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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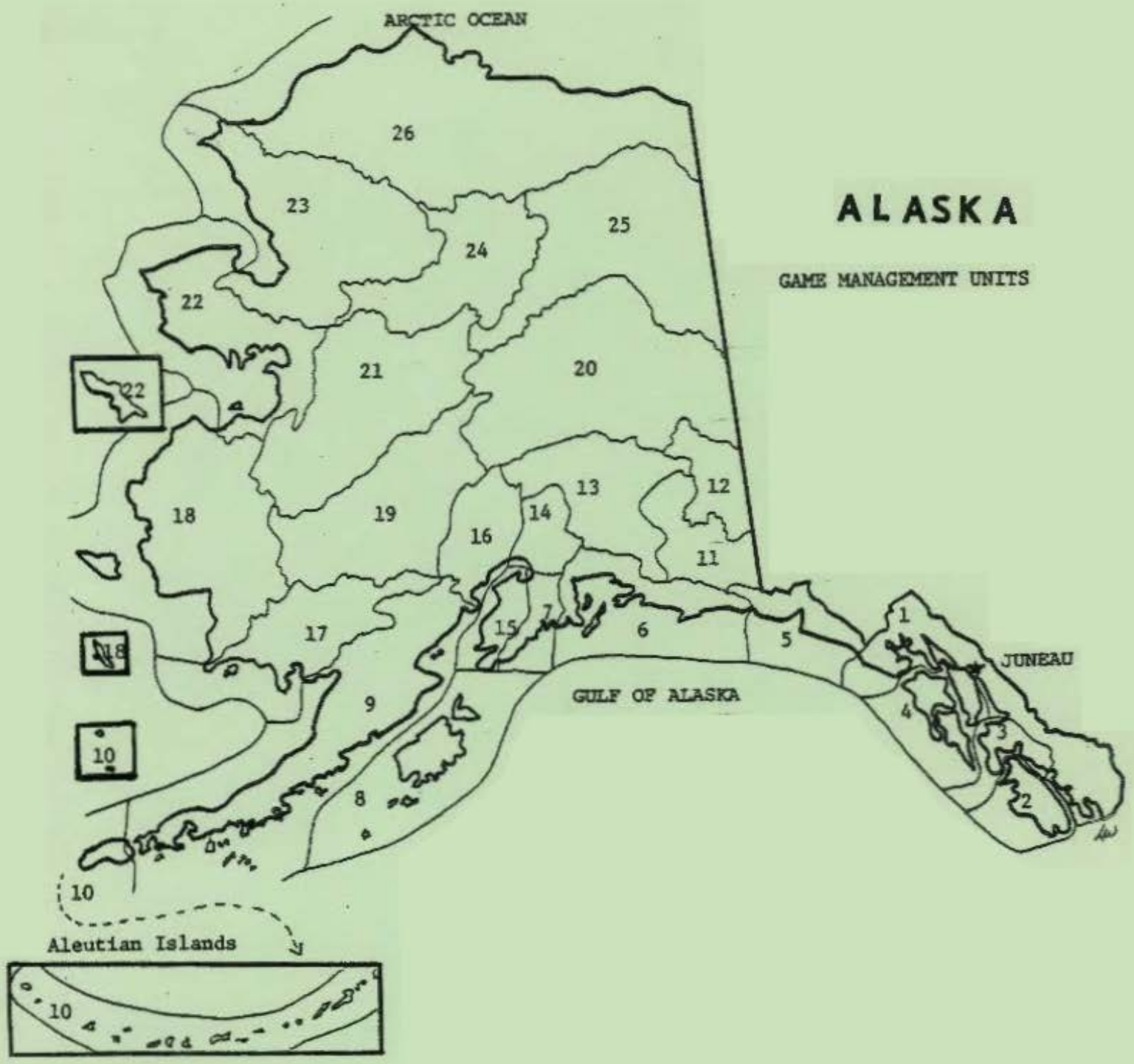
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Statewide Harvest and Population Status

Moose

The winter of 1983-84 was again generally mild, and moose populations suffered little winter mortality. Population status varied considerably, however, depending on the area: moose are generally abundant in Units 14, 16, 13, and 22, but continue at low levels throughout much of the Interior, except for Unit 20A where predator management has partially restored moose populations.

Hunter harvest of moose were generally equal to or better than last year, reflecting improved populations of moose or favorable hunting conditions, depending on the area. Highest harvests were realized in Unit 14 (1221 moose), Unit 20 (989 moose), Unit 13 (904 moose), Unit 16 (773 moose), and Unit 15 (755 moose). However, it should be noted that in all cases, figures reflect reported harvest, and in many units, unreported harvest is significant, sometimes greater than reported harvest.

The following is the reported harvest by Unit:

Unit	Harvest Reported bull	cow	unk. sex	total	Population trend
1A	5			5	
1B	44			44	
1C	11	5	3	29	stable to increasing
1D	61			61	slight decrease
5A	49			49	stable (?)
5B	11			11	stable (?)
6A	47	8	1	56	increasing
6B	35	39		74	stable
6C	30			30	increasing
7	58			58	low and stable
9	159	15	1	175	stable (9E down)
11	84			84	stable-low
12	73			73	stable
13	904			904	stable
14A	340	148	43	531	stable-high
14B	218	228	14	460	stable-high
14C	131	99		230	increasing
15A	351	36	8	395	stable to decreasing
15B	114		2	116	stable
15C	238	2	4	244	stable
16A	184	42	2	228	stable to increasing
16B	362	124	3	489	stable to increasing
16B (Kalgin)	23	33		56	high
17	120	1	6	127	increasing
18	63			63	?
19A	99	3		102	increasing
19B	110			110	stable
19C	102			102	declining
19D	120			120	stable to decreasing
20A	282			282	increasing
20B	329			329	stable to increasing
20C	217			217	low and stable
20D	105			105	mixed
20E	31			31	stable to decreasing
20F	25			25	low and stable
21A	135			135	stable ?
21B	77			77	stable to increasing
21C	15			15	low and stable
21D	136	8	40	184	stable
21E	95			95	stable
22	291	82	32	405	stable
23	129	12		141	stable ?
24	120			120	stable
25	137			137	low, stable ?
26A	37			37	stable
26B	9	3		12	stable to increasing
26C	1			1	low and stable
Total				7,374	

Robert A. Hinman
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MOOSE
SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT SUBUNITS 1A, 1B, and Unit 3

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

PERIOD COVERED: 1 July 1983 - 30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose occur throughout Subunits 1A and 1B along major drainages and on several of the major islands of Unit 3 (Figure 1). The species was not recorded in these management areas until after 1875. The future of moose on the islands is uncertain, since the successional vegetation created by clear-cutting is low in nutritive value (Doerr et al. 1980). The severity of winters is likely to be the limiting factor 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). Moose populations in the Unuk River drainage are low, but some hunting occurs.

The Thomas Bay moose herd in Subunit 1B supported a small harvest during 1970-1981. The limited kill in this area (Table 1) does not justify extensive surveys, but limited aerial flights are made annually to monitor gross changes in sex and age ratios. An aerial survey by fixed wing aircraft showed improvement in the calf survival rate over surveys in the past 2 years (Table 2). The Stikine River herd appeared to be stable during the period.

Subjective observations and hunter reports indicate that the Unit 3 population is continuing to increase.

Population Composition

In upper Subunit 1B (north of LeConte Bay), an aerial survey was conducted in Thomas Bay on 12 December 1983, resulting in a count of 22 moose (Table 2). The sex ratio of known-sex

animals was 40 bulls:100 cows, while the inclusion of unclassified adults in the cow class gives a ratio of 15 bulls:100 cows, a marked improvement over the 1982 ratio of 5 bulls:100 cows. A total of 32% of the observed moose in 1983 were calves; no calves had been seen on 2 surveys in 1982. Nine percent were bulls, 23% were cows, and 56% were adults of undetermined sex.

In lower Subunit 1B (south of LeConte Bay), a fixed-wing aircraft survey of the Stikine River was conducted on 10 August 1983. The pre-season 1983 sex ratio was 14 bulls:100 cows, as compared to the 1982 ratio of 5:100. The calf count was 21 calves:100 cows as opposed to 27:100 in 1982.

Mortality

Five bulls were killed in Subunit 1A during the 1983 season (R. Wood, pers. commun.). All of the animals were taken in the Unuk River drainage.

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 this information, 41 bulls were taken on the Stikine during 1983. Three bulls were taken elsewhere in Subunit 1B during 1983, 2 at Aaron Creek and 1 at Virginia Lake. The last telemetered bull from the Stikine River moose study (Craighead et al. 1984, Boertje and Young 1982) was killed at Elbow Slough on the Stikine River.

While the northern portion of Subunit 1B was closed to moose hunting in 1983, there appeared to be an increase in the number of hunters on the Stikine River in the southern portion of the subunit. There were approximately 130 hunters on the Stikine, and there seemed to be a slight increase in the number of hunters from Petersburg. Petersburg hunters normally make up the bulk of those hunting in Thomas Bay.

The success ratio in Subunit 1B based on the check station data was 27%, as opposed to a 30% success reported by those returning harvest report cards. In Subunit 1A the reported success rate was 16%. Only 3 of 5 successful hunters in 1A and 26 of 41 successful hunters in 1B actually returned the "mandatory" moose harvest report cards.

The unsuccessful hunters in Subunit 1B spent an average of 6.3 days in the field as compared to 8.4 days for the successful hunters. In Subunit 1A, successful hunters spent 3.7 days hunting, while unsuccessful hunters reported an average of 3.9 days.

Successful hunters in Subunit 1B were most likely to use boats for transport (92%) while 55% of the unsuccessful hunters reported boat use and 45% used aircraft. Two of the 3 successful reporting hunters in Subunit 1A used boats and the other used an airplane as transportation.

On the Stikine River, 35% of the bulls were taken during the 1st week; 10% during the 2nd week, 35% during the 3rd week, and 20% during the 4th week. An early frost in September forced an early leafdrop, creating excellent visibility for hunters.

Management Summary and Recommendations

The Subunit 1A kill was 5 bulls and the Subunit 1B harvest was 44 bulls. The Stikine harvest of 41 bulls was the 2nd highest recorded bull harvest, the 1957 kill of 42 being the highest on record.

The continued hunting pressure on the male segment of the herd is cause for concern, since most of the available breeding males are killed each year. While bulls are capable of breeding with many cows (Rausch and Bratlie 1965), there is some point at which the number of bulls could be reduced below the number needed for minimum successful reproduction. A proposal to limit the kill of young bulls in Subunit 1B was unpopular in Wrangell at a public meeting, but widely accepted in Petersburg. In 1984, the definition of a legal bull in northern Subunit 1B will be "a bull with at least 3 tines on at least 1 antler." This regulation should help to protect a segment of the bull population and insure survival for the herd. The effects of the regulation will be monitored for at least 2 years in the Thomas Bay area where recent heavy calf declines occurred, and a similar regulation will be recommended for the Stikine if proven effective.

Continued logging and road construction in southeast 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 is sought 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 1982). Clearcutting and logging roads in combination 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 heavily logged Thomas Bay were not matched by similar losses in the unlogged Stikine-LeConte wilderness during the same winter. Predation in Thomas Bay

may have increased by wolves utilizing the road system and preying 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 seral vegetation, the population may not be able to withstand severe winters.

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Table 1. Subunit 1B moose harvest locations, 1970-1982.

Year	Thomas Bay		Stikine River		Other areas		Total	
	Bulls	Cows	Bulls	Cows	Bulls	Cows	Bulls	Cows
1970	12	--	28	--	0	--	40	--
1971	10	--	25	--	0	--	35	--
1972	5	0	8	18[a]	0	0	13	18
1973	3	0	25	22[a]	1	0	29	22
1974	4	--	25	1	0	--	30	1
1975	8	--	16	--	1	--	25	1
1976	16	--	21	--	0	--	37	--
1977	13	1	19	--	0	--	32	1
1978	9	--	29	--	0	--	38	--
1979	21	--	26	--	0	--	47	--
1980	17	--	33	1	0	--	50	1
1981	10	2	33	1	4	--	47	3
1982	0	--	32[b]	--	4	--	36	--
1983	0	--	41	1	3	--	44	1
Means	9		26				36	

[a] Cow permits were issued only in 1972-73. All other cows were taken illegally.

[b] One bull was killed after the season closed.

Table 2. Thomas Bay moose harvest and aerial observations, 1980-1983.

Year	Fall bull harvest	Winter bull ratio	Percent bulls	Winter calf ratio	Percent calves
1980	17	0:100 cows	0	47:100 cows[a]	32
1981[b]	10	9:100 cows	7	20:100 cows	17
1982[c]	0	5:100 cows	5	0:100 cows	0
1983[d]	0	15:100 cows	9	54:100 cows	32

[a] Adult moose of undetermined sex were included as cows for ratios.
[b] Bull harvest limited to 10 by emergency order.
[c] Season closed by emergency order.
[d] Season closed.

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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The status of the lower Chilkat Range moose population is not known; however, hunters reported an increase in the number of moose and sign observed in 1983 over prior years. Sightings of moose and tracks were reported near Pt. Coverden (southern tip of Chilkat Range in Subunit 1C), Mansfield Peninsula (north end of Admiralty Island in Unit 4) and on Douglas Island in Subunit 1C.

Results of a survey conducted in December 1983 in the Taku drainage showed a bull:cow ratio of 5 bulls:100 cows. This low ratio is cause for concern, but because the U.S. portion of the Taku is heavily hunted adjacent a Canadian segment that has been in the past lightly hunted, the significance of this low ratio is difficult to assess.

An increase in the number of legal and illegal moose taken in this Canadian hunt area was reported in 1983 over the previous year. The bull:cow ratio of the Canadian segment surveyed was 10 bulls:100 cows in December 1983 ($\underline{N}$ = 53 moose:4 bulls, 40 cows, and 9 calves).

Population Composition

Sex and age composition counts were conducted by helicopter in the Berners Bay area 29 November 1983 and in the Taku River area 1 December 1983. In Berners Bay, 93 moose were observed, including 9 bulls, 66 cows and 18 calves. Sex and age ratios were as follows: 14 bulls:100 cows, 27 calves:100 cows, and 19% calves in the herd. A total of 54 moose was observed in the Taku area:2 bulls, 40 cows, and 12 calves. The sex and age ratios for this area were 5 bulls:100 cows, 30 calves:100 females and 22% calves in the herd.

Mortality

Based on harvest ticket returns, the harvest for the Taku River and Inlet area in 1983 was 11 bulls; 85 hunters hunted and the success rate was 12%. Unsuccessful hunters ($\underline{N}$ = 74) spent an average of 5.6 days ($\underline{N}$ = 412 days) hunting moose; successful hunters ($\underline{N}$ = 11) averaged 7.0 days hunting ($\underline{N}$ = 77 days). Mean antler width was 31.0 inches ($\underline{N}$ = 10, range 20-36 inches). In the lower Chilkat Range, 5 bull moose were killed in 1983, 3 at Endicott River and 2 at St. James Bay. Twenty-one hunters hunted the area for a success rate of 24%. Successful hunters spent an average of 4.6 days hunting; unsuccessful hunters spent 4.3 days. Chronology of the harvest showed that 4 bulls were taken in September and 1 bull in October. Mean antler width was 47.8 inches (range was 28-62 inches).

In the Berners Bay drawing permit hunt, which was antlerless only, 14 of the 15 permittees hunted (93%); 13 were successful for a success rate of 93%. All the harvested animals were cows. Successful hunters hunted an average of 1.8 days; the one unsuccessful hunter spent 12 days. Nine cows were taken in September and 4 in October.

The mean age of 13 cows taken during the Berners Bay hunt was 7.0 years (range 2-15 years).

One calf mortality was observed in the Taku Inlet area 21 June 1984 at the west edge of Grizzly Bar (Norris Glacier Flats). Cause of death was not known. Two calves were seen in the same rocky shore area the previous day separated from their mother by tide water and a rocky point.

Management Summary and Recommendations

The antlerless season in the Berners Bay area appeared successful in obtaining desired results and its continuance was recommended for the 1984 season. The local Fish and Game Advisory Committee in Juneau supported this recommendation and the Board of Game during their spring 1984 meeting adopted the antlerless season proposal.

Plant and pellet samples were collected for the Berners Bay Moose Winter Habitat Study in late winter 1983-84. These will be used to determine nitrogen and plant composition, respectively. All information should be complete at the end of 1984.

In 1984, it would be desirable to encourage the harvest of animals more evenly throughout the population by some means.

Most animals in 1983 were taken from about 50% of the population; 9 of the 13 were taken in the Berners River area alone. During surveys about 25% of the total observed moose are seen here. If this disproportionate distribution of harvest continues, an overall herd reduction objective cannot be achieved, particularly in the more remote portions of the herd.

A registration permit hunt was proposed and adopted by the Board of Game for the remainder of Subunit 1C to provide accurate and timely information on hunting pressure, hunter success rates, and total harvest. Hunter information has been minimal for the Chilkat Range and the Taku River areas even though interest is high and both hunting areas are located near a large city. The status of the Chilkat Range moose population is unknown; however, it is believed to be stable. In 1983, an aerial survey conducted in the Taku River drainage indicated a bull:cow ratio of 5.0 bulls:100 cows. Of 54 animals seen, 22% were calves. Bulls only have been harvested from this area for the past several years. Although the harvest has appeared relatively stable, the reported harvest may have included moose taken across the border in Canada.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT 1D

GEOGRAPHICAL DESCRIPTION: Upper Lynn Canal

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Sex and age composition of the Chilkat Valley moose population was obtained by aerial surveys on 16-17 November 1983 (Table 1); 211 moose were recorded in 5.8 hours of survey time with the following composition: 31.8 calves:100 cows, 10.8 bulls:100 cows, and 28.7 calves:100 adults. An overwinter survival survey conducted on 8 March, 1984 accounted for 88 moose in 3.8 hours.

Recent historical survey data (Appendix A) indicate a downward trend in overwinter calf survival in the Subunit 1D moose herd; in 1981-1984 late winter surveys, 1984 showed the lowest percentage of calves in the sample (13%). There has also been a dramatic drop in the total number of moose seen in these surveys: 211, 183, 88, and 88, chronologically. Similarly, 1982 and 1983 fall composition counts have shown declines in number of bulls:100 cows (from 30 to 11), number of cows:100 (from 30 to 11), and number of calves:100 adults (from 44 to 32). The percentage of calves in the fall sample has shown a moderate decline; 26% and 22% in 1982 and 1983, respectively.

Mortality

A total of 61 bull moose were reported in harvest statistics for 1983 in GMU 1D, compared with the 1976-82 average harvest of 36 bulls. Three hundred fifty-four hunters hunted; hunter success rate was 17%. This hunter success rate compares favorably to the 1973-82 average of 14% (Appendix B). Sixty successful hunters spent 261 days afield for an average of 4.4 days:hunter, while 285 unsuccessful hunters spent 1,546 days hunting moose, for a mean of 5.4 days:hunter. One successful and 8 unsuccessful hunters spent an unspecified time afield.

The 1983 Subunit 1D moose season was a week later than the prior 7 years, running from 22 September through 6 October.

Thirty-three (54%) of the moose kills occurred during the 1st 5 days of the season, 16 (26%) during the 2nd 5-day period, and 12 (20%) during the final 3rd of the season.

Fifty-nine of the 61 moose killed were taken from the Chilkat drainage, with 26 from above Wells Bridge, 31 below Wells Bridge, and 2 from unspecified locations within the Chilkoot drainage.

A sample of 55 bulls from the harvest had antler widths averaging 38 inches (range 18-56 inches) (Fig. 1). Cementum ages of 30 bulls averaged 3.2 years, (range 0.5-9 years) (Fig. 2).

Natural mortalities recorded during the report period included 4 moose. One radio-collared cow found at mile 14 along the Haines Highway was probably a victim of nutritional stress; a 2nd radio-collared animal was located aerially at mile 6 but never observed on the ground. One positive and 1 possible wolf kill was found in the Big Boulder Creek area (a short yearling and an older bull). One road kill was retrieved by Fish and Wildlife Protection officers for human consumption.

Management Summary and Recommendations

The 1983 Subunit 1D harvest of 61 moose exceeded the sustainable yield for a population estimated at about 350 animals. This level of harvest, along with results of fall composition counts, led the Game Division to propose an earlier season and a permit registration system for the 1984 hunt. The Board of Game, during its March 1984 meeting, established a 15-30 September season with a quota of 35 bulls.

The relatively consistent total numbers of animals observed during fall surveys since 1978 indicate that the population is probably stable. However, the lowered bull:100 cows ratio in recent surveys suggests that spreading some of the harvest pressure among the cow portion of the herd would create a better balance in the population. A limited cow harvest, under a restrictive management scheme, should be approached with the assistance of the Upper Lynn Canal Fish and Game Advisory Committee. Until the moose population shows definite indications of increasing, the harvest of bulls should remain on a permit registration basis.

Finally, habitat alteration is a major consideration for moose populations in Subunit 1D. Logging in the Haines State Forest may be proceeding at a rate that will eliminate significant portions of critical range, such as winter escape cover, calving areas, and migratory routes. Game Division biologists

should continue to work with Habitat Division and Department of Natural Resources in providing maximum protection for such critical habitats.

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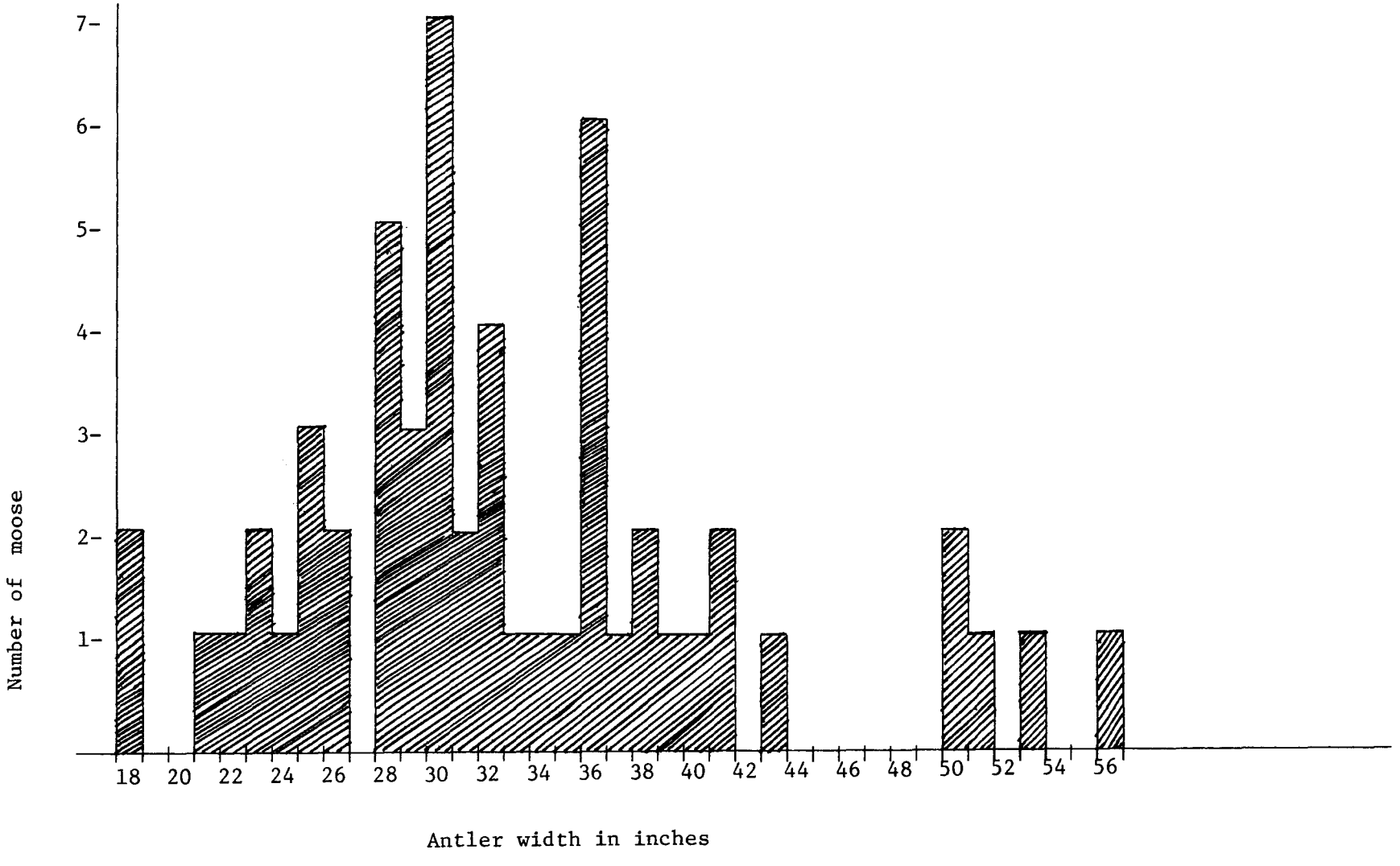

Figure 1. Antler widths from 55 bull moose harvested in GMU 1D, 1983.

Figure 2. Cementum ages of 30 bull moose harvested in GMU 1D, 1983.

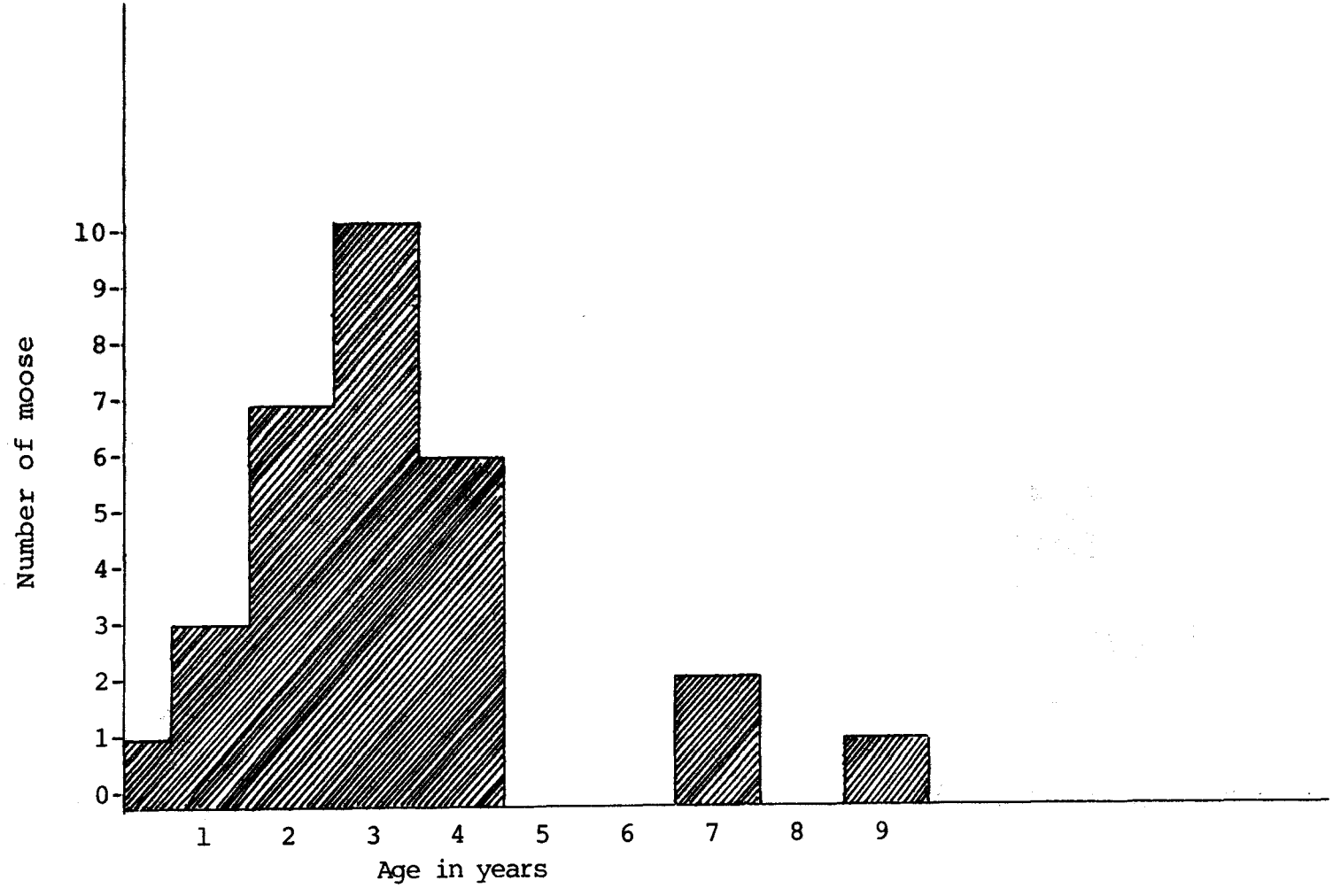

Figure 5. Cementum ages of 11 bull moose harvested from GMU 5B, 1983.

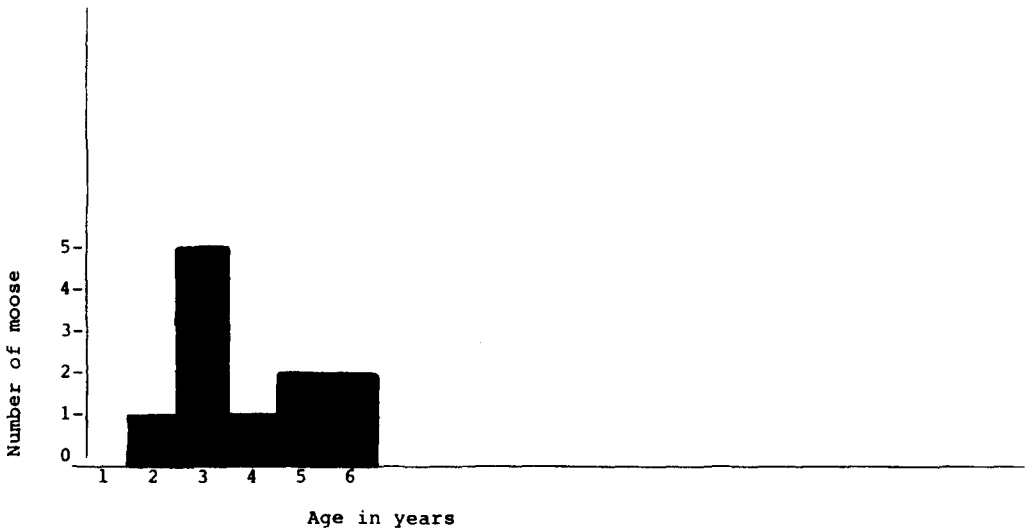

Table 1. Game management Unit 1D moose survey results, 1983-1984.

Date	Location	Total bulls	Total cows	Total adults	Total calves	Percent calves	Count time (Hr)	No. moose observed
Nov 83[a]	Above Wells Bridge	2	41	43	6	12.2	1.5	32.7
Nov 83	Below Wells Bridge	14	107	121	41	25.3	4.3	37.7
Totals		16	148	164	47	22.3	5.8	36.4
Mar 84[b]	Above Wells Bridge	--	--	54	3	5.3	2.2	25.9
Mar 84	Below Wells Bridge	--	--	23	8	25.8	1.6	19.4
Totals		--	--	77	11	12.5	3.8	23.2

[a] Survey conditions fair to excellent.
[b] Survey conditions fair.

Appendix A. Game management Unit 1D historical moose survey data, 1962-1984.

Year	No. bulls	No. cows	No. calves	Unk.	Total moose	No. bulls: 100 cows	No. calves: 100 cows	Percent calves	Count time (hrs)	Moose/ hour
1962	8	134	39	0	181	6	29	22	ND[a]	--
1963	ND[b]	ND[b]	36	157	193	--	--	19	ND[a]	--
1965	ND[a]	ND[a]	ND[a]	ND[a]	349	41	49	21	3.0	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	49	258	72	1	380	19	29	19	4.4	85
1969	23	91	31	0	145	25	34	21	2.1	69
1971	27	170	34	0	231	16	20	15	4.9	47
1972	33	178	56	0	267	18	32	21	6.4	42
1973	30	189	49	0	268	16	24	17	4.4	60
1974	30	135	41	0	206	22	30	20	6.2	33
1975	ND[b]	ND[b]	30	151	181	17	--	17	4.2	43
1977	30	186	71	0	287	16	38	25	5.8	50
1978	29	125	37	1	192	23	30	19	6.4	29
1979	15	149	36	18	218	10	24	17	4.5	48
1981	ND[b]	ND[b]	38	173	211	--	--	18	4.3	49
1982	ND[b]	ND[b]	29	154	183	--	--	16	4.3	43
1982	34	115	51	0	200	30	44	26	4.8	42
1983	ND[b]	ND[b]	19	69	88	--	--	22	5.6	15
1983	16	148	47	0	211	11	32	22	5.8	36
1984	ND[b]	ND[b]	11	77	88	--	--	13	3.8	23

[a] Data not available.
[b] Late winter surveys; sex composition not available.

Appendix B. Game management Unit 1D historical moose harvest data, 1962-1983.

Year	Season	Legal Moose	Hunter Success (%)	Harvest M	F	Unk.	Total
1962	1 Sep-15 Oct	M	--	66	0	0	66
1963	1 Sep-15 Oct	M	--	81	0	0	81
1964	1 Sep-15 Oct	M F	54	79	65	2	146
1965	1 Sep-15 Oct	M F	--	66	34	1	101
1966	1 Sep-15 Oct	M F	58	92	60	0	152
1967	1 Sep-15 Oct	M F	--	80	47	0	137
1968	1 Sep-15 Oct	M F	--	82	61	2	145
1969	1 Sep-15 Oct	M F	--	52	24	2	78
1970	1 Sep-15 Oct	M F	--	48	48	0	96
1971	1 Sep-15 Oct	M F	31	67	30	0	97
1972	1 Sep-15 Oct	M F[a]	28	46	45	1	92
1973	1 Sep-15 Oct	M F[b]	23	69	46	0	115
1974	15 Sep-18 Sep	M F	13	21	37	0	58
1975	15 Sep-18 Sep[c]	M F	9	25	0	1	26
1976	15 Sep-30 Sep	M	13	36	18[d]	1	55
1977	15 Sep-30 Sep	M	15	30	0	1	31
1978	15 Sep-30 Sep	M	15	44	1	0	45
1979	15 Sep-30 Sep	M	20	38	0	1	39
1980	15 Sep-30 Sep	M	14	48	0	0	48
1981	15 Sep-30 Sep	M	11	34	1	0	35
1982	15 Sep-30 Sep	M	9	24	1	0	25
1983	22 Sep-6 Oct	M	61	0	0	0	61

[a] Cow season 1 Sep-10 Sep 72.
[b] Cow season 1 Sep-9 Sep 73.
[c] Season closed by emergency order.
[d] Two-day anterless hunt during season.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5

GEOGRAPHICAL DESCRIPTION: Cape Fairweather to Icy Bay
Eastern Gulf Coast

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Yakutat Forelands (Subunit 5A). Aerial surveys of the Yakutat Forelands moose population were conducted between 9 January and 7 March 1984 (Table 1). A total of 382 moose were enumerated in 12 hours of survey time, with 22% calves observed. This compares to the previous survey in December 1981 (Table 1) when 402 moose were counted in 15.7 hours (16% calves). Based on this year's survey conditions (fair at best), good reproduction, and a high percentage of cows with twins (15% of all cows with calves), the Subunit 5A moose population appears stable and probably numbers around 650-700 animals.

Nunatak Bench. An aerial survey conducted on 28 November 1983 found 15 adult and 10 calf moose, similar to the 1982 survey of 22 moose. Because the 1982-83 harvest removed 3 bulls and 6 cows from Nunatak Bench and the 1983 survey accounted for 40% calves, the population is apparently healthy and increasing in size.

Malaspina Forelands (Subunit 5B). A survey from Galiano Glacier to Schooner strip enumerated a total of 66 moose, 32% of which were calves. Results of this survey, along with interviews with pilots (63 animals documented west of Malaspina Glacier on 13 December 83), hunters, and fishermen, indicate the Subunit 5B moose population is stable or slightly increasing at this time.

Mortality

Yakutat Forelands (Subunit 5A). During the 15 October-15 November permit registration season, 47 bull moose were harvested by 235 active hunters (20% success). An additional 44 permittees did not hunt. The 47 successful hunters spent a

total of 87 days hunting (average 1.9 days/hunter), while the 188 unsuccessful hunters averaged 5.1 days afield. Forty-one moose (87%) were taken during the 1st week of the season. Twenty-eight (60%) were taken from drainages east of and including the Dangerous River, while the remaining 19 (40%) came from west of the Dangerous River watershed. Ages of moose in the harvest are available for 1981, 1982, and 1983 (Figures 1, 2, and 3). Cementum ages reflect the availability of older animals in the population and indicate that excessive exploitation of bulls is not occurring.

Nunatak Bench. During the 15 November-15 February Nunatak Bench season, 2 bulls were harvested of the 10-moose quota. Thirty permits were issued for this hunt; 21 permittees did not hunt, 7 hunted unsuccessfully for an average of 12 days, and 2 hunted successfully for an average of 10.5 days (hunter success = 22%). Both moose taken were killed in the last week of season.

Malaspina Forelands (Subunit 5B). The 1 September-31 October GMU 5B moose season attracted 86 permittees, 31 (36%) of whom did not hunt. Of 55 permittees hunting, 11 (20%) killed bull moose. Successful and unsuccessful hunters spent an average of 2.4 and 4.0 days hunting, respectively. Seventy-three percent of the harvest, (8 moose), occurred during 29 September-12 October; 82% of the harvest (9 moose) came from Point Manby and points east in the subunit. Teeth of all moose harvested were sampled for cementum ages. Five of the 11 animals taken were classified as 3-year-olds, and 5 more were older animals (Figures 4 and 5).

No natural mortality was documented during the reporting period.

Management Summary and Recommendations

Yakutat Forelands (Subunit 5A). No change in seasons or bag limit is recommended. A proposal to the Board of Game by the Yakutat Fish and Game Advisory Committee would have reduced the bull quota to 25. In light of the age structure of the 1983 harvest and the aerial survey results, the Board maintained the status quo. Because sex and age composition data have not been obtained since fall 1981, it is imperative that these data be collected. The Yakutat Forelands population could sustain a tightly controlled harvest of cow moose in the near future, relieving some harvest pressure from the bull segment while allowing for the optimum harvest of moose, as outlined in the Yakutat Moose Management Plan.

Nunatak Bench. No changes in season or bag limits are recommended. Surveys are planned for FY 1985 to determine if the 10-moose quota is appropriate for this population.

Malaspina Forelands (Subunit 5B). No changes in seasons or bag limits are recommended. Again, fall surveys were not accomplished during the report period, thus sex and age composition data are lacking. This information should be collected in fall 1984.

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SUBMITTED BY:

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Table 1. GMU 5A historical moose survey data, 1974-1983.

Year	No. bulls	No. cows	No. calves	Unid. Sex and Age	Total Sample	Bulls: 100 cows	Calves: 100 cows	Percent calves	Flight time (hrs)	No. moose/ hour
1974	21	81	29	--	131	27	37	22	5.2	25
1975	43	183	32	30	288	24	17	11	10.9	26
1976[a]	--	--	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]	--	--	25	95	120	--	--	21	2.8	43
1980[b]	19	23	8	3	53	83	35	15	2.3	23
1981	93	243	65	1	402	38	27	16	15.7	26
1982[c]	--	--	--	--	--	--	--	--	--	--
1983[c]	--	--	--	--	--	--	--	--	--	--
1984[a]	--	--	83	299	382	--	--	22	11.9	32

[a]Late winter count; sex indeterminate.

[b]Survey from Situk-Ahrnklin Rivers only.

[c]No survey conducted.

Figure 1. Cementum ages of 24 bull moose harvested from GMU 5A, 1981.

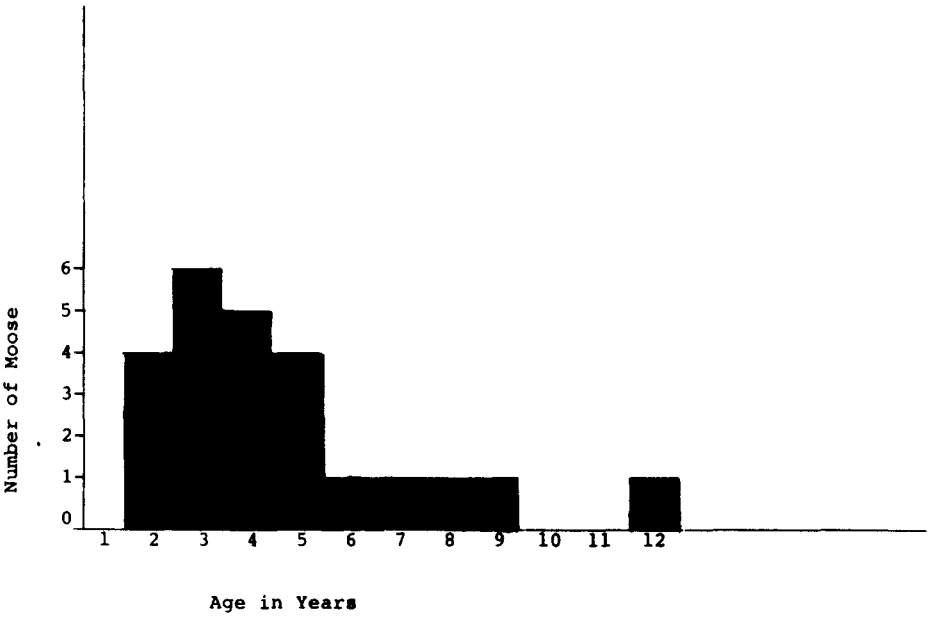


Figure 2. Cementum ages of 46 bull moose harvested from GMU 5A, 1982.

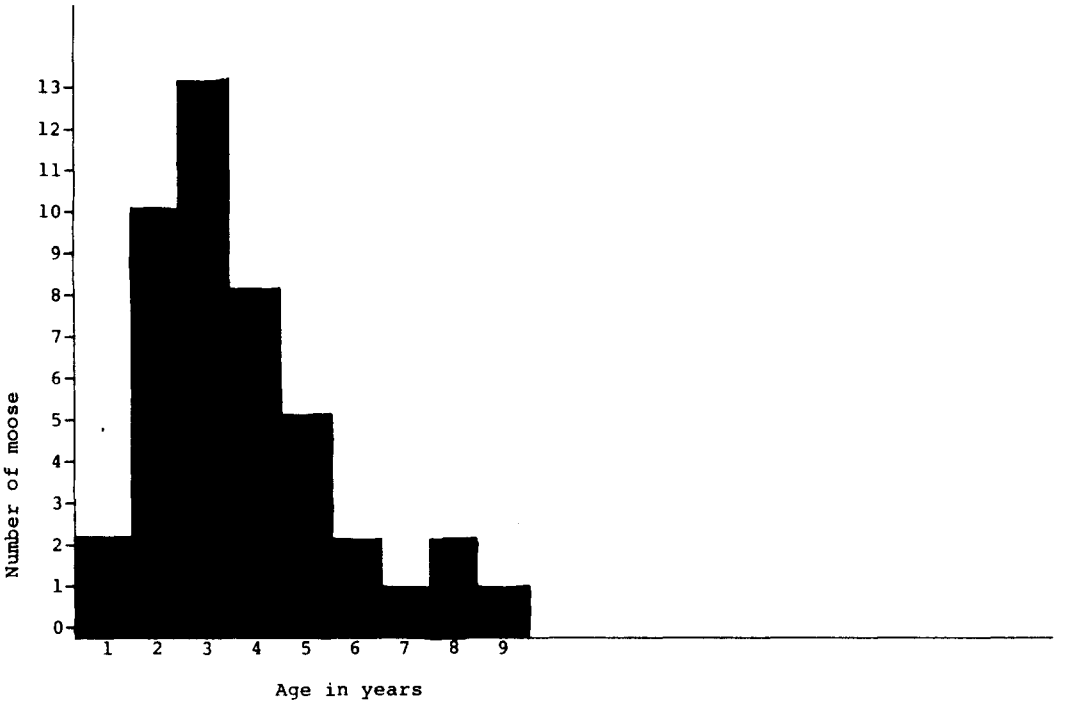


Figure 3. Cementum ages of 43 bull moose harvested from GMU 5A, 1983.

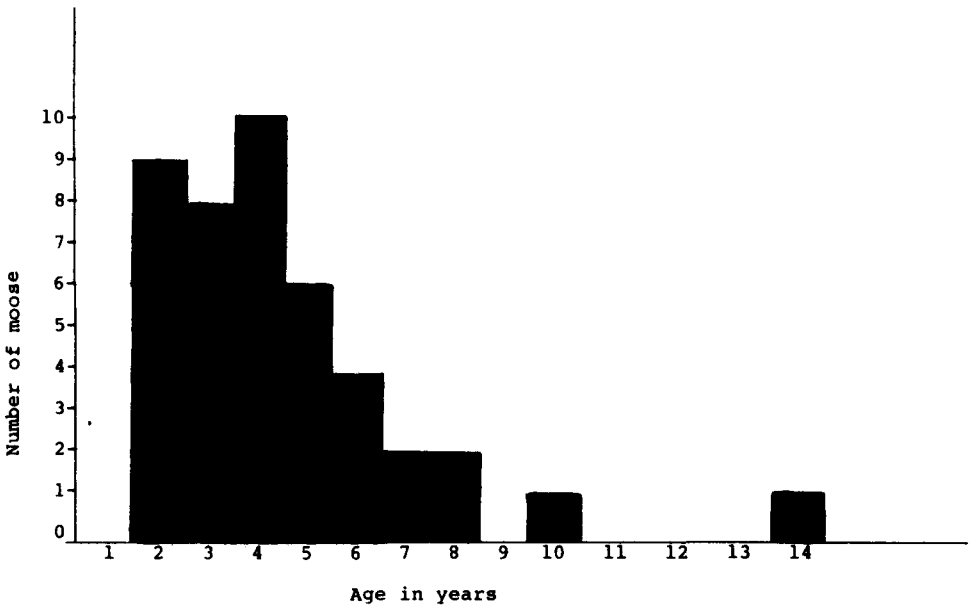
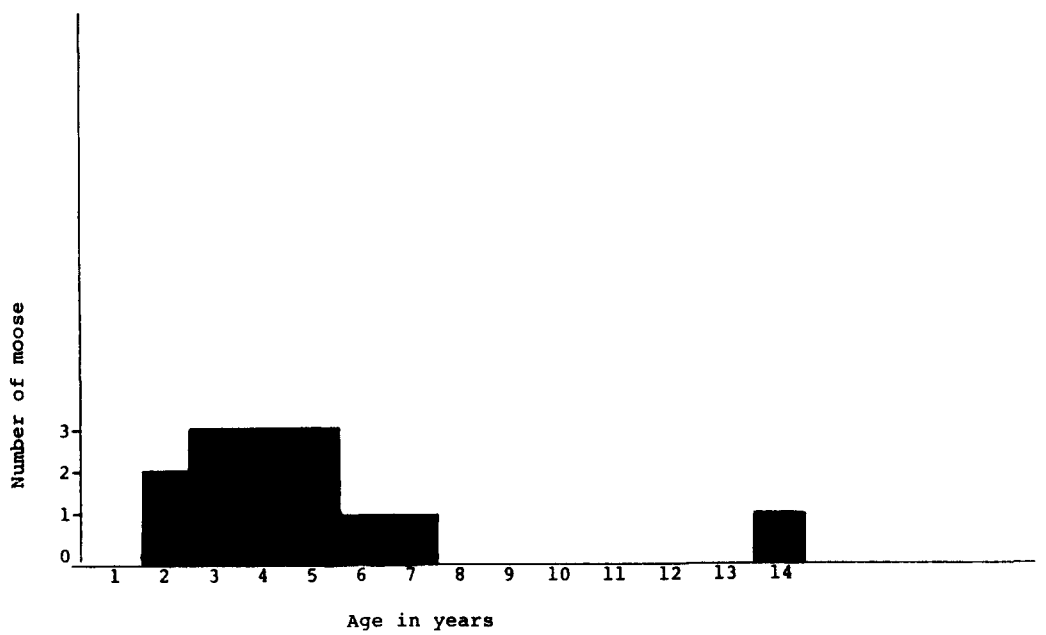


Figure 4. Cementum ages of 14 bull moose harvested from GMU 5B, 1982.



MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6A

GEOGRAPHICAL DESCRIPTION: Katalla to Icy Bay

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The Bering River/Controller Bay moose herd continues to increase gradually with the good calf production and/or survival. The Tsiu River herd has rapidly increased in size. Weather conditions were mild during the winter of 1983-84 and contributed to the high survivorship rate.

Population Composition

A moose survey in the Bering River/Controller Bay area was flown on 19 December. Survey conditions were good and 307 moose were observed with a bull:cow ratio of 27:100 and a calf:cow ratio of 44:100. The Tsiu River area was flown 21 December also under good survey conditions; 311 moose were observed with a bull:cow ratio of 33:100 and a calf:cow ratio of 36:100. Survey data for both herds are shown in Table 1.

Mortality

The moose harvest for Subunit 6A was 56 animals: 47 bulls, 8 cows and 1 of unknown sex. Forty-two moose were taken from the Bering River/Controller Bay herd (37 bulls and 5 cows) and 14 moose were taken from the Tsiu River herd (10 bulls, 3 cows and 1 of unknown sex).

Successful hunters used the following methods of transportation: airplane, 33; airboat 19; riverboat, 1; ATV, 1. Actual hunting pressure was unknown, but 270 moose hunting permits were issued. The season was allowed to run the full duration; 1 September-31 December.

Management Summary and Recommendations

The 2 moose herds in Subunit 6A are increasing, with substantial growth noted in the Tsiu River herd. The Bering River/Controller Bay herd increased from 224 animals in December

1980 to 307 in December 1983. The Tsiu River herd increased from 109 in January 1980 to 311 in December 1983.
The 1983 harvest of 56 moose was similar to the 1982 harvest (58) in both the numbers of animals taken and distribution of kill. Hunting and predation has not had a detrimental impact on either herd.

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SUBMITTED BY:

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Table 1. Sex and age composition and ratio data for the Tsiu River and Bering River/Controller Bay moose herds from survey data obtained December 1983.

Herd	M	F	Calves	Total sample	Bulls: 100 cows	Calves: 100 cows	Percent calves	Survey conditions
Tsiu River	61	184	66	311	33.2	35.9	21.2	Good
Bering River/ Controller River	48	180	79	307	26.7	43.9	25.7	Good

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6B

GEOGRAPHICAL DESCRIPTION: Martin River

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Following the moose hunting season in September, the Martin River moose herd was estimated to be slightly above the desired population size of 150-175 animals. Calf production and/or survival, however, continued poor.

Population Composition

A moose composition survey was flown on 17 December and 179 moose were classified, including 115 cows, 32 bulls and 32 calves. Bull:cow and calf:cow ratios were each 28:100. Calves made up 18% of the herd. The December survey was flown under good weather and observation conditions.

Mortality

The moose harvest for Subunit 6B was 74 animals:35 bulls and 39 cows. The season was closed by emergency order on 15 September after 13 days of hunting. Actual hunting pressure was unknown, but 487 permits were issued. Methods of transportation used by successful hunters were: airboat, 47; airplane, 17; riverboat, 6; and highway vehicle, 4.

Management Summary and Recommendations

The 1983 moose season was regulated to reduce the Martin River moose herd to the desired size of 150-175 animals. A moose survey was subsequently flown (December) and 179 animals were counted. Results of that survey indicated the population was near the size desired.

The calf:cow ratio of 28:100 was an improvement over previous years but was still considered poor.

No changes in regulations were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6C

GEOGRAPHICAL DESCRIPTION: West Copper River Delta

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The size of the West Copper River Delta moose herd increased over the past 4 years and was probably within the desired post-season level of 175-200 animals.

Population Composition

A fall moose sex and age composition survey was flown on 10 December. Survey conditions were only fair, but 164 moose, including 120 cows, 18 bulls and 26 calves, were observed. Survey data revealed a bull:cow ratio of 15:100 and a calf:cow ratio of 22:100. Calves made up 16% of the herd.

Mortality

Thirty bulls were taken during the half-day season held on 10 September. Actual hunting pressure was unknown, but 573 permits were issued.

Management Summary and Recommendations

The West Copper River Delta moose herd has been rebuilding since spring of 1979 when approximately one-third of the herd moved to the Martin River valley. Moose harvests from 1979 through 1983 have been restricted to bulls only in order to allow this herd to increase. Population data collected during the past 2 winters indicate the herd may have reached the desired population size of 175-200 animals.

The desired moose harvest for the 1983 season was approximately 20 bulls. The actual harvest was 30 bulls. The increased kill resulted from increased hunting pressure; for example, 573 permits were issued in 1983 compared to 359 in 1982. Although the harvest was excessive, it was not detrimental to the population.

The winter of 1983-84 was mild and over-winter survival should be excellent.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 7

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

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose occur throughout the intermountain valleys of Unit 7; however, no data were available to access their current status.

Population Composition

No data were available.

Mortality

Hunters reported killing 58 bull moose, compared to 36 the previous year. The success rate for 271 hunters in the 1983 season was 21%. Fifty-two of the 58 successful hunters reported the following antler spread of their moose: ≤30 inches reported by 18 hunters; 30-39.9 inches reported by 13 hunters; 40-49.9 inches reported by 15 hunters; and ≥50 inches reported by 6 hunters. The methods of transportation used by successful hunters were: highway vehicle, 56%; horse, 21%; boat, 9%; airplane, 9%; and offroad vehicle, 5%.

Management Summary and Recommendations

Aerial surveys of the moose population have not been made since 1980, primarily due to poor survey conditions. However, based on general observations of moose density, I believe the population stabilized in 1980 and has remained at relatively low densities. The U.S. Forest Service are currently engaged in prescribed burning for the purpose of enhancing moose winter range. During 1984, controlled burns were completed in the following areas: Resurrection Creek (2,800 acres); Tern Lake (50 acres); and Snug Harbor Road (15 acres). A total of 5,905 acres of moose winter range have been burned within

Chugach National Forest since 1981. These habitat enhancement activities are expected to substantially improve winter browse for moose.

No changes in the season or bag limit were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 9

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

In recent years the moose population has been relatively stable in the northern and southern subunits. However, the moose population in the central Subunit (9E) continued to decline because of poor calf recruitment.

Population Composition

Three trend count areas were flown in Subunit 9C (Table 1), and counts showed a slight increase in the bull:cow ratio (46:100) and a substantial increase in the calf:cow ratio (33:100) over the 1981 and 1982 average (40:100 and 19:100, respectively). The Katmai trend count area was also flown and results (Table 1) indicate a slight increase in both bull:cow and calf:cow ratios over 1982 levels. Because the moose population in Subunit 9E continues to decline, fall sex and age composition surveys were concentrated in that area. Seven trend count areas in Subunit 9E were flown from 31 October-19 November (Table 1). Compared to 1982, calf survival improved slightly from 9 calves:100 cows to 14 calves:100 cows. The bull:cow ratio also improved to 42 bulls:100 cows. From 30 May-6 June, moose parturition surveys were flown in the central portion of Subunit 9E. Overall, the calf:cow ratio was 43:100, with an incidence of twins of 44:100 cows with calves. Calves comprised 20% of the total sample of 114 moose.

Mortality

Hunters in Unit 9 reported killing 175 moose: 159 bulls, 15 cows, and 1 of unspecified sex. During the September season, 143 bulls were killed, which was about 90% higher than the previous year's kill. Table 2 shows harvest data for Unit 9. Excluding Subunit 9A, all subunits showed an increase in the size of kill, with Subunit 9E having the greatest increase. Fifteen bulls and 15 cows were killed during the December

season, which was slightly below the 1978-1982 average. Poor hunting conditions in December and the elimination of an antlerless season in Subunit 9E were responsible for the slight drop in the December harvest.

There were 462 people who reported hunting moose in Unit 9, an increase of 100 over the previous year. Moose hunting success remained about the same (39%). The net result was 45 additional moose killed in 1983.

No data were available on natural mortality, but the large drop in calf:cow ratios from spring to fall suggests that mortality of calves is still the major factor limiting population growth.

Range Analysis

Moose browse was sampled in 3 drainages of Subunit 9E and 1 drainage of Subunit 9C during April 1984 (Fig. 1). Catana's (1963) wandering quarter method was used, but modified to include both random distribution and clumping tendencies into stem density calculations. At least 20 points were sampled at each site. For each sampled stem, browsing intensity was classified as 0%, 1-10%, 11-50%, 51-95% or greater than 95% of the current annual growth removed. Current production was estimated from current annual growth twigs clipped from 20 stems of the dominant browse species in each stand. Sampling was designed to more efficiently utilize time. By using the plotless method (versus intensive plot sampling which produces more precise estimates but takes longer) a greater area was covered in less time. This method is more applicable to moose management on the Alaska Peninsula, where habitat manipulation is not presently a practical management tool.

Sampled stands consisted of lowland, upland, or riparian shrub-tundra communities. Diamondleaf willow (Salix pulchra), Barclay's willow (Salix barclayi), littletree willow (Salix arbusculoides), and grayleaf willow (Salix alexansis) were present. Diamondleaf willow, a preferred species in much of Alaska, was the dominant willow in all but 2 sample stands; littletree willow was dominant in the Dog Salmon riparian stand; and alder (Alnus crispa) was dominant in 1 of the Contact Creek upland stands.

When present, littletree willow was the most heavily utilized willow. That is consistent with observations made in previous years' sampling (Sellers and McNay 1984), and littletree willow can be considered the most preferred species of moose browse on the Alaska Peninsula. However, because of the morphology of littletree willow twigs and stems, annual per stem

production is low; and possibly because of heavy browsing pressure, overall stem densities of littletree willow are low.

Browsing intensities were highest in the Contact Creek sample stand (within Katmai National Park) where moose are not hunted and moose densities are higher than elsewhere on the Peninsula. Only light to moderate browsing was recorded on dominant willow species at the other 3 locations. Browsing intensities at those sites were similar to those found at Painter Creek in 1983 and at Pumice Creek in 1982 (Sellers and McNay 1984). Based on browse production estimates and browsing intensities, moose numbers in Subunit 9E are below the carrying capacity. Results of sampling are summarized in Table 3.

Management Summary and Recommendations

The moose population in Subunit 9E has declined at least 60% since the early 1970's, and a census in 1983 showed 0.9 moose/mi^2 in 1,314 mi^2 from Ugashik River to Cinder River. The population has failed to respond to significantly reduced harvests in recent years because of poor calf recruitment.

Despite an increase in the September bull harvest in Subunit 9E, the bull:cow ratio increased from an average of 16:100 during 1974-1979 to 42:100 in 1983. This increase was the result of the minimum 50-inch antler size regulation and a drastically shortened fall season. If management for trophy bull moose is to continue in Subunit 9E, reduced season or a permit hunt may be necessary to maintain a relatively high percentage of legal (minimum 50-inch antler spread) bulls.

Although the moose population in Subunit 9B appears relatively stable, there are apparent differences in bull:cow and calf:cow ratios within the subunit. More intensive fall trend counts should be conducted in Subunit 9B to provide data needed to evaluate different management regimes within the subunit.

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Aid in Wildl. Rest. Prog. Rep. Proj. W-22-2, Job 1.0. Juneau. 154pp.

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Table 1. Fall sex-age ratios of moose in Unit 9, 1983.

Area	Bulls: 100 cows	Small bulls: 100 cows	Calves: 100 cows	Total moose	Percent calves in herd
Subunit 9C	46	7	33	429	17
Katmai	56	4	12	309	7
Subunit 9E	42	4	14	677	9

Table 2. Unit 9 moose harvest data by subunit, sex and season, 1983.

Subunit	Bulls			Cows	Unspecified	Total
	Sept	Dec	Unk.	Dec		
9A	9	--	0	--	0	9
9B	36	7	0	11	1	55
9C	30	4	0	4	0	38
9E	68	4	1	--	0	73
Total	143	15	1	15	1	175

Table 3. Summary of results from browse sampling at 4 sites on the Alaska Peninsula, 17-23 April 1984.

Location	Site	Species	Number of points sampled N	Total stem density each site stem/ha $\bar{x}$ ($S\bar{x}$)	Coefficient of variation %	Relative density %	Frequency of occurrence %	Estimated production (kg/ha)	Estimated browsing intensity %
Featherly Cr.	Lowland		30	29,588 (3356)	62				
		Salix pulchra				36	30	136	9
		Salix baraclayi				33	47	203	1
		Salix glauca				28	20	-	0
		Salix sp.				3	3	-	0
Upper Ugashik L.	Lowland		20	23,128 (3775)	73				
		Salix pulchra				75	90	-	9
		Salix glauca				16	5	-	2
		Salix arbscusbides				9	5	-	57
Contact Cr.	Upland		20	21,994 (3463)	70				
		Alnus crispa				97	95	569	3
		Salix sp.				3	5	-	73
	Upland		20	72,645 (12,776)	78				
		Salix pulchra				80	80	249	37
		Salix barclayi				18	15	-	43
		Alnus crispa				2	5	-	5
Dog Salmon R.	Lowland		20	93,794 (24,534)	116				
		Salix pulchra				53	45	511	2
		Salix barclayi				42	50	-	1
		Salix glauca				5	5	-	35
	Riparian		20	36,547 (8,172)	100				
		Salix arbusculoides			26	20	51	45	
		Salix alaxensis				23	35	155	3
		Salix pulchra				15	15	-	<1
		Salix barclayi				4	10	-	1
		Salix crispa				32	20	-	<1

1. Contact Cr. 1984
2. Featherly Cr. 1984
3. Upper Ugashik Lake 1984
4. Dog Salmon River 1984
5. Painter Creek 1983
6. Pumice Creek 1982

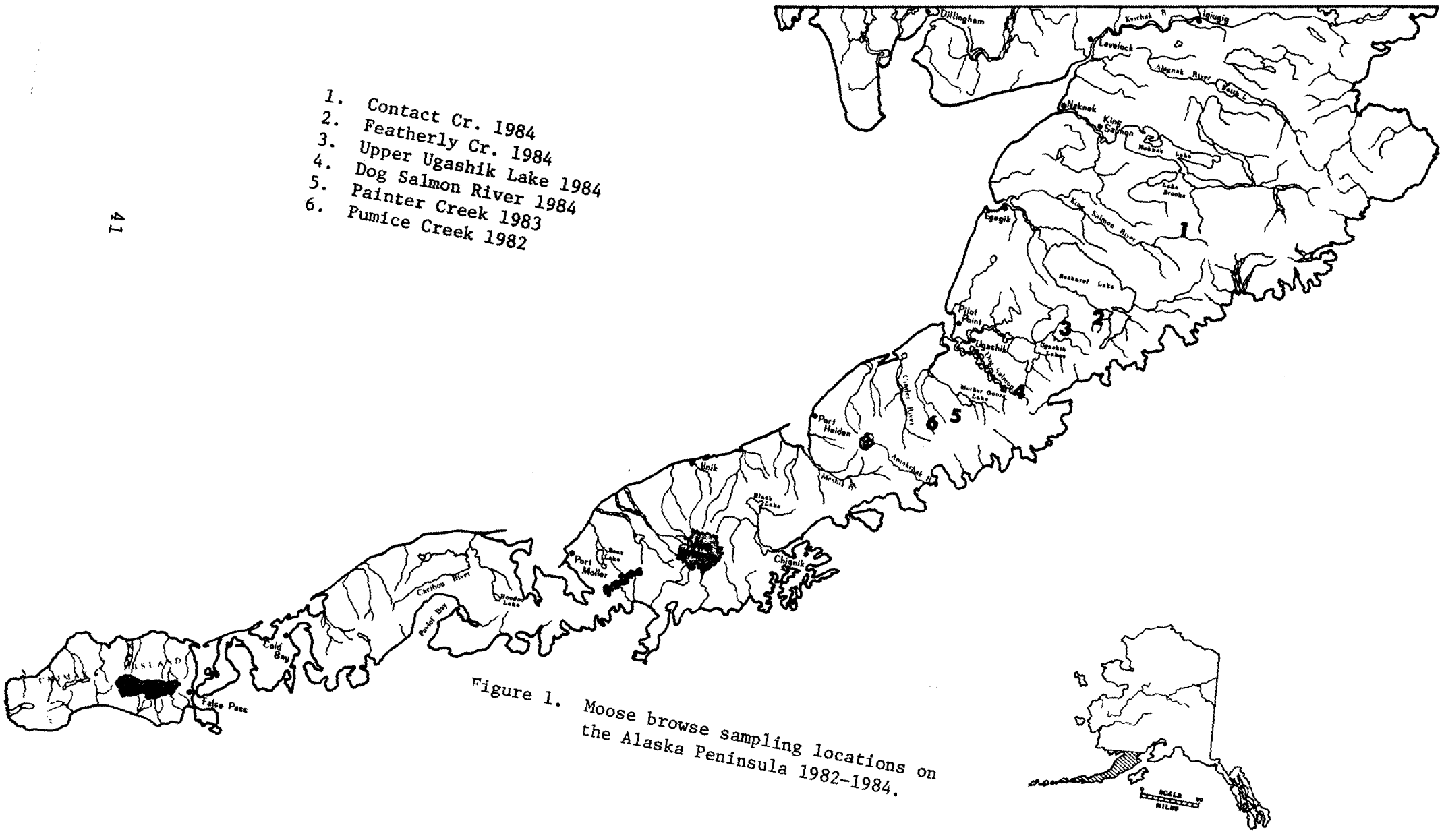

Figure 1. Moose browse sampling locations on the Alaska Peninsula 1982-1984.

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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose numbers are low in Unit 11. Little change in population density was observed this year (26 moose counted per hour) compared to last year (23 moose counted per hour).

Population Composition

During a November survey flown in the Mt. Sanford-Mt. Drum area, 84 bulls:100 cows and 23 calves:100 cows were observed (N = 84).

Mortality

There were 84 bull moose reported killed by 195 hunters during the season. Hunter success was 25%, and nonresidents killed 4 moose.

Management Summary and Recommendations

Although moose numbers are low, fall composition counts for the past 3 years have indicated a small increase in population size from the extreme lows of the late 1970's. Harvest and hunting pressure also remain low, although both increased slightly during 1983. With continued low harvest and high bull:cow ratios, there is no evidence to indicate that hunting has impeded population growth; thus, no changes in season or bag limits were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 12

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White River

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Approximately 2,500 moose are thought to inhabit the 8,500 mi^2 Unit 12 area. Moose densities are low throughout much of the Unit, and estimated densities range from 0.1 moose/mi^2 in the Tetlin-Northway Flats to 1.0 moose/mi^2 in the Tok River drainage.

Populations in most areas are stable, but moose numbers apparently declined in the Little Tok River drainage and have increased in the northwestern portion of Unit 12. Recruitment to the moose population in the northwest portion has increased since the initiation of wolf control in 1980.

Population Composition

During the period 10-23 November 1983, 654 moose were classified during 15.1 survey hours (Table 1). Sample size was lower than expected for the Little Tok and Nabesna to Chisana foothills surveys, due to abnormally early movements by moose to lower elevations.

With exception of the survey in the Little Tok drainage, bull:cow ratios were unchanged from previous years. Only 14 bulls:100 cows were observed in the Little Tok drainage.

Calf survival to 5 months of age was low to moderate throughout the unit, with the lowest survival observed in the Tok and Little Tok drainages. Based on studies in areas near Unit 12, the high rate of early calf mortality is likely caused by predation by grizzly and black bears and wolves.

Yearling recruitment is uniformly low throughout Unit 12, with the exception of the area benefited by wolf control along the northern side of the Alaska Range where yearling bulls comprised 12% of the sample. This indicates that wolf control

facilitated overwinter calf and adult survival; wolf control apparently had less effect on survival of calves under 5 months of age.

A sample of 10 moose captured on the Northway-Tetlin Flats in March 1984 revealed that 7 (70%) were 10 or more years of age. This suggests poor recruitment during the past decade.

Habitat Conditions

Observations indicate that utilization of browse by moose during winter 1983-84 was extremely low throughout the unit. Moose moved down from subalpine rutting areas by late November, but low snow accumulation allowed them to winter at low densities over wide areas. Browse use along the Tanana in Unit 12 was only 11%, and only 6-30% in the Tok drainage.

Approximately 350 acres of old-age, riparian felt-leaf willow (Salix alaxensis) habitat were crushed by crawler tractors in March 1983. Production of available browse is expected to increase 5-fold in the crushed area within 2 years.

The Fortymile Fire Management Plan was implemented in May 1983 and is expected to result in the restoration of a near-natural fire regime over 60-80% of the unit. This, in turn, should eventually result in a habitat mosaic with a higher percentage of brush land and deciduous forest.

Mortality

Predation by black bears, grizzly bears, and wolves is the primary mortality factor limiting moose populations in Unit 12. Poaching in the vicinity of some villages is believed to further contribute to overall moose mortality in several local areas. Less than 5 moose were thought to have been accidentally killed by automobiles during the reporting period, but 20-30, and perhaps more, are believed to have been killed illegally.

Moose hunting pressure in Unit 12 during 1983 decreased 17%; 340 hunters reported hunting moose in 1983, compared to 408 in 1982. Seventy-three bull moose were reported taken, for a success rate of 21%. The take has declined from 86 bulls in 1982 and 91 bulls in 1981. The harvest was heaviest in the Tok and Little Tok drainage where 35 bulls (51%) were taken. The remainder of the harvest was well distributed throughout the Tanana, Nabesna, Chisana, and White River drainages.

Unit 12 residents (154) comprised 45% of the hunter effort, but unit residents took only 27 bulls (37% of the harvest). Hunter success for unit residents was only 18%.

Management Summary and Recommendations

Most moose populations in Unit 12 exist at low densities and appear to be stable. Surveys indicate declining numbers in the

Little Tok drainage and increasing numbers due to wolf control on the northern portions of the Alaska Range.

Efforts to improve habitat conditions for moose in the Tok and Tanana River valleys should continue, to ensure high quality food sources for moose during hard winters. Crushing and prescribed fires are the recommended habitat management techniques.

Wolf control throughout the unit is recommended, to increase moose numbers from the present level of 2,500 to 4,500. Browse surveys indicate that the habitat can sustain such an increase. Completion of the calf mortality study in summer 1985 will serve to guide future moose management efforts.

A shorter hunting season for the Little Tok River drainage will be implemented in fall 1984 to prevent further decline of the bull:cow ratio until predator management improves recruitment.

PREPARED BY:

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SUBMITTED BY:

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Table 1. Unit 12 moose sex and age ratios observed during aerial surveys, 10-23 November 1983.

Area	Total bulls: 100 cows	Small bulls: 100 cows	Percent small bulls	Calves: 100 cows	Percent calves	Moose: hour	Total moose
North Alaska Range	54	21	12	32	17	29	52
Tok River	33	8	5	19	14	59	158
Dry Tok Creek	27	12	7	30	19	90	162
Little Tok River	14	5	4	15	12	46	139
Tetlin River-Tuck Creek	55	9	5	33	17	33	103
Nabesna River-Cheslina River (foothills)	79	0	0	32	15	15	40

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 13

GEOGRAPHICAL DESCRIPTION: Nelchina and Upper Susitna Rivers

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Observations of the Unit 13 moose population suggest little change in overall numbers during the last 2 years. There was only a small decrease in the number of moose counted per hour this year (56) compared to last year (65). Mild weather patterns continued during the winter and were an important factor limiting the rate of natural mortality.

Population Composition

Moose sex and age composition counts were completed in 9 count areas from October through November. The bull:cow ratio, 24:100, was identical to that obtained in 1982. Additionally, the yearling bull:adult bull ratio remained high, indicating a bull population composed predominantly of younger animals.

Calf production and/or survival was similar to the previous year. Results of survey data since 1981 are shown in Table 1.

Mortality

During the 1983 season, 904 moose were killed by 3,243 hunters (28% success rate). This total includes 36 moose killed by subsistence hunters. Nonresident hunters took 9% of the harvest. The most popular method of transportation among hunters was highway vehicles, 39%; ATV's, 30%; aircraft, 17%; and boat, 13%.

A subsistence moose hunt was held by drawing permit for the 1st time in 1983. Only residents of Unit 13 were eligible, and only 1 permit application per household was accepted. A total of 100 permits were issued from 230 applicants. The season dates for the subsistence hunt were the same as the general hunting season. The permit was valid for 1 bull moose regardless of antler size, thus eliminating the 36-inch or 3

brow tine minimum antler requirements for subsistence hunters. Ninety-one of the subsistence permittees reported hunting, and the harvest was 36 moose (40% success rate).

Management Summary and Recommendations

The size of the Unit 13 moose population has increased from 1979 through 1981 and has remained stable for the past 2 years. Favorable weather conditions have continued and are a factor which have limited the rate of natural mortality. Fall composition counts indicate higher bull:cow ratios, largely due to increased yearling bull survival under restrictive hunting regulations. These regulations protect yearlings and 2-year-old bulls by requiring hunters to select for older, mature bulls. The number of adult bulls in the population has therefore declined.

The 36-inch minimum size antler regulation was originally implemented to reduce the harvest of young bull moose and reverse the declining trend in the bull:cow ratio. Although the regulation has satisfied this goal it may not be a biologically sound long-term management strategy, since the harvest pressure is focused on adult bulls. Over time, this strategy tends to place too many 1- and 2-year-old bulls in the breeding population. I recommend, therefore, that regulations be implemented to allow hunters to take only young bulls. Young bulls should be defined as those bulls having a spike or forked antler on at least 1 side. To test this regulatory change, without restricting hunter participation, an experimental hunt area located in portions of Subunits 13B and 13E was recommended and adopted by the Board of Game. The experimental area, which includes both sides of the Denali Highway between Brushkana Creek and Maclaren River, will be open to moose hunting for spike or fork-antlered bulls only. Check stations on the Denali Highway will be used to monitor hunter compliance and response to this regulation.

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Table 1. Moose survey data for Unit 13, 1981-83.

Year	Large bulls	Small bulls	Cows	Bulls:100 cows	Calves	Calves:100 cows	Total moose	Moose/ hour
1981	455	294	3508	21.4	1,054	30.0	5,311	56.4
1982	427	475	3773	23.9	970	25.7	5,645	65.3
1983	417	437	3557	24.0	887	24.9	5,298	56.0

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14A

GEOGRAPHICAL DESCRIPTION: Matanuska Valley

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

No current data were available to assist in evaluating the status of the moose in Subunit 14A.

Population Composition

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

Mortality

Hunters took 531 moose, including 340 bulls, 148 cows, and 43 of unknown sex, during the 1983 hunting season; 143 of these were taken by 400 hunters who were successful in drawing an antlerless moose permit. Analysis of successful hunters shows 98% Alaskan residents and 2% nonresidents. Successful hunters spent an average of 5.1 days afield.

Climatic conditions during the winter of 1983-84 were favorable for moose and consisted of mild temperatures with little snow accumulation. A review of moose/vehicle accidents records indicated 94 moose were killed by highway vehicles during winter 1983-84. This figure compares to 182 killed by highway vehicles during the previous winter.

Management Summary and Recommendations

Lack of adequate snow cover forced cancellation of moose composition surveys; however, we believe the moose population is stable and at high densities throughout the subunit.

The light snowfall in Subunit 14A during the winter of 1983-84 allowed moose to remain on summer range. This range is located in remote portions of the subunit removed from areas of high human density. The lack of conflict with humans was

evident by the 48% reduction in moose mortalities caused by moose/vehicle collisions.

The small size of moose antlers taken by hunters may suggest that few bulls mature to the older age classes. Since hunting pressure is expected to increase with the expanding Alaskan population, it may be necessary to restrict the harvest of bull moose.

No changes in seasons or bag limits were recommended.

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Nicholas C. Steen
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SUBMITTED BY:

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14B

GEOGRAPHICAL DESCRIPTION: Willow to Talkeetna

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Based on analysis of survey data, the moose population appears stable and at a high density estimate of 3.5 moose/mi^2.

Population Composition

Composition surveys were flown throughout the subunit in early December. Weather and snow conditions varied from good to excellent, depending on the area surveyed. The majority of moose were located above timberline making 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 1,828 moose were classified in 38.6 hours of flight time. The bull:cow and calf:cow ratios were 34:100 and 23:100, respectively. There were 7 cows with twin calves per 100 cows with calves.

Mortality

Hunters took 460 moose (218 bulls, 228 cows, and 14 of unknown sex) during the season. These totals include 422 killed during the fall season and 38 antlerless moose killed during a late winter (1-15 February) permit hunt. During the fall season, 2,258 hunters reported hunting moose and 19% were successful.

The mean age of moose killed during the late winter permit hunt (excluding calves) was 7.6 years for males and 7.5 years for females. These ages compare to 4.9 and 7.0 years of age for males and females, respectively, killed during the previous year's hunt. Of 11 adult females (including 1 yearling) checked for pregnancy, 9 were found to be pregnant with an *in utero* ratio of 1.6 calves:cow.

Records obtained from the Department of Public Safety and from Alaska Railroad personnel indicate that 39 moose were killed by highway vehicles and 21 by trains.

Management Summary and Recommendations

During winter 1983-84, mild temperatures and below normal snow accumulations were recorded through January; these conditions allowed moose to remain at higher elevations on traditional summer range. Deep snows in early February then forced moose onto traditional winter range and into contact with human activities. This contact increased the incidence of vehicle-caused moose mortality.

The total moose harvest increased this year as a result of implementing a 30-day either sex season. This regulatory change encouraged more people to hunt in the subunit. Kill locations were plotted on a map which shows the majority of kill occurring in close proximity to the Parks Highway and access trails into the subunit. Considering the lack of access, we believe the majority of the subunit is receiving moderate to light hunting pressure. We also believe the moose population is near maximum density and, therefore, recommend the current season and bag limit remain in effect.

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SUBMITTED BY:

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14C and 7 within the Portage and Placer River drainages

GEOGRAPHICAL DESCRIPTION: Anchorage Area

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Calf production and winter survival have been near maximum levels during the past 5 years, mainly as a result of 5 consecutive mild winters. During this time, the population increased slightly, despite deteriorating browse conditions. This trend will likely continue, barring the inevitable return of more severe winters.

Population Composition

Aerial surveys conducted during October and November enumerated 1,243 moose. The surveys covered all areas within the subunit where significant concentrations of moose are found. A ratio of 49 bulls:100 cows was observed, which was identical to the bull:cow ratio observed the previous year. Fifty calves:100 cows were also observed, which compares to the 1979-82 ratio of 48 calves:100 cows.

The mean age of 46 cow moose and 45 bull moose killed by hunters was 3.2 years and 2.4 years, respectively, clearly indicating a young, growing population.

Mortality

Sport hunters took 230 moose, including 99 antlerless and 131 antlered, in Subunit 14C. The overall harvest was the 2nd highest on record, exceeded only by the 497 taken in 1965. The antlerless moose were taken during several drawing or registration permit hunts at various locations throughout the subunit. Seventy-five bulls were also taken under permit, and the remainder (56) were taken during a general open season within other portions of the subunit. The total bull harvest was 111% above the 1978-82 mean of 62 bulls. Excluding the Fort Richardson winter hunt, 736 persons reported hunting

moose for a success rate of 27%. In the Fort Richardson hunt, each of the permittees who hunted (32) took a moose.

An additional 130 moose, approximately 40 of which were calves, were killed by vehicles on Subunit 14C roadways between 1 June 1983-31 May 1984. This compares to 159 killed on local highways during the 1982-83 reporting period, and 77 killed annually between 1977-81. There were 24 moose mortalities from other causes, such as poaching and train kills. The total reported mortality for the subunit was 384 moose.

Management Summary and Recommendation

Following the 5th consecutive mild winter the moose population remained high at a level not seen since the early 1970's. Liberalized seasons and additional permit hunts, including 4 archery-only hunts, allowed harvests in several drainages which brought segments of the population more in line with available habitat. Harvests of this magnitude should continue provided mild winters persist and calf survival remains high. Reducing the harvest may increase the mortality associated with a severe winter and increase the possibility of long-term habitat damage. Therefore, no changes in existing seasons or bag limits were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15A

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The 85,000 acre 1969 burn still provides excellent browse for moose, and within this area the population appears to be increasing. Other scattered areas of improved habitat also contribute to population productivity. Areas of good moose habitat, however, make up only 12% of the subunit and the remainder can be classified as unproductive, relative to browse production. The moose population within these areas is decreasing.

Population Composition

Composition surveys were completed in the fall by the U.S. Fish and Wildlife Service (within the 1969 burn), and 595 moose were classified: 368 cows, 51 bulls and 173 calves. The bull:cow and calf:cow ratios were 14:100 and 47:100, respectively. Calves represented 23% of the total moose observed, and there were 12 cows with twins per 100 cows with calves.

Mortality

Hunters took 395 moose, including 351 bulls, 36 cows, and 8 of unknown sex during the season; 98% of the hunters were Alaskan residents. The majority of the harvest came from the 1969 burn, including 28 antlerless moose taken by 30 hunters with drawing permits for the area within the 1969 burn. The average age of these moose was 7.0 years old. Antler spread of harvested bulls ($\bar{N}$ = 310) was as follows: 123 at §30 inches; 106 at 30-39.9 inches; 58 at 40-49.9 inches; and 23 ¶50 inches.

Studies by Franzmann et al. (1984) have indicated that black bears kill approximately 35% of the moose calves within the 1st month of life in both the 1947 and 1969 burns. In

addition, the subunit supports several wolf packs, which prey primarily on moose (Peterson 1981).

Management Summary and Recommendations

The moose harvest increased 87% and the number of hunters increased 32% over the previous year. When compared to historical data, the 1983 harvest was the highest since 1972 (the last year both antlered and antlerless moose seasons were held). Cool dry weather during most of the season created favorable hunting conditions; this tended to the increase hunting pressure. Hunters were also aware of the high moose density within the 1969 burn and concentrated their effort in that area, which contributed to the increased harvest.

The 85,000-acre 1969 burn is currently producing excellent browse, and the moose population is increasing in size. However, browse in this area will soon grow beyond the productive stage, and the population will start to decline. Other areas of the subunit with maturing spruce and aspen stands which have not been altered since the 1947 burn are currently producing poor browse, and the moose population is decreasing. This year the department, assisted in part by the U.S. Fish and Wildlife Service, conducted a habitat improvement program. Approximately 1,720 acres of habitat was mechanically crushed in the southeastern corner of the subunit. As funds become available, similar habitat improvement programs should be conducted to reverse the trend of overall deterioration of moose browse. While these mechanical vegetation crushing programs will help, only burning on a large scale will ensure adequate amounts of good browse to maintain a productive population.

Predation on newborn moose calves by black bears and on all age classes of moose by wolves is likely to remain high. At present the moose population is productive and can withstand high predation rates and still provide moose for human use. However, if browse conditions result in a declining moose population, a low density eventually may be reached where predation alone controls the size of the population. If this situation is allowed to occur, moose hunting would have to be restricted and some form of predator control implemented.

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Peterson, R. O. 1981. Wolf-moose investigations on the Kenai National Wildlife Refuge. Final Rep. USF&WS Contract No. 14-16-0007-81-5202.

PREPARED BY:

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SUBMITTED BY:

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15B

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulation No. 24.

Population Status and Trend

Although available data were not sufficient to assess the population status, limited surveys in the eastern portion of the subunit indicated a continuing trend of high bull:cow and low calf:cow ratios. Based on this limited information and the fact there have been mild winters since 1979, I believe there has been little change in population status.

Population Composition

An aerial survey conducted in November classified 178 moose. Composition of observed moose was 63 bulls:100 cows and 12 calves:100 cows. Calves made up 7% of the total moose observed.

Mortality

There were 29 bull moose killed in Subunit 15B East and 85 bulls and 2 moose of unreported sex killed in Subunit 15B West. The mean antler spread of bulls ($\underline{N}$ = 27) killed in 15B East was 56 inches and the largest spread was 72 inches. In 15B West, the antler spread was obtained from 73 bulls and can be grouped as follows: 30 at ≤30 inches; 34 at 30.0 to 49.9 inches; and 9 at ≥50 inches. Sixty-two of 100 permittees reported hunting in Subunit 15B East and their success rate was 47%. The success rate in Subunit 15B West was 25%.

Management Summary and Recommendations

The harvest of 87 moose in Subunit 15B West was the highest harvest since 1974 when 95 moose were reported killed. The increased harvest was attributed primarily to favorable weather conditions during the hunting season.

The trophy bull moose hunt in Subunit 15B East continues to provide excellent hunting opportunities and was highly popular

among resident and nonresident sportsmen. The harvest of 29 bulls was well within limits needed to maintain a trophy bull population.

Winter and summer moose ranges on the Kenai National Wildlife Refuge in Subunit 15B continues to deteriorate due to restrictive management policies which favor advanced forest succession. Outside the refuge, state land is so interspersed with private, borough and native lands that significant areas of habitat improvements are not feasible. The department and the U.S. Fish and Wildlife Service should cooperate on improving 2 areas of habitat. These are the Slikok and Coal Lake areas where habitat improvement through mechanical crushing and prescribed burning could be accomplished.

No changes in seasons or bag limits were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15C

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose are moderately abundant and probably near the ecological carrying capacity of the maturing forest habitats of this subunit. 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

Complete aerial surveys of the Caribou Hills, Deep Creek/Ninilchik Dome, and the area southwest of Anchor River were made between 31 October and 13 November 1983. Survey conditions were excellent, and 1,159 moose were classified: 119 bulls, 782 cows and 258 calves. The bull:cow and calf:cow ratios were 15:100 and 33:100, respectively.

Mortality

The reported harvest was 244 moose, including 238 males, 2 females, and 4 of unknown sex. Fair weather conditions prevailed throughout most of the season, and a record 1,153 hunters hunted moose. Hunter success was 21% compared to 22% in 1982. The distribution of hunters by major drainages is presented in Table 1. The primary methods of transportation used by hunters were: highway vehicles (48%), off-road vehicles (32%), boats, (9%), horses (7%), and airplanes (4%). There were 221 successful hunters who reported the antler spread of their bull moose: 69 at ¶30 inches; 75 at 30-39.9 inches; 56 at 40-49.9 inches; and 21 at¶50 inches.

Management Summary and Recommendations

Since 1981, aerial surveys have been conducted over approximately 70% of the land area in Subunit 15C. The following general conclusions about the moose population within this

Subunit are drawn from analyses of data derived from these surveys: (1) moose are now moderately abundant at a minimum densities between 2.0 and 2.9 moose/mi^2; (2) the population has been slowly increasing since about 1977; and (3) mild winter weather conditions have prevailed in recent years and helped to maintain population stability.

The season and bag limit for moose in Subunit 15C has remained the same for the past 8 years. During this period, the number of moose hunters and the bull harvest have risen 55% and 46%, respectively. Hunter success has declined slightly since 1980. It is likely that hunting pressure will increase over the next 5 years and managers will have to closely monitor the age structures of the harvest and bull:cow ratios to avoid an overharvest of bulls.

Land between Tustemena Lake and Kachemak Bay provide important habitat for moose. The major long-term threat to moose in this area is expected to come from land developments which are not compatible with moose. Based on this premise, the department's highest priority in Subunit 15C should be: (1) to determine the overall habitat requirements of the moose population; and (2) to pursue land management policies which will preserve and enhance essential habitat types. Accurate information concerning population size, seasonal habitat use, and movements will be needed to effectively accomplish this goal. Delineation of spring calving areas, fall rutting areas and winter ranges is especially important. In the meantime, the department continues to pursue special land classification status for state and borough lands to protect essential fall and winter ranges. Negotiations have begun with the Department of Natural Resources to have portions of the Deep Creek Management Area classified into a wildlife habitat category.

No change in season or bag limit was recommended.

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Table 1. Distribution of hunters by major drainages in Subunit 15C during the moose season, 1983.

Drainage	Successful hunters		Unsuccessful hunters		Total hunters	
	N	%	N	%	N	%
Tustemena Lake	23	9.4	140	15.4	163	14.1
Ninilchik River	21	8.6	98	10.8	119	10.3
Deep Creek	83	34.0	154	16.9	237	20.6
Stariski Creek	3	1.2	27	3.0	30	2.6
Anchor River	61	25.0	304	33.4	365	31.7
Kachemak Bay	30	12.3	95	10.5	125	10.8
Fox River/Sheep Creek	8	3.3	33	3.6	41	3.6
Seldovia River	4	1.7	15	1.7	19	1.7
English Bay	2	0.8	2	0.2	4	0.3
Rocky River	0	-	4	0.4	4	0.3
Unknown	9	3.7	37	4.1	46	4.0
Totals	244		909		1,153	

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16

GEOGRAPHICAL DESCRIPTION: West Side of Cook Inlet

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

A census of the Unit 16 moose population was completed and was estimated at 9,000 animals.

Population Composition

Moose composition surveys were flown in November and December. These surveys included portions of the Peters-Dutch Hills in Subunit 16A and all or portions of the following trend count areas in Subunit 16B: McArthur, Lone Ridge, Redoubt, Sunflower, Susitna, Willow Mt., Yenlo Hills, N. Beluga, and Alexander Creek. Results of these surveys are shown in Table 1.

Mortality

In Subunit 16A, 228 moose, including 184 males, 42 females, and 2 of unknown sex, were reported killed by 1,076 hunters. In Subunit 16B, the harvest was 489 moose including 362 males, 124 females, and 3 of unknown sex; 431 of these moose were killed during the season in September (by 1,434 hunters), 37 were killed during the season in November, and 21 were taken from the Tyonek area during the season in January.

Management Summary and Recommendations

Composition data from both subunits were comparable to that obtained in previous years. The lack of adequate snow cover prevented completion of a number of surveys scheduled for Subunit 16A. The overall calf:cow ratio of 36:100 indicates that reproductive success would allow population growth in the absence of significant winter mortality. The total harvest of 717 moose from Unit 16 represents only 8% of the estimated moose population. In lightly hunted areas, the bull:cow approached 50 bulls:100 cows, while lower ratios were obtained

in heavily hunted areas. Should the bull:cow ratio continue to decline in the Redoubt Bay area, (31 bulls:100 cows in 1980 to 20 in 1983), it may be necessary to implement season or bag-limit restrictions.

The high level of harvest that occurred this year is not biologically harmful to the Unit 16 moose population. Additional harvest could be allowed in many areas and the department may wish to support public proposals to accomplish this. Presently, no changes in season or bag limits were recommended.

PREPARED BY:

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Leland P. Glenn
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Table 1. Moose sex and age ratios in Game Management Unit 16, 1983.

Count area	Bulls:100 cows	Calves:100 cows	Twins:100 cows w/calves	Moose/ hour	Sample size	Count time (hr)
Subunit 16A						
Peters-Dutch Hills	50.5	30.3	7.1	52.7	179	3.4
Subunit 16B						
McArthur	28.6	39.3	3.1	42.7	141	3.3
Lone Ridge	35.8	25.9	10.5	16.8	131	7.8
Redoubt	19.8	37.9	24.1	37.2	279	7.5
Sunflower	48.3	24.6	11.5	127.5	405	3.2
Susitna	42.7	33.1	7.9	99.1	218	2.2
Willow Mtn.	39.7	30.2	2.9	151.5	197	1.3
Yenlo Hills	34.6	20.2	10.0	94.4	85	.9
N. Beluga	50.0	80.0	25.0	30.7	46	1.5
Subunit 16B						
Totals					1.658	29.6
Means	27.7	32.0	11.5	56.0		
Unit 16						
Totals					1,837	33.0
Means	39.1	31.8	11.1	58.7		

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16B

GEOGRAPHICAL DESCRIPTION: Kalgin Island

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The moose population on Kalgin Island is estimated to be 110 animals. The population has been significantly reduced by hunting from an estimated 7 moose/mi² in 1981 to 2 moose/mi² in 1983. During this time nearly 200 moose were killed. The present density is still considered high in relation to the available habitat and further reductions are necessary.

Population Composition

During a moose composition survey flown on 6 November, 40 moose including 12 bulls, 19 cows, and 9 calves were classified.

Mortality

During an 8-day season, 204 people hunted on Kalgin Island and killed 56 moose, including 23 bulls and 33 cows. The harvest was composed primarily of young animals (83%) less than 4 years of age (N = 53). Most of the moose (93%) were killed in the 1st 4 days of the season, after which hunting effort declined rapidly. After the 1st few days of hunting, moose tend to move into areas of escape cover which reduces the rate of moose hunting success.

Management Summary and Recommendations

The existing density of 2 moose/mi² is too high to allow vegetation to recover from past overutilization. Observations of the island's vegetation indicated that extreme overbrowse had occurred, and significant winter mortality could be expected even with moderate snow depth. I recommend, therefore, that the overwintering population be reduced to a level of 1 moose/mi². Future adjustments in population size can be made

in response to the ability of browse species to recover and support the population through a winter of moderate snow depth. A registration hunt provides the best means of directing hunters to the island and monitoring the level of harvest. A season length of 4 days is recommended and eliminates the need to close the season early.

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Game Biologist III

SUBMITTED BY:

Leland P. Glenn
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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 17

GEOGRAPHICAL DESCRIPTION: Northern Bristol Bay

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

A succession of mild winters since 1974-75 has had a positive effect on moose populations in most drainages of the unit. Moose densities in Subunit 17A, however, remain very low--less than 0.1 moose/mi^2. This low density is primarily due to the illegal take of moose by local residents. Moose densities in Subunits 17B and 17C have not changed since the last reporting period when they were estimated to be between 0.8 to 1.3 moose/mi^2 and 0.7 moose/mi^2, respectively.

Population Composition

Lack of snow forced cancellation of fall surveys in most areas of the unit. Surveys were flown in Sunshine Valley, the Iowithla River, and near Kemuk Mountain. The bull:cow ratio in both the Sunshine Valley and Iowithla River count areas dropped significantly; however, the calf:cow ratio in both areas was the highest ever recorded (Table 1). Survey data in the Kemuk Mountain area are highly variable due to poor counting conditions, and no trends have been established.

Mortality

A total of 580 hunters reported killing 127 moose, (120 bulls, 1 cow and 6 of unknown sex) during the 1983 seasons; 49 of these moose were taken during the 20 August-4 September registration permit hunt in Subunits 17C and western 17B. Eighty-one percent of the successful hunters were Alaskan residents and 19% were nonresidents. Most of the nonresident hunting occurred in the eastern portion of Subunit 17B. Residents of Unit 17 reported taking 74 moose, 58% of the total harvest. Antler size was reported for 71 bulls, of which 40 (56%) had an antler spread of 50 inches or greater.

The harvest chronology indicates most moose were taken during the 5-15 September season. Most of the kill occurred during

the 1st week of the season. Only 11 moose were reported taken during December.

Boats were the primary means of transportation for hunters in both Subunits 17B and 17C during the early permit hunt. However, during the regular September season, aircraft were used far more extensively in 17B, while boats remained the primary mode of access in 17C.

Management Summary and Recommendations

The 20 August-4 September moose registration permit hunt added 16 days to the fall season. This season was designed to reduce the illegal take of cow moose by local residents by increasing the number of days they could legally hunt for bulls without attracting a significant number of hunters from outside the Unit. The hunt was very successful, in that local residents were much more discriminatory in taking moose during the fall, and no illegal cow moose were reported taken. In addition, reporting was much superior to the harvest ticket system. Over 97% of the permittees returned their permit reports, and I believe more accurate kill locations were obtained. I recommend that the registration permit hunt be held again next year.

Also benefiting the moose population was the westward expansion of the Mulchatna caribou herd into the region of the Nushagak River villages. Because of the relative ease with which caribou could be legally taken during the winter months, there was less pressure on moose than in previous years.

During this reporting period, the Board of Game adopted a proposal which makes moose and caribou seasons concurrent in Unit 17. Overlapping seasons have historically been avoided in Unit 17 to prevent generating additional pressure on the low density moose population. Additional trend count areas, particularly along the Chilakadrotna and Mulchatna drainages, should be established to monitor the effect of new seasons on these populations.

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Table 1. Fall and winter moose sex and age ratios from Sunshine Valley, Kemuk Mountain and the Iowithla count areas in Unit 17, 1972-1984.

Area	Date	Total bulls: 100 cows	Yrlg. males % in herd	Calves: 100 cows	Incidence of twins: 100 cows w/calf	Calf % in herd	Animals/ hour	Total moose
Sunshine Valley	3/11/72	ND[a]	ND	ND	33.3	33.3	68	48
	3/28/80	ND	ND	ND	40.0	15.6	15	45
	11/26/80	118.2	9.1	27.3	0.0	11.1	15	27
	1/5/82	ND	ND	ND	33.3	19.6	57	46
	12/6/82	153.4	14.2	29.4	25.0	10.2	49	49
	2/24/83	ND	ND	ND	20.0	17.6	26	68
	10/31/83	86.4	7.0	72.7	45.5	28.1	30	57
Kemuk Mtn.	12/2/80	135.3	12.0	23.5	0.0	9.1	42	88
	12/8/82	161.0	9.3	65.2	25.0	20.0	38	75
	2/16/84	ND	ND	ND	16.6	15.2	58	46
Iowithla River	12/1/80	171.4	12.5	71.4	25.0	20.8	37	48
	12/3/81	70.0	9.0	30.0	20.0	13.6	19	44
	1/6/84	46.2	2.6	85.7	33.3	31.6	13	38

[a] No data available.

MOOSE

SURVEY-INVENTORY SURVEY

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Alaska Hunting Regulations No. 24.

Population Status and Trend

With the exception of the Yukon River drainage above Ohogamiut, moose densities remain extremely low throughout Unit 18. Many local residents, particularly those residing in lower Yukon villages, believe the moose population is increasing; however, this is difficult to substantiate from harvest reports or aerial survey data. A paucity of historical information, low moose densities, and the resultant small sample sizes make assessment of population trends from aerial survey data difficult. Although much suitable habitat is available along both the Yukon and Kuskokwim River drainages, heavy hunting pressure and a high illegal harvest effectively limit moose populations throughout the unit.

Population Composition

Aerial composition counts were conducted during November along the Yukon River from Ohogamiut to Paimiut, and along the Reindeer, Kisaralik, Kwethluk, and Andreafsky Rivers to determine composition and productivity (Table 1). Due to shallow snow, survey conditions were not ideal, and results were not as good as normally expected. No moose were observed during the Reindeer and Andreafsky River surveys. Although moose were observed during the Kwethluk and Kisaralik River surveys, composition and productivity estimates cannot be made due to the extremely small samples involved.

Due to the sparse snow cover encountered, the fall 1983 Yukon River survey may not be comparable with past surveys conducted in the same count area (Table 2). Potential differences in moose sightability and seasonal movements make such comparisons difficult, and all conclusions should be regarded as tentative. The reduced sample size of the 1983 survey compared to previous surveys primarily appears to reflect a lower number of bulls. This may be related more to a change in

dispersal and movement patterns as a result of sparse snow cover than to reduced sightability. Bulls that tend to form fall aggregations with other bulls and with lone cows usually have higher sightability in marginal snow conditions than do more solitary cows and calves. Because bulls are normally the last to migrate to riparian wintering areas, the smaller number of bulls observed is not surprising.

Low calf productivity observed during the fall 1982 Yukon River survey did not persist during 1983, and both the calf:cow ratio and the incidence of twinning increased to more normal levels. All bulls were classified as yearlings, young adults (antler spread, < 50 inches), or older adults (antler spread, > 50 inches). As in 1982, all adult bulls observed were young adults, a result consistent with the heavy hunting pressure this population sustains. Although low in density, the lower Yukon River moose population appears to be young, highly productive, and could probably expand rapidly into available habitat if given the opportunity.

Winter/spring composition counts were conducted along the Yukon River between Ohogamiut and Paimiut, and along the upper Chuilnak and Nageethluk Rivers (Table 3). As in fall, snow cover was either shallow or nonexistent and sightability of moose was poor. The density of moose in all count areas was low, averaging only 15 moose/hr. No moose were sighted in the Nageethluk drainage. The calf percentage observed during the Yukon River survey (32%) was nearly identical to the calf percentage observed the previous fall (34%) in the same count area, indicating light calf mortality. This conclusion may not be valid, however, because the proportion of lone cows and bulls wintering in the riparian zones along the river may have changed by an unknown amount since last fall. Because the winter was mild and snow depths were minimal, I nevertheless believe that calf mortality was light.

Calf percentages observed along the Yukon River (Russian Mission to Paimiut) were similar to results of surveys conducted in the same count area during the previous 4 years (Table 4). Although fall survey data indicate annual variation in the calf crop, recruitment of short yearlings into the population each spring appears stable. It should be noted, however, that data are limited, and conclusions regarding long-term trends are tentative.

Mortality

Hunting is undoubtedly the most significant source of moose mortality in Unit 18. During fall 1983, 236 hunters reported a harvest of 63 moose. Forty moose were reported taken from the Yukon drainage, 21 from the Kuskokwim drainage, and 2 from

the intervening delta lowland. Most of the harvest occurred upriver from Mountain Village on the Yukon and from Bethel on the Kuskokwim. Five moose were reported taken during the October and early November mid-season closure. Moose of either sex are normally taken throughout the year, especially in the portion of the unit downriver from Marshall on the Yukon and from Tuluksak on the Kuskokwim. Therefore, we believe the magnitude of the unreported harvest is usually quite high, perhaps exceeding 100% of the reported harvest. Because 1984 winter and spring snow conditions were exceedingly poor for travel by snowmachine, the unreported harvest was probably substantially lower than normal this year.

The 1983 reported harvest of 63 moose was similar to the 1982 reported harvest (58 moose) but substantially lower than the 1981 reported harvest (82 moose). Hunters contacted in the field during September reported that moose abundance was normal and hunting conditions were good, particularly later in the month. During the late season (15 November-31 December), all hunters contacted reported that conditions were extremely poor for hunting. Lack of snow not only made tracking difficult, but prevented snowmachine access to many portions of the Unit. The unusually low reported harvest (1 moose during November and December) attests to the difficult conditions encountered during that time of year.

As in the past, most of the reported harvest was taken by local hunters using boats as the primary means of transportation (83%). Users of aircraft (predominantly nonlocal hunters) accounted for 5% of the harvest. Users of other means of transportation such as highway vehicles or 3-wheelers accounted for 12% of the harvest. Interestingly enough, no successful hunter reported using a snowmachine as the primary means of transportation.

During the 1983 season, 84% of the harvest was taken by residents of Unit 18. During the 1980, 1981, and 1982 season, 81, 86 and 83% of the harvest, respectively, was taken by Unit 18 residents. In the past, local residents have complained about increasing competition from nonlocal hunters. Our data, however, indicate that the harvest by nonlocal hunters is small and has not increased in recent years. Because nonlocal hunters primarily use aircraft for transportation, they are highly visible to ground-based hunters and create the impression that they are more numerous than they actually are.

Little is known about other sources of moose mortality in Unit 18. Winter mortality caused by deep snow can be substantial, especially among calves, Although the 1983-84 winter was cold, snowfall was light, and I believe mortality attributable to weather was low. Because wolves are rare or nonexistent

throughout most of the unit, I believe wolf predation is negligible. Although grizzly bears are numerous in Unit 18, they are found predominantly in the Andreafsky and Kilbuck Mountains. Because neither area supports many moose, predation by bears is probably not a significant source of mortality.

Management Summary and Recommendations

Because conditions were extremely poor for snowmachine travel during the 1983-84 winter, I believe the illegal harvest was lower than normal this year. During most years, however, the illegal harvest during winter and spring is 1 of the most serious management problems we face in Unit 18. A lack of alternative game resources, a poorly developed cash economy, and an unusually high density of people and villages combine to aggravate the problem and make finding an acceptable solution difficult. All available information indicates that the moose population is young and productive, and probably could exploit more available habitat if given the opportunity. Public education efforts by Department personnel informing people of the need to abide by seasons should continue. Enforcement during the closed seasons must be significantly increased as well.

Although compliance with the harvest ticket requirement has improved, many hunters still do not know that they must return their hunter reports after the season has closed. We need to continue efforts to inform the public and license vendors of the need for complete compliance with the harvest ticket requirement.

Moose populations in Unit 18 appear to be highly migratory, and we do not yet understand the nature of their seasonal movements. Because the population is heavily hunted throughout the year, I believe movement patterns are different from those of moose populations existing under more normal circumstances. Aerial surveys are of limited value in most areas, because moose densities are so low. A study using radiotelemetry would be an invaluable aid to better understanding and managing this moose resource.

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Table 1. Unit 18 moose composition counts, fall 1983.

Area	Adult bulls	Yearling bulls	Cows	Calves	Percent calves	Sample
Yukon R., Ohogamiut to Paimiut	6	4	41	28	34%	83[a]
Kwethluk R.	2	0	1	0	0	3
Kisaralik R.	0	0	2	0	0	2

[a] Includes 4 moose of unidentified age/sex class.

Table 2. Yukon River fall surveys (Ohogamiut to Paimiut), 1981-1983.

Date	Yearling bulls: 100 cows	Total bulls: 100 cows	Calves: 100 cows	Incidence of twins: 100 cows w/calves	Percent calves	Sample
1981	10	55	88	50	36%	102
1982	18	51[a]	35	13	19%	138
1983	10	24[a]	68	22	34%	83

[a] All adult bulls had antler spreads < 50 inches.

Table 3. Unit 18 moose composition counts, winter/spring 1984.

Area	Adults	Calves	Percent calves	Sample
Yukon R., Russian Mission to Paimiut	43	20	32%	63
Yukon R., Ohogamiut to Russian Mission	15	7	32%	22
Chuilnak R.	2	3	60%	5

Table 4. Moose composition counts from the Yukon River, Russian Mission to Paimiut, 1980-1984.

Date	Adults	Calves	Percent calves	Sample	Moose/ hour
February 1980	38	11	22%	49	15
February 1981	27	12	31%	39	18
March 1982	22	15	35%	37	19
March 1983	35	10	29%	45	18
February 1984	43	20	32%	63	29

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 19

GEOGRAPHICAL DESCRIPTION: Middle and Upper Kuskokwim Drainages

PERIOD COVERED: 1 July 1983-30 June 1984

Seasons and Bag Limits

See Hunting Regulations No. 24.

Population Status and Trend

The moose population in Subunit 19A appears to be increasing, and current recruitment, based on calf survival to late February, should provide for a continued increase. The population in Subunit 19B appears stable, but numbers in Subunit 19C may be declining. Abnormal snow conditions during fall 1983 may have prevented an accurate assessment of population trends in some areas. The population in most of Subunit 19D outside the Upper Kuskokwim Controlled Use Area is probably stable, although fewer moose were observed in 1983-84 surveys than in the recent past. Yearling recruitment and calf survival continued to decline in the Cloudy-Sunshine Mountains area. Although hunters in the Controlled Use Area reported more moose, the population remained relatively low.

Population Composition

Fall 1983 was unseasonably warm and little snow fell throughout the Kuskokwim region. The first significant snowfall did not occur until mid-December. Only limited fall composition surveys were attempted, and they suggested low calf survival and a decline in moose numbers.

Surveys in late February in the lower Holitna drainage indicated the highest calf survival (26%) in that area since 1977. Twenty-five percent of the cows with calves had twins. Conversely, along the Kuskokwim near McGrath, calf survival was lower (19%) and no cows with twins were sighted.

Mortality

The total Unit 19 moose harvest during fall 1983 and winter 1984 is estimated between 925 and 975 moose. The value of moose meat taken by Unit 18 and 19 residents during these seasons is estimated at $1.5 million. A record number of

hunters (849) reported taking a record number of moose (438) in Unit 19 during the season. The increased hunting pressure and harvest occurred in all subunits, but was particularly noticeable in Subunits 19A and 19D. Harvest ticket data showed the proportion of rural residents hunting in Unit 19 (52%) was up from the previous 3-year average of 41%. Much of the increase resulted from residents of Unit 18, who traveled by boat from as far away as Nunivak Island to hunt moose in Unit 19. Surveys by the Subsistence Division in Nikolai, Telida, Sleetmute, Stony River, Lime Village, and Chauthbaluk indicate that on the average only 25% of the moose taken by residents of these villages are reported. My observations indicate that 75% of the successful moose hunters from McGrath reported taking a moose. Based on these circumstances, it is estimated that residents in Units 18 and 19 may have taken as many as 675 moose.

One hundred two moose were reported taken by 281 hunters in Subunit 19A. Although there was a season for antlerless moose during November and February, only 3 cows were reported taken. Surveys by the Subsistence Division suggest that 35-45 cow moose were taken during this season. The 1983-84 season marked a 55% increase in hunters and a 32% increase in number of moose taken compared to the previous 3-year averages. Participation by Unit 18 residents tripled over their previous 3-year average. This, along with a slight increase in hunters from Subunit 19A, accounted for the increased hunting pressure. Hunting pressure and harvest in Subunit 19A by other residency groups declined. Most hunting effort was centered along the lower Aniak and the Kuskokwim Rivers between Kalskag and the Holokuk, but moose harvest and hunter success were highest on the Holitna drainage.

Two hundred hunters reported hunting in Subunit 19B; they took 110 moose. This marks increases of 20% and 31%, respectively, over the previous 3-year average in number of hunters and moose taken. Subunit 19B continued to be a popular hunting area among hunters from other areas. Forty-seven percent of the Subunit hunters were from Southcentral Alaska, and 34% were aliens. Hunting pressure from aliens appears to be increasing to levels recorded before 1982. The upper Hoholitna drainage near Whitefish Lake, the upper Stony River drainage near Telaquana, and Two Lakes were the most heavily hunted portions of the subunit, but hunter success was greatest (71%) on the Stony River below the Telaquana River.

One hundred thirty-seven hunters reported taking 102 bull moose in Subunit 19C. Unlike the other Subunits, the number of hunters declined and success increased in Subunit 19C. Most of the hunters were Southcentral Alaska residents or aliens, but 11% were from rural areas, primarily Subunit 19D.

Over 25% of the harvest occurred near Farewell, mostly within the Bear Creek burn. The large airstrip at Farewell, roads, 2 guides, the bison hunt, and a relatively concentrated moose population near the burn all combined to concentrate hunting pressure in this area.

The number of hunters (215) in Subunit 19D increased 27% and the kill (120) increased 23% over the previous 3-year average. Except for aliens, the number of hunters in all residency categories increased. The largest increase was in Unit 18 residents who traveled to hunting areas in Subunit 19D by boat. They hunted principally along the Kuskokwim from Stony River to McGrath. Residents of McGrath and Nikolai accounted for 59% of the moose taken in Subunit 19D. Nearly half of the hunters reported hunting along the Kuskokwim River from the Swift River to Medfra and half of those hunted within 15 miles of McGrath. The Takotna and North Fork of the Kuskokwim drainages were the next most frequently hunted areas. Hunter success was highest on the North Fork (82%) and the main Kuskokwim valley between the Selatna and Nunsatuk Rivers.

Movements

In late February 1983, 10 bull moose near Farewell and 9 bulls in the flats along the Kuskokwim River were radio-collared to determine the interchange of moose between the foothills in Subunit 19C and the Controlled Use Area in Subunit 19D and to assess the impact of the Bear Creek burn on the moose population.

The 10 bulls captured near Farewell were all part of the moose population that uses the Bear Creek burn during winter. Six were 3-4 years of age, and 4 were 5-6 years old. The collar slipped off a 3-year-old bull within 2 weeks. All of the radio-collared moose remained on the Bear Creek burn until late April or early May 1983, when they began to disperse. Two remained within 12 miles of the capture site and their principal movements were along the foothills of the Alaska Range and in both burned and unburned areas near Farewell. Unfortunately, one of these, a 6-year-old, was shot on the opening day of moose season.

Four of the radio-collared bulls moved as far as 45 mi to summer along the Kuskokwim River and near the northern boundary of the Bear Creek burn. A 5-year-old bull moved 28 mi east from the capture site and summered in dense black spruce stands. Only one, a 3-year-old, moved south into the mountains for the summer. Contact was lost with 1 bull from early May 1983 until April 1984. Several attempts were made to locate this bull during summer, fall, and winter, but the radio signal was not heard until April when it was located

near Farewell with several other radio-collared moose. Either the radio malfunctioned or the moose must have been somewhere in the mountains out of radio range.

Most of the bulls returned to the Farewell area during August and September and remained there through the winter and until May 1984, when they again moved to summer ranges. A bull that summered in the mountains near Post Lake moved back near Farewell Lake in August, but unlike the other collared moose, this bull remained near timberline along the Dillinger River through winter 1983-84.

Of the 9 bulls captured in the flats near Nikolai, 1 8-year-old slipped its collar within 1 month. Most were 3-4 years old, but 1 bull calf and an 11-year-old were also radio-collared. Most of the collared moose remained near the capture site, but they moved more during winter than moose collared near Farewell. Two 4-year-old bulls moved from the lowland over 30 mi to the foothills in Subunit 19C during summer 1983 and remained there until mid-February. Two bulls captured on the lower North Fork of the Kuskokwim moved to the hills between the North Fork and Nixon River in May and June where they remained until March 1984. The bull calf captured along the North Fork was seen with a cow through October. They traveled from the North Fork to a large willow stand at the mouth of the Tonzona River. The other 3 bulls frequented drainages within 20 mi of the capture site. Of the 8 bulls collared on the flats, only 2 returned close to their original capture site a year later. Three of the 8 were in areas accessible to hunters in the Upper Kuskokwim Controlled Use Area during the hunting season.

Management Summary and Recommendations

Winter 1983-84 was relatively mild and recruitment to the moose population, based on late-winter surveys, appears to have been excellent in the Holitna drainage in Subunit 19A. This area is important to Unit 19 moose hunters. Recruitment in Subunit 19D was low and probably reflected relatively heavy losses to predators.

The 1st year of monitoring radio-collared bulls indicates that most of the moose found in Subunit 19C during the hunting season only move to the Upper Kuskokwim Controlled Use Area in Subunit 19D during the summer. However, 2 of 8 bulls that wintered in the flats moved to the foothills during late summer and were in Subunit 19C during the fall season. Moose in the Controlled Use Area tend to disperse more widely than those from the foothills of Subunit 19C.

Hunting pressure and harvests were at record levels in 1983-84 and would have undoubtedly been greater except that poor weather during the last week of the September season caused many hunters to cancel hunting trips. Only in the Upper Kuskokwim Controlled Use Area was the winter season long enough to provide unsuccessful fall hunters opportunity to kill a moose.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20A

GEOGRAPHICAL DESCRIPTION: Tanana Flats, Central Alaska Range

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Inadequate snow cover during November and December precluded the moose population estimate scheduled for the foothills portion of Subunit 20A. Had the foothills census been completed as scheduled, a reliable population estimate would have been available for all of Subunit 20A, rather than just for the flats.

Although the 1982 population estimate surveys conducted on the Tanana Flats in 1978 and 1982 indicated that the resident moose population had increased by approximately 25% annually during that time period, the growth rate has probably declined in recent years. Recruitment to the resident moose population has been declining since 1979.

The Tanana Flats moose population probably numbered about 3,500 in fall 1983; an estimated 1,500-2,500 additional moose occupied the foothills.

Population Composition

Inadequate snow cover in Subunit 20A also precluded all but 1 trend count scheduled for the area during November and December.

The Bear Creek trend area revealed 36 bulls:100 cows, 18 yearling bulls:100 cows, 33 calves:100 cows, 40 calves:100 cows older than 2 years, and a recruitment rate of 20%. Although calf survival through November was lower in 1983 than during the previous year, recruitment was about the same. These data are probably not indicative of sex/age composition throughout the remainder of the Tanana Flats. The bull:cow ratio in the Bear Creek trend area is normally lower than that for the remainder of the subunit because of greater hunting pressure and the resulting large bull harvest that occurs there.

Annual preparturition surveys conducted in the central Tanana Flats calving area during mid-May revealed 33 yearlings: 100 cows; 19% of the herd consisted of yearlings, the 1st time since 1976 that yearlings composed less than 20% of the sample. Moose from the Chena and Salcha River drainages in Subunit 20B and the Alaska Range foothills in Subunit 20A calve in this area, as do moose that are residents of the Tanana Flats.

Mortality

Hunter reports indicate 282 moose were harvested in Subunit 20A, an 18% increase over the 1982 harvest. The hunter success rate was 26%. Along with the moose population increase in Subunit 20A, the subunit harvest has also increased annually since 1978. Thirty-five moose were taken during the November season, a decline of 40% from the previous year. Half of the total harvest occurred on the Tanana Flats between the Wood and Little Delta Rivers where the harvest has traditionally been largest. The proportion of the harvest from the foothills and other locations in the subunit increased from about 21% in 1982 to 50% in 1983. Residents accounted for 81% of the harvest, about the same as in recent years.

Transportation patterns in 1983 were also similar to those of recent years; hunters using aircraft harvested more moose and had greater success than hunters using any other transportation modes. The harvest by transportation type was aircraft, 117; horse, 7; boat, 88; snowmachine, 19; off-road vehicle, 36; and highway vehicle, 10.

Assuming yearling moose possess antler spreads of 30 inches or less, 19% of the harvest was composed of yearlings, about the same as the previous year.

Hunts averaged 5.7 days in length, with no significant difference in hunt length between successful and unsuccessful hunters.

Management Summary and Recommendations

Although moose numbers continue to increase in Subunit 20A, the rate of increase may be declining. Increased predation because of higher wolf numbers is probably responsible for reduced recruitment. The rate of increase has been much lower in the foothills portion of the subunit, probably because of predation by both grizzly bears and wolves. Grizzly bears are largely absent from the Tanana Flats. Overall, harvest levels are increasing in proportion to increases in moose numbers.

Habitat limitations will ultimately dictate the upper population limits attainable by moose in Subunit 20A, and management plans must address a population goal that takes management objectives and habitat limitations into account.

Predator populations should be monitored and control exerted when and where warranted. Range rehabilitation, either through prescribed burning or reduced wildfire suppression, should be addressed.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20B

GEOGRAPHICAL DESCRIPTION: Fairbanks and Central Tanana Valley

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Presently we estimate the moose population at 4,800 animals, for an average density of 0.57 moose per square mile in Subunit 20B.

Survey of the Munson Creek trend count area indicated an increase in moose density in that portion of the Chena drainage, which was expected after the successful wolf reduction program in the area during 1982-83. Although a slight decrease in moose density was observed in the Sorrels, Angel, and Colorado Creek survey areas, proportionately fewer moose may have been observed than in previous years due to marginal snow conditions during November 1983. Good calf survival and yearling recruitment (Table 1) suggest that the moose population continues to increase in this portion of the Chena drainage.

The trend area on the eastern side of the Minto Flats showed a substantial increase in moose density, possibly a reflection of the successful 1982-83 wolf reduction on Minto Flats, although the trend area is within the territory of a pack of 7 radio-collared wolves. Moose densities are lower on the western side of Minto Flats and in the Manley Hot Springs area where the population is either declining or stable at a low density.

No trend counts were conducted in the Salcha River drainage in 1983. The moose population in the lower Salcha is thought to be increasing, based on previous surveys in Ninetyeight Creek. A 1982 survey in Butte Creek, farther upriver in the Salcha drainage, suggested that calf survival to 18 months of age was much lower than elsewhere in the drainage. Thus, population trend in the upper two-thirds of the Salcha valley may differ from that depicted by data from the lower portion.

Population Composition

Fall sex and age composition surveys were flown on the Minto Flats and in the Chena drainage (Table 1). The bull:cow ratios remain high. Minto Flats had an increase in calf and long yearling survival, probably due to the removal of a significant number of wolves during winter 1982-83. In the Chena drainage, calf survival remained moderately high (37 calves:100 cows) although down considerably from the 52 calves:100 cows noted in 1981. The decrease in early calf survival was probably due to increased loss of calves to predation on the Tanana Flats where a high proportion of the population migrates each spring. These losses have been offset by increased survival among moose after they return to the Chena drainage in late summer. Thus, recruitment of yearlings to the population has actually increased.

Mortality

According to 1983 harvest ticket returns, 329 bulls were harvested by 2,067 hunters (Table 2). This represented a 112% increase in the harvest and a 46% increase in hunters over 1982. Seventy-nine or 24% of the bulls were taken in the last 5 days of the season. Hunter success also increased from 11% in 1982 to 16% in 1983. Successful hunters spent an average of 4.7 days afield.

Eight moose were taken by bow and arrow in the Fairbanks Management Area. Eighteen moose were taken in the Minto Flats Management Area.

Overall, yearling bulls comprised 29% of the reported harvest (bull moose with antler spreads of less than 30 inches were considered yearlings). An additional 54% of the antlers measured 31-49 inches and 18% measured 50 inches or greater. Since most bull moose in Interior Alaska do not reach or exceed a 50-inch antler spread until at least 4 years of age, young bulls comprised most of the harvest. The high percentage of young moose in the harvest is likely due to improved calf survival in the Chena drainage, which accounted for 36% of the total Subunit 20B harvest. Yearling bulls comprised 40% of the harvest in the Chena drainage.

Hunters harvested about 7% of the estimated moose population in Subunit 20B during the 20-day season. An even higher harvest rate (9%) was reported for the highly accessible Chena drainage. In 1982, hunters took about 4% of the total population during a 15-day season. The increased harvest was due to season extensions, increased hunter participation, and an increase in the moose population. Restrictive seasons were employed in the late 1970's to keep harvests at less than 3%

of the estimated population, but regulations have been gradually relaxed as the moose population increased.

According to Fish and Wildlife Protection Division records, a minimum of 26 moose were illegally taken by poachers. Accidental road-killed moose accounted for an additional 44 moose in Subunit 20B. These losses, plus an unknown number of unreported illegal kills, could comprise an additional 3% of the estimated population.

Mortality due to bears and approximately 25 wolf packs is thought to be substantial. Four of 13 calves from 10 radio-collared cow moose on Minto Flats were known to have been killed by black bears.

Habitat Conditions

Browse utilization in Subunit 20B is light, and habitat is not presently limiting growth of the moose population. The moose population is less than one-third the size that the habitat is currently capable of supporting. However, unless enhancement of aging habitats occurs, browse species will decline in abundance and productivity, and the high moose densities which occurred in the past will no longer be possible. The regrowth in many burned areas in the Chena and Salcha drainages has advanced beyond its prime usefulness as food for moose. A wildfire management plan to improve habitat by restoring a near-natural fire regime to portions of Subunit 20B has been implemented. However, changing land ownerships and continued development will preclude the use of wildfire for habitat improvement in many areas. A progressive program involving prescribed burning and mechanical enhancement is needed to ensure that important winter range in the Chena and Goldstream drainages remains productive since wildfire will become increasingly unacceptable as the human population grows.

Management Summary and Recommendations

Moose densities are low throughout most of Subunit 20B, but are increasing where wolf control has been effective. However, the habitat is underutilized and the moose population is well below carrying capacity. The present management objective for the moose population is to double the size of the population to better accommodate the large and growing demand for moose to view and hunt. Wolf control should be conducted throughout the subunit to maintain an average moose:wolf ratio of 50:1 until a moose population of about 10,000 is attained.

Trend count areas should be established in the Chatanika and Tolovana River drainages. Additional cow moose should be

radio-collared to determine seasonal movements and the effects of predation.

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Table 1. Moose survey data for Subunit 20B, fall 1983.

Area	Total bulls: 100 cows	Small bulls: 100 cows	Percent small bulls	Calves/ 100 cows	Calves: 100 cows ≥ 2 yr	Percent calves	Sample size
Minto	55	11	5.5	44	50	22	54
Chena	50	17	9.0	37	44	20	212

Table 2. Distribution of bull moose harvest in Subunit 20B during 1981, 1982, and 1983.

Area	No. of moose		
	1981	1982	1983
Chatanika River	24	33	48
Chena River	64	63	117
Goldstream Valley	7	6	22
Minto Flats	6	7	18
Salcha River	16	28	56
Tanana River	16	15	47
Tatalina River	10	2	9
Tolovana River	8	4	12
Unknown	3	0	0
Totals	154	158	329

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20C

GEOGRAPHICAL DESCRIPTION: Kantishna, Cosna, and Nenana River Drainages

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Little is known about the moose abundance in Subunit 20C except that densities are low. Survey data from a portion of Denali National Park indicated that moose numbers in the Savage River drainage continued to decline. Population trends are unknown elsewhere in the subunit.

Population Composition

Composition surveys in the Savage River drainage of Denali National Park revealed only 30 bulls:100 cows and 22 calves:100 cows (N = 166). Although the number of calves:100 cows was greater than during the 2 previous years, it remained below that of an increasing moose population. Several hunters commented that they saw many cow moose but very few calves in the area east of the Nenana River and south of the Rex Trail.

Mortality

According to harvest tickets, 655 hunters took 217 moose (Table 1). This represents a 100% increase from the 1982 harvest, although 65 moose (30%) were taken during the lengthened season. Hunter success rate was 33%, up 11% from the previous year. Increased use of 3-wheelers was partially responsible for the rise in harvest and success rate. Successful hunters spent an average of 5 days afield. Assuming yearlings have antler spreads <30 inches, yearling bulls comprised 18% of the reported harvest. This was down from 33% yearlings in the 1982 harvest, although the actual number of yearlings taken was about the same both years. Poaching and predation are thought to be substantial mortality factors in Subunit 20C.

Management Summary and Recommendations

Moose densities are considerably below carrying capacity in Subunit 20C. Access to the subunit is good and the human demand for moose is high. The moose population should be increased by controlling predation and hunter take. Continuing short, bulls-only seasons are recommended.

Wolf survey and moose trend count areas should be established and monitored to determine population status and trend.

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Table 1. Distribution of the bull moose harvest in Subunit 20C during fall 1981, 1982, and 1983.

Location	No. moose harvested		
	1981	1982	1983
Lake Minchumina	9	11	16
Cosna River	10	2	6
Kantishna River	19	16	27
Ferry area	11	11	19
Healy area	38	20	34
Totatlanika River	15	11	38
Nenana River	29	25	49
Teklanika River	6	6	15
Yanert Fork	22	6	11
Unknown	0	0	2
Totals	159	108	217

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20D

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Status of the moose population varies throughout Subunit 20D. South of the Tanana River and downstream from Johnson River, a population of medium density appears to be increasing at approximately 5% per year. South of the Tanana and upstream from Johnson River, the low to medium density population appears to be increasing more slowly. North of the Tanana River, limited data suggest a stable or declining low-density population.

Population Composition

Poor snow cover hindered composition counts during the reporting period. A total of 486 moose was classified in 8 count areas (Table 1). South of the Tanana River, most data were obtained from trend count areas using 4-minute/mi^2 minimum search intensities. The 2 surveys flown north of the Tanana were not as intensive (less than 2 minutes of search/ mi^2) and yielded data that are more likely to be biased. Survival of calves and bull:cow ratios south of the Tanana downstream of Johnson River were the highest recorded since 1970: nearly 50 calves:100 cows and 42 bulls:100 cows. A similar pattern was observed south of the Tanana upstream from Johnson River, where 37 calves:100 cows and 61 bulls:100 cows were recorded. Calf survival there was 100% better than any year since 1975, when the area was 1st surveyed. In both areas, yearling survival was not significantly improved in 1983 over previous years. North of the Tanana, low survival of calves and yearlings continues.

Movements

During the reporting period, 6 cow moose and 1 bull moose were radio-collared south or southeast of Delta Junction. All were yearlings or older. Six moose stayed within 12 mi of the

location in which they were collared. One moose, collared near Donnelly Dome, traveled approximately 21 mi in the spring to the Goodpaster flats, north of Delta.

Mortality

According to harvest ticket returns, hunters harvested 105 moose in Subunit 20D during 1983; a total of 542 hunters reported hunting, for an overall success rate of 19%. About half hunted north of the Tanana, where 248 hunters took 54 moose. West of the Johnson River and south of the Tanana, 229 hunters reported taking 38 moose. In the remaining portion east of Johnson River, 45 hunters took 12 moose.

More than 90% of the hunters were Alaska residents, and 96% of the successful hunters were residents. Of successful hunters, 60% were Subunit 20D residents.

In the easily accessible portion of the subunit south of the Tanana, most successful hunters used offroad vehicles or highway vehicles for transportation. North of the Tanana, most used boats, aircraft, or ATVs.

Measurements reported by hunters indicated that approximately 60% of the moose taken in Subunit 20D had antler spreads of 39 inches or less. Most of these were moose 3 years of age or under. Similar proportions of young versus older moose were seen throughout the subunit.

Other causes of mortality were predation by wolves, poaching, and road kills (Table 2).

Habitat

Browse utilization transects were conducted in several parts of Subunit 20D during the reporting period. Browse does not currently appear to be limiting moose populations. Examinations of the Jarvis Creek and Gerstle burns suggest that their best browse production is past.

Management Summary and Recommendations

The moose population south of the Tanana River appears to be faring well. Continued monitoring through trend counts and other surveys should be continued. North of the Tanana, the status of the population is less well understood, and efforts should be made to learn more about moose populations and human use in that area.

While browse does not seem to be limiting moose now, habitat manipulation in the older burns should be initiated, at least

on an experimental basis. Expanding moose populations in the southern portion will require additional browse in the foreseeable future.

Moose movements should be better understood throughout Subunit 20D, especially southwestern portions of the subunit. This can be accomplished by radio telemetry.

Increased calf survival in the southern portion of the subunit is probably due to a large harvest of wolves in winter 1982-83. Wolf management efforts should be continued in the southern and eastern portions of the subunit and extended to the northwest portion where survival of calves and yearlings remains poor.

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Table 1. Sex and age composition of the Subunit 20D moose population, 1983.

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	42	6	49	55	8	25	279
20D SE	61	4	37	40	6	19	95
20D NW	36	3	10	11	0	7	59
20D NE	37	11	14	17	0	9	53
All areas combined	44	6	37	41	7	20	486

[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 1983-30 June 1984.

Cause of death	Cows		Bulls			Unknown sex				Total
	Calf	Ad	Calf	Yrlg	Ad	Calf	Yrlg	Ad	Unk	
Road kill	1	3	1	1	1	2	0	1	0	10
Illegal kill	0	7	0	1	5	1	0	0	0	14
Wolf kill	0	2	0	0	1	1	1	0	7	12
Other[a]	0	2	1	0	0	1	0	0	0	4
Totals	1	14	2	2	7	5	1	1	7	40

[a] Two died in snares, 1 in a fence, and 1 of unknown causes.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20E

GEOGRAPHICAL DESCRIPTION: Fortymile, Charley, and Ladue River Drainages

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Subunit 20E is estimated to contain 1,400-2,000 moose. Moose densities are low (0.2 moose/mi^2) and likely declining in Subunit 20E, except in a 3,000 mi^2 area in the southwestern portion where wolf numbers were controlled from 1981-83. In that area, adult moose mortality has been reduced, and as a result the general population decline is believed to have been arrested.

Population Composition

Poor snow cover prevented completion of regular fall moose surveys, but 215 moose were classified during 10.7 hours of flying from 10-13 January 1984 (Table 1).

The low number of bulls observed on the Mosquito Flats may be attributed to moose movements rather than an actual decline of the bull:cow ratio. Casual observations in fall 1983 suggest that bull:cow ratios in the Mosquito Flats are not unusually low.

Survival of calves to 6.5 months of age is uniformly low due to predation. As of 10 June 1984, 65% of calves born in 1983 were lost to grizzly bears, drownings, wolves, and black bears. Because of the high rate of early calf mortality, yearling recruitment is also low, but wolf control is contributing to overwinter survival of remaining calves and adults.

Habitat Conditions

Based upon inspection of more than 1,500 browse plants in Subunit 20E, browse use by moose was less than 10%. Thus, browse is definitely not limiting population growth. Implementation of the Fortymile Fire Management Plan in May 1984

will ensure a near-natural fire regime in much of the area which will result in a more heterogeneous habitat mosaic than currently exists.

Mortality

Hunter pressure in the subunit more than doubled; 166 hunters reported hunting in 1983 compared to 76 hunters in 1982. Only 31 bull moose were taken for a hunter success of 19%. During 1982, 19 bulls were taken.

Harvest was heaviest in the Mosquito Fork drainage (13 bulls taken). The remainder of the harvest was well distributed throughout the subunit.

Fifty-five percent of bulls taken had antler spreads of 50 inches or greater, which illustrates the old-age structure of the population. Only 16% of the bulls taken had antler spreads of less than 35 inches, reflecting the poor rate of yearling recruitment.

Management Summary and Recommendations

Moose densities remain low in Subunit 20E and are likely declining throughout most of the subunit. The injunction against

continued wolf control efforts contributed to an increased wolf population, and, consequently, a higher rate of moose mortality. An ongoing research project indicates that grizzly bears are a major predator of neonate moose. Therefore, moose populations in the subunit continue to be composed of old, unproductive animals that exist at low densities.

Food is not the limiting factor, based upon observed browse use rates of less than 10%. Even so, the Fortymile Fire Management Plan was implemented in May 1984 to provide for future habitat needs of moose and other species.

Recommendations for future management of moose in Subunit 20E are:

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

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

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

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Table 1. Subunit 20E moose sex and age ratios observed during aerial surveys, 10-13 January 1984.

Area	Total bulls: 100 cows	Small bulls: 100 cows	Percent small bulls	Calves: 100 cows	Percent calves	Moose/ hour	Total moose
Kechumstuk-Mt. Veta	60	7	4	13	8	14	26
Mosquito Flats	14	3	2	11	9	24	44
Upper Mosquito Fork-Wolf Creek	70	8	4	11	6	20	114
North Knob (Fairplay)	76	0	0	6	3	22	31

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20F

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

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Although little population data are available, indices suggest a low and probably static population. Habitat appears to be generally poor throughout Subunit 20F, but it is probably not limiting population size at present. Other factors, including predation and poaching, may be restricting the population to its current low level.

Population Composition

Inadequate snow cover precluded surveys in the Hess Creek trend area, but surveys were conducted by Bureau of Land Management personnel in portions of the Tozitna and Big Salt Rivers. Although the samples obtained were small, the calf:cow ratio of 45:100 suggests calf survival through November was good. Observed moose density in the surveyed areas was low: 0.24 moose/mi^2.

Mortality

Hunter report data indicate 25 moose were harvested by 111 hunters for a 22% success rate. Three moose were taken during the November season. The harvest is about average for recent years, and the hunter success rate is unchanged from last year. The largest harvests were from the Yukon River drainages (excluding Hess Creek) followed by the Manley-Tofty area. The remaining harvest came from scattered locations throughout the subunit. Assuming that yearling moose have an antler spread of $\leq$30 inches, 24% of the harvest was composed of yearlings. Out-of-season hunting and consequent unreported harvest is believed to be significant in Subunit 20F.

Management Summary and Recommendations

The moose population in Subunit 20F is low and probably stable. Habitat limitation is not believed responsible for present low moose numbers; predation by wolves and grizzly bears may be limiting recruitment.

Virtually all hunting is by state residents, and the 22% hunter success rate is average for Unit 20.

If recruitment improves and the moose population substantially increases, habitat will then become a major limiting factor. Range rehabilitation, either through prescribed burning or reduced wildfire suppression, should be an ongoing part of management.

Increased efforts should be made to obtain information on moose population size, composition, recruitment, and trend. In addition, the significance of predation on moose in Subunit 20F should be examined.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21A

GEOGRAPHICAL DESCRIPTION: Upper Nowitna, Iditarod, and Upper Innoko Drainages

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Late winter surveys in the middle Innoko, upper Innoko, and Dishna River drainages resulted in lower than average moose/hour figures. Recruitment will apparently be low on the Dishna and upper Innoko, based on percentage of calves in the herd during March (11% and 13%, respectively for the Dishna and upper Innoko). Calf percentage in the herd was good (26%) in the middle Innoko area.

Mortality

Wolf predation continued to be the largest source of adult moose mortality in the subunit, and in the upper Innoko and upper Nowitna may also be responsible for the poor yearling recruitment.

Reported hunter take in the upper Nowitna was 22 moose during the September hunt and 2 in November. In the Innoko drainage 107 moose were harvested in September and 4 in November. This is an increase by 20 moose over previous years' harvests.

Aircraft were used as the primary means of transportation by 85 successful hunters in the Innoko drainage. Guided hunts accounted for approximately 30 of the moose taken.

Management Summary and Recommendations

During winter 1982-83, more than 50 wolves were taken from the middle Innoko area. This was likely responsible for the higher calf survival noted for the middle Innoko area.

Moose populations in Subunit 21A appear stable, but without trend surveys, this heavily hunted area may undergo an undetected decline. Trend surveys should be conducted biannually

in selected areas. Composition surveys along the Innoko River should be done annually. More funds need to be allocated toward hunter check stations and trend area surveys in the Innoko drainage.

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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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

In November 1980, a population census conducted in the Nowitna drainage within Subunit 21B produced an estimate of 2,700 moose. Two trend areas were established in 1982, and 3 additional areas were established in 1983. Although these trend areas encompass areas which were not actually flown during the census, habitats and relative stratification densities are similar enough that some projections of moose population trends are possible. In the area of the Nowitna-Sulatna confluence, a slight decline in moose density is indicated. Along the Yukon River there has been an increase in observed moose density. Elsewhere in the subunit, the population appears to be stable.

Population Composition

Results of November 1983 surveys (Table 1) show the highest calf:cow ratios in several years, although the percentage of yearling bulls in the herd was very low. Recruitment ranged from 6-19%.

Mortality

The reported harvest from Subunit 21B was 77 moose. This was a slight increase over the average take during the past 5 years, and most of the increase resulted from increased hunter activity along the Yukon River. The harvest by drainage was Nowitna, 45; Sulatna, 4; and Yukon, 17. Eleven moose were taken along the Ruby Road.

A moose hunter check station was operated from 3-27 September at the mouth of the Nowitna River. Of the 144 hunters who were checked at the station, 59 had taken moose from the Nowitna drainage (Subunits 21A and 21B).

Management Summary and Recommendations

Along the Nowitna River, low recruitment has contributed to a declining moose population. The increased calf:cow ratio may indicate a large cohort which will be able to sustain wolf predation and hunter take in the future.

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Table 1. Moose composition surveys in Subunit 21B, November 1983.

Area	Bulls: 100 cows	Percent yearling bulls	Calves: 100 cows >2 yrs	Percent calves	Area (mi^2)	Observed density[a]	Sample size
Novi mouth	28	2	50	25	26.6	3.20	87
Little Mud/Novi	71	5	116	37	25.8	0.73	19
Novi/Sulatna	32	5	52	26	36.1	1.70	61
Deep Creek	28	5	26	16	29.5	1.30	38
Mason Slough	25	0	75	37	44.7	0.53	24
Totals	36	3	52	26	--	--	229

[a] Does not include a correction for moose missed during survey efforts. Actual density is somewhat higher.

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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The moose population in the Melozitna River drainage is low but is thought to be stable. One trend area surveyed by Bureau of Land Management personnel in 1983 had an observed density of 0.67 moose/mi^2. No other useful information is available for moose in Subunit 21C.

Population Composition

The November 1983 survey was conducted on Sithdondit Creek at the Melozitna River headwaters, and resulting data shows 130 bulls:100 cows and 27 calves:100 cows over 2 years of age. Recruitment was 15% (6% yearling bulls and 9% calves in the herd), but because of the small sample size (33 moose) these rates should not be applied to the remainder of Subunit 21C.

Mortality

Hunters reported taking 15 moose from Subunit 21C. All hunters used aircraft as their transportation means. Since the Subunit 21D-21C boundary on the Dulbi River is unclear and unmarked, all hunters using boats for transportation on the Dulbi River had their harvest attributed to Subunit 21D.

No data are available on natural mortality, but 2 wolf packs inhabit the lower and middle portions of the Melozitna drainage, and 1 additional pack occurs in the headwaters. There are also numerous grizzly bears in Subunit 21C.

Management Summary and Recommendations

Moose populations in Subunit 21C are low, and natural mortality keeps the population stable. Harvest by hunters was low

for the 2nd year following enforcement of the same-day-airborne regulation.

More trend areas should be established in Subunit 21C to assess density and status of moose populations.

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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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Observed moose densities in November 1983 were high (4-6 moose/mi^2) along the Koyukuk River from Kateel River mouth to Dulbi Slough, and the population is stable. Both recruitment and mortality are estimated at 12%. Densities are moderate (2.3-3.8 moose/mi^2) along the Yukon River lowlands from Ruby to Last Chance and lower (1.5 moose/mi^2) from Last Chance to Quail Island. Along the Yukon River lowlands, recruitment and mortality are both 24% and the population is stable.

Surveys in the Nulato Hills and the Kaiyuh foothills produced early winter moose densities of 0.4-0.5 and 0.2 moose/mi^2, respectively. Population trends are unknown.

Population Composition

The Three-day Slough area continues to maintain an adequate bull:cow ratio (Table 1). A good calf:cow ratio has been evident since 1981 (30-41 calves:100 cows $\geq$2 years of age), which is a marked improvement over ratios observed in the late 1970's (18-23 calves:100 cows $\geq$2 years of age). Elsewhere in Subunit 21D, the calf:cow ratios were excellent and most bull:cow ratios were good.

Mortality

The 1983-84 hunting season was split into 2 periods, both allowing harvest of antlerless moose. In September, 136 bulls and 8 cows were reported taken. The numbers of cows harvested depends upon hunting success during the first 15 days of September, when only bulls may be taken.

Through public relation efforts, more than 90% of the moose taken during the September hunt were reported. A moose hunter

check station was operated at Mary Vernetti's cabin, 18 mi up the Koyukuk River. Of the 164 hunters checked, 29 resided outside of Subunit 21D and 3 were from out-of-state. Among 85 moose which came through the check station, age and antler measurements were recorded for 52. The data suggest moose from the Koyukuk drainage grow larger antlers than moose from elsewhere in the Interior.

The 2nd season occurred during 10 days in February when very low temperatures (-30° to -50°F) prevented most hunters from getting safely into the field. In the Galena area, 26 moose were taken; residents of Koyukuk, Nulato, and Kaltag together took only an additional 6 moose during the February season. An emergency order was issued, extending the season 5 days in the area downriver from Last Chance. During that period, 8 moose were taken.

Management Summary and Recommendations

Moose populations in Subunit 21D along the riparian lowlands are high, appear stable, and are adequate to support current seasons. Low recruitment in the Three-day Slough area justifies retaining the Koyukuk Controlled Use Area. The established trend areas should continue to be monitored yearly and new survey areas should be established in the uplands.

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Table 1. Moose composition surveys in Subunit 21D, November 1983.

Area	Bulls: 100 cows	Percent yearling bulls	Calves: 100 cows ≥2 yrs	Percent calves	Density moose/mi^2	Area (mi^2)	Sample size
Three-day Slough	31	5	40	22	6.2	84.8	526
Dulbi River	38	4	30	16	4.0	57.1	228
Squirrel Creek	58	7	41	18	3.5	37.3	137
Kaiyuh Slough	74	9.5	76	25	1.6	39.8	63
Pilot Mt. Slough	21	4	57	26	3.8	40.6	153
Ruby Slough	42	11	40	19	2.3	39.8	91
Quail Island	24	7	81	30	1.5	66.8	103

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21E

GEOGRAPHICAL DESCRIPTION: Yukon River Drainage upstream from Paimiut-Kalskag Portage, including the Lower Innoko River downstream from the Iditarod River, to the mouth of Blackburn Creek

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Mortality

Hunters reported taking 95 moose (6 in November) from Subunit 21E during the 1983 season. Although this represents a substantial increase in compliance with the reporting requirement, the unreported harvest by residents of the subunit villages remains substantial. The reported moose harvest by residents of subunit villages was: Grayling, 5; Shageluk, 0; Holy Cross, 14; and Anvik, 6. This is 5 less than the number of moose reported taken by residents of these villages during the 1982 season. Some license vendors did not have harvest tickets to issue and many people hunted without licenses or tickets. Residents of Unit 18 hunt moose in Subunit 21E, especially in the Paimiut Slough area and the lower Innoko drainage. They reported taking nearly half (47) the reported harvest, and they constituted 46% of all hunters who reported hunting in Subunit 21E.

Seventy-two hunters used boats as their primary transportation means, 14 used aircraft, and 6 used snowmachines.

Management Summary and Recommendations

The moose population is apparently healthy and capable of supporting the current level of reported and unreported harvest.

It is recommended that funds be allocated toward a public information program involving personal contact in the area villages to increase harvest reporting. A hunter check station at the mouth of the Innoko River would contribute greatly toward program goals.

Trend area counts or composition surveys should be established and conducted annually.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 22

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Historical records indicate that moose did not inhabit Unit 22 prior to 1900. During the mid-1930's, a few moose immigrated westward onto the Seward Peninsula from Yukon River drainages. Moose numbers gradually increased, most noticeably during the late 1960's. By 1970 moose had expanded into most suitable habitats, and subpopulations increased dramatically in many drainages. The central Seward Peninsula subpopulation exhibited the greatest increase and appeared to be near or above winter range carrying capacity. Densities were much lower in the western and southern portion of Unit 22, and moose appeared to be stable or increasing only slightly, even though range was not a limiting factor. Changes in population status since the last reporting period were minor.

Population Composition

During the past decade, greatest moose density and highest moose harvests have occurred in Subunit 22D. For these reasons, this area has the highest management priority, as well as the most complete aerial survey history. Subunit 22D contains 2 major drainages: the Kuzitrin River, an area with relatively good access and high annual harvests; and the American/Agiapuk River, an area without road access and with low-to-moderate harvests. During all but 4 years during 1971-83, fall population composition and productivity data have been obtained in these 2 drainages (Table 1). During the last 3 years, bull:cow ratios in the Kuzitrin exhibited a slow decline from 50:100 to about 30:100. With increased hunting pressure and higher harvest, this decline was not unexpected. Bull:cow ratios in the American/Agiapuk drainage also declined slightly during the same period, but still remain quite high at approximately 60:100. Movements of radio-collared animals have shown that moose regularly travel between the Kuzitrin and American River drainages during fall and early winter

(Grauvogel 1985). Because of population intermixing and because no single count area exhibited a ratio below 30:100, I believe that a sufficient number of bulls have always been available for breeding. However, fall composition data from the Kuzitrin and Agiapuk drainages indicate that a decline in calf productivity and/or survival has occurred in Subunit 22D. To determine if this decline was a recent occurrence, the percentage of cows with calves during 1973-81 was compared to the percentage of cows with calves during 1982 and 1983 using a chi-square test for difference in proportions (Table 2). In the Agiapuk drainage the decline was significant (P 0.05), and in the Kuzitrin drainage the decline was highly significant (P 0.001). The cause of lower productivity is not known, but may be attributed in part to cows being in poorer physical condition. This hypothesis is supported by blood analysis that showed decreases in packed cell volume (PCV) and hemoglobin (Hb) from the period 1981-84 (Grauvogel 1985). Increased predation by grizzly bears and/or wolves may also be a contributing factor. Cow:calf ratios are not unacceptably low, but a long-term downward trend in calf productivity may be occurring. Changes in population composition should be carefully monitored in the future.

Mortality

Hunting was undoubtedly the major source of moose mortality in Unit 22 during the reporting period. Hunting seasons were the longest in the State, ranging from 5 to 8 months. Reported harvest from moose harvest tickets and antlerless permits was 405 moose: 291 bulls, 82 cows, and 32 of unspecified sex. This harvest is the highest on record. During the previous 10 years, annual harvests ranged from 183 to 344 with a mean of 253. From the early 1970's, interest in taking moose in Unit 22 has steadily increased, especially among local residents. Whereas moose hunting was once only a minor activity, it has become 1 of the most important hunting activities during September and October. Although hunting effort subsided after freeze-up, many hunters still went afield through December or January until seasons in Subunits 22D and 22B terminated. Local residents spent literally 100's of man-hours in search of a legal moose. Increasing hunting pressure has resulted in ever-increasing annual harvests. In portions of Subunits 22B and 22D, annual harvest approached or exceeded annual recruitment. The number of hunters who obtained antlerless moose permits is a good indicator of the tremendous interest in moose hunting. During the open season, 747 antlerless permits were issued for Subunits 22B, 22D, and 22E. Most permits were obtained by local residents during September and October. Hunters with antlerless permits harvested 145 moose: 82 cows, 33 bulls, and 30 of unspecified sex (Table 3).

Every year many hunters fail to report taking their moose, even though it is a requirement under game regulations. Reminder letters to hunters who held antlerless moose permits have provided an estimate of the nonreporting problem. Upon receipt of the antlerless permit, the signator agreed to voluntarily return the permit by a specified date even if he was unsuccessful; or, if successful, the completed permit together with appropriate specimens were to be returned within 5 days of taking the moose. These instructions were clearly explained to each applicant and were plainly legible on the permit itself. Yet, of the 693 antlerless permits issued for Subunits 22B and 22D, only 355 (51%) were returned voluntarily. The department sent reminder letters to 338 delinquent permit holders. From this mailing, we received 193 replies and determined that 120 hunters were unsuccessful, 66 did not hunt, and 7 had taken a moose (4% success rate). Subsequently, reminder letters were sent a 2nd and 3rd time to all nonrespondents. Success rate by those who replied was 4% for each mailing (3 of 69 and 3 of 70). Data from these 3 mailings indicated the minimum success rate for all nonrespondents was 4%. A similar mailout I conducted after the 1981-82 hunting season resulted in an estimated success rate of 5% for nonrespondents.

Hunters who obtained antlerless permits usually had direct contact with department staff and were probably more cognizant of regulations than were other moose hunters. Thus, a success rate of 4% is probably minimal for all classes of moose hunters who failed to report.

Approximately 1,600 moose harvest tickets were issued in Unit 22. The State computer run tabulated 1,292 successful and unsuccessful hunters who reported. Therefore, approximately 300 hunters did not report. Assuming a minimum success rate of 4% for nonrespondents, I estimate an additional 12 moose were killed.

Hunters from rural villages accounted for another source of unreported moose mortality. Comparing village populations with the number of moose tickets issued by local vendors, it seems unlikely that every hunter who took a moose also obtained a moose harvest ticket. I estimate that "unlicensed" hunters killed 5-15 moose. Using all sources of data from reported and unreported harvest, I estimate the total moose kill in Unit 22 numbered 420-435.

Management Summary and Recommendations

Moose were virtually absent from the Seward Peninsula 50 years ago. A few immigrants from the east probably established initial colonizing stock 30-40 years ago. During the past

decade, aerial surveys have documented a substantial increase in moose. Moose numbers in Subunits 22B and 22D increased most dramatically during the 1970's, but population growth has tapered off within the last few years. Winter browse is restricted to a narrow belt along the major rivers, and in some locations moose density may be exceeding the long-term carrying capacity of the winter range. Long either-sex seasons have slowed and/or curtailed excessive population growth throughout most of the unit. However, more information is needed to determine the desired density of moose on the winter range.

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 unhunted areas. Recent aerial surveys showed a marked decline in calf survival compared to previous years. This condition may be temporary, but appears to be a long-term trend. Bull:cow ratios and annual recruitment should be carefully monitored over the next few years, especially in Subunit 22D, where hunting pressure and harvest are highest. During the last decade, hunting pressure and harvests have increased. In portions of Subunits 22B and 22D, harvest is near annual recruitment. Mortality of radio-collared bull moose in Subunit 22D was 21% annually (Grauvogel 1985). Status of the moose population and effects of hunting should also be carefully monitored during the next few years. If survival of calves continues to decline, a research and/or intensive management study should be initiated to determine the cause and identify a possible remedy.

Long hunting seasons were established because moose exhibited high annual recruitment and because density of moose on some winter ranges was high. For the immediate future, liberal hunting seasons should be retained. However, as the harvest continues to escalate and as environmental conditions change, precise harvest information becomes increasingly important for management. The department must continue to work with the public to stress the importance of complying with regulations. Hunters who acquire moose tickets and antlerless moose permits should be sent reminder letters to determine the percentage of successful hunters who fail to report voluntarily. The quality of harvest data should be improved in all villages, especially at locations where many hunters fail to acquire a hunting license or harvest ticket.

Antlerless permits should be retained because they provide a level of positive control not available through harvest tickets. However, permits should be issued only in areas where cows are sufficiently abundant to warrant a season. When a desired cow harvest is attained in a specific drainage, the antlerless season should be terminated by field announcement.

The Seward Peninsula is extremely vulnerable to overhunting, due to its open terrain and accessibility from aircraft and snowmachines. Seasons and bag limits should be critically reviewed in all subunits of GMU 22 on an annual basis.

Literature Cited

Grauvogel, C. A. 1985. Seward Peninsula moose population identity study. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Final Rep. Proj. W-22-11, Job 1.29R. Juneau. In press. pp.

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Table 1. Fall moose population composition from the Agiapuk and Kuzitrin drainages 1971[a], 1973-76, and 1979-83.

	Agiapuk drainage				Kuzitrin drainage			
Year	Bulls: 100 cows	Yrlg bulls: 100 cows	Calf % of herd	Sample size	Bulls: 100 cows	Yrlg bulls: 100 cows	Calf % of herd	Sample size
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

[a] Agiapuk drainage not surveyed in 1971.

Table 2. Moose calf productivity in the Agiapuk and Kuzitrin drainages as determined by aerial surveys during October-November, 1971[a], 1973-76, and 1979-83.

	Agiapuk drainage				Kuzitrin drainage			
Year	2+ cows w/calves	Total cows	% Cows/w calves	Calves: 100 cows	2+ cows w/calves	Total cows	% Cows/w calves	Calves: 100 cows
1971					26	30	87	107
1973	12	25	48	60	18	35	51	54
1974	3	4	75	125	99	158	63	75
1975	2	6	37	68	10	15	67	73
1976	44	72	61	64	52	86	60	63
1979	57	120	48	58	102	202	50	62
1980	17	38	45	58	53	129	41	48
1981	30	54	56	69	40	82	49	71
1982	31	79	39	48	73	237	31	35
1983	27	60	45	57	66	185	36	45

[a] Agiapuk drainage not surveyed in 1971.

Table 3. Unit 22 antlerless permit data by Subunit, 1983-84 hunting season.

Subunit	Hunt No.	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Antlered bulls	Anterlerless bulls	Cows	Unk.
22B	992	274	75	151	48	7	10	22	9
22D	991	419	91	254	74	5	3	49	17
22E	990	54	18	13	23	0	8	11	4
Totals		747	184	418	145	12	21	82	30

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 23

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

In 1983-84, late winter surveys were conducted in most historical survey areas (Table 1), and fall surveys were conducted in some drainages (Table 2). Due to a prolonged cold spell, winter surveys were not begun until late March, at which time some population segregation had begun. For example, surveys of the Kelly and Kugururok Rivers revealed lower calf percentages than did the main Noatak River (Table 1). Such local discrepancies are probably due to the movement of the bulls up tributaries and toward timberline; these movements begin by mid-February, except in years of deep snow. During spring surveys, 2,897 moose were classified, of which 17% were calves (range 7%-32%). Estimates of unreported harvest and subpopulation status and trend are presented in Table 3.

Subpopulations in Unit 23 are not discrete, and movement between groups probably occurs frequently. However, due to differences in hunting pressure, access, habitat, and productivity, it is useful for management purposes to discuss moose subpopulations in the Unit.

Northwest Area: Wulik Drainage to Cape Lisburne. The Wulik and Kivalina Rivers and Rabbit Creek were intensively surveyed to establish baseline population information in an area slated for a large-scale mining operation and transportation corridor. Calves comprised 22% of the sample, indicative of an expanding population. Although most of the area's moose occur within the Wulik and Kivalina drainages, sightings of moose west of the Kivalina River and near Point Hope during the summer are becoming increasingly numerous. Habitat north and west of the Kivalina River is marginal and could at best support a low-density population.

Notatak River Drainage. Due to lower sightability of moose in spruce habitat and to incomplete survey coverage, I believe

that 60% at most of the moose present was observed. Most areas of high moose density were surveyed, and all habitat types were sampled. The observed calf percentage (14%) is probably representative of the entire subpopulation. Moose are abundant, and the population probably exceeds carrying capacity. Willows are heavily browsed along the Kelly and Kugururok Rivers, and the carrying capacity of some winter ranges may already have been reduced. This population is eventually expected to decline but will probably remain relatively high for many years.

1982 a trend-count area containing 67 moose was established south of Noatak Village. In 1984 the area contained 71 moose, indicating a stable population in the lower Noatak area.

Kobuk River Drainage. The Kobuk River subpopulation has never reached high densities, because of intensive harvest by local residents and Kotzebue hunters. The calf complement (23%) was higher than that of any other subpopulation; however, 23% may be an overestimate, because surveys were primarily done along the main Kobuk River where calf percentages are usually highest.

The moose subpopulation on the Kobuk Delta (downstream from Kiana) appears to be held well below carrying capacity by heavy harvest from Kiana and Noorvik residents. Productivity remains high and the subpopulation appears stable. The Kobuk Delta contains some of the best moose habitat in Unit 23, and is similar to the high-density range along the Koyukuk River in Subunit 21D. The Kobuk Delta could become an extremely valuable moose management area in the future, especially if the moose subpopulation declines in the Noatak drainage. Because the Kobuk Delta is accessible to most hunters in the unit, it may be desirable to maintain a low population and high habitat quality until the need for a greater harvest from the area arises.

Selawik Area: Selawik, Tagagawik, Mongook and Kauk Rivers. The Selawik area subpopulation is healthy. Large burns in the Tagagawik and Mongook River drainages have provided good winter range. Hunting pressure comes primarily from Selawik residents and some fly-in hunters, and the harvest is below the sustainable level. We estimate that 40% of the moose present were observed during the surveys, and calves comprised 20% of the sample. At a trend-count area established in 1984 by the USFWS west of the Tagagawik River, 91 mi^2 were surveyed at 2.5 minutes/mi^2, and a density of 1.6 moose/mi^2 was recorded.

Future moose management in this area will be influenced by fire management on refuge lands. The subpopulation is currently healthy, partly because of past wildfires. To maintain

this subpopulation in its current state, sizeable acreages must burn at 10-15 year intervals. Fire suppression to protect caribou winter range could reduce moose numbers. If caribou decline, moose could become the most important meat animal in the Selawik area and in many other areas of the unit. We need more information to evaluate the effects of fire on various habitat types and to develop a fire management plan benefiting both moose and caribou.

Buckland River Drainage. Seasons and bag limits have always been more restrictive here than in other parts of the unit, because moose are much less common here than elsewhere. Calves comprised 9% of the herd, and moose density (18 moose/hr) was lower than in all but 1 area surveyed. The drainage has had few wildfires in the recent past. Winter range is restricted primarily to riparian willow stands, except near Granite Mountain, where some alpine range is available. The southern portion of the drainage contains the largest stand of old-growth spruce habitat on the Northern Seward Peninsula and has consistently been an important wintering area for caribou. The Northern portion of the drainage is covered by lava flows which are a poor substrate for willows and other plants important to moose. However, in spite of relatively poor habitat, the drainage could support more moose, particularly along the West Fork of the Buckland River.

Survey coverage was extensive, and moose were present throughout the drainage. Densities were low and an estimated 40% of the animals present were observed.

Boat access usually does not extend above the confluence of the Buckland and the West Fork except during periods of high water. Residents of Buckland harvest some moose in August and early September but rarely kill moose during the winter when caribou and reindeer are available. Hunting may be partially responsible for the low population density; however, predation by bears and wolves may also be limiting moose in the area.

Kiwalik, Kugruk, Inmachuk and Goodhope Rivers. The moose population is high, relative to available habitat throughout this area, and has reached or exceeded maximum desirable density. Hunting pressure is low, despite very liberal seasons and bag limits. Access by boat and aircraft during fall is usually poor, and residents of Buckland, Deering, and Kotzebue have little interest in taking a moose from the area during winter. However, a few people selectively hunt calves, which are considered better eating than adult moose in late winter. Winter range consists of narrow bands of short to medium-height riparian willows and may be potentially limiting, especially in the Goodhope Drainage. Water collection ditches for gold mining operations at Candle Creek and the Inmachuk River, as

well as the gold mining activities themselves, have created a significant amount of good moose browse in this region.

Unitwide population estimate. We estimated the observed proportion of each subpopulation from subjectively determined sightability, survey coverage, moose distribution, and habitat, and combined these values to estimate the unitwide population (Table 4). A unitwide estimate of 5,000 moose is probably conservative but will be used as a basis for management until better data are available. The unitwide population may actually be as high as 7,000 animals.

Mortality

The 1983 reported harvest was 141 moose (129 bulls, 12 cows), compared to 128 in 1982 and 176 in 1981. Other known mortality included 2 bulls which died after antler entanglement on the Tagagawik River, 1 adult observed along the Kiwalik River during the survey, 4 moose (3 adults, 1 calf) which were shot and abandoned in the vicinity of Deering in March, and 3 moose (1 bull, 1 cow, 1 calf) which were shot and abandoned along the beach near Point Hope in July.

As in previous years the Noatak and Kobuk drainages sustained most of the hunting pressure and harvest, and accounted for a combined reported take of 199 moose. Most moose (89%) were taken during August and September. Only 14 moose were reported taken after 1 October and only 1 moose was taken after 1 January in that portion of the Unit open until 31 March.

During 1983, 306 people reported hunting moose, 46% of which were successful. Resident hunters had a success rate of 45% (N = 267) while 50% (N = 26) of nonresidents were successful. Hunters using aircraft were slightly more successful (55%; N = 109) than were boat hunters (48%; N = 131). Eighteen hunters (12 successful and 6 unsuccessful) used other transportation means. Unit 23 residents took 45% (N = 63) of the reported harvest, other Alaskan residents took 41% (N = 58), and nonresident and alien hunters took 14% (N = 20).

We contacted knowledgeable village residents and Subsistence Division research personnel to obtain estimates of village moose harvest. People contacted were asked to estimate the minimum and maximum harvest of moose in their village during a normal year and during the 1983-84 season. Information for Noatak and Kivalina was derived from interviews conducted by Subsistence Division researchers. Estimates for Ambler, Buckland, Deering, Kiana, Kobuk, Noatak, Noorvik, Selawik, and Shungnak were provided by knowledgeable local residents judged by us to be reliable. No attempt was made to estimate the unreported harvest by Kotzebue residents because of the size

of the community, the diversity of hunting methods and the large geographical area used. Kotzebue residents probably have the highest rate of harvest reporting in the unit because of the "urban" nature of the community, the composition of the hunting public there, and the presence of ADF&G and FWP. Table 5 presents the estimated and reported harvests for communities in the unit.

The estimated harvest from 10 outlying villages (Table 5) with a combined population of 2,547 people was 280-450 moose, compared to a reported harvest of 25. If our estimates are accurate, the reporting rate for outlying villages is 6-9% of the actual annual harvest. Our estimate implies a harvest rate of 1 moose/6-10 people.

Combining our estimate with the harvest reported by other Alaskan residents and nonresidents results in a total harvest of 358-528 animals, of which Unit residents take 78-85%. The Kobuk River is the area sustaining the greatest harvest (150-250 moose annually).

Several people stated that a significant number of cows and calves were being taken in August and early September prior to the official opening of the cow season. These moose are considered excellent eating, and residents of the smaller villages harvest them before residents of Kotzebue come upriver to hunt. Although this activity reduces competition with nonlocal hunters and provides subsistence harvest in the smaller communities, it may be impacting the moose herd in the Kobuk drainage. Taking cows along the Kobuk prior to the season was identified as an enforcement need several years ago.

Management Summary and Recommendations

According to knowledgeable "old-timers" moose were occasionally taken as early as the 1920's in the Upper Noatak River drainage. By the late 1930's moose were killed on a more regular basis in this area, and by the late 1940's moose were present in low numbers through most of Unit 23 except in the drainages of the northern Seward Peninsula. Intensive enforcement by territorial game wardens, predator control by the USFWS, and excellent habitat allowed moose to increase rapidly and to reach peak numbers by the early to mid-1970's. For the past 8-10 years this subpopulation has remained relatively stable, with increases and declines in selected areas as previously noted.

Moose meat has become an important food resource throughout Unit 23. Although caribou may still be the preferred meat animal, most families in outlying villages take moose each year, and some people actually prefer moose to caribou. Following the decline of the Western Arctic Caribou Herd,

substantial harvest pressure may have been redirected at moose. Many people discovered that moose were good eating and that despite their size it is possible to handle one and transport it home.

Information gathered on the unreported harvest and estimates of subpopulations should be useful in identifying moose management problem areas and in allocating future effort and funding. The Kobuk and Buckland River drainages should probably receive more attention. The Kobuk River should be a high priority because of the substantial harvest of moose from 5 villages in the area.

We recommend that the moose season be opened earlier near Point Hope to allow people an opportunity to legally harvest transient moose. No other changes in seasons or bag limits are recommended at this time.

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Table 1. Unit 23 winter moose surveys, March 1984.

Survey area	Date	Total moose	No. Calves	Calf % of sample	Survey time (hrs)	Moose/ hour
Kivalina/Wulik Rivers	3/14/84	148	33	22	4.0	37
Rabbit Creek-Mulgrave Hills	3/27/84	10	1	10	1.8	6
Subtotals, northwest area		158	34	21	5.8	27
Lower Noatak to Eli River	3/02/84	96	15	16	1.3	72
Noatak-Eli to Kelly R.	3/09/84	295	53	18	3.0	98
Kelly River	3/13/84	124	9	7	2.1	60
Eli, Aggy, Noatak Flats	3/13/84	122	22	18	2.6	47
Kugututok River	3/19/84	412	41	10	3.9	105
Noatak trend count area	3/02/84	71	12	17	2.8	26
Subtotals, Noatak area		1120	152	14	15.7	72
Squirrel River	3/08/84	170	26	15	3.7	46
Lower Kobuk	3/10/84	100	32	32	2.8	36
Kobuk-Kiana to Ambler	3/20/84	197	53	27	3.6	55
Upper Kobuk	3/23/84	174	37	21	7.3	24
Subtotals, Kobuk area		641	148	23	17.4	37
Tagagawik River	3/22/84	173	30	17	4.3	40
Kugarak, Selawik, Pick Rivers	3/22/84	205	43	21	5.5	37
Mongook, Kauk Rivers	3/21/84	50	12	24	1.5	33
Subtotal, Selawik area		428	85	20	11.4	37
Buckland River	3/21/84	67	6	9	3.7	18
Kiwalik River	3/20/84	124	20	16	2.0	62
Kugruk River Inmachuk	3/20/84	127	18	14	1.9	66
Inmachuk River	3/23/84	80	11	14	2.0	39
Goodhope, Cripple River	3/23/84	152	28	18	2.7	56
Subtotal, Seward Peninsula		550	83	15	12.3	45
Totals, all areas		2897	502	17	62.5	46

Table 2. Unit 23 fall moose surveys, October 1983.

Survey area	Date	Bulls			Cows	Calves	Total moose	Percent yrlgs.	Percent calves	Calves: 100 cows	Bulls: 100 cows
		Yrlgs	Med	Lg							
Wulik/ Kivalina Rivers	13 Oct 83	8	7	8	16	12	51	16	24	75	144
Kelly River	18 Oct 83	6	26	7	55	7	94	6	8	13	60
Kugururok	18 Oct 83	5	8	14	37	17	81	6	20	46	73

Table 3. Unit 23 moose subpopulations; size, percentage of calves, harvest, and trend

Drainage	Subpopulation size	Percent calves	Estimated 1983 harvest	Percent of harvest	Trend
Wulik, Kivalina	175	22	10	6	increasing moderately
Noatak	1,900	14	120	6	stable or slowly increasing
Kobuk	1,600	23	200	13	stable or declining slowly
Selawik, Tagagwik, Mongook, Kauk	1,000	20	60	6	increasing slowly
Buckland	175	9	15	9	declining
Kiwalik, Kugruk Inmachuk, Goodhope	700	16	25	4	increasing moderately
Totals	5,550	17	430	7	stable

Table 4. Unit 23 moose subpopulation estimates from late winter surveys, March 1984.

Drainage	No. observed	Estimated % observed	Estimated subpopulation
Wulik, Kivalina	158	90	175
Naotak	1,120	60	1,900
Kobuk	641	40	1,600
Selawik, Tagagawik Mongook, Kauk	428	40	1,000
Buckland	67	40	175
Kiwalik, Kugruk Inmachuk, Goodhope	483	70	700
Totals	2,897	52	5,550

Table 5. Estimated Unit 23 moose harvest by community.

Community	Population (1980 census)	Reported harvest	Estimated harvest	Comments
Ambler	192	3	25-35 and 50 in 1983-84	Average 25-35, 3 estimates. Harvest probably twice the average in 1983-84 due to unavailability of caribou.
Buckland	175	1	15-20	Usually about 15, sometimes as many as 20. People hunt mainly in August and early September.
Deering	149	0	14-20	Usually 14: occasionally 5-6 more. People hunt from August to mid-October.
Kiana	344	4	20-25 (min.) 20-30 (min.) 37-60	No maximum estimate given. No maximum estimate given. About 3/4 of households get moose (50-80 households).
Kivalina	241	3	6-10	Tiger Burch-Kivalina subsistence survey.
Kobuk	55	2	12-15	12 bulls plus 2-3 other moose were taken in 1983-84. About normal for the village.
Kotzebue	2044	38	50-70	ADF&G estimate. Harvest reporting is better in Kotzebue than in the villages.
Noatak	273	2	12-15 30 20-40	Gref Moore subsistence survey, 1982-83. Average from discussions with 4 Noatak men. At least 1/3 of families get moose (67 families).
Noorvik	490	2	50-100	Every family gets 1 moose; hunting done in summer and fall.

Table 5. Continued.

Community	Population (1980 census)	Reported harvest	Estimated harvest	Comments
Selawik	628[a]	6	30-50	Moose hunting begins in August.
Shungnak	202	2	25	Average village harvest.
Point Hope	Unknown	0	5 (max)	ADF&G estimate; moose are scarce in the area hunted by Point Hope residents.
Totals		63	280-450	Harvest by Unit residents only.

[a] Census performed by Wilbur Skin.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 24

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

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

The moose population in the Koyukuk River lowlands in the southern third of Unit 24 is high, and observed densities ranged from 1.0 to 3.3 moose/mi^2. The population appears stable. On the Kanuti Flats portion in the Kanuti Controlled Use Area, moose density is very low (approximately 0.3 moose/mi^2). Populations are stable in the Alatna Hills but they are declining throughout most of the area. In the portion of Unit 24 lying north of Bettles (including The Gates of the Arctic National Park), the moose population is at a moderate level. Densities range from 0.9 to 1.5 moose/mi^2, and moose numbers are increasing.

Population Composition

Five composition surveys were flown during October 1983 in the central and northern portions of the unit. Due to low moose densities, survey data from within the Kanuti Controlled Use Area were combined for analysis (Table 1). Four trend areas in the Koyukuk Controlled Use Area (Dulbi Slough, Huslia River flats, Huggins Island, and Treat Island) were flown in November 1983.

Survey results from the Kanuti Controlled Use Area indicate that a good calf:cow ratio exists. However, yearling bulls comprised only 2% of the herd, which suggests poor overwinter survival of yearling bulls. The Fish Creek survey (east of the Haul Road) indicated fair recruitment, adequate bull:cow ratios, and fair density for an area with light but increasing hunting pressure. The Koyukuk area is similar to adjacent Subunit 21D, where moose populations along the river are dense but calf:cow ratios are low.

Mortality

During a split season, 120 moose were reported taken from Unit 24. Hunters took 111 during September and 9 in March. The moose

reported taken in March may have been taken throughout the winter. In addition, an estimated 35 moose were taken but not reported. The number of moose taken (26) along the Haul Road was double the 1982-83 harvest; the harvest has been doubling yearly as access on the road has increased. Within The Gates of the Arctic National Park, the reported subsistence take was 1 moose from the John River. The unreported harvest by Anaktuvuk residents is unknown.

Management Summary and Recommendations

Trend areas were established in the central portion of Unit 24 and should aid in future management efforts. The Koyukuk Controlled Use Area should be maintained to keep the moose harvest at its present level. The increase in hunters using the Haul Road should be monitored and more trend areas established along the road.

Within the Kanuti Controlled Use Area, management options to increase the moose population should be initiated. Mortality is currently estimated at 17-20% of the population and exceeds the estimated 6% recruitment rate.

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Table 1. Composition of moose in Unit 24, October-November 1983.

Area	Bulls: 100 cows	Percent yrlg. bulls	Calves:100 cows >2 yrs	Percent calves	Density	Area (mi^2)	Sample size
Dulbi Slough	17	5	36	22	2.9	39.0	113
Huslia River	36	4	25	15	2.6	80.1	212
Huggins Island	85	9	18	7	1.0	51.8	54
Treat Island	51	8	23	12	3.3	35.9	118
Kanuti Controlled Use Area	30	2	63	31	0.3	145.6	44
Fish Creek	41	6	53	23	0.8	37.0	34

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 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose surveys were done only in Subunit 25D (West). This area is west of Birch Creek and the Hadweenzic River and was given priority over the remainder of the unit because the moose population is critically low and may be declining. A fall survey was done in cooperation with U.S. Fish and Wildlife Service to estimate the population size and to establish new trend areas.

Population size was estimated by first stratifying the area (6,740 mi^2) into 10-20 mi^2 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 $\geq$ 4 minutes/mi^2. Blocks surveyed in the high and medium strata will be resurveyed in future years to measure population trend.

The moose population in western Subunit 25D was estimated to be 805, at an average density of 0.1 moose/mi^2. Previously, the population was estimated to be approximately 1,700. It became apparent when the stratification was completed, that the previous estimate was biased because earlier surveys had been done mostly in the medium and high density strata, with inadequate representation of the low density areas.

Population Composition

Composition information is available for Subunit 25D (West) only. Observations made while estimating the population size were pooled to generate fall composition data. Also, a composition survey was conducted in late winter by subjectively searching favorable habitat and by relocating and observing 20 radio-collared moose.

Survival of moose to 18 months of age was good (Table 1). Calf survival during the 1st 6 months of life was excellent. Comparison of early and late winter calf survival data suggests that most calf mortality occurred during winter. There appeared to be almost equal numbers of bulls and cows in the population during fall. This was probably due to a substantial illegal kill of cows.

Movements of radio-collared moose in Subunit 25D (West) indicated that 2 distinct populations exist in the area. One group was found in a relatively small area along the Yukon River corridor between Beaver village and the lower mouth of Birch Creek. The other group occupied the remainder of Subunit 25D (West). The 2 groups were dissimilar in several ways: (1) moose density in the river corridor was 0.2/mi^2, while outside it the density was 0.1/mi^2; (2) within the corridor, moose were nonmigratory, but outside it at least half the animals migrate between the Yukon Flats and surrounding uplands; and (3) calf survival to late winter 1984 within the corridor was much greater (27% of the herd) than outside (9% of the herd). Moreover, analysis of composition data from the past 4 years indicated that calf survival to fall was consistently higher inside the corridor (31% of the herd) than outside (22% of the herd). Similarly, moose survival to 18 months of age was greater inside the corridor (17%) than outside (10%).

Mortality

Reliable mortality information is unavailable for most of Unit 25. At least half the total 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 137 (42%) of the 341 reporting hunters killed a moose (Table 2). The reported harvest and the total number of hunters was greater than in 1982 by 19 and 22, respectively. Most of this increase was due to improved reporting in Subunit 25D (West) where the hunt was changed to registration permit in 1983. Prior to implementation of the permit system, there was virtually no reporting by local hunters.

Subunit 25D had the largest harvest (40), with a moderate success rate (33%). The harvest was somewhat smaller in Subunit 25A (33); however, it had the highest success rate (64%). Subunit 25C had the lowest harvest (26) and the lowest success rate (20%).

Airplanes and boats provided transportation for 39% and 52%, respectively, of successful hunters in Unit 25. Road access is not available except in Subunit 25C.

Progress was made toward quantifying sources of mortality in Subunit 25D (West). Survival and productivity of 20 radio-collared moose was monitored, an improvement of harvest reporting was accomplished through implementation of the registration permit hunt, and a wolf survey was completed for the 2nd consecutive year.

Hunting and wolf predation were the 2 most important sources of mortality. Hunters harvested 20-35 moose, or approximately 4% of the fall population. This total included 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. There were 7 packs in western Subunit 25D with a fall population of about 53 wolves. The moose:wolf ratio was probably 15:1. The high rate of calf survival during summer months suggested that bear predation was not a major source of mortality.

Some differences in wolf predation existed between the 2 moose populations in Subunit 25D (West). Only 1 pack preyed upon the population in the Yukon River corridor between Beaver village and the lower mouth of Birch Creek. The moose:wolf ratio of this area was 25:1. The other 6 packs preyed upon moose in the remainder of the area, which had a moose:wolf ratio of 13:1. This difference in predation pressure is reflected in higher calf survival to late winter and higher yearling survival to fall for the river corridor than for the remainder of the area.

Management Summary and Recommendations

Moose density is low in most of Unit 25, and population trends vary from stable to declining. 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 significant management actions are taken. Those actions should be specified, along with population and user objectives, in a formal management plan. Sufficient information about the moose population has been collected to proceed with this effort. However, public opinion on various objectives must be solicited through meetings and questionnaires.

The management actions required to rehabilitate the moose population in Subunit 25D (West) include: (1) continuation of the registration permit hunt to restrict harvest and encourage reporting; (2) reduction in illegal kill by expanding the law enforcement effort; and (3) reduction of the wolf population by 50-80%.

Survey effort should be shifted during the coming year from Subunit 25D (West) to other areas of Unit 25. Priority should be given to Subunit 25D (East), because communities in that area are heavily dependent upon the surrounding moose population, and to Subunit 25A, because no surveys have been conducted there for 2 years.

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Table 1. Moose sex and age ratios for Subunit 25D (West), winter 1983-84.

Date	Bulls: 100 cows	Calves: 100 cows	Twins: 100 cows w/calves	Percent calves	Percent yearlings	Sample size
Nov 83[a]	93	72	33	27	20	79
Apr 84	--	--	--	15	--	99

[a] Data supplied in part by U.S. Fish and Wildlife Service.

Table 2. Residency of successful moose hunters in Unit 25, fall 1983.

Subunit	Local resident	Nonlocal Alaska resident	Nonresident	Unspecified	Total harvest
25A	4	14	14	1	33
25B	11	23	0	0	34
25C	2	20	1	3	26
25D (West)	12	0	0	1	13
25D (East)	17	6	1	3	27
Unspecified	0	3	0	1	4
Totals	46	66	16	9	137

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26A

GEOGRAPHICAL DESCRIPTION: Western Arctic Slope

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

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. Occasional animals 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.

Aerial surveys covering all of Unit 26 were conducted in 1970, 1977, and 1984. Coady (1981) reported that about 1,500 moose were observed in 1970 and 1977 and that distribution patterns were similar in both years. The results of my 1984 survey, when combined with those of 1984 surveys conducted in Subunits 26B and 26C, reveal a unitwide increase to 2,329 moose. In Subunit 26A, 1,429 moose were observed in the 1984 late winter counts. Nearly all of these animals were in the Colville River drainage. Counts on the Colville from 1970, 1977, and 1984 are compared in Table 1. The 1984 count indicates an increase of 161 moose (13%) since 1977. The extent to which this increase is due to differences in survey conditions and methodology is not known. However, moose on the Colville River and its tributaries are probably slightly more numerous than in 1977.

Conditions for observing moose during the 1984 counts were generally excellent. All known wintering areas in the subunit were intensively surveyed. Drainages known to have very low moose density were not flown in 1984. The 1,429 moose counted throughout Subunit 26A are a minimum population estimate, and no sightability index was calculated. Based upon previous experience and that of other observers, I believe that at least 89% of the moose in Subunit 26A were actually observed. Thus the late winter population, just before calving, numbered at least 1,429 moose and may have numbered as many as 1,786.

A trend count was included in the 1984 surveys. The trend-count area on the central Colville includes the best known wintering habitat in the subunit. The 1984 trend count revealed 756 moose, a 10% increase over the mean of 9 previous surveys conducted from 1970 to 1982 (Table 2). Trend data also suggest that for recent years moose on the Colville River and its tributaries reached a high in 1980 when 841 moose were observed, 20% of which were short yearlings. Relatively few calves survived the following winter, and by spring 1981 calves comprised only 7% of 639 moose observed. No surveys were conducted in 1982. The 1983 trend count was only partly completed; snow was rapidly melting, and counting conditions were very poor. However, 15% of the animals observed were calves, indicating that over winter calf survival had improved. The 1984 trend count indicates that population size and calf survival returned to levels observed from 1977-1980.

Population Composition

Composition surveys were flown on part of the Colville River trend-count area in October 1983. Of 188 moose, 122 were observed on the Anaktuvuk River. Composition ratios were 54 bulls:100 cows and 38 calves:100 cows. Calves comprised 20% of the sample, and 19% of the cows with calves had twins.

Of adult moose observed during fall counts, 35% were males. When this percentage is applied to the 1984 late winter count (1,429 moose), at least 502 were males, including short yearlings. Short yearlings comprised 20% (286) of the 1,429 moose observed.

Mortality

For Unit 26 as a whole, the 1983 report moose harvest (51) and the number of participating hunters (76) declined from 1982 values (Table 3); however, hunter success rate increased from 59% to 67%.

In Subunit 26A, the 1983 reported harvest and number of participants was virtually identical to the 1982 season (Table 4). Nearly 75% of hunters reported killing a moose. Of 45 hunters reporting, 18 (40%) were from the Fairbanks area, 16 (36%) were from outside Alaska, and 7 (16%) were from elsewhere in Alaska. Four of the reporting hunters (9%) lived on the North Slope.

A significant number of moose killed in the subunit were not reported nor were they taken during the traditional season (1 Sep-31 Dec). An early (1 Aug) opening which excluded use of aircraft was held on the lower Colville for the 1st time in

1983. This early opening was requested by hunters from Nuiqsut hunters was probably 20-25 moose for the extended legal season (1 Aug-31 Dec), compared to an estimated harvest of no more than 6 moose in 1982. No information on sex of kill is available.

The known harvest in Subunit 26A thus include 37 reported moose plus 20-25 unreported moose taken by Nuiqsut residents, for a total of at least 57 moose. An additional 4 moose were killed illegally during the previous 12 months, bringing the total kill to at least 61. Additional illegal or unreported moose kills can be assumed to have occurred and might bring the total harvest to as many as 81 animals. The estimated harvest (61-81 moose) represents 4-6% of the 1,429 moose observed during late winter counts.

No information on natural mortality was available for the 1983-84 reporting period.

Management Summary and Recommendations

Trend-count data on the Colville River suggest an increase in population size and calf survival since 1981. Harvest appears to be light (4-6% of the overwintering population).

Aircraft-based hunting was light during the last 2 years, perhaps because of poor fall weather on the North Slope. Increased moose hunting opportunity close to Fairbanks may have also contributed. Hunters using riverboats from Nuiqsut appeared to have killed substantially more moose in 1983 than in 1982. The apparent increase was probably due to a new, earlier season opening for hunters using ground transportation on the lower Colville River.

Although hunting pressure appears light at this time, maximum allowable harvest has not yet been determined for Subunit 26A. The effect of hunting on moose in specific drainages is also unknown. The Colville River system from Killik Bend to Nuiqsut is relatively heavily hunted. Other areas receive almost no pressure. Because moose appeared in the subunit in large numbers only recently and are at the northern limit of their range in North America (Coady 1980), the impact of hunting must be carefully evaluated.

The proliferation of special-interest moose hunting seasons designed to liberalize harvest restrictions in the subunit is a recent complication. The 1st of these was the early opening for riverboat hunters on the lower Colville River. Beginning in 1984, special seasons and bag limits will also be in effect for moose in Gates of the Arctic National Park. Moose hunters using aircraft in the subunit have recently requested earlier

opening dates to avoid bad fall weather. Pressure from this quarter of the hunting community will probably continue. There is thus a growing need to standardize hunting seasons in the subunit while meeting the diverse needs of subsistence and recreational hunting styles. Efforts to meet these demands must be consistent with the ability of the population to produce a harvestable surplus.

An assertive moose management program should recognize and attempt to perpetuate the special characteristics of moose hunting that are identified with the subunit. Both subsistence and recreational hunting styles should be considered. During the 1983 moose seasons, hunter distribution and activity was observed on the Colville River and its tributaries. A field questionnaire was developed and given to 28 aircraft-based hunters with the intent of developing reliable survey methods for full-scale use in 1984. The purpose of the survey is to more fully describe both the people who hunt moose in the subunit and the recreational experience that they have. Results of the survey pretest are attached to this report as Appendix A. Experience with the survey in 1983 suggests that a more rigorous and extensive application of the same methods should be made during the 1984 season. This effort will be directed at aircraft-based hunters on the Colville above Nuiqsut, in the vicinity of Umiat. In 1985, a separate investigation using appropriate methods will be directed toward Nuiqsut hunters, with the assistance of the Division of Subsistence. Both investigations are seen as a 1-time effort to develop an understanding of hunter methods and needs in the subunit.

The following projects are planned for completion by the next reporting period:

1. Develop a trend analysis of late-winter count data. An in-depth analysis of existing data from late-winter counts is needed, especially for the Anaktuvuk, Chandler, Killik, and Lower Colville Rivers. This analysis should include both the annual late-winter trend counts and the extended counts completed in 1970, 1977, and 1984.

2. Develop a theoretical upper limit for annual hunter harvest in Subunit 26A. This value should be available for planning and policy-making purposes and it should reflect: (a) experience gained from management and research on other moose populations in Alaska; (b) lack of knowledge about natural mortality acting on moose in the subunit; (c) data gained from previous surveys and from harvest estimates; and (d) special circumstances pertaining to a newly-established population at the northern limit of the species' range.

3. Collect and analyze descriptive data on aircraft-based recreational hunters using methods developed in 1983. The purpose of this effort is to develop a hunter profile for the Colville River and to identify special characteristics of the moose hunting experience there.

4. With the Division of Subsistence, develop appropriate methods for collecting parallel information from Nuiqsut moose hunters. These data will be collected and analyzed in FY 86. Cultural differences make field questionnaires developed for aircraft-based recreational hunters inappropriate for Nuiqsut hunters. Close coordination with the Division of Subsistence and informal field and village interviews during the 1984 hunting season will be used to develop more systematic data collection in the 1985 season.

5. Design methods for encouraging harvest reports and the purchase of hunting licenses in Subunit 26A. Few hunters in Subunit 26A currently purchase hunting licenses and few report their harvest on moose harvest reports. Estimating harvests is consequently difficult. Changing this situation requires the development of trust and understanding between local residents and the Department of Fish and Game. This is a long-term project for which increased contact between biologists and residents in a non-confrontational manner is a primary ingredient. Nuiqsut, the most active moose hunting community on the North Slope, is a logical starting point for this effort.

6. Maintain intensive surveillance of moose hunters during the 1984 season. This will entail maximizing contact with hunters on the Colville in order to collect data as described above and to minimize violations of Alaska hunting regulations by maintaining a visible presence on the River.

Literature Cited

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Table 1. Late winter moose counts for the entire Colville River drainage, 1970, 1977, and 1984.[a]

Year	Total moose	Calf % herd
1970	1,223	25
1977	1,257	21
1984	1,418	20

[a] 1970, 1977 data reported in NPRA Values and Resource Analysis, Vol. 3, 1978.

Table 2. Colville River trend counts: Anaktuvuk River, Chandler River and Colville River between the Anaktuvuk and Killik Rivers, 1970, 1974-81, and 1983-84.

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

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

Table 3. Unit 26 moose hunter success, 1977-1983.

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

Table 4. Unit 26A reported moose hunter success, 1982 and 1983.

Year	Harvest	Sex		Hunters	Success rate (%)
		M	F		
1982	38	31	7	54	70
1983	37	30	7	50	74

Table 5. Reported antler spread (in inches) of moose killed in Subunit 26A, 1983.

Unknown	20	20.0-29.9	30.0-39.9	40.0-49.9	50.0-59.9	> 60.0
11	0	1	9	4	9	3

APPENDIX A

A PRELIMINARY STUDY OF RECREATIONAL MOOSE HUNTING ON THE COLVILLE RIVER DRAINAGE SYSTEM

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Alaska Department of Fish and Game

December, 1983

INTRODUCTION

The moose ranges of Subunit 26A are remote, isolated and unique. And assertive moose management program should recognize and attempt to perpetuate the characteristics of moose hunting that are identified with the subunit. Both subsistence and recreational hunting styles should be considered, and management should proceed on the basis of the following assumptions:

1. Certain aspects of moose hunting in Subunit 26A are unique and worth maintaining;

2. Economic and social pressures are changing North Slope habitats and the way people hunt moose;

3. Not all moose management philosophies are equally desirable or compatible for the unit;

4. Moose habitat in Unit 26 is geographically discrete from other habitats, and can be managed as a unit or a collection of units;

5. Cooperative management agreements can be developed with agencies and landowners having authority over Unit 26 habitat;

6. It is possible to measure and report how hunters, landowners, and other individuals perceive the importance and special characteristics of moose hunting in the subunit.

The information in this report was collected with a field questionnaire during September 1983. The study was part of an intensive effort to observe moose hunter activities on the Colville River and its tributaries. The questionnaire is a "pretest", a dress rehearsal intended to work out problems in sampling, distribution and question design. One important limitation of these pretest results stems from the conveniently small sample of 28 hunters that was used. The results, therefore, cannot be validly generalized to all of the approximately 100 moose hunters who were on the Colville in late 1983. Valid description of all these hunters remains to be done, perhaps in 1984. Nor does this pretest study attempt to describe hunting done by "subsistence" moose hunters living in the lower Colville River community of Nuiqsut. Such a study should probably be done with methods other than field questionnaires.

PURPOSE

A. Determine if Alaskan hunters will respond positively to standard survey research methods.

B. Develop reliable survey methods for full-scale use in 1984.

C. Within the limits of a pretest with built-in sample bias, determine:

1. Who are the moose hunters on the Colville River and its tributaries (age, education, income, etc.)?

2. What are their motivations for hunting on the Colville?

3. What kind of hunt do they typically have?

a. Days afield
b. Species hunted
c. Transportation used
d. Success
e. Satisfaction
f. Approximate cost

METHODS

The population of interest was moose hunters on the Colville River and its tributaries. Residents of Nuiqsut on the lower Colville were considered to be a separate population. They were not included in this study.

One-page field (8½" x 11" folded) questionnaires were developed with the help of moose hunters living in Barrow who were known to hunt the Colville River. The questionnaires were then inserted in stamped, preaddressed envelopes. Questionnaires were distributed personally to Colville hunters at Barrow, Umiat, Colville Village, and in hunting camps on the Colville and Chandler Rivers using an aircraft (C-185). Ray Smith of Umiat assisted in this distribution. Questionnaire collection boxes were installed at Umiat and at Bettles. Hunters were encouraged to return their questionnaires to these boxes or to a department employee before leaving the hunting area. Another option for the hunter was to mail the questionnaire after he returned home.

The questionnaires were designed to be anonymous in order to minimize any perceived threat to hunters and to encourage participation on questions about education levels and annual income. Thus no follow-up or reminder letters were possible.

No attempt was made to sample the population of interest. The strategy was simply to distribute questionnaires to as many

hunters as possible. Although less rigorous than a sampling strategy, this approach does not allow the study results to be validly generalized to the entire population of hunters using the Colville River system in 1983.

RESULTS

A. Hunter Participation

Twenty-eight usable questionnaires were returned. They represent virtually a 100% response rate from the hunters who actually received a questionnaire and hunted moose on the river in 1983. (one hunter was given a questionnaire but weather prevented his hunting moose on the Colville. He did not return the questionnaire.)

Questionnaire distribution was most thorough at Barrow, Umiat, and on the Colville River itself. We were unable to get in to mountain camps on the Chandler, Ayiyak, and Ikpikpuk with a Cessna 185. There was no distribution of questionnaires at Bettles or in Fairbanks. The total number of hunters on the river system was about 100.

B. The Colville River Moose Hunter

All of the hunters in the sample were males. They ranged in age from 16 to 74 years of age with a mean of 35 years. Most commonly, these hunters were from Barrow, Fairbanks, and Anchorage (29, 29, and 21 percent of the sample respectively). Five hunters (18%) were from out of state. Three of the five were on guided hunts. Practically all of these hunters had at least a high school education. Fifty-four percent had continued beyond high school. Almost 40% held a bachelor's or higher degree.

This sample of Colville moose hunters has a considerably higher level of education than other U.S. hunters reported in the literature. For example, only 9% of Maryland turkey hunters in 1978-79 and 11% of Wisconsin deer hunters in 1977 held a bachelor's or higher degree (Donnelly and Vaske 1980).

The most sensitive of the questions asked concerned total family income before taxes. Twenty-three of the twenty-eight men in the sample (82%) did answer this question. Reported income varied from $5,000 or less at the bottom of the scale to more than $100,000 at the top end. The mean family income reported by these hunters is approximately $55,000 per year. Largely because of the Alaskan wage scale, this value far exceeds comparable income estimates for other hunters reported in the literature.

C. Characteristics of the Colville River Moose Hunt

Most of the hunters we interviewed (82%) hunted on the Colville River. Next in order of importance were the Chandler (11%), Anaktuvak (7.1%), and Ikpikpuk Rivers.

Fifty-four percent of the hunters had hunted moose on the north side of the Brooks Range before. One such hunter had nine years of previous hunting experience. The mean was four years.

None of these moose hunters hunted alone. The most common group size (model category) was 2. Because of the small sample and several large groups, the average number of hunters reported in a party was nearly 4.

Aircraft use is a distinguishing characteristic of this moose hunt. All hunters used aircraft for transportation in some way. Sixty-eight percent flew into the area by air charter or seat-fare. Nearly one-third of the sample had an airplane with them throughout the hunt. Only 7% of this sample reported actually being pilots.

Not unexpectedly, boats and rafts were popular additional means of transportation. Nearly half the sample (46%) reported using these crafts.

All the hunters queried in this sample were hunting moose but most (86%) also said they were hunting caribou. The third most popular activity (50% of the sample) was photography. Three of the twenty-eight men in the sample were hunting grizzlies as well as moose. Moose hunting was rated as most important to 7 out of 10 of the hunters questioned. Caribou hunting was rated as second in importance for 60% of the sample. Only 10% said they engaged in just one activity on the trip. These were all moose hunters.

No question in this questionnaire was asked about hunter success. But historical data from harvest reports indicate a relatively high succcess rate. The six-year mean for 1977-1982 is 67%. Reported hunter success in 1982 was 59% (Trent 1983).

Reported satisfaction is also high for Colville River moose hunters. The model category for the 6-point satisfaction scale was "excellent". Three hunters (11%) had bad experiences and rated their hunts as "poor". Fifty-four percent said the hunt was excellent. No one said his hunt was "perfect". The mean rating was 4.1 which is to say that the average hunt for moose and other species on the Colville is rated as "very good."

This level of satisfaction far exceeds any other reported in the literature for hunters in the United States. Only 25% of the Wisconsin deer hunters rated their hunts as excellent or perfect, as did 27% of Horicon Marsh (Wisconsin) goose hunters in 1978 (Heberlein and Laybourne 1978).

If a Colville River moose hunt is a relatively satisfactory experience, it is also an expensive one. Hunters in the sample were asked to estimate the total cost to them for their Colville River trip. Estimates were as low as 0 for dependents in a family group to $18,000 for one guided nonresident! Mean costs for various types of hunters are listed below:

All Residents	$\bar{x}$ =	$846	N = 23
Residents from Barrow	$\bar{x}$ =	$1,119	N = 8
Residents excluding Barrow	$\bar{x}$ =	$709	N = 15
All Non-Residents	$\bar{x}$ =	$9,800	N = 5
Guided non-residents	$\bar{x}$ =	$13,333	N = 3
Unguided non-residents	$\bar{x}$ =	$4,500	N = 2

These hunters were also asked to label the style of hunting that they were engaged in on a continuum from "purely subsistence" to "purely recreational" hunting. A 7-point scale was used for this measure. No attempt was made to define the terms "purely subsistence" or "purely recreational." All 28 hunters answered the question.

Table 1. Self-labeled hunting styles for "this particular hunt."

Scale		N	(%)
1	"Purely subsistence"	0	0
2		4	14.3
3		4	14.3
4	"About half and half"	8	28.6
5		3	10.7
6		3	10.7
7	"Purely Recreational"	6	21.4
Total		28	100.0

$\bar{x}$ = 4.54

However they defined recreational or subsistence hunting in their own minds, most of these hunters thought of themselves as a mixture of the 2 pure types. About one-fifth of the sample, including 4 of the 5 nonresident hunters, did say that their hunt was purely recreational. Forty-three percent placed themselves above the midpoint on the scale. Twenty-nine percent said that their hunt was about half subsistence and half recreational. This was the model category. The arithmetic mean, at 4.5, was also close to this point. A substantial proportion of the sample (29%) saw the hunt as being more subsistence than recreational in style. No hunter in the sample claimed to be on a purely subsistence-style hunt. Responses to this question thus indicate that most hunters saw their activity as a mixture of subsistence and recreational activity.

D. Motivations for Hunting on the Colville and its Tributaries

The hunters were asked in an open-ended question why they hunted on the North Slope. Fifty-two responses were given by the 28 hunters in the sample, just under 2 reasons per hunter. These responses were analyzed and placed into the categories reported in Table 2.

Table 2. Reported Motivations

Reason for hunting on the North Slope	Number of hunters responding	% of sample
Good moose hunting opportunities	16	57
It is not crowded; few other hunters	10	36
Social motivations: to be with family/friends	9	32
Unique terrain; scenic beauty of the area	8	29
Trying new experience; escape from daily routines	4	14
Convenience: this is closest moose population	3	11
This hunt was recommended by others	3	11

The Colville hunters most commonly said that they came to the area for its good moose hunting opportunities. Next in frequency of mention was the uncrowded nature of the area; by inference there was little competition or interference from other hunters. Just under a third of the sample mentioned social motivations. Nearly a third pointed to the beauty and open features of the Colville River country. Three of the Barrow hunters (11% of the entire sample) said they hunted there because it was the closest available moose population they had access to. All 3 guided non-residents simply said that the hunt under a particular guide had been recommended to them.

Examples of these motivational statements are:

> "The quality of the hunting. It's remote. It's quiet. It's beautiful. The moose population is very healthy."
>
> "The general hunting experience up north is unparalleled as far as availability of game, density of hunters and scenic beauty."

"I come to the North Slope to hunt because it isn't so crowded."

"Because (there are) no people. Good hunting for moose."

"I accompanied my father."

"(1) (There are) not many people in the area. (2) I eat wild meat and it is a substantial part of my diet. (3) (It is) a beautiful area. (4) People in the party are great company."

These hunters were also asked what it was about hunting on the north slope that they most wanted to see preserved. Their concerns can be organized into 3 main categories (Table 3).

Concerns about maintaining game populations are reflected in the following statements:

"Game Management and law enforcement of game violations needs to be maintained and improved."

"I doubt the area will sustain heavy hunting pressure or development without loss of present hunting."

"Don't shoot the cows."

"Keep a healthy and large herd size of game animals for subsistence and sport hunting."

Table 3. Concerns About Hunting on the North Slope

Concern	Number of hunters responding	% of sample (N = 25)
Maintain the present quality of game populations	17	68
Maintain an atmosphere of isolation and wilderness quality	13	52
Maintain sport hunting as a legitimate activity on the North Slope	3	11

Next in frequency of mention were concerns about maintaining the wilderness-like quality of hunting in this area. Some stated this concern directly such as "keep the remoteness secure; maintain the beauty of the land." Others expressed specific concerns about a build-up of trash and the impact of extensive industrial development and the more restrictive regulations or even closure to hunting that would result from development.

In the 3rd main category of concern, 3 hunters directly opposed "subsistence" hunting at least to the extent that it threatened the style of hunting that these men engaged in.

SUMMARY AND CONCLUSIONS

This survey was intended to test the applicability of survey research methods on Colville River drainage moose hunters. The results suggest that there is utility in this approach and that a more rigorous and extensive application of the survey would be appropriate in 1984. However, it is important to consider this survey as a pretest or "dress rehearsal." THESE RESULTS CANNOT BE GENERALIZED TO THE ENTIRE POPULATION OF COLVILLE RIVER AREA MOOSE HUNTERS BECAUSE OF A BIASED CONVENIENCE-STYLE SAMPLE.

However, this survey does offer a tantalizing glimpse of the people who hunt on the middle and upper Colville as well as the type of recreational experience that they seem to enjoy. A hunter in this sample was typically in his mid-thirties, male and an Alaskan resident. Nearly all held at least a high school-level education. Slightly more than half had continued their schooling beyond high school. The mean reported family income was about $55,000 a year.

A substantial income is important because hunting on the Colville is an expensive proposition. On an average, residents thought they spent nearly $850 each on this hunt. Nonresidents paid much more. All these hunters used aircraft in some way. Nearly half also employed boats or rafts as well.

The Colville River experience is typically a multiple species hunt. These men all came to hunt moose. Most also planned on hunting caribou. Three also hunted grizzly bears.

It is also a wilderness-style hunt that allows the use of motorized transport, with a minimum of regulation, interference, crowding, and competition. The area has an excellent reputation for producing game. Among the hunters who go there, most see themselves as a mixture of recreational and subsistence hunters. Over half the hunters have hunted there

before. It is not surprising, then, that reported satisfaction with this hunt is very high, higher in fact than any other similar measure in the hunting literature.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26B and 26C

GEOGRAPHICAL DESCRIPTION: Central and Eastern Arctic Slope

PERIOD COVERED: 1 July 1983-30 June 1984

Season and Bag Limit

See Hunting Regulations No. 24.

Population Status and Trend

Moose counted in Subunits 26B and 26C totaled 569 and 321, respectively, between 9 April and 5 May 1984. Moose surveys were conducted in all major and most small drainages using a PA-18 Super Cub. These data should provide good baseline estimates of total moose numbers in these subunits, as survey conditions were good to excellent. My estimates of total numbers of moose in these subunits are 600-650 (26B) and 330-360 (26C) based on knowledge of moose habitat in areas not surveyed and experience with the survey technique and survey conditions.

Moose populations in Subunits 26B and 26C appear healthy and apparently are stable or increasing slowly. Unfortunately, previous moose population data for Subunit 26B are scarce and were collected incidental to caribou surveys. Nevertheless, trends indicate that moose numbers in Subunit 26B have increased since the 1970's. Data for Subunit 26C were collected by U.S. Fish and Wildlife Service biologists and clearly indicate that moose numbers have increased substantially (29%) in the Kongakut River drainage since 1980 and remained stable in the Canning River drainage.

Population Composition

Percent total calves and percent twins found in Subunit 26B during April and early May were 20 and 17, respectively ($\underline{N}$ = 569 total moose). Comparable percentages for Subunit 26C were 13 and 5 ($\underline{N}$ = 321 total moose).

Mortality

The 1983 reported harvest for Subunit 26B was 12 (9 bulls and 3 cows). Previous Subunit 26B harvests totaled 12 in 1982, 37 in 1981, 17 in 1980, 20 in 1979, and 4 in 1978. The increased

harvest in 1979 reflected completion of the Dalton Highway and the decreased harvest in 1982 likely reflected the restriction whereby only bows and arrows may be used for hunting in the Dalton Highway corridor. Only 1 moose was shot by bow and arrow in 1983.

The 1983 reported harvest for Subunit 26C was 1 bull. Previous Subunit 26C harvests have been similar.

Alaskan residents accounted for 50% of the reported harvest in Subunit 26B and 100% in Subunit 26C. Harvest success was 65% in Subunit 26B and 33% in 26C. Unreported harvest by residents probably accounted for only a few moose in Subunits 26B and 26C.

Data on natural mortality are poor. Only 1 dead moose was observed during moose surveys in Subunit 26B in April 1984. Wolves have increased in both subunits in recent years, but are still uncommon. Their major prey species is caribou, hence moose calf mortality is not currently limiting the growth of the population.

Management Summary and Recommendations

Recruitment to the Subunit 26B and 26C moose population was approximately 115 and 55, respectively, during 1983-84. Total reported harvest was only 13 moose in these subunits, and unreported harvest was probably less than 10 moose.

I recommend that a 20 August-31 December season replace the present moose hunting season in Subunits 26B and 26C. The current restrictive hunting season is not providing for a maximum sustained opportunity for hunting moose, and restrictive seasons are not currently necessary. Objectives of a more liberal season include increasing hunting opportunity during more favorable weather conditions and protecting winter ranges from overutilization. Although browse utilization has not been measured, species diversity is low and moose are highly concentrated along river drainages during winter.

The highest annual moose harvest in Unit 26 has been 99 (1981) and, therefore, although more liberal seasons in Subunits 26B and 26C will likely attract more hunters from Subunit 26A, harvests exceeding recruitment are not expected. Continued closure of Subunit 26B within 2 mi of the Dalton Highway to bow-and-arrow hunting and within 5 mi to hunting with firearms will help protect moose viewing opportunities in and near

Oksrukuyik Creek, where 5 to 20 moose spend most of the winter and are very vulnerable to hunting.

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