Fall composition counts on the middle Innoko River in Subunit 21A indicated a bull:cow ratio of 27:100 and a calf:cow ratio of 16:100. Ten percent of the cows with calves had twins. Along the Yukon in Subunit 21E the corresponding ratios were 54 bulls:100 cows and 49 calves:100 cows. Twenty-three percent of the cows with calves had twins.

Mortality

In Subunit 21A, 190 hunters reported taking 136 moose along the Innoko drainage between the mouth of the Iditarod River and North Fork, and along the Iditarod drainage. Most hunters were from southcentral Alaska (37%), the Interior (16%), Unit 18 (12%), and Unit 19 (8%). Twenty-one percent were nonresidents. No aliens reported hunting in Subunit 21A. Only 8 hunters who reported hunting in Subunit 21A were Unit 21 residents.

In Subunit 21E, 160 hunters reported taking 133 moose. Distribution of the harvest was equally split between the lower Innoko and the main Yukon drainages. More residents from Unit 18 (73) than from Unit 21 (44) reported hunting in Subunit 21E. Other hunters were from southcentral Alaska (25), rural areas outside Units 18 and 21 (5), and areas outside Alaska (7). Six hunters did not specify residency. The reported moose harvest by residents of villages in Subunit 21E were Holy Cross, 19; Shageluk, 6; Anvik, 9; and Grayling, 4. The actual harvest in Subunit 21E probably approached 250 moose.

The Board of Game approved a petition submitted by the Grayling-Anvik-Shageluk-Holy Cross Fish and Game Advisory Committee for a late winter season, primarily because lack of snow during November made it difficult for hunters from these 4 villages to travel and hunt. An emergency season was established for the period 19-28 February 1985. The bag limit was 1 bull moose. Although weather conditions during this February season were suitable for hunting and moose were concentrated along major drainages because of deep snow, only 3 bulls were reported taken. The remaining reported harvest from Subunits 21A and 21E occurred during September, with the exception of 7 moose taken in November.

Management Summary and Recommendations

Snow accumulations throughout Subunits 21A and 21E were at or near record levels from January through May 1985. Observations during wolf surveys in Subunit 21A indicate that loss to wolves during winter was higher than normal because moose concentrated along rivers and were unable to escape wolves. Breakup of the rivers was late and in late May and early June both the Innoko and Yukon Rivers flooded much of the calving grounds. Further effort should be directed toward obtaining accurate harvest data, especially from residents of Subunit 21E.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21B

GEOGRAPHICAL DESCRIPTION: Lower Nowitna River, Yukon River
between Melozitna and Tozitna
Rivers

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population in the Subunit 21B portion of the Nowitna drainage was approximately 2,300 in 1980 and since that time the population is thought to have remained stable. However, deep snow, higher wolf predation, and extensive flooding during the 1985 calving season probably contributed to a decline. Poor snow conditions in November 1984 precluded composition and density surveys.

Mortality

The harvest of 97 bull moose from Subunit 21B was the largest reported take on record. The increase is due to a greater harvest along the Yukon River (26 moose) than during previous seasons. Low water on the Nowitna River in September 1984 possibly caused a shift in hunting pressure to areas along the Yukon River. The take from the Nowitna drainage (50 moose) has remained stable the past 5 seasons.

For the 2nd time since 1978, a hunter check station was not operated at the mouth of the Nowitna River. Tim Osborne toured the river from 17 through 19 September 1984 and contacted 63 hunters. The water level was very low and few boats were able to navigate above the Little Mud River. The weather was warm and few bulls had started rutting. Therefore, most moose taken before 19 September were small bulls.

Management Summary and Recommendations

The potential for a decline in the Subunit 21B moose population is great. Consequently, surveys should be conducted to monitor population status.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21C

GEOGRAPHICAL DESCRIPTION: Upper Dulbi River and Melozitna
River Drainage above Grayling Creek

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population in the Melozitna River drainage is low but is thought to be stable. No surveys were conducted in the subunit.

Mortality

Hunters reported taking 17 bulls from the Melozitna drainage and 1 bull from the Dulbi drainage. All the hunters used aircraft for transportation. Only 1 successful hunter was a resident of Unit 21.

No data were available on natural mortality, but at least 3 wolf packs inhabit the Melozitna drainage and numerous grizzly bears inhabit Subunit 21C.

Management Summary and Recommendations

Moose populations in Subunit 21C are low and natural mortality prevents the population from increasing. Although hunter interest is low in the subunit, survey data are needed for this moose population.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21D

GEOGRAPHICAL DESCRIPTION: Middle Yukon, Eagle Island to Ruby,
Koyukuk River below Dulbi Slough

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

November 1984 moose densities along the Koyukuk River ranged from an observed 2.8 moose/mi² between Koyukuk village and Nikolai Slough, to 1-1.5 moose/mi² between Long Stretch and the Kateel River, and to 4-6 moose/mi² between Three-day Slough and Dulbi Slough. The population is thought to be stable.

The only survey along the Yukon River indicated a decrease in observed density from 3.8 to 2.3 moose/mi², but the survey may have been biased due to an inexperienced observer.

Population trends in the remainder of Subunit 21D are stable.

Population Composition

The Three-day Slough and Dulbi River trend areas continued to maintain stable bull:cow and good calf:cow ratios (Table 1). The ratio of yearling bulls to cows remains fair to poor. Two new trend areas were established on the Koyukuk River. They are the Four Corners area at the mouth of the Kateel River and the Koyukuk River mouth area between Nikolai Slough and Koyukuk village. The low bull:cow ratio in the latter area could indicate excessive hunting pressure; 42% of the subunit harvest comes from this area where recruitment of bulls is low.

Mortality

Mortality due to predation is believed high because of the large numbers of wolves observed in the area and the relative scarcity of yearling bulls in the survey areas. However,

overwinter mortality of 19 radio-collared moose in the Three-day Slough area was low in spite of a record 4-5 foot snow pack and the large number of wolves in the area.

The 1984-85 hunting season was split into 2 periods. Both allowed the harvest of antlerless moose. In September, 170 bulls and 25 cows were reported taken. This is the largest harvest ever reported from Subunit 21D. Because excellent, almost rain-free weather prevailed, some of the increase can be attributed to hunters spending more time afield. However, public relation efforts to increase compliance with the harvest reporting requirements have also been successful. An estimated 95% of the moose taken during September were reported.

A moose hunter check station was operated at Mary Verneti's cabin, 18 miles up the Koyukuk River. Of the 169 hunters checked, 67 resided outside the subunit and 9 were not Alaska residents. This is a 50% increase in nonlocal hunters over 1983. Antler measurements and incisor teeth were collected from 88 of the 116 moose checked through the station. Twenty-seven percent more moose were checked than in 1983. Higher hunter success and better cooperation with the check station operation contributed to this increase.

The 2nd season was conducted under a registration permit system. One hundred six permits were issued, and 14 bulls and 28 cows were taken. The harvest, listed by residency of hunters, was as follows: Nulato, 9; Galena, 16; Koyukuk, 5; Ruby, 10; and nonsubunit residents, 2.

Movements

In the Three-day Slough lowlands, 10 bulls and 10 cow moose were radio-collared between 16-18 October 1984. Moose were shot with darts from a helicopter, and etorphine (M99, Lemmon Co., Sellersville, Pa.) was used as the immobilizing agent. In almost all cases the initial 8 cc dose was insufficient and additional M99 had to be administered. Two females received a total of 22 cc each, yet were alert when handled.

Some anomalies were noted in the month following capture. One 16-year-old female, found dead on 16 November 1985, may have died as a result of stress from being captured. A field necropsy indicated general starvation. This animal had received only 8 cc of M99. By 16 November 1985, 2 of the 9 males located had shed their antlers, possibly as a result of the stress associated with capture.

Distribution tracking flights were flown on 7 January, 12-13 March, and 2, 10, and 21 May 1985. Two bulls (10%) traveled 21.5 miles northwest and 9 miles north, respectively. The other radio-collared moose stayed in the Three-day Slough lowlands. Males moved an average of 4.2 miles (range 0.1 to 21.5 miles), and movements of females averaged 3.5 miles (range 0.25 to 10 miles).

Management Summary and Recommendations

Moose populations along the riparian lowlands are high, are thought to be stable, and are adequate to support current seasons. The low bull:cow ratios in the Four Corners-Koyukuk Mouth trend areas and the Pilot Mountain Slough area should be monitored. The radio-collaring study indicates that antler drop may occur early enough to bias sex ratios in some parts of Subunit 21D. The study also indicates that the observed high moose densities along the riparian lowlands might be restricted to those areas; in the uplands densities may be lower.

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Table 1. Moose composition survey data in Subunit 21D, November 1984.

Area	Bulls: 100 cows	Percent yearling bulls	Calves: 100 cows ≥2 years	Percent calves	Density (moose/mi ²)	Area (mi ²)	Sample size
Three-day Slough	30	8	36	19.0	5.7	57.8	332
Four Corners	20	4	58	31.0	1.4	47.8	68
Dulbi River	36	2	46	24.0	4.3	42.1	184
Koyukuk River Mouth	26	6	46	24.5	2.8	65.5	183
Pilot Mountain Slough ^a	11	1	48	30.0	2.3	36.0	84

^a Inexperienced observer.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 22

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

PERIOD COVERED: 1 July 1984-30 June 1985

Seasons and Bag Limits

See Hunting Regulation No. 25.

Population Status and Trend

Moose in the central Seward Peninsula may now be near or above winter range carrying capacity. Moose densities in the western and southeastern portions of Unit 22 are lower and appear to be stable or increasing only slightly, even though range is probably not a limiting factor. Predation and hunting in these 2 areas are probably prime factors in keeping moose densities at lower than expected levels. Since the last report, changes in Unit 22 moose population status were minor.

Population Composition

During March, aerial surveys were conducted throughout Unit 22 to determine population size and annual recruitment. Snowfall during the winter of 1984-85 was above normal, and survey conditions were nearly ideal. Except in Subunit 22A, moose were concentrated along major drainages in riparian willow habitat, making it possible to count a high percentage of the population. In treeless areas moose sightability was high; I estimate that at least 90% of the moose in these count areas were observed and that surveys from all count areas combined represented 60-80% of the moose in that subunit. During 56 hours of aerial survey, 2,727 moose were observed in Unit 22 (Table 1).

The lowest density of moose occurred in Subunit 22A. Only 69 moose were observed, although the population was not concentrated in riparian habitat as in other subunits, and this count was certainly the least accurate. However, the scarcity of tracks in the snow clearly indicated that moose density throughout Subunit 22A was very low; I estimate that 250-400 moose inhabit the subunit. Moose numbers and density were much higher in Subunit 22B west of and including the Koyuk

River drainage. Observers counted 820 moose in Subunit 22B, and I estimate that the subunit population was 1,000-1,400 moose. Subunit 22D contained the most animals and the highest density; 1,487 moose were observed. I estimate that the subunit population was 1,600-1,800. Winter habitat in Subunit 22E is sparse and confined largely to the Nuluk, Arctic, and Serpentine Rivers. Willow browse is much less abundant than in similar areas to the southeast. These conditions were reflected in the relatively low number of moose. Only 202 moose were counted, and I estimate that the subunit population was 250-350.

Winter habitat in Subunit 22C is confined to a few small rivers and is less extensive than in similar areas to the north. Moose numbers in Subunit 22C were low prior to 1975 and have remained so, partly because of heavy hunting pressure and the subunit's small size (approximately 1,800 mi²). However, since the mid-1970's moose numbers have increased 3-5 fold. In March, observers counted 149 moose, and I estimate that the population was 160-200. Considering that at least 3,500 people reside within the subunit and that many of them hunt moose, continued growth of the population is encouraging.

Combining counts from all 5 subunits, I estimate that the Unit 22 moose population was 3,260-4,150 (Table 1). The number of moose observed (2,727) was the highest on record. In previous survey and inventory reports, I estimated that the Unit 22 population was 2,500-3,000 moose. The last comprehensive spring surveys were conducted in 1980, but they were not as thorough as surveys in March 1985. I believe the moose population may have grown slightly since 1980; however, the main reason I revised the population estimate upward was because spring surveys in 1985 were more reliable and comprehensive than any in the past. It is unlikely that the Unit 22 moose population has increased by 1,000 animals during the last 5 years.

Percent calves ranged from a low of 11% in Subunit 22B to a high of 35% in Subunit 22C (Table 1). As a general rule the eastern portion of Unit 22 exhibited the lowest recruitment, while the central and western portions exhibited the highest. The reason for lower recruitment in Subunits 22A and B is not known, but these areas have the highest densities of wolves and bears. Conversely, areas with the highest recruitment contain the lowest densities of predators. Grauvogel (1985) reported below-average values for packed cell volume (PCV) and hemoglobin (Hb) during 1983 and 1984, suggesting that poor physical condition may be influencing moose recruitment.

However, these blood samples were taken from a portion of the Subunit 22D moose population that exhibited 21% annual recruitment in 1985. Although moose may be in poor physical condition in some areas, it is unlikely that physical condition is the sole reason for lower recruitment in Subunits 22A and 22B. Because moose density is very low in some of these areas, food is probably not a serious limiting factor. I believe low recruitment in Subunits 22A and 22B is primarily due to predation.

Greatest moose density and highest moose harvest have occurred in Subunit 22D. For these reasons this area has the highest management priority and is the subunit with the most complete historical data. Fall composition surveys have been conducted in all but 4 years during 1971-84. The 2 principal trend-count areas are the Kuzitrin drainage (an area with good access and high harvest) and the Agiapuk drainage (an area with limited access and moderate harvest). In the early 1970's, bull:cow ratios in the Kuzitrin were generally greater than 50:100, but declined to approximately 40:100 in recent years (Table 2). Hunting pressure is heavy in the Kuzitrin, and lower bull ratios are expected. However, considering the high harvest of bulls during the last decade, the present ratio is very favorable. Bull:cow ratios in the Agiapuk drainage have remained relatively high and stable or have decreased only slightly. Fall bull:cow ratios in 1983 and 1984 were 80:100 and 89:100, respectively (Table 2). Bull:cow ratios in other subunits were usually 50:100 or greater.

Mortality

No comprehensive studies to determine natural mortality rates throughout Unit 22 have been conducted. Grauvogel (1985) reported that annual natural mortality among adult radio-collared moose in Subunit 22D was 4.5% for bulls and 8.4% for cows. Wolves were relatively uncommon in this study area; brown bears were common. Because predator densities are higher in Subunits 22A and 22B, natural mortality rates in these areas probably equalled or exceeded those of Subunit 22D.

The major source of adult mortality throughout Unit 22 was hunting. Hunting seasons were the longest in the state, ranging from 5 to 8 months. In the early 1960's, few local residents hunted moose. Moose were a species of casual interest but typically were not a meat animal that people pursued vigorously. As the population grew, people's attitude toward hunting changed, and now moose are eagerly sought by almost everyone in the hunting community. Demand for moose meat by the local public has increased several-fold. This

interest has been reflected in an ever-increasing harvest. In 1972, the reported kill was 42 moose; 11 years later in the 1983-84 hunting season it had climbed to 405 (Table 3). The reported harvest during the most recent hunting season was 395 moose: 298 bulls, 91 females, and 6 unspecified. This harvest is the 2nd highest on record and nearly equals the all-time high harvest in the 1983-84 season.

The number of hunters who obtained antlerless moose permits is a good indicator of the tremendous interest in moose hunting. From September through March, 610 permits were issued: 60 to Alaska residents from outside the unit, 15 to nonresidents, and the remaining 535 to unit residents.

In past years applicants requesting antlerless permits in Subunits 22B and 22D were issued separate permits for each subunit (Hunts 991 and 992). This practice made reporting obligations confusing to the public (2 reports, 2 reminder letters, etc.), and redundancy increased staff administrative time. During 1984-85, 1 permit was issued for both subunits. This change is important to remember when comparing the number of antlerless permits issued for each hunting season. In the 1983-84 season, 747 antlerless permits were issued for all 3 subunits combined. However, approximately 250 applicants received separate permits for Subunits 22B and 22D. Therefore, the number of antlerless permits issued in 1983-84 is inflated compared with the number issued in 1984-85.

Hunters holding antlerless permits reported killing 200 moose: 69 in Subunit 22B, 109 in Subunit 22D, and 21 in Subunit 22E. The composition of this harvest was 84 antlered bulls, 30 antlerless bulls, and 86 cows (Table 4).

Many hunters reported success on both their antlerless permit and their moose harvest report card. Resulting duplicate reporting errors required considerable staff editing time to correct. For instance, the State computer tallied a harvest of 91 cows. At least 3 were duplicates. The actual reported harvest was no more than 88 cows, according to a cross-check of records. Accuracy of harvest reporting would be improved considerably if a system were implemented in which successful hunters reported on only 1 report card, even if 2 or more antlerless permits or harvest reports were obtained during the hunting season.

Even though the State computer run contains minor errors, the reported harvest of 395 moose is only a minimum estimate. Every year a substantial number of hunters fail to return their moose harvest reports. The reminder letter follow-up described below indicates the extent of the problem. Upon receipt of the antlerless permit, the signator agreed to

voluntarily return the permit by a specified date even if he was unsuccessful. In spite of written and oral instructions to return the completed permit together with the lower jaw within 5 days of taking the moose, only 317 of 610 permits were returned without reminders. Approximately 2 weeks after the permit expiration date, 293 reminder letters were sent to all those who were delinquent. From this mailing, we received 156 replies, and determined that 102 hunters were unsuccessful, 32 hunters did not hunt, and 22 hunters had killed a moose (14% success rate or 22/156). Subsequently, we mailed a certified letter to the remaining 137 nonrespondents. This mailing produced 60 replies indicating that 31 hunters were unsuccessful, 24 hunters did not hunt, and 5 killed a moose (8% success rate or 5/60). In a 3rd mailing, 49 respondents reported that 31 were unsuccessful, 12 did not hunt, and 6 killed moose (12% success rate or 6/49).

Using the data from the 3 mailings, the success rate was determined to be 12% or $(22 + 5 + 6) / (156 + 60 + 49)$. However, 6 hunters killed antlered bulls and possibly reported this kill on their moose harvest report. Assuming this was the case, the absolute minimum success rate among permit reminder letter respondents was 10% (27 successful/265 replies).

Hunters who obtained antlerless permits were generally more cognizant of their responsibilities under the game regulations than the average hunter, because they had more personal contact with Department employees. Thus a success rate of 10% is probably minimal for all moose hunters who failed to turn in a harvest report. License vendor records indicate that at least 1,300 moose harvest reports were issued in Unit 22. The State computer run tabulated 1,086 successful and unsuccessful reporting hunters, and I estimate that an additional 65 people did not hunt (30% of 1,300 minus 1,086). This leaves approximately 150 hunters (214 minus 65) whose report status is unknown. Assuming a minimum success rate of 10%, I estimate that an additional 15 moose were killed but not reported ($150 \times 10\%$).

Hunters from rural villages may be another source of unreported moose mortality. Comparing village populations with the number of moose harvest reports issued by local vendors, it seems unlikely that every person who hunted moose obtained a harvest ticket. I estimate that unlicensed hunters killed 10-20 moose in Unit 22. Therefore, the total number of moose killed in Unit 22, from 1 August through 31 March, is estimated at 420-430.

Highway vehicles (31%), snowmachines (21%), and boats (21%) were the principal means of transportation and accounted for 73% of the harvest. Off-road vehicles (7%), three-wheelers

(6%), and aircraft (6%) were used for transportation by only 19% of the hunters taking moose. The method of transportation was not identified in 8% of the reports.

Harvest chronology was similar to that of previous years. People hunting on the road system (Subunits 22B and 22D) took 51% of the harvest during August and September, primarily in September. The kill was distributed almost uniformly over the remaining 3 or 4 months of the season, with 1 exception. Because Subunit 22B was the only area close to Nome with a January hunting season, it has become a popular place for a late season moose hunt. This year 33% of the Subunit 22B harvest occurred in January.

The harvest in subunits without a road system (22A and 22E) was distributed almost uniformly over time, with the exception of a heavier harvest late in the season. In Subunit 22E, 37% of the harvest occurred from January through March. Long days in late winter and excellent snowmachine conditions were incentives to take moose late in the season, particularly when a family was unsuccessful in August and September.

Management Summary and Recommendations

Moose did not occur on the Seward Peninsula 50 years ago. The present population was probably established by a few immigrants who moved into the area from the east or north in the 1940's or the 1950's. During the past 15 years, aerial surveys have documented substantial growth of the population.

Although moose spread throughout the Seward Peninsula, the most dramatic population growth occurred in the central peninsula in Subunits 22B and 22D. Moose numbers may have approached range carrying capacity in some drainages by the late 1970's. Population growth has tapered off in most areas, largely due to increasing annual harvests, but competition for winter forage may also be a contributing factor. At present, optimum winter range densities are unknown. Winter browse on the Kuzitrin and Agiapuk drainages appears to be heavily used, yet overwinter survival has remained high. However, recruitment is declining over time, and late-winter blood values suggest deterioration in physical condition of some subpopulations.

Even though annual harvest in many areas has approached annual recruitment, aerial surveys in March 1985 revealed no significant population decline in any subunit. In fact, moose have increased in all areas since the last comprehensive survey was conducted in 1980.

Moose composition surveys have revealed a gradual decline in bull:cow ratios in heavily hunted areas, but relatively stable and high bull:cow ratios in lightly hunted areas. Available

information indicates that Unit 22 moose populations are stable and doing well in most areas. However, the following management problems exist:

1. Moose density in Subunit 22A is low. Predation and hunting mortality are high in relation to annual recruitment. Curing this chronic situation will require active Department involvement, and cooperation of local residents.

2. Hunting pressure and annual harvests have been increasing, and the public continues to press for more opportunities to kill moose. In many drainages annual harvest approaches or equals annual recruitment. Because most of Unit 22 has open terrain, moose are very susceptible to overharvest. The Department must continue to carefully monitor moose population status and annual harvests.

3. Although local hunters are usually very cooperative, nonreporting and some illegal harvest still continue to be problems. Without accurate harvest reporting, it will become increasingly difficult to ensure sustained-yield management.

4. In some areas in Subunit 22B, calves have declined from 25% of the population in the early 1970's to as low as 8% recently. The reason for this decline is not clear. Predation may be the primary cause, but other factors may also be contributing. The Department must determine why recruitment has declined and what actions must be taken to reverse the trend.

5. Moose densities on most winter ranges in Subunits 22B, 22D, and 22E are high, and production of willow browse has probably declined following several years of heavy use by moose. The following should be determined in the near future: 1) the impact browsing moose have had on willows, and 2) optimum moose density on winter range.

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Table 1. Unit 22 moose population status, by subunit, as determined from aerial surveys, March 1985.

	Subunit					Totals (22A-E)
	22A	22B	22C	22D	22E	
Moose observed	69	820	149	1487	202	2727
Estimated population	250-400	1000-1400	160-200	1600-1800	250-350	3260-4150
% Short yearlings	13%	11%	35%	21%	26%	$\bar{x}$ = 19%

Table 2. Fall moose population composition from the Agiapuk and Kuzitrin drainages 1971, 1973-76, and 1979-84.

Year	Agiapuk drainage				Kuzitrin drainage			
	Bulls: 100 cows	Yrlg bulls: 100 cows	Calf % of herd	<u>n</u>	Bulls: 100 cows	Yrlg bulls: 100 cows	Calf % of herd	<u>n</u>
1971	--	--	--	--	38	19	39	83
1973	91	22	20	76	50	17	23	82
1974	178	57	17	30	52	22	28	427
1975	86	14	24	17	35	12	32	34
1976	62	27	22	205	56	24	24	230
1979	65	21	22	320	31	9	30	418
1980	61	23	22	101	30	7	26	243
1981	59	18	26	142	71	16	26	226
1982	66	17	19	196	33	11	19	437
1983	80	27	19	181	41	11	21	373
1984	89	37	24	67	41	13	19	354

Table 3. Unit 22 historical moose harvest, 1969-84.

Regulatory year	Males	Females	Unknown sex	Total harvest	Hunters ^a	Percent success
1969	69	1	2	72	182	39
1970	70	0	1	71	139	51
1971	59	--	1	60	168	35
1972	44	0	0	44	99	44
1973	103	32	1	136	317	43
1974	149	72	1	222	479	46
1975	136	0	2	138	389	35
1976	186	51	3	240	611	39
1977	151	88	5	244	457	53
1978	198	97	2	297	596	50
1979	193	75	2	270	760	36
1980	156	71	1	228	492	46
1981	225	72	1	298	696	43
1982	244	100	0	344	904	38
1983	291	82	32	405	1,292	31
1984	298	91	6	395	1,086	36

^a Minimum known number of hunters.

Table 4. Unit 22 antlerless permit data by subunit, 1984-85.

Subunit	Hunt No.	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Antlered bulls	Antlerless bulls	Cows
22B	992			62	69	23	16	30
22D	991	564 ^b	123 ^b	173	109	58	5	46
22E	990	46	13	11	21	3	9	9
Unknown	--	--	--	28	1	0	0	1
Totals		610	136	274	200	84	30	86 ^a

^a Two hunters stated on their moose harvest report that they killed cows, but there is no record that they obtained antlerless permits. Total cow harvest in Unit 22 was 88.

^b Hunts 991 and 992 were administered with a single permit.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 23

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound

PERIOD COVERED: 1 July 1984-30 June 1985

Seasons and Bag Limits

See Hunting Regulations No. 25.

Population Status and Trend

The moose population in GMU 23 appears to be stable. Heavily browsed winter forage in some drainages and moderate recruitment in some segments of the population suggest the possibility of future local declines. Estimated harvest of moose appears to be well below sustained yield for the unit as a whole.

Population Composition

Sex and age composition surveys were conducted during October and November in the Kobuk River drainage. Calves composed 20% of the sample; the bull:cow ratio was 72:100; the calf:cow ratio (corrected for yearling cows) was 50:100; and the yearling:adult ratio was 21:100 (Table 1). These data do not indicate any major problems with the Kobuk population. Only 10 moose were seen per hour of survey time, suggesting relatively low population density. However, the survey technique required intensive coverage of low- as well as high-density strata, and the number of moose observed per hour is therefore not comparable with numbers counted in other surveys. Also, local hunters do not complain of a lack of moose. A census of the Kobuk population would provide useful information.

The U.S. Fish and Wildlife Service (Spindler and Hall 1985) conducted a moose demographic survey in the Selawik drainage during 4-19 December 1984 (Table 1). The bull:cow ratio was markedly lower in the Selawik drainage than in the Kobuk drainage (44:100 and 72:100, respectively). I have no satisfactory explanation for the difference, but methodology may partially account for it.

Age composition surveys were conducted during March and April 1985 in the Goodhope, Inmachuk, and Kugruk River drainages (Table 2). Calves composed 17% of the sample, an indication of satisfactory recruitment; 40 moose were seen per hour of survey time, suggesting a medium-density population. Willows appeared to be heavily browsed, suggesting that this northern Seward Peninsula population is near range carrying capacity.

A 2,115 mi² area in the middle Noatak drainage was sampled in March to estimate moose density, total numbers, and proportion of calves in the herd. The survey area contained an estimated 2,227 + 579 moose (90% CI). Additional data are presented in Table 2, and the technical report is on file in the Kotzebue ADF&G office (James and Cannon, unpubl. data). Appendix A summarizes findings and conclusions.

The 1985 spring surveys demonstrated that the 1984 estimates of the Noatak and northern Seward Peninsula populations (Quimby and James 1985) were very conservative. They reported an estimate of 1,900 moose in the Noatak drainage; the 1985 survey accounted for 2,227 + 579 moose (90% CI) within a 2,115 mi² portion of the Noatak including only one-fourth to one-half of the best moose habitat. The actual Noatak population appears to number at least 3,000. A fall demographic survey in a portion of the Noatak would provide an additional useful estimate of moose numbers.

Quimby and James (1985) estimated that 700 moose inhabit the Kiwalik, Kugruk, Inmachuk, and Goodhope River drainages. However, 694 moose were counted in the Kugruk, Inmachuk, and Goodhope Rivers in 1985. Had the Kiwalik River been surveyed in 1985, the northern Seward Peninsula count would have been well in excess of 700.

The USFWS conducted an intensive survey of a 91 mi² trend-count area in the Selawik drainage on 18 April 1985 (Peterson and Spindler 1985). Calves composed 16% of the sample, which is comparable to results of other 1985 spring surveys in Unit 23 (Table 2).

Mortality

The reported harvest of moose in Unit 23 was 180 during the 1984-85 hunting season. Kotzebue residents reported taking 34 moose, and residents of all other communities in Unit 23 reported taking 28. The harvest reported by Unit 23 residents was probably much lower than the actual number of moose killed. The 1983-84 harvest reported by Unit 23 residents was 14-24% of the estimated actual harvest (Quimby and James

1985). The estimated actual harvest plus the nonresident and nonlocal resident reported harvest for the 1983-84 season was 335-521, incorrectly reported as 358-528 in 1984. If the 1983-84 methodology is used to estimate the 1984-85 harvest, the result is 369-554. The Unit 23 resident harvest changed only slightly from 63 in 1983-84 to 62 in 1984-85; the non-local resident harvest changed from 58 to 62 during the same period. The nonresident reported harvest increased from 13 to 49. These estimates are obviously conjectural, and their utility for management is limited. Clearly, better harvest estimates are a high priority for moose management in Unit 23. Despite these shortcomings, I believe that current harvests are well below sustained yield for the unit as a whole.

Sex composition of the reported harvest was 160 males, 17 females, and 3 of unknown sex. This composition is not applicable to the entire harvest, because the unreported harvest by local residents probably includes a larger proportion of females.

Management Summary and Recommendations

Fall 1984 and spring 1985 survey data suggested a stable population of moose capable of sustaining the current moderate level of hunting in Unit 23. Significant questions remain unanswered concerning absolute numbers of moose in various major drainages, and more comprehensive data would reduce guesswork in the present management program. Discrepancies between 1984 and 1985 population estimates illustrate this point. The existing harvest reporting system is clearly not working at the local community level. This failure should be addressed with a well-considered and carefully executed alternative. It is imperative to begin solving the harvest reporting problem before a resource shortage occurs, because delay will only compound the inevitable difficulty of reducing harvests should that become necessary.

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Table 1. Unit 23 fall moose sex and age composition counts, 1984.

Count area	Date	Large bulls	Yrlg bulls	Total bulls	Cows/calves w/0 w/1 w/2			Total cows	Total calves	Total moose	Count time (hrs)	Survey conditions
Upper Kobuk	10/17-20/84	18	14	46	50	21	3	74	27	147	18.0	good
Lower Kobuk	10/25/84, 10/30-31/84, 11/02/84	32	8	62	44	25	6	75	37	174	13.2	good
Kobuk totals		50	22	108	94	46	9	149	64	321	31.2	--
Selawik ^a	12/4-19/84	--	--	63	--	--	-	143	43	249	--	--

^a Survey conducted by USFWS. This was a moose demography survey; hence, data are not directly comparable with those of previous years.

Table 2. Unit 23 moose aerial surveys, late winter 1985.

Area	Date	Cows/calves			Total adults	Total calves	Total moose	Calf % of herd	Count time(hrs)	Moose/hour
		W/0	W/1	W/2						
Goodhope	3/9-27/85	131	37	9	177	55	232	24 ^a	5.4 ^b	43
Inmachuk	3/27/85	109	16	2	127	20	147	14	2.5 ^b	56
Kugruk	4/1-2/85	236	38	1	275	40	315	13	9.5 ^b	33
Totals (Seward Pen.)		476	91	12	579	115	694	17	17.4	40
Middle Noatak ^c	3/17-19/85	--	--	--	491	110	601	18	--	--
Selawik ^d	4/18/85	153	20	1	174	33	207	16	--	52

^a Identification of calves during this survey may have erroneously included some yearlings still associated with cows.

^b Survey times may not be directly comparable with past surveys because 1985 surveys included riparian and some non-riparian areas usually not surveyed.

^c Noatak data resulted from moose demography survey; hence are not directly comparable with previous years' data.

^d Survey conducted by USFWS intensively covered a 91 mi² trend count area.

Appendix A. Criteria used and data obtained in middle Noatak moose surveys, March 1985.

1. The estimated number of moose in the 2,115 mi² Middle Noatak River Moose Survey Area during March 1985 was $2,227 \pm 579$ (90% CI).
 2. The estimated number of calf moose was 388 ± 114 (90% CI), and the estimated calf/adult ratio was 0.22 ± 0.03 (90% CI).
 3. Proper identification and classification of relative members of moose during stratification flights is extremely critical during late winter surveys because of dense aggregations.
 4. It may not be possible to estimate the number of calves within an acceptable level of precision if the stratification is based on relative numbers of all moose instead of relative numbers of calves.
 5. The estimated number of moose in a small portion of the Noatak drainage ($2,227 \pm 579$) suggested that the previous, subjective estimate of moose in the entire Noatak drainage (1,900) was very conservative.
 6. The estimated density of moose within the survey area was 0.8-1.3 moose/mi².
 7. Estimated densities of moose within the high, medium, and low strata were 33.9, 2.8, and 0.3 moose/mi², respectively.
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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 24

GEOGRAPHICAL DESCRIPTION: Koyukuk River drainage north of and including Dulbi Slough

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

The moose population in the Koyukuk River Lowlands in the southern one-third of Unit 24 is high, with observed densities averaging 2.5 moose/mi². The population appears stable. The middle one-third of the unit, the Kanuti Controlled Use Area, has low densities (0.45 moose/mi²). The trend is unknown but the population is suspected to be declining. In the northern one-third of the unit, which includes the Gates of the Arctic National Park, densities are moderate and range from 1.0 to 1.6 moose/mi². Moose numbers in northern Unit 24 are increasing.

Population Composition

Through a cooperative project with the U. S. Fish and Wildlife Service, 10 trend areas were flown within the Kanuti Controlled Use Area. The results indicate low moose numbers, but the population has growth potential if mortality could be decreased (Table 1). The 1983 calf crop showed good survival. Yearling recruitment in 1984 was 17%, which is equal to the estimated mortality rate (recruitment, as used here, is derived by comparing the number of yearlings observed with the number of adults observed). However, initial survival of the 1984 cohort was poor. Because over-winter mortality was also high, few yearlings are expected to survive until 1985. The bull:cow ratios, while good, could be misleading because the area along the Koyukuk River is subject to illegal either-sex hunting throughout the winter.

A survey along Ekokpuk Creek indicated good bull:cow and calf:cow ratios and an expanding population with 38% recruitment (Table 1). The density (1.6 moose/mi²) was comparable to the average found in good moose habitat in the northern one-third of Unit 24.

U. S. Fish and Wildlife Service personnel conducted 1 survey in the Koyukuk Controlled Use Area in the Dulbi Slough trend area (Table 1). The results indicate a decreasing population. During the last 3 years different observers and slightly different areas have been surveyed, hence the trend of this population is not known for certain.

Mortality

Hunting seasons in Unit 24 are diverse and reflect varying moose densities and consumptive use patterns throughout the area. The reported harvest for the unit was 122 moose. Hunters reported taking 106 moose during the fall season, 8 in December and 8 in March. The estimated total harvest, including unreported kills, is 159 moose.

Most of the harvest, 71 moose, came from the southern section. However, harvest tickets were not available to many of the local residents because the Huslia license vendor resigned in early September. I estimate an additional 15 moose were taken from southern Unit 24.

In central Unit 24, the Dalton Highway continued to attract hunters. Thirty-seven moose were taken, and 49 unsuccessful hunters used the road for access or hunted within 15 miles of the road.

The fall season opened 10 days earlier in the northern section of the unit, and 14 moose were taken during that season. No moose were reported taken during March or from the Anaktuvuk Pass area.

Management Summary and Recommendations

The trend areas established in the Kanuti Controlled Use Area should help management efforts. Moose mortality should be decreased to allow an expansion of the population. The Koyukuk Controlled Use Area should be maintained to keep the moose harvest at its present level until trends in the moose population are known. Hunting pressure in the Dalton Highway area needs to be monitored and more trend count areas should be established in this area.

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Table 1. Moose composition surveys in Unit 24, November-December 1984.

Area	Bulls: 100 cows	Yearling bulls	100 cows ≥2 yrs.	Percent calves	Density moose/mi ²	Area (mi ²)	Sample size
Kanutl NWR and CUA	77	6.5	27	13	0.45	322.6	147
Ekokpuk Creek	90	12.0	41	13	1.60	40.4	66
Dulbi Slough	19	5	22	15	2.5	54.2	130

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 25

GEOGRAPHICAL DESCRIPTION: Yukon Flats, Chandalar, Porcupine
and Black River drainages, Birch
and Beaver Creeks

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose surveys were done only in Subunit 25D East. This area is east of Birch Creek and the Hadweenzic River. It was given priority over the remainder of the unit because relatively little was known about the moose population and because the area receives relatively heavy hunting pressure. A fall survey was made in cooperation with the U.S. Fish and Wildlife Service to estimate the population size and to establish new trend areas.

Population size was estimated by first stratifying 58% of the area into 10-20 mi² blocks of high, medium, and low moose density, and by then surveying selected blocks from each stratum to estimate the number of moose present. Search intensity in all blocks was ≥ 4 minutes/mi². Blocks surveyed in the high and medium strata will be resurveyed in future years to measure population trend.

The moose population in eastern Subunit 25D was estimated to be 2,130, with an average density of 0.2 moose/mi². Previously, the population was estimated at approximately 4,600. It became apparent when stratification was completed that the previous estimate was biased because earlier surveys had been done mostly in medium- and high-density strata, with inadequate representation of low-density areas.

Population Composition

Composition information is available for Subunit 25D East and West only. In 25D East, 226 observations made while conducting surveys to estimate the population size were pooled to generate fall composition data. In 25D West, 20 radio-collared moose were relocated 1-4 times per month to monitor

movements, calf production, and survival. This radiotelemetry work was done in cooperation with the U.S. Fish and Wildlife Service and was initiated because moose density is critically low ($0.1/\text{mi}^2$) in the area.

Ratios calculated for Subunit 25D East were 76 bulls:100 cows, 44 calves:100 cows, and 12 yearling bulls:100 cows. Calves and yearlings composed 20% and 10% of the population, respectively.

Movements of radio-collared moose in Subunit 25D West indicated that 2 distinct population segments existed in the area. One nonmigratory group was found in a relatively small area along the Yukon River "corridor" between the mouth of the Hadweenzic River and the lower mouth of Birch Creek. The other group was migratory and occupied the remainder of Subunit 25D West. In this group, 3 of 9 radio-collared bulls and 4 of 6 radio-collared cows migrated seasonally between fall-winter ranges in alpine cover types and spring-summer ranges at lower elevations. Downward movements generally occurred in early May, with return to alpine areas in early September.

Production of calves and calf survival to fall were excellent for both groups. Inside the Yukon River corridor, 4 radio-collared cows produced 7 calves, 5 of which survived until fall. Outside the corridor 6 cows produced 8 calves, with 6 surviving until fall. Excellent survival was also indicated in this area by surveys conducted during the period 1980-83. Inside and outside the corridor calves averaged 31% and 22%, respectively, of the fall population.

Survival of calves to late winter was higher among radio-collared moose inside the corridor than for those outside. Inside, all 5 calves alive in the fall survived until late winter, while outside, only 2 of 6 survived. Survey data from 1980-83 also indicated this difference. Inside and outside the corridor calves averaged 27% and 9%, respectively, of the late winter population.

Mortality

Reliable mortality information is unavailable for most of Unit 25. At least half the total hunter harvest is illegal and, therefore, is not reported through the harvest ticket system. Other sources of mortality are also largely unquantified.

Harvest ticket returns for Unit 25 indicated 140 (36%) of the 386 reporting hunters killed a moose (Table 1). Most animals (62) were taken by local residents. Subunit 25D had the

largest harvest (41), with a moderate success rate (29%). The harvest was somewhat smaller in Subunit 25A (34), although success was highest there (67%). Subunit 25C had the lowest harvest (25) and success rate (25%).

Airplanes and boats provided transportation for 25% and 42% of the hunters, respectively. Other means of transport were less frequently used (<10%). Road access is not available except in Subunit 25C.

Magnitude and characteristics of the reported harvest did not change significantly compared with previous years. The only season change was adjustment of timing in Subunit 25D West to institute 10-day hunts in December and February. This change increased the reported harvest by only 4 moose.

Monitoring of radio-collared moose in Subunit 25D West provided additional mortality information. Inside the Yukon River corridor there was no mortality among the 5 radio-collared adults. Outside the corridor, 1 bull and 1 cow among the 15 radio-collared animals were killed. The bull was taken in early September by either a grizzly bear or wolves. The cow was killed by wolves in early April.

Differences in both calf survival and adult mortality inside the Yukon River corridor, versus outside the corridor, were probably due to differences in wolf predation rates. Only 1 pack was present inside the corridor and the moose:wolf ratio was approximately 25:1. Outside the corridor there were 6 packs and the moose:wolf ratio was approximately 13:1.

Hunting and wolf predation were the 2 most important sources of mortality in Subunit 25D West. Hunters harvested 25-35 moose, or approximately 4% of the fall population. This total includes the legal harvest and an estimate of the illegal kill. Wolves probably killed a minimum of 120 moose, or approximately 15% of the fall population. Most predation losses appeared to occur during winter and consisted primarily of calves and yearlings. The high rate of calf production suggests that habitat was not a factor influencing mortality. Also, the excellent survival of calves until fall implied that bear predation was not significant.

Management Summary and Recommendations

Moose density is low in most of Unit 25, and populations are probably stable. The magnitude and characteristics of the legal harvest show little change from last year. The illegal kill of moose includes cows and is probably greater than the legal harvest.

Subunit 25D West continues to be a major problem area. Moose density is critically low and will remain so unless the management plan recently formulated is implemented. The plan's objective is to increase the moose population from the current 800 animals to approximately 1,300 over the next 5-10 years and to provide an average annual harvest of 50 bulls.

Management actions required are to: (1) reduce the average annual wolf population from the current 53 animals to 25, primarily through efforts of local trappers; (2) maintain the current moose harvest of 25-35 animals per year; (3) cooperate with the U.S. Fish and Wildlife Service to improve moose habitat through fire management; (4) consider ecological relationships and human benefits of moose in Unit 25; and (5) maintain citizen involvement through public review of plans and through the regulatory process.

A management plan should be formulated for Subunit 25D East. This will require additional surveys to evaluate the role of wolf predation and also public meetings and questionnaires to establish moose population and user objectives.

The present season in Subunit 25D West (10-30 September) should be changed to 10-20 September. This would allow a more even distribution of harvest among migratory and nonmigratory segments of the population.

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Table 1. Residency of successful hunters and total harvest of moose in Unit 25, 1984-85 season.

Subunit	Local resident ^a	Nonlocal Alaska resident	Nonresident	Unspecified	Total harvest
25A	3	18	9	4	34
25B	25 ^b	12	2	0	39
25C	1	24	0	0	25
25D West	17	0	0	0	17
25D East	15	6	3	0	24
Unspecified	1	0	0	0	1
Totals	62	60	14	4	140

^a Resident of Unit 25.

^b Includes residents of Eagle.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26A

GEOGRAPHICAL DESCRIPTION: Western Arctic Slope

PERIOD COVERED: 1 July 1984-30 June 1985

Seasons and Bag Limits

See Hunting Regulations No. 25.

Population Status and Trend

Over the last 3 decades, moose have become well established in most of the favorable habitat on Alaska's Arctic Slope. Animals occasionally range as far north as the arctic coast in summer, but wintering moose are confined primarily to the inland riparian systems. Highest wintering densities occur on the central Colville River and its tributaries.

Late winter surveys were flown over all of Unit 26 in 1970, 1977, and 1984. About 1,500 moose were observed in 1970 and 1977; the 1984 surveys revealed an increase to 2,329 moose unitwide. In Subunit 26A, 1,429 moose were observed in the 1984 late winter counts. Of these, 1,418 were observed in the Colville River drainage, an increase of 161 moose (13%) since 1977. The 1984 survey results suggest a late-winter population of 1,429-1,786 moose in Subunit 26A.

Colville River late-winter trend counts flown during 1970-85 are reported in Table 1. In 1985, 757 moose were counted under excellent survey conditions. This represents a 9% increase over the mean of the 10 previous counts since 1970 (partial 1983 count excluded from mean). Of the 757 moose observed in 1985, 19% were calves (short yearlings), compared with 22% in 1984. Trend data suggest that the Subunit 26A population is stable and that recruitment of short yearlings has not declined significantly.

Population Composition

No fall composition surveys were flown during the reporting period; composition surveys are planned for 1985. The most recent surveys were flown in October 1983. Of 188 moose

observed, 122 were on the Anaktuvak River. Composition ratios were 54 bulls:100 cows and 38 calves:100 cows. Calves composed 20% of the sample, and 19% of cows with calves had twins.

Mortality

Of 97 hunters who reported hunting in Unit 26 in 1984, 75% were successful (Table 2). More hunters were in the field, and the success rate was higher than in 1983. The same trend was apparent in Subunit 26A. Sixty-six hunters reported in 1984 compared with 50 in 1983 (Table 3). Fifty moose were killed in 1984 (76% success) compared with 37 in 1983 (74% success).

Most reporting hunters were Alaska residents (Table 4). Forty-one percent of resident hunters were from the Fairbanks area, 19% from the North Slope, and 25% from other parts of Alaska. Of 40 moose for which antler measurements were recorded, 5 had an antler spread of at least 60 inches, and the maximum spread was 63 inches (Table 5).

In addition to the 50 moose that were reported, hunters from Nuiqsut on the lower Colville River killed as many as 10. This is half the number (20-25) estimated to have been taken by Nuiqsut residents in 1983. The decline in estimated harvest in 1984 may reflect a higher employment rate in the village and poorer access to moose on the Colville River due to low water in fall 1984. Two moose were killed but not reported in other parts of the subunit. As many as 8 additional moose may have been killed illegally. Thus, total estimated harvest for Subunit 26A is 70 moose: 50 from harvest reports, 10 from Nuiqsut, and 10 additional illegal or unreported kills. This harvest represents 4-5% of the 1,429-1,786 moose inhabiting the subunit at the time of the 1984 spring survey.

No information on natural mortality is available for the 1984-85 reporting period.

Management Summary and Recommendation

Hunters probably removed no more than 5% of the moose population in Subunit 26A during the reporting period. This harvest is similar to that of 1983, although the proportion taken by recreational hunters increased in 1984. No theoretical maximum allowable harvest has been identified for moose in Subunit 26A. This needs to be done as soon as possible. Any such estimate must consider the special circumstances of a population that has recently expanded onto the North Slope and is at the northern limit of range for moose in Alaska.

During the 1984 hunting season, field questionnaires were given to recreational hunters near Umiat. The purpose of this research (to describe moose hunters and moose hunting styles typical of the subunit) was described by Trent (1985). Results of the 1984 survey are not yet available. A study with the same goal but different methods will be undertaken in 1985 for moose hunters from Nuiqsut. Data collection will be supervised by Sverre Pederson of the Division of Subsistence. The assumption underlying the 1984 and 1985 studies is that an assertive moose management program should recognize and attempt to perpetuate the special characteristics of moose hunting identified with the subunit.

While interviewing Colville River moose hunters in 1984, I became aware of the inadequacy of law enforcement in that area. Shooting moose same-day-airborne appears to be the most common infraction, although there is also evidence of failure to salvage edible game and of hunting during closed seasons. Recreational hunters using aircraft for transportation have obviously become accustomed to light and sporadic law enforcement activities during most moose seasons in Subunit 26A. The Department of Public Safety did have an officer in the area in 1984 and was able to investigate some of these illegal activities. These efforts should be continued in 1985 and increased if possible. However, the work load of the Department of Public Safety is so great during fall hunting months that the presence of a Game Division biologist prepared to enforce regulations is also essential on the Colville River drainage.

No changes in hunting seasons or bag limits are recommended at this time.

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Table 1. Colville River trend counts: Anaktuvuk River, Chandler River, and Colville River between the Anaktuvuk and Killik Rivers, 1970, 1974-81, and 1983-85.

Year	Total moose	Adults	Calves	Calf % of herd
1970	750	523	227	30
1974	544	458	86	16
1975	556	386	170	31
1976	650	494	156	24
1977	802	632	170	21
1978	767	623	144	19
1979	644	536	108	17
1980	841	676	165	20
1981	639	594	45	7
1983 ^a	315	268	47	15
1984	756	590	166	22
1985	757	613	144	19

^a Partial count due to incomplete snow cover and wide dispersal of moose.

Table 2. Unit 26 moose hunter success, 1977-84.

Season	Harvest	Hunters	Success rate (%)
1977	36	48	75
1978	46	81	57
1979	90	108	83
1980	89	132	67
1981	99	145	68
1982	60	102	59
1983	51	76	67
1984	73	97	75

Table 3. Unit 26A reported moose hunter success, 1982-84.

Year	Harvest	Sex			Hunters	Success rate (%)
		M	F	Unk		
1982	38	31	7	0	54	70
1983	37	30	7	0	50	74
1984	50	42	7	1	66	76

Table 4. Residency of reporting Subunit 26A hunters, 1983 and 1984.

Year	North Slope		Fairbanks area		Elsewhere in Alaska		Outside Alaska		Totals
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	
1983	4	(9)	18	(40)	7	(16)	16	(36)	45
1984	12	(19)	26	(41)	16	(25)	10	(16)	64

Table 5. Antler spread (inches) of moose harvested in Subunit 26A, 1983 and 1984.

Year	<20	20-29	30-39	40-49	50-59	60	Totals
1983	0	1	9	4	9	3	26
1984	1	2	7	13	12	5	40

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26B and 26C

GEOGRAPHICAL DESCRIPTION: Central and eastern Arctic Slope

PERIOD COVERED: 1 July 1984-30 June 1985

Season and Bag Limit

See Hunting Regulations No. 25.

Population Status and Trend

Moose surveys were conducted by U. S. Fish and Wildlife Service personnel in the Kavik River drainage in Subunit 26B on 16 April 1985 and in the Canning and Kongakut drainages in Subunit 26C on 25-28 April 1985. A Piper PA-18 Super Cub was used for surveys. More moose were counted in each drainage than had been seen during any previous survey: 97 in the Kavik, 208 in the Canning, and 205 in the Kongakut. These figures represent increases of 28%, 33%, and 53%, respectively, over the previous highest counts, obtained during April and May 1984. Moose populations in Subunits 26B and 26C are thought to have grown since the early 1970's before becoming stable or slowly increasing in the 1980's. The current high counts are likely a result of excellent sighting conditions coupled with relatively deep snow which may have concentrated moose in the major river valleys. Recent productivity and survival (13% short-yearlings in May 1984 and 15% in 1985) are insufficient to support rapid population growth.

Thus, it appears that moose numbers are higher in Subunits 26B and 26C than previously thought (>700 in 26B and >450 in 26C), but these populations are stable or growing slowly.

Population Composition

Calves (short-yearlings) composed 15% of 510 total moose observed in April 1985. Six of 72 females with calves had twins (8%).

Mortality

The 1984 reported harvest for Subunit 26B was 16 bulls, and the harvest for Subunit 26C was 7 bulls. The harvest in Subunit 26B was similar to harvests of most past years, while

in Subunit 26C, the take was slightly higher. All hunters in Subunit 26C and two-thirds of those in Subunit 26B used aircraft access. The remaining hunters in Subunit 26B used the Dalton Highway for access and then hunted away from the road with three-wheelers or snowmachines. Four hunters in Subunit 26B took moose with bows and arrows; all hunted outside the Dalton Highway Corridor Management Area and used aerial access.

Alaskan residents took 40% and 71% of the reported harvest in Subunits 26B and C, respectively. Harvest success was 76% and 88% in Subunits 26B and 26C, respectively. Unreported harvest by local residents accounted for few, if any, moose in both subunits.

Natural mortality rates are unknown. Wolves kill some moose, but wolves are relatively uncommon in these subunits and feed primarily on caribou and sheep. Moose calf survival to spring is only moderate. Initial productivity rates and causes and timing of subsequent calf mortality are unknown.

Management Summary and Recommendations

Moose in Subunits 26B and 26C are very lightly harvested. However, low yearling recruitment and stable or only slowly increasing populations indicate that higher harvests may not be sustainable. The moose hunting closure within 2 miles of the Dalton Highway in Subunit 26B has so far effectively ensured opportunities for viewing moose along the road, although recent discovery of three-wheeler access routes into open hunting areas on the upper Sagavanirktok River could once again adversely impact the small moose population viewable from the road. For the near future, however, the seasons and bag limits currently in effect in Subunits 26B and 26C will continue to allow for sustained harvest of moose.

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