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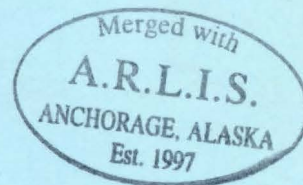
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STATE OF ALASKA

Bill Sheffield, Governor

DEPARTMENT OF FISH AND GAME
Don W. Collinsworth, Commissioner



DIVISION OF GAME
Robert A. Hinman, Acting Director

ANNUAL REPORT OF
SURVEY-INVENTORY ACTIVITIES

PART III. MOOSE

Edited and Compiled by
Joann A. Barnett, Publications Technician

Volume XIII

Federal Aid in Wildlife Restoration

Project W-22-1, Job 1.0

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(Printed March 1983)

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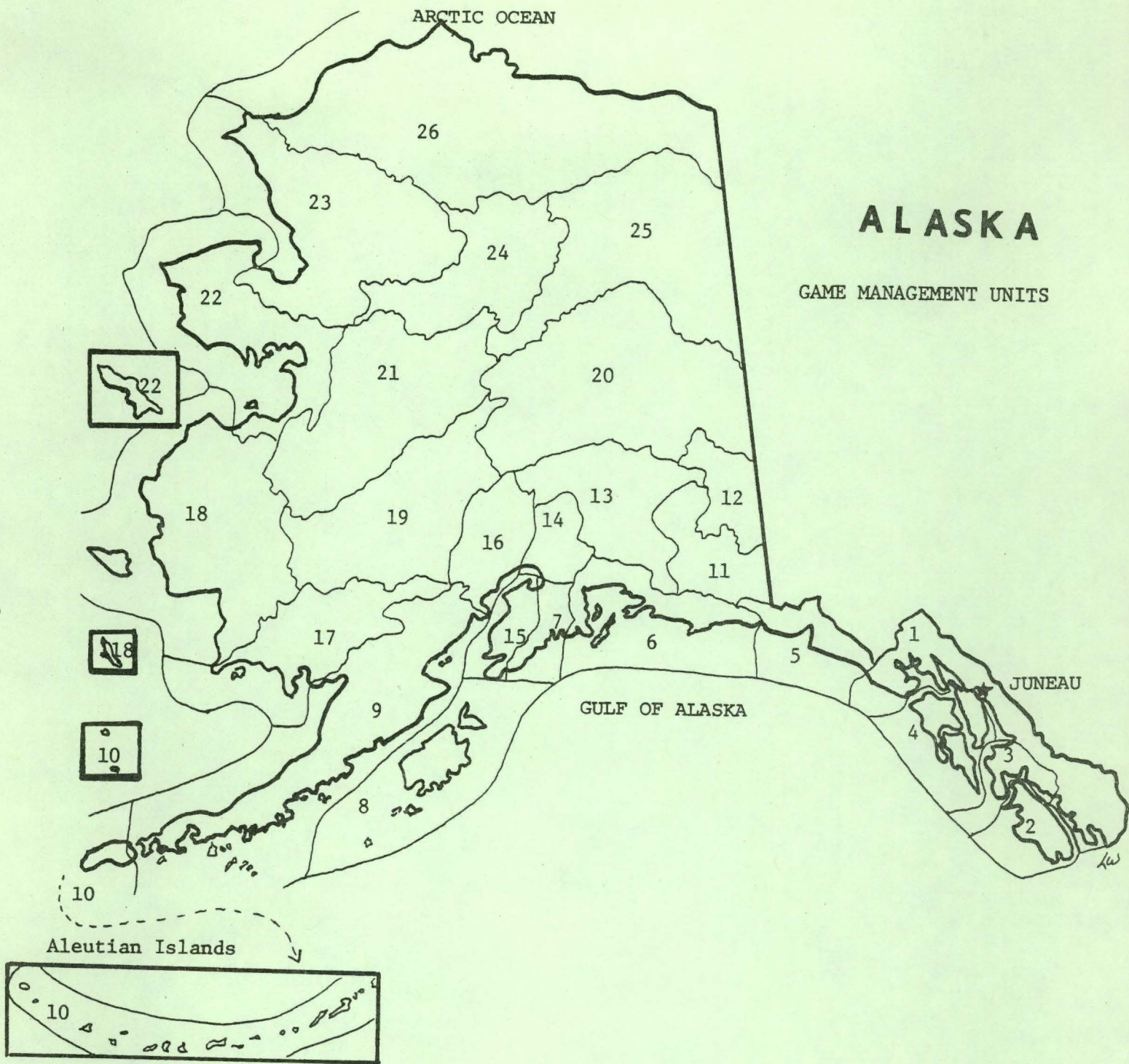
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(Printed March 1983)

CONTENTS

Game Management Unit Map.....	ii
Statewide Harvest and Population Status.....	iii
Game Management Unit/Geographical Description	
GMU 1A and 1B - Southeast Mainland from Cape Fanshaw to the Canadian Border.....	1
GMU 1C - Southeast Mainland from Cape Fanshaw to the Latitude of Eldred Rock.....	12
GMU 1D - Haines-Skagway Area.....	15
GMU 5A - Yakutat Forelands and Nunatak Benchlands.....	18
GMU 5B - Malaspina Forelands, Gulf of Alaska.....	22
GMU 6A - Katalla to Icy Bay.....	26
GMU 6B - Martin River.....	28
GMU 6C - West Copper River Delta	31
GMU 7 - Kenai Peninsula(except the Placer and Portage River Drainages.....	34
GMU 9 - Alaska Peninsula.....	36
GMU 11 - Chitina Valley and the Eastern Half of the Copper River Basin.....	43
GMU 12 - Upper Tanana and White Rivers.....	45
GMU 13 - Nelchina and Upper Susitna Rivers.....	49
GMU 14A - Matanuska Valley.....	52
GMU 14B - Willow to Talkeetna.....	55
GMU 14C and 7 - Within the Placer and Portage River Drainages.....	58
GMU 15A - Kenai Peninsula.....	60
GMU 15B - Kenai Peninsula.....	62
GMU 15C - Kenai Peninsula.....	65
GMU 16 - West Side of Cook Inlet.....	67
GMU 16B - Kalgin Island.....	70
GMU 17 - Bristol Bay.....	73
GMU 18 - Yukon-Kuskokwim Delta.....	77
GMU 19 - Middle and Upper Kuskokwim Drainages.....	84
GMU 20A - Tanana Flats and Central Alaska Range.....	90
GMU 20B - Fairbanks and Central Tanana Valley.....	94
GMU 20C - Kantishna, Cosna, and Nenana River Drainages...	98
GMU 20D - Central Tanana Valley.....	101
GMU 20E - Fortymile, Charley, and Ladue River Drainages.	107
GMU 20F - Central Yukon, Hess Creek, and Tozitna River Drainages.....	110
GMU 21A - Upper Nowitna, Iditarod, and Upper Innoko Drainages.....	112
GMU 21B - Lower Nowitna River, Yukon River between Melozitna and Tozitna Rivers.....	115
GMU 21C - Upper Dulbi River and Melozitna River Drainage above Grayling Creek.....	118
GMU 21D - Middle Yukon, Eagle Island to Ruby, Koyukuk River below Dulbi Slough.....	119
GMU 21E - Yukon River Drainage Upstream from Paimuit- Kalskag Portage, Including the Lower Innoko River Downstream from the Iditarod River, to the Mouth of Blackburn Creek.....	124
GMU 22 - Seward Peninsula.....	125
GMU 23 - Kotzebue Sound.....	135
GMU 24 - Koyukuk River Drainage North of and Including Dulbi Slough.....	140
GMU 25 - Yukon Flats; Chandalar, Porcupine, and Black River Drainages; Birch and Beaver Creeks.....	141
GMU 26 - Arctic Slope.....	147



Statewide Harvest and Population Status

Moose

Status of moose varies widely among different areas of the State. The mild winter of 1981-82, the latest in a series of mild winters in many areas, minimized overwinter mortality and resulted in some increases or population stabilization. Generally, moose were abundant in Units 14 and 16 in Southcentral, and Units 22 and 23 in western Alaska. Populations are increasing rapidly in Subunit 20A (where wolf reduction has been successful), stable or declining on the Kenai and Alaska Peninsulas, and low in many of the Interior Units.

The total reported harvest of moose in Alaska in 1981-82 was 5,909. The actual harvest may be considerably greater; compliance with regulations, particularly reporting requirements, is very poor in many Units, particularly rural areas. Units reporting the greatest harvests were as follows: Unit 13 (794 moose), Unit 14 (736), Unit 20 (667), and Unit 16 (647).

Harvest by Unit/Subunit were as follows:

<u>Unit/Subunit</u>	<u>Reported harvest</u>	<u>Unit/Subunit</u>	<u>Reported harvest</u>
1A and 1B	50	16B	519
1C	33	17	76 ^a
1D	35	18	78 ^a
5A	31	19	369
5B	27	20A	200
6A	28	20B	154
6B	60	20C	174
6C	19	20D	102
7	48	20F	27
9	180	21A	124
11	75	21B	73
12	91	21C	25
13	794	21D	179
14A	425	21E	82
14B	189	22	298
14C	122	23	176
15A	278	24	146 ^a
15B	62	25	114 ^a
15C	225	26	99
16A	122		

^a Actual harvest probably 2-3 times greater.

Robert A. Hinman
Acting Director

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1A and 1B

GEOGRAPHICAL DESCRIPTION: Southeast Mainland from Cape
Fanshaw to the Canadian Border

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Units 1A and 1B, Stikine River drainages only	Sept. 15-Oct. 15	One bull
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Unit 1B, Thomas Bay Area: from Dry Bay to Horn Cliffs (by emer- gency order closure)	Oct. 1-Oct. 6	One bull
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Remainder of Unit 1B	Oct. 1-Oct. 31	One bull
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Population Status and Trend

Moose populations in Subunit 1B have benefited from a series of mild winters. The winter of 1981-82 was a "normal" winter with snow accumulations on level areas exceeding 2 m in many portions of Subunits 1A and 1B (Boertje and Young 1982). Subunit 1A populations appear to be low and stable.

Both the Stikine River and Thomas Bay herds are heavily hunted with over 100 hunters hunting Thomas Bay during the 6-day season and over 150 hunters on the Stikine River during the 1-month season.

Although estimating numbers of free-ranging animals has pitfalls and numbers are not exact, estimates provide a means for determining trends in the population. Population estimates used in this report have not been statistically evaluated and should be considered as usable for trend purposes only. Wide variation exists depending on the method of estimation (Appendix A).

Stikine River:

A project to study the potential effects on the moose herd of hydroelectric impoundments on the Stikine and Iskut Rivers was begun in 1981 (Boertje and Young 1982). The Iskut is a Canadian tributary of the Stikine. Twenty moose (16 males and 4 females)

were captured and fitted with radio collars during the period March 11-13, 1982. The project was funded by the State legislature, and progress reports are produced annually.

A population survey of the Stikine herd was conducted utilizing the "mark-recapture" technique (Lincoln Index) March 22, 1982. The survey indicated a wintering population of 170-180 moose ($1.2-1.3/\text{km}^2$). Eighty-eight moose were sighted during the survey, and all observed animals were classified (see Population Composition).

Thomas Bay:

Assuming that hunting pressure per unit area in the Stikine River valley and at Thomas Bay are roughly equal and population composition is similar, harvest data from 5 years (1976-1980) in both areas indicate a herd of about 100 animals ($1.96/\text{km}^2$) at Thomas Bay. The mark-recapture technique was utilized in 1978 during a telemetry study of Thomas Bay (Doerr et al. 1980) and indicated a fall population of 180 moose ($3.5/\text{km}^2$). If the Stikine River winter density of $1.3/\text{km}^2$ is applied to Thomas Bay, then there are about 66 moose present. Appendix A shows various estimates of the population.

Population Composition

Population composition counts were conducted during winter 1981-1982. Personnel of the U.S. Forest Service assisted with winter counts throughout Subunit 1B, and that agency funded some of the census flights. Aerial observation of moose is difficult in the habitat types of Southeast Alaska, and the technique is not a valid means of estimating absolute numbers but provides trend data (LeResche and Rausch 1974). No counts were made in Subunit 1A because of its sparse moose population.

Stikine River:

As a part of the telemetry project, a helicopter was used to find and classify moose. Appendix B shows the results of the survey.

Thomas Bay:

A total of 65 moose were seen in December, January, and March during 9.5 hours of helicopter flying time (Appendix C). Concern has been expressed by biologists about the effects of increased hunting pressure on the male segment of the Thomas Bay herd (Young 1981).

Sighting conditions in Thomas Bay are extremely poor. The most concentrated effort consisted of 4.5 hours of observation by helicopter on March 4, 1982 during which 21 moose were seen and 81% classified by 3 Forest Service biologists (J. Doerr, pers. commun.). Sexing of animals on all surveys was based on the

presence or absence of the vulval patch (Mitchell 1970). The Thomas Bay calf:cow ratio declined from an average of 1.0 calves/cow in winter-spring 1980-81 to 0.20 in 1981-82.

Moose hunting in Thomas Bay depends heavily on recruitment of bull calves into the population. Although snowfall during 1981-82 was significant, winter conditions cannot be singled out as the major cause of mortality. Since field observations and hunter reports during the season did not indicate a scarcity of calves, the loss must have occurred after the October season. In 1980-81, 33% of the cows with calves had twins, while no twins were seen during aerial surveys in 1981-82. The 1981-82 surveys indicated an average of 14 calves/100 cows in Thomas Bay.

Mortality

Because of the concern with increasing hunting pressure and the scarcity of bulls at Thomas Bay, an emergency closure order was issued by Commissioner's announcement after 6 days to restrict the 1981 harvest to 10 bulls. Even though the season was restricted, over 100 hunters participated in the hunt. Appendix D shows the chronology of the harvest. The 10-bull quota was achieved on day 6 of the season, and hunters were notified of the closure by loudspeaker from a circling aircraft.

The harvest quota of 10 bulls was established after conferring with the Petersburg Fish and Game Advisory Committee. It was agreed that the quota was liberal enough to provide hunting opportunity, but restrictive enough to protect the bull segment of the herd from overexploitation. Two cows were shot illegally by hunters during the season.

During the 1981 Stikine River hunt, 13% of the moose were taken on opening day of the season, and 65% were killed during the 1st half of the season. Appendix E shows the chronology of the Stikine River harvest.

Moose in Subunit 1B are occasionally taken outside the principal harvest areas of Thomas Bay and the Stikine River. Appendix F shows the location by drainage of Subunit 1B kills. In the northern portion of Subunit 1B (north of LeConte Glacier), 12 bulls and 2 illegal cows were taken. In the area south of LeConte Glacier (including the Stikine River), 35 bulls and 1 illegal cow were harvested. The known illegal take amounts to 6% of the legal harvest.

Of the 10 moose harvested at Thomas Bay, 8 were recovered for aging. Seven of the 8 were yearlings (88%). On the Stikine, 24 moose jaws were obtained from hunters; 18 (75%) were yearlings. The known illegal kill of cow moose in Subunit 1B was 6% of the total bull harvest.

Either a low calf crop or high calf mortality occurred at Thomas Bay during 1981. The number of calves/cow declined from 1.0 in

1980-81 to 0.2 in 1981-82. Normal numbers of calves were reported during the hunting season by hunters, although no records were kept. Field observations of moose by biologists did not indicate low natality. Winter stress, poor habitat quality, and predation are factors which could have contributed to the loss.

Three bulls were taken from the Unuk River in Subunit 1A during 1981. This small native herd is probably limited by a lack of habitat. The Chickamin River transplant is not considered successful (R. Wood, pers. commun.). The transplant was attempted with 14 moose in 1963-64.

All moose hunters were issued a postpaid hunter report card by license vendors prior to hunting. Thirty successful hunters who hunted the Stikine responded. Of these, 13 (43%) did not respond until a reminder letter was sent. The cards indicated that 80% of the successful hunters on the Stikine River were from Wrangell, and the remaining 20% were from Petersburg. Successful hunters spent an average of 14.2 days hunting. The average maximum antler spread was 27 inches ($N = 26$). Two hunters reported spike bulls, and 4 others did not report antler width.

Nine successful hunters in Thomas Bay returned hunter report cards (90% return). Of those, 78% resided in Petersburg; the remaining 2 were from Point Baker and Ketchikan. Successful hunters spent an average of 4.6 days hunting. The average antler spread was 28 inches ($N = 6$).

Four successful hunters who hunted elsewhere in Subunit 1B reported their kills by hunter report card. The hunters spent an average of 4.5 days hunting moose. The average antler spread was 30.3 inches ($N = 3$). One spike bull was reported taken.

Of the 43 successful hunters in Subunit 1B, 2 reported using aircraft, while 40 (95%) reported utilizing boats for transportation.

Appendix G shows the Subunit 1B harvest since 1970 and the location of harvest. An average of 35 bulls has been taken each year since 1970. Besides legal hunting mortality, natural factors controlling the Subunit 1B moose population are habitat limitations; predation by black bears, brown bears and wolves; and illegal hunting. The extent of predation on the herd is unknown but has been found to be a factor elsewhere in Alaska (Ballard et al. 1980, Franzmann and Schwartz 1978, Franzmann et al. 1980) and is felt to be significant in Subunit 1B.

Blood parameters have been used in Alaska to determine physiological condition which is an indicator of an animal's ability to survive and reproduce (Franzmann et al. 1976). Moose at Thomas Bay and the Stikine River were examined during the

winters of 1977-78 and 1981-82, respectively, to determine condition. Blood samples, hair samples, and physical measurements were taken. Appendix H provides a comparison of selected mean blood values for the herds.

Management Summary and Recommendations

Moose in Subunit 1B are highly prized game animals which require careful monitoring and sound management practices to offset hunting pressure and habitat changes.

A proposed State subdivision in Thomas Bay may cause human conflicts with moose utilization of the area. Illegal hunting may also become a problem with an influx of permanent residents. The population will need careful monitoring, seasons and bag limits adjusted as necessary, and law enforcement efforts increased to ensure that a huntable herd is maintained.

A proposed dam in British Columbia on the Iskut and Stikine Rivers may alter habitat in the downstream portions of the river in Alaska. Since Stikine moose depend heavily on riparian habitat, changes in the hydrologic regime could affect moose habitat and populations. A study is underway to attempt to predict habitat changes and resulting moose population fluctuations.

Because of the decline of the Thomas Bay calf crop (14 calves/100 cows), recruitment of yearling bulls into the herd will be low in 1982. Yearling bulls composed 88% of the harvest in 1981, and aerial surveys indicated a low mature bull population in 1981 after the hunting season. A season closure is recommended for the northern portion of Subunit 1B (Cape Fanshaw to LeConte Bay) to avoid excessive harvest of bulls.

The Stikine River herd seems to be in good condition and had an overwintering calf:cow ratio of 38.0, almost 3 times that of Thomas Bay. Bull numbers are very low, comparable to Thomas Bay. Yearling bull recruitment into the herd should remain stable if hunting pressure does not increase significantly.

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APPENDIX A. Thomas Bay moose population estimates, 1976-82.

Method	Moose/km ²	Estimated pop.
a. Mark-recapture, 1978	3.4	180
b. Hunter success ratios, 1976-80	2.0	100
c. Utilizing Stikine density, 1982	1.3	66

method a.	$P = \frac{Mn}{m}$	where P = the population, M is the number marked and released, m is the number resighted, and n is the total sighted.
method b.	$P = \frac{Tp}{s}$	where P = the population, T is the Thomas Bay average harvest, p is the known population on the Stikine River, and s is the Stikine average harvest.
method c.	$P = \frac{a}{\bar{d}}$	where P = the population, a is the known area (km ²) of Thomas Bay, and d is the known density of moose in a comparable area.

APPENDIX B. Moose population composition data, Stikine River.

Date	Cows	Calves	Bulls	Calf/ cow	Bull/ cow	Calf/ adult	Total
3/11-13/82	39 (69%)	15 (27%)	2 (4%)	.38	.05	.37	56

APPENDIX C. Moose population composition data, Thomas Bay.

Date	Hours	Cows	Calves	Bulls	Unk.	Calf/ cow	Bull/ cow	Calf/ adult	Total
12/23/81	2.0	16	4	0	0	.25	--	.25	20
1/11/82	2.0	3	2	3	0	.67	1.0	.33	8
1/19/82	1.0	11	1	0	2	.09	--	.09	14
3/4/82	4.5	14	2	1	4	.14	.07	.13	21
Totals	9.5	44 (77%)	9 (16%)	4 (7%)	6	.20	.09	.19	63

APPENDIX D. Thomas Bay moose harvest chronology, October 1-6, 1981.

Day	1	2	3	4	5	6	Total
Harvest	3	4	0	1	1	1	10

APPENDIX E. 1981 Stikine River moose harvest chronology.

Sept. 15-23	Sept. 24-30	Oct. 1-7	Oct. 8-15	Total kill	Season length
17 (52%)	3 (9%)	5 (15%)	8 (24%)	33 (100%)	31 days

APPENDIX F. 1981 Subunit 1B moose harvest locations.

	Stikine River	Thomas Bay	Farragut River	Jap Cr.	Aaron Cr.	Total
Bulls ^a	31	10	1	1	2	45
Cows ^a	1	2	0	0	0	3

^a Cows were shot illegally.

APPENDIX G. Subunit 1B moose harvest locations, 1970-81.

Year	<u>Thomas Bay</u>		<u>Stikine River</u>		<u>Other areas</u>		<u>Total</u>	
	Bulls	Cows	Bulls	Cows	Bulls	Cows	Bulls	Cows
1970	12		28				40	
1971	10		25				35	
1972	5		8	18 ^a			13	18
1973	3		25	22 ^a	1		29	22
1974	4		25	1			30	1
1975	8		16		1		25	1
1976	16		21				37	
1977	13	1	19				32	1
1978	9		29				38	
1979	21		26				47	
1980	17		33	1			50	1
1981	10	2	33	1	4		47	3
Average bull harvest	10.7		24.0				35.3	

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

APPENDIX H. Selected blood values for Subunit 1B moose.

Value	Thomas Bay ^a	Stikine R. ^b	Average or ^c good condition
Packed cell volume	36.2 ± 5.9	40.0 ± 5.5	50
Hemoglobin	14.1 ± 2.2	14.7 ± 1.6	18.6
Calcium	9.9 ± 0.5	pending	10.4
Phosphorous	5.0 ± 0.9	pending	5.2
Total protein	6.4 ± 0.4	pending	7.4
Albumin	3.6 ± 0.2	pending	4.5
Glucose	139 ± 65	pending	140

^a Doerr et al. (1980). It should be noted that the Thomas Bay blood values are lower than those of the Stikine herd, although Thomas Bay moose were sampled during a mild winter (Doerr et al. 1980) when there was little snow (snow depths less than .5 m). Stikine moose were sampled during a normal winter with snow depths of 1-2 m (Boertje and Young 1982). Pending analyses will be reported during the next segment.

^b Boertje and Young (1982).

^c Franzmann and LeResche (1978).

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1C

GEOGRAPHICAL DESCRIPTION: Southeast Mainland from Cape Fanshaw to the Latitude of Eldred Rock

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 1C, except Berners Bay	Sept. 15-Oct. 15	One bull
--------------------------------	------------------	----------

Unit 1C, Berners Bay drainages only	Sept. 15-Oct. 15	One bull by drawing permit; up to 25 permits may be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.
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Population Status and Trend

Aerial surveys were not conducted in the lower Chilkat Range or Taku River areas during 1981-82. Moose population status in these areas is not fully known, but these populations are believed to be stable.

Data for the Berners Bay herd indicate this population is still experiencing poor calf recruitment. Data do not suggest significant winter calf mortality, but rather low natality rates and/or poor calf survival during the 1st 6 months of life. Range conditions and/or predation are suspected causes. In June 1981, 2 parturition counts were conducted by helicopter in Berners Bay. Of the 33 and 35 moose seen, 30% and 21%, respectively, were calves. The respective calf:cow ratios were 25 calves:100 cows and 46 calves:100 cows. Results of subsequent surveys in November 1981 and April 1982 showed 30 and 33 total moose observed with percent calves in the herd of 20 and 15%, respectively. However, ratios derived from such small sample sizes are questionable and should be used with caution.

Mortality

The reported harvest for the Taku drainage in 1981 was 23 bulls, 6 more than reported in 1980, but closely comparable to the annual average of about 20 animals for prior years. Of the 65

hunters known to have hunted Taku, the success rate was 31%. Successful hunters spent an average of 5.9 days in the field. Chronology of the harvest showed 14 bulls taken in September and 9 in October. Ten animals were killed during the 1st 7 days of the season.

For the Berners Bay moose drawing permit hunt, 19 of the 25 permittees hunted; 10 were successful for a success rate of 53%. While all hunters hunted an average of 4.9 days each, successful hunters averaged 3.8 days, and unsuccessful hunters 6.4 days.

Chronology of the harvest for the Berners Bay hunt indicated an equally divided harvest between September (5) and October (5). Four bulls were taken during the 1st 2 days of the season, the same as 1980.

In 1981, the antler widths of bulls ($N = 9$) killed in Berners Bay ranged from 24 to 47 inches, averaging 37 inches. For the previous year, the size range and the average antler widths of 4 bulls were 42 to 58 inches and 50 inches, respectively. Teeth collected during the 1980 and 1981 seasons will be sectioned and aged in early 1983. Other mortalities recorded during 1981-82 were 1 bull shot and unclaimed by an unknown hunter during the Berners Bay permit hunt, and 2 winter kills (a cow and calf together) observed in April 1982 in the upper Berners River area. The femur bone marrow condition of the cow indicated malnutrition.

Management Summary and Recommendations

The reported hunter pressure and harvest for the Taku drainage in 1981 were comparable to previous years. Since aerial surveys were not conducted in this area during 1981-82, the status of the Taku herd is not fully known. No season and bag limit changes are recommended at this time.

Data for the Berners Bay herd indicate no significant improvement in calf recruitment since January 1980. Winter calf mortality has not been significant. It appears, then, that low natality rates due to range conditions and/or poor calf survival during the 1st 6 months of life due to predation are suspected causes for low recruitment. Parturition counts, which provide baseline information to help ascertain herd productivity and to measure calf cohort level changes during the 1st year, have not been successful in Berners Bay. Leaf emergence prior to the peak calving period in June has hindered the observability of moose, resulting in small sample sizes and questionable ratios.

Since range conditions could be affecting overall herd condition, a study was initiated in 1981 to determine the relative carrying capacity of riparian winter range in Berners Bay. Vegetative data collected during the study will be used in a model being developed by ADF&G and USFWS. Major vegetation types have been

determined, and fieldwork to sample the browse production and availability within these types is scheduled for fall 1982.

Based on available survey data and winter range browse condition information, it would be desirable to maintain this herd at a lower level until the carrying capacity of the range is better understood. A reduction of the herd should include a controlled harvest of cows. Following the fall 1982 hunting season, weather permitting, a comprehensive composition count will be conducted to more fully assess the current status of the herd. Sample sizes during the 1981-82 surveys may have been too small to be usable.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1D

GEOGRAPHICAL DESCRIPTION: Haines-Skagway Area

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 15-Sept. 30

One bull

Population Status and Trend

Based on 1 winter survey, hunter reports, and general observations, the Subunit 1D moose population appears stable. However, calf production, or survival into the winter, is moderate. The estimated population is about 300-350 animals.

Population Composition

The Chilkat valley was surveyed on February 2-3, 1982, using a Helio Courier aircraft. No effort was made to differentiate sexes, although calves were recorded when observed. One hundred eighty-three moose were observed in 4.34 hours (42.2 moose/hour) with a ratio of 18.5 calves:100 adults. This is a slight decline from the total number observed (211 moose) in February 1981 and a dramatic drop in the number of moose observed per unit of time (63.4 moose/hour). It should be noted, however, that the ratio of calves:100 adults observed was almost identical for each survey (18 in 1981 and 18.5 in 1982), indicating moderate and stable production.

Mortality

Thirty-five moose (34 bulls, 1 cow) were harvested during the 1981 season. This corresponds favorably with the 40 moose/year average for the previous 6-year period (Appendix A).

An additional bull was killed illegally during December, and a yearling female was found dead (from apparent starvation) adjacent the Haines Highway. The remains of 2 additional females were discovered in late May by Commercial Fisheries personnel on the upper Chilkat River near Turtle Rock. Specific causes of death could not be determined, but natural mortality was assumed.

Cementum ages were determined for 22 of the moose harvested, averaging 4.5 years with a range from 1.4 to 16.4 years. Based on this sample, 59% of the moose killed were <4 years old; 77% were <6 years (Appendix B).

Management Summary and Recommendations

Based on the current population estimate of 300-350 animals, the harvest level is at its upper limit.

Most of the harvested bulls are relatively young while recruitment to the population is moderate and the demand for the resource is high. Based on general observations during radio-telemetry flights and hunter reports, the bull:cow ratio appears low. A strong effort will be made to obtain an accurate sex and age composition count during fall 1982.

The major problem now facing moose in the Chilkat valley is the loss of critical winter habitat due to timber harvest. Recent (Doerr et al. 1980) and on-going research (Eberhardt and Ball 1981; Ball and Eberhardt, in press) indicate that some stands of commercial grade timber are important to moose during late winter and early spring. They use the forest at this time to feed on evergreen plants and new herbaceous vegetation emerging at the bases of the trees. In addition, logging roads increase access and thus the harvest of moose in previously remote, low hunter density areas. If the current rates of habitat loss and increased access continue, it may be necessary to implement more restrictive management to severely curtail moose harvest.

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APPENDIX A. Moose harvest for Subunit 1D, 1975-1981.

Year	Male	Female	Unk.	Total	No. Hunters	Success Ratio (%)
1975	25	0	1	26	300	8.7
1976	36	18 ^a	1	55	430	12.8
1977	30	0	1	31	202	15.3
1978	44	1	0	45	293	15.3
1979	38	0	1	39	192	20.3
1980	48	0	0	48	342	14.0
1981	34	1	0	35	315	11.1

^a A 2-day either-sex hunt was conducted during the regular season.

APPENDIX B. Cementum age of 22 moose harvested in the Chilkat valley, 1981.

	Age class (years)								
	1.4	2.4	3.4	4.4	5.4	6.4	7.4	8.4	16.4
No. moose	1	6	6	3	1	2	1	1	1

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5A

GEOGRAPHICAL DESCRIPTION: Yakutat Forelands and Nunatak
Benchlands

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit:

Unit 5A, except Nunatak Bench	Oct. 15-Oct. 18	One bull
Unit 5A, Nunatak Bench	Nov. 15-Dec. 31	One bull by registra- tion permit; up to 10 bulls may be taken.

Population Status and Trend

An intensive sex and age composition count of the Yakutat Forelands, from Yakutat Bay to Dry Bay, was conducted during December 1982, using a Piper PA-18-125 aircraft. Flights were conducted daily December 8-10 and again on December 12 and 14. Overall, survey conditions were fair to good, with 6 to 8 inches of fresh snow at the start of the survey and additional light snow prior to subsequent flights. Visibility was also good during most of the flights; however, flat light and turbulent winds during 1 flight necessitated a resurvey of the area resulting in a higher count during the 2nd flight. Final survey results were modified to reflect this resurvey. Accuracy was considered good since both the observer and the pilot have flown this same survey for the past 3 years.

This survey yielded the highest total count since the major decline of the early 1970's. Four hundred and two moose were observed in 15.8 hours of survey time (Appendix A). The 25.4 moose/hour observation rate compares favorably with that of recent years as does the ratio of 26.7 calves/100 calves.

A sex ratio of 28 bulls/100 cows was observed during the survey. This compares favorably with past survey results but is probably not an accurate representation of herd composition. Twenty-six percent ($N = 24$) of the 93 bulls observed had only 1 antler. Given this high incidence of shedding, it is probable that a small percentage of the males in the herd were misidentified as females because they had already dropped both antlers. The result would be an underestimation of the bulls:100 cows ratio. No survey was conducted on the Nunatak Bench this report period.

Mortality

Yakutat Forelands:

The 1981 moose season was a 4-day, bulls-only, open hunt, with no upper limit on the number of bulls that could be harvested. This was the 2nd consecutive season utilizing this hunt design; the pressure, harvest, and distribution remained basically the same. Based on hunter report returns and field interviews, 27 bulls were harvested by about 180 hunters for a success rate of 15%.

In addition, 2 predator kills of undetermined sex and age were observed in the Dangerous River drainage; a large adult bull was also found dead of what appeared to be natural causes at Summit Lake near Yakutat.

Nunatak Bench:

Twelve persons reported hunting on the Nunatak Bench for a combined effort of 41 man-days, averaging 3.4 days each and ranging from 1 to 6 days of hunting. Only 4 bulls were killed for a success rate of 33%. This low harvest is once again the result of moose remaining on the high summer grounds until after the season closes. No nonsport mortality was recorded for the report period.

Management Summary and Recommendations

Yakutat Forelands:

The Forelands moose population appears to be increasing. Recent winters have been mild; mortality directly attributable to weather has been correspondingly low. Based on recent aerial surveys, the current population estimate is 650-700 moose. The current sport harvest of about 5% can be safely increased.

Originally, the 4-day hunt was designed to yield a harvest of about 40 bulls, but after 2 years, the kill has remained below 30 animals. Using this harvest rate and pending an adequate sex and age composition count, the season should be liberalized to provide for increased harvest.

The most efficient way to achieve this would be to conduct a registration hunt with an upper limit of 50 bulls. This would allow maximum hunter participation while providing good control over the harvest. Using the current population estimate, the herd could easily sustain a harvest of 50 bulls. In addition, a limited cow harvest should be seriously considered in the near future to help keep the bull:cow ratio in proper proportion.

Nunatak Bench:

The Nunatak moose population is considered stable. Despite a late and lengthy season, the desired level of harvest (10 bulls)

was not achieved. To accomplish this management goal, the following changes in the season and bag limit should be made. First, the bag limit should be changed to include cows, while retaining the upper harvest limit of 10 animals. Secondly, the season should be lengthened into mid-winter when snow accumulation should be sufficient to force moose down off the bench, even in mild winters, to more accessible coastal areas.

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APPENDIX A. Subunit 5A moose sex and age composition, Yakutat Forelands, 1978-1981.

Date	Lg. males	Yrlg. males	Total males	Female w/0	Female w/1	Female w/2	Total females	Total adults	Lone calves	Total calves	Unk. Age/ Sex	Total sample	Count time (hours)
12/78	--	--	50	109	18	7	134	184	7	39	6	229	7.40
12/79	--	--	20	50	12	1	63	83	1	15	0	98	3.65
3/80	--	--	--	--	15	5	--	73	0	25	2	95	2.80
12/80	--	--	19	15	5	3	23	42	0	11	0	53	2.25
12/81	54	39	93	188	46	9	243	336	1	65	1	402	15.78

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5B

GEOGRAPHICAL DESCRIPTION: Malaspina Forelands, Gulf of Alaska

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Oct. 31

One bull by permit only;
up to 25 bulls may be
taken. See 5 AAC 81.055
and separate permit hunt
supplement.

Population Status and Trend

Based on a fall sex and age composition count (Appendix A), hunter reports, and interviews, the Malaspina Forelands moose population appears to have expanded in recent years.

Population Composition

A fall sex and age composition survey was conducted between Sitkagi Bluffs and Bancas Point on December 7, 1981, using a Piper PA-18-125. Fresh snow, good light, and calm winds combined to make good survey conditions. One hundred thirty-four moose were observed in 3.12 hours of survey time. Composition was 21 bulls (5 yearling, 16 older bulls), 88 cows, and 25 calves. Overall, this survey produced the best results obtained for this count area in recent times (Appendix A).

Mortality

The sport harvest of 27 moose (26 bulls, 1 cow) during this report period was a 79% increase over the 15.1 average kill for the previous 12-year period. One cow was killed illegally and forfeited to the State.

One hundred nineteen persons registered for the bulls-only hunt, but 34 (29%) did not hunt. The 85 who did hunt spent a total of 297 man-days in the field. The successful hunters averaged 3.3 days (range 1-12) per kill, while unsuccessful hunters averaged 3.6 days (range 1-8) in the field.

No nonhunting mortality was recorded for this report period.

Management Summary and Recommendations

For the 1st time in 12 years, the management goal of a 25-bull harvest was achieved for this area. Based on analysis of permit

returns and the chronology of the kill, the increase in harvest can be attributed primarily to the extension of the season from 1 to 2 months in 1981. Hunting pressure increased only slightly, while the harvest was well distributed throughout the entire season.

Inclement weather, due to the strong maritime influence of the Gulf of Alaska, has historically affected hunter mobility and access during the early fall season. By extending the season, we have increased the opportunity for sportsmen to plan their hunt or at least modify their plans to take advantage of breaks in the fall equinox storms.

Although the moose population appears to be doing well in Subunit 5B and hunter success is rising, it may be necessary to reduce the allowable harvest. Several factors are operating that will probably make this necessary unless the State can elicit some change.

First, the land status and land managers have changed and consequently so have the resource use regulations. In that portion of the Forelands currently included in Wrangell-St. Elias National Park, sport hunting has been restricted to 1 small section classified as "preserve," while "subsistence" hunting by local residents can take place anywhere within the park. This sounds workable at first but is actually more complicated. Ninety percent of the traditional subsistence hunting has occurred in the area that was designated as preserve, because of its accessibility by boat. Most sport hunting by nonlocals, on the other hand, has generally occurred from Alder Stream westward in an area that is now closed because of park designation. The result of this reclassification of the land appears to be a compression of hunting pressure into 1 small area, causing heavy pressure on just a portion of the moose herd.

Secondly, the portion of Subunit 5B that stretches west-northwest from Yana Stream to Point Riou in Icy Bay is slated to be transferred to the Chugach Native Corporation, making it private land. This segment of land supports a substantial portion of the 5B moose population and is the area where much of the "sport" hunting for moose has traditionally occurred. At this point, it is still public land and open to hunting; however, if in the future, access is shut off by the new land owners, the park/preserve problem will be aggravated by a further compression of hunting pressure.

Based upon this land ownership pattern and the probability that significant modifications in the land status and Federal resource use regulations will not occur in the near future, a reduction in the allowable harvest will probably be necessary.

The moose hunt should continue to be conducted as a registration hunt until the land status changes favorably. The moose population should be closely monitored, and a complete population estimation made in the area designated preserve to aid in determining the maximum allowable harvest on that segment of the moose herd.

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Appendix A. Moose composition counts, Malaspina Forelands-Sitkagi Bluffs to Bancas Point.

Date	Bulls		Adults			Total adults	Total calves	Total moose	% Calves in herd	Count time (hour)	Moose/ hour
	Lg	Sm	w/0	w/1	w/2						
3/61	--	--	--	--	--	--	--	40	--	1.7	23.6
2/12/79	--	--	--	--	--	--	--	47	--	1.8	26.1
2/14/80	--	--	--	--	--	49	7	56	12.5	1.8	31.1
2/24/81	--	--	68	4	1	73	6	79	8.2	2.6	30.4
12/17/81	16	5	65	21	2	109	25	134	22.9	3.1	43.2

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6A

GEOGRAPHICAL DESCRIPTION: Katalla to Icy Bay

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Dec. 31

One moose by registration permit; up to 20 antlerless moose may be taken. See 5 AAC 81.055 and separate permit hunt supplement.

The conditions outlined in the 1981-82 permit hunt supplement were as follows:

Moose Hunt 950

1. Permits were available at the Cordova Fish and Game office from August 3, 1981 throughout the season.
2. Harvest was restricted to 30 bulls and 20 cows.
3. Successful hunters were required to report their kill within 5 days to the Cordova Fish and Game office.

Population Status and Trend

Sufficient data were not available to determine current status or trend of moose in Subunit 6A.

Population Composition

No data were available.

Mortality

The 1981 moose harvest in Subunit 6A was 28 animals, 22 bulls and 6 cows. Twenty-five moose were taken from the Bering River/Controller Bay herd and 3 from the Tsiu River herd. Nonresidents took 39% of the total harvest. Methods of transport were airplane (18), airboat (6), all-terrain vehicle (3), and riverboat (1).

Actual hunting pressure was unknown, but 219 permits were issued.

Management Summary and Recommendations

The harvest of 28 moose from these 2 moose herds was considered modest. The 1981 harvest was slightly less than the previous 2 years.

This was the 1st year that moose were reportedly taken from the Tsiu River herd. Guided hunters took 3 bulls west of the Tsiu River using all-terrain vehicles.

Sex and age composition surveys were not flown due to poor weather conditions. The winter was cold, but relatively snow free. Moose survival through the winter should have been good.

Liberal either-sex seasons should be maintained in Subunit 6A to encourage utilization of this resource.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6B

GEOGRAPHICAL DESCRIPTION: Martin River

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Aug. 10-Sept. 30*

One moose by registration permit; up to 35 antlerless moose may be taken. See 5 AAC 81.055 and separate registration permit hunt supplement.

* Season subject to closure by emergency order.

The conditions outlined in the 1981-82 registration permit hunt supplement were as follows:

Moose Hunt 951

1. Permits could be obtained at the Cordova Fish and Game office from August 3, 1981 throughout the season.
2. Harvest was restricted to 25 bulls and 35 cows.
3. Successful hunters were required to report their kill within 5 days to the Cordova Fish and Game Office.

Population Status and Trend

The Martin River Moose herd is 65-90 animals larger than the desired herd size of 150-175. Poor calf crops have been observed during the past 3 years.

Population Composition

A moose survey was flown December 5, 1981 in the Martin River count area. Survey conditions were excellent, and 239 moose were observed. Calf production was poor, but the bull:cow ratio was good (Appendices A, B).

Mortality

The Subunit 6B moose harvest was 60 animals: 25 bulls and 35 cows. The season was terminated September 5 by emergency order when the desired quota was taken. Actual hunting pressure was unknown, but 455 permits were issued.

Methods of transportation used by successful hunters were airboat (39), automobile (10), riverboat/canoe (7), and airplane (4). All but 3 moose were taken in August.

Management Summary and Recommendations

The 1981 harvest of 60 moose was designed to reduce the Martin River moose herd to a desired level of 150-175 animals. The objective was not accomplished as indicated by the December 5, 1981 survey. Excellent survey conditions revealed a larger moose population (239) than anticipated, plus another poor calf crop. The calves/100 females for the past 3 years have been 24 (1979), 17 (1980), and 15 (1981). Even though the Martin river moose herd is larger than desired, quality of the range is not thought to be the cause of poor calf survival. The past 3 winters have been relatively mild and have not subjected the moose population to stress.

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APPENDIX A. Subunit 6B moose sex and age composition, 1981.

Date	Large males	Small males	Total males	Females w/O	Females w/1	Females w/2	Total females	Total adults	Lone calves	Total calves	Unid. sex/ age	Total sample	Count time (hour)
12/5/81	35	21	56	136	20	2	159	215	0	24	0	239	3.0

30

APPENDIX B. Subunit 6B moose sex and age ratio data, 1981.

Date	Total males/ 100 females	Small males/ 100 females	Small males/ 100 large males	% small males in herd	Calves/ 100 females	Incid. of twins/ 100 females w/calves	% calves in herd	Survey conditions	Total sample
12/5/81	35.2	13.2	60.0	8.8	15.1	9.1	10.0	Excellent	239

MOOSE
SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6C

GEOGRAPHICAL DESCRIPTION: West Copper River Delta

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 6-Sept. 15*

One bull moose by registration permit. See 5 AAC 81.055 and separate registration permit hunt supplement.

* Season subject to closure by emergency order.

The conditions outlined in the 1981-1982 registration permit hunt supplement were as follows:

Moose Hunt 952

1. Permits were available at the Cordova Fish and Game office beginning August 3, 1981.
2. Hunting was permitted until 12 noon on September 6, 1981 and each day thereafter until the desired quota of approximately 20 bulls were taken.
3. Successful hunters had to report their kill by 5 p.m. on the same day the kill was made to the Department of Fish and Game in Cordova. Shooting hours for the following day were announced by 6 p.m. via KLAM radio.
4. Boats, airboats, or ATV's could not be used to hunt moose but could be used to retrieve an animal after 10 a.m.

Population Status and Trend

The West Copper River Delta moose herd is slightly below the desired herd size of 175-200. However, the herd is gradually increasing with the aid of reduced harvests in 1980 and 1981 and with a good calf crop in 1981. This herd should be at the desired population level by fall 1982.

Population Composition

A moose survey was flown December 22, 1981 (Appendices A, B). Survey conditions were only fair, and 138 moose were observed. The number of males/100 females was adequate, and the number of calves/100 females was good.

Mortality

Seventeen bull moose were taken in Subunit 6C during the 1981 season. This season was closed September 6 at noon by emergency order after one-half day of hunting. Actual hunting pressure is unknown, but 373 permits were issued.

Management Summary and Recommendations

Approximately one-third of the West Copper River Delta herd in Subunit 6C moved into the Martin River moose management area in Subunit 6B during spring 1979. Thus, the 1980 and 1981 seasons have been restricted to the taking of approximately 20 bulls in order to allow this moose herd to increase.

The 1980 and 1981 seasons were identical in harvest, with 17 bulls taken in one-half day of hunting.

The number of moose observed in 1981 was nearly identical to 1980; however, the increase in number of calves (27 to 35) indicated an increasing population. There was no indication of moose egressing from the area. Winter 1981-82 was cold but relatively snow free. Thus, overwinter survival should have been excellent.

Next year, the moose harvest should again be restricted to approximately 20 bulls. By fall 1982, the moose population is expected to reach the desired herd size.

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APPENDIX A. Subunit 6C moose sex and age composition data, 1981.

Date	Large males	Small males	Total males	Females w/O	Females w/1	Females w/2	Total females	Total adults	Lone calves	Total calves	Unid. sex/ age	Total sample	Count time (hour)
12/22/81	10	7	17	58	7	7	86	103	0	35	0	138	2.3

APPENDIX B. Subunit 6C moose sex and age ratio data, 1981.

Date	Total males/ 100 females	Small males/ 100 females	Small males/ 100 large males	% small males in herd	Calves/ 100 females	Incid. of twins/ 100 females w/calves	% calves in herd	Survey cond.	Total sample
12/22/81	19.8	8.1	70.0	5.1	40.7	25.0	25.4	Fair	138

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 7 (except the Placer and Portage River Drainages)

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Unit 7, that No open season
portion drained
by Resurrection
Creek downstream
from Rimrock and
Highland Creek
(including Palmer
Creek)

Remainder of Sept. 1-Sept. 10 One bull
Unit 7

Population Status and Trend

Moose surveys suggested that the number of bulls and calves:100 cows increased compared to 1980. The number of moose observed/hour has shown a downward trend since 1971; however, it has stabilized over the past 2 years.

Adequate numbers of moose are available throughout the Unit to allow for a limited bulls-only season.

Population Composition

Twelve of the 22 count areas were surveyed during 1981, and 469 moose (178 cows, 123 calves, and 68 bulls) were observed. The bull:cow and calf:cow ratios were 24:100 and 44:100, respectively. Calves made up 16% of the total moose observed, and there were 8 sets of twins/100 cows with calves. Twenty moose were observed/hour of survey time.

Mortality

Harvest reports indicated that 48 bulls were killed by 256 hunters. Hunter success was 19%. Forty-three percent of all bulls taken had an antler spread <35 inches; 7% had an antler spread >50 inches.

Transportation means for successful hunters were highway vehicles (35%), horses (29%), aircraft (17%), boats (10%), motor bikes (4%), off-road vehicles (2%), and method unknown (2%). Fifty percent of the moose harvested were taken by local residents.

Management Summary and Recommendations

Results from surveys conducted during 1981 suggested that the number of bulls and calves:100 cows has increased. However, the number of moose observed/hour of survey did not increase, indicating the moose density has probably remained stable. The harvest of 48 bulls indicated a significant increase when compared to 28 taken in 1980. Since the density of moose did not appear to increase, the higher harvest may have resulted from increased hunting effort.

Probable cause of the low density of moose is the lack of suitable winter habitat during moderate-to-severe winters and the increase in predation by wolves since the late 1960's. The U.S. Forest Service is presently engaged in research with experimental burning to enhance wildlife habitat. Approximately 240 acres were burned in 1981, and an additional 600 acres were burned in April 1982. Preliminary results indicate the prescribed burning is an effective management tool for retarding plant community succession, and if applied properly, the moose population will benefit. However, until this management tool is more widely used and/or wolf numbers are reduced (particularly in the Russian River and Juneau and Resurrection Creeks drainages), the ability of the moose population to increase is limited.

No changes in season or bag limits were recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 9

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 9A	Sept. 5-Sept. 25	One bull
Unit 9B and 9C except the drainage of the Naknek River	Sept. 5-Sept. 25 Dec. 1-Dec. 31	One moose, provided that antlerless moose may be taken by reg- istration permit only. Permits are valid be- tween Dec. 1-Dec. 31. See 5 AAC 81.055 and separate registration permit hunt supplement.
Unit 9D	No open season	
Unit 9E	Sept. 10-Sept. 20 Dec. 1-Dec. 31	One moose, provided that antlered moose must have a minimum antler spread of 50 inches or 3 brow tines on 1 side of the antlers and that antlerless moose may be taken only from Dec. 1-Dec. 31.

Population Status and Trend

The moose population in Subunits 9A, 9B, and 9C appears relatively stable while the population in Subunit 9E continues to decline as a result of inadequate recruitment. A winter reconnaissance survey in Subunit 9D revealed no significant increase in moose densities or distribution.

Population Composition

Because of poor snow conditions, fall composition surveys were limited to 3 areas in 9B (Chekok, Nakeen-Bear Creek, and Big Mountain), 3 areas in 9C (Branch River, King Salmon Creek, and the park border), the Katmai area, and 2 areas in 9E (Dog Salmon and Mother Goose).

The high bull:cow ratio in Subunit 9B (Appendix A) may be a result of the small sample size and the extremely high percentage of bulls in the Big Mountain area. Chekok Creek had 55 bulls and 35 calves:100 cows which is probably more representative of the moose composition in 9B. During fall and winter moose surveys in 9B, 577 moose were seen; 21% were calves.

The Katmai trend area traditionally has had higher bull:cow and calf:cow ratios than other areas in Subunits 9C and 9E. This was also the case in 1981, but again recruitment into the yearling age class was poor. This population sustains a small amount of illegal hunting pressure and appears to be relatively stable.

In Subunit 9E, some increase in bull:cow and calf:cow ratios was recorded, but other parameters (moose/hour and total sample sizes) suggest that the population has not yet stabilized. It is suspected that changes in bull:cow and calf:cow ratios may be the result of increasing natural mortality in the old-age cow segment. In 1977, 74% of the cows captured in the center of Subunit 9E were >7 years old. With poor recruitment since that study, the mean ages of cows probably have increased, and natural mortality may become an increasingly important factor. During winter surveys, 595 moose were observed; 12% were calves.

Mortality

Harvest reports indicated a harvest of 180 moose in Unit 9. The 1981 fall hunting season in Subunit 9E was shortened from 1 month to only 10 days, and the bull harvest dropped from 95 in 1980 to 56 in 1981. Twenty-eight cows were harvested in 1981, including 8 taken on King Salmon Creek during the 1st week of the Naknek drainage registration hunt. Because a large number of permits had been issued and travel conditions were favorable, the Naknek cow hunt was closed north of the river on December 10 by emergency order.

In Unit 9, 415 individuals (292 residents, 103 nonresidents, and 20 of unspecified residency) reported hunting moose. Thirty-six percent of the residents and 60% of the nonresidents were successful, for a combined hunter success of 40%.

Range Analysis

A browse inventory project was started on moose winter range near Pumice Creek in Subunit 9E. Percent cover and frequency of shrub species were determined by the line intercept method with 25 10 m transects on upland sites and 5 in a riparian area. Six permanent, point-centered quarter plots were established to provide future trends in stem density and height. Browse utilization (percent of current annual growth twigs that had been browsed) was measured on both line transects and on permanent plots. Qualitative assessment of current and past use of browse species was made at 103 randomly selected points. A single plant nearest each point was assessed.

Measurements of diameter at point of browsing and at the beginning of current annual growth were made; corresponding mean weights were determined from clipped twigs. Current growth twigs clipped from feltleaf willow (*Salix alaxensis*), diamondleaf willow (*Salix pulchra*), and alder (*Alnus* sp.) were air dried and shipped to the Palmer Agricultural Experiment Station for nutritional analysis. Preliminary results of the browse inventory are shown in Appendices B-E.

Data from both the line transects and the random points indicated the present use of moose browse on the study area was relatively light, with the greatest use occurring in the riparian zone. Although more extensive sampling is needed to adequately assess the condition of the winter range near Pumice Creek, the results from the preliminary sampling suggested the number of moose currently wintering in the study area is not adversely impacting the range.

Management Summary and Recommendations

The moose population in Subunit 9B appears to be relatively stable and more productive than in Subunits to the south. Winter surveys showed that calves composed 21% of the population, suggesting better calf survival than farther south. Local moose hunters continue to complain about competition from airborne hunters, and recommendations for controlled use areas will be drafted.

Although calf recruitment is low in Subunit 9C, the moose population has not suffered the drastic prolonged decline witnessed in Subunit 9E. Trend areas in 9C should be surveyed annually when snow conditions permit.

Poor snow conditions on the Alaska Peninsula limited fall composition surveys and canceled a census of moose in Subunit 9E. Continued poor calf survival was evident during winter surveys. Only 12% of 595 moose seen in 9E were calves.

Fall harvest of bulls in 9E was further restricted in 1981 by reducing the season to 10 days. The curtailed season resulted in 42% drop in bull harvest. It is recommended that the 10-day season and 50 inches/3 brow time regulation be retained to hold down the bull harvest. Smith (1981), in a comprehensive evaluation of the 50-inch experiment, concluded, "antler size criteria can indirectly stabilize harvest by limiting take to the number of moose in the minimum legal cohort or antler class." However, with continued heavy hunting pressure, most bulls are cropped the 1st year they grow legal-sized antlers. If trophy moose management is to remain the management objective in 9E, short seasons and possibly other means of restricting the harvest will be required to allow significant numbers of bulls to survive past the 1st season or 2 after they have achieved legal size. If management philosophy is altered to emphasize maximum sustained yield, other harvest strategies will have to be employed in 9E.

In either case, hunting restrictions should remain under tight control until the population stabilizes and a realistic carrying capacity is determined for the Alaska Peninsula moose population. A high priority should be placed on completion of fall composition surveys and a census in Subunit 9E when snow conditions are favorable.

Literature Cited

Smith, C. A. 1981. A summary of results of the "50 Inch Law" moose management experiment in Game Management Unit 9E. Unpubl. rep. to the Alaska Board of Game, ADF&G files, King Salmon, AK. 17pp.

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APPENDIX A. Fall sex-age ratios of moose in Unit 9.

Area	Total males/ 100 females	Small males/ 100 females	Calves/ 100 females	Sample size	% calves in herd
9B	85	18	23	127	11
9C	42	8	20	386	12
Katmai	47	6	28	204	16
9E	28	7	25	127	17

APPENDIX B. Percent cover, frequency of occurrence, and browsing intensity determined from line transects on upland sites near Pumice Creek.

Species	% cover	% frequency	% browsing intensity	Sample size
<i>S. pulchra</i>	25.9	88	3.6	3,298
<i>S. glauca</i>	13.6	72	3.7	1,119
Decadent willow (all spp.)	3.2	88	--	--
Nonbrowse spp.	58.1	100	--	--

APPENDIX C. Percent cover and frequency of occurrence determined from line transects on riparian sites near Pumice Creek.

Species	% cover	% frequency	% browsing intensity	Sample size
<i>S. pulchra</i>	14.3	80	38.2	228
<i>S. glauca</i>	14.9	100	20.4	98
<i>S. alaxensis</i>	23.3	100	32.1	243
<i>Alnus</i> sp.	3.1	60	59.5 ^a	42
Decadent willow (all spp.)	10.0	100	--	--
Decadent alder	0.3	60	--	--
Nonbrowse spp.	41.3	100	--	--

^a Note small sample size.

APPENDIX D. Percent of plants classified into each of 4 use categories at randomly selected points in an upland area.

Species	Current use category ^a				Past use category ^a			
	1	2	3	4	1	2	3	4
<i>S. glauca</i> (<u>N</u> = 24)	83	17	--	--	66	12	21	--
<i>S. pulchra</i> (<u>N</u> = 24)	76	9	15	--	55	18	24	3

^a Use categories: 1 = <10%; 2 = 10-50%; 3 = 51-90%; 4 = >90%.

APPENDIX E. Percent of plants classified into each of 4 use categories at randomly selected points in a riparian area.

Species	<u>Current use category</u> ^a				<u>Past use category</u> ^a			
	1	2	3	4	1	2	3	4
<i>S. glauca</i> (<u>N</u> = 12)	67	33	--	--	25	67	--	8
<i>S. pulchra</i> (<u>N</u> = 11)	64	18	--	18	36	55	9	--
<i>S. alaxensis</i>	48	26	22	4	17	44	26	13

^a Use categories: 1 = <10%; 2 = 10-50%; 3 = 51-90%; 4 = <90%.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 11

GEOGRAPHICAL DESCRIPTION: Chitina Valley and the Eastern Half of the Copper River Basin

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 20

One bull

Population Status and Trend

The moose density in Unit 11 is low with no present indication of change. In a survey of the Mt. Sanford-Mt. Drum area, a biologist observed 30 moose/hour. Previous surveys in this area during the periods, 1965-72 and 1973-79, averaged 82 and 16 moose/hour, respectively.

Population Composition

One composition count was conducted during November; a sample of 81 moose was obtained. Ratios of 86 bulls:100 cows and 46 calves:100 cows were observed.

Mortality

Harvest report data indicate 210 hunters killed 75 moose during 1981. This harvest was more than in 1980 when 151 hunters took 42 moose.

Hunter success was 35.7%. Nonresidents hunters killed 11 (14.7%) moose. Aircraft was the most popular method of transportation among successful hunters followed by highway and off-road vehicles.

Management Summary and Recommendations

Reported hunting pressure and moose harvest increased in 1981. These increases were expected to occur once the Alaska National Interest Lands Conservation Act was settled and the Wrangell-St. Elias National Park and Preserve was created. This year, sport hunters could legally hunt in the newly designated preserve while local subsistence hunters could hunt both the preserve and park

areas. Although moose densities were low, harvest was similarly low and not hindering population recovery. In addition, bull:cow ratios remain high; thus, no change in season dates or bag limits was recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 12

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White Rivers

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 12, that No open season
portion along
Nabesna Road east
of Unit 11 which
includes all
drainages of Jack
Creek and Jacksina
Creek upstream to
the head of the
north branch of
Canyon Creek

Remainder of Sept. 5-Sept. 20 One bull
Unit 12

Population Status and Trend

Moose densities in Unit 12 vary considerably (0.1 moose/1.0-1.5 sq mi). Densities are high in the Tok River drainages and lower along the northern slopes of the Alaska Range, Mentasta, and Nutzotin Mountains. Moose density is lowest on the Northway and Tetlin Flats as a result of heavy wolf predation and chronic poaching.

Populations in most areas are believed stable; however, moose along the north slope of the Alaska Range appear to be increasing due to substantial wolf reductions in adjacent Subunit 20D during the past 2 winters.

Population Composition

During October 20-November 30, 21.5 hours were spent surveying moose populations in Unit 12 (Appendix A).

Bull ratios were substantially higher in eastern Unit 12 than elsewhere in the Unit. Hunting pressure in the eastern mountainous areas is extremely light, and poaching on the flats is not believed sex specific, hence the greater proportion of bulls in the population.

Calf survival to 5 months of age in the Little Tok-Tetlin River area is extremely low due to wolf predation. This moose population appears to be at or above long-term carrying capacity, however. Observed calf survival is higher in areas where browse use is lower and where moose are below carrying capacity, such as from the Kalukna River east to the Canadian border.

A moose movement and population identity study was continued during this reporting period. Of 10 cow moose equipped with radio collars in the Tok River and Dry Tok Creek drainages during November 1980 and 1981, 6 moved south into Unit 11 and Subunit 13C to calve. Thus, composition data collected in these drainages each fall reflect 2 distinct calving subpopulations with a common rutting-wintering area in Unit 12.

Habitat Conditions

A total of 1,100 plants along 11 transects were inspected for percent frequency utilization by moose. Transects were run on the Tok, Tanana, and Chisana River winter ranges. While nearly all moose were forced out of mountainous, fall habitat by deep snow, snow depths were shallow enough (18-22 inches) on lowland winter ranges to provide unrestricted movements. High densities along the Tok River produced a high browsing frequency (59%). Rates of browse use were moderate on the Tanana River near Tanacross (39%) and lower along the upper Tanana and Chisana Rivers (12%). Transects near Northway showed extremely low use (6.5%). With the exception of the Tok, Little Tok, and upper Tetlin River drainages, winter ranges are used only moderately or are grossly understocked. In the Tok drainage, *Populus balsamifera* and *Alnus tenuifolia* were browsed as were preferred willows (*Salix alaxensis*, *S. arbusculoides*, and *S. interior*).

Experimental crushing of decadent stands of mixed willow during midwinter resulted in vigorous sprouting from root crowns and horizontal stems by mid-June. Approximately 30 acres of 15-25 foot tall willows were crushed with a JD450 tractor for \$1,000.

Available browse should increase manyfold within 2 years after treatment.

Mortality

Predation is the primary mortality factor influencing Unit 12 moose populations. Grizzly and black bears and wolves are abundant. Low calf survival rates indicate high rates of predation where habitat quality is adequate. As a result of wolf population reductions in adjacent Subunits 20D and 20E, moose populations in northwestern Unit 12 are expected to increase.

Approximately 8 moose were killed by automobiles during the reporting period; 3 moose were taken by Natives for funeral potlatches. An estimated 20-30 moose were illegally taken.

Moose hunting pressure in Unit 12 in 1981 increased 24% to 354 hunters from 285 hunters in 1980. Hunter numbers were comparable to 1978 when 350 hunters reported hunting for moose in the Unit.

Ninety-one bull moose were reported taken; overall hunter success was 26%. Thus, known man-caused mortality (including road kills and potlatch moose) was 102. Including poaching losses, total human-caused mortality was approximately 125 moose.

Harvest distribution (Appendix B) has not changed significantly from 1980.

Management Summary and Recommendations

Most moose populations in Unit 12 exist at relatively low densities and appear stable. Wolf population reductions in Subunits 20D and 20E should result in increased moose numbers in adjacent areas of Unit 12.

The Tok River Operational Moose Management Plan should be implemented to protect habitat quality and moose population productivity in the Tok River drainages.

Efforts to manipulate winter range in the Tok River drainage should continue. In other portions of the Unit, persuading major land managers to tolerate natural or near-natural fire regimes is the only feasible habitat management strategy.

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APPENDIX A. Unit 12 moose sex and age ratios calculated from aerial surveys, October 20-November 30, 1981.

Area	Total bulls/ 100 cows	Small bulls/ 100 cows	% small bulls in herd	Calves/ 100 cows	% calves in herd	Moose/ hour	Total moose
North Alaska Range	45	23	12	42	22	45	58
Tok River	35	14	7	51	28	46	69
Dry Tok Creek	14	5	4	20	15	134	147
Little Tok River	27	11	8	16	11	91	228
Nabesna Road	23	3	2	13	10	21	42
Chisana River-Border	76	22	11	26	13	44	101
Nabesna-Chisana Rivers	86	16	7	28	13	45	122
Cheslina-Kalukna Rivers	116	14	6	30	12	38	107
Tetlin R.-Tuck Creek	35	9	6	16	11	54	113
Tetlin Flats	107	0	0	13	6	NA	33
Tower Bluffs	25	5	4	10	7	30	27

APPENDIX B. Number and percentage of bulls/moose harvested in major Unit 12 drainages, 1981.

Drainage	Bulls taken	% harvest
Tok	25	27
Little Tok	21	23
Tanana	11	12
Nabesna	9	10
Chisana-White		
Beaver Creek	15	16
Tetlin	2	2

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 13

GEOGRAPHICAL DESCRIPTION: Nelchina and Upper Susitna Rivers

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 20

One bull having an antler spread of at least 36 inches or at least 3 brow tines on at least 1 antler.

Population Status and Trend

The Unit 13 moose population increased slightly during 1981. With the exception of the severe winter of 1978-79, moose numbers have increased during each of the past 6 years.

Population Composition

Moose sex and age composition counts were conducted in 10 count areas during November 1981 (Appendix A).

The ratios obtained in 1980 and 1981 were similar except 23 calves:100 cows were obtained in 1980, indicating a slightly lower calf:cow ratio in 1980.

During the November counts, antler widths were also estimated to determine the composition of the male segment of the population. Bulls were classified according to antler development (Appendix B).

No age data were collected from hunter-killed moose; however, age data were obtained from moose captured during Susitna Hydroelectric Project studies. In 1976 and 1977, the average ages of tagged cow moose were 7.5 and 7.0, respectively (Ballard and Taylor 1980). In 1980 and 1981, the average ages of tagged cow moose were 9.4 years ($N = 37$) and 7.6 years ($N = 12$), respectively (Ballard et al. 1982).

Mortality

There were 794 moose killed by 3,105 hunters during the 1981 season. Nonresident hunters took 101 moose, or 12.7% of the harvest. Harvest ticket reports indicated that the overall success rate was 25.6%, up from the 1980 success rate of 19.5%.

Moose mortality during winter 1981-82 was probably greater than during the previous 2 winters. Poor body condition of moose captured in spring 1982 seemed to support this belief. Excessive snow accumulations and cold temperatures extended winter conditions 2-3 weeks, creating additional stress that may decrease calf survival.

Management Summary and Recommendations

The Unit 13 moose population appears to be increasing. In 5 of the past 6 years, mild winters were the major factor contributing to this increase. The more severe winter of 1978-79 was the exception. The 1981-82 winter was also severe enough to cause increased mortality, but data are not yet available to verify those suspicions.

The moose population is comprised of predominantly older cows and young bulls. However, the number of mature bulls present in the population is sufficient to insure adequate breeding. The reproductive capabilities of the cow segment have not decreased, as indicated by the number of calves observed with collared cows. However, should the average age of the cows continue to increase, calf production would be affected. Additionally, should the average age of the bull segment decline further, the majority of breeding would be accomplished by bulls <3 years of age. Younger bulls may be less efficient breeders, resulting in an increased calving interval and thus smaller, more vulnerable calves going into the winter.

The bull:cow ratio increased slightly this year compared to the substantial increase in 1980 following the implementation of the 36-inch minimum antler size regulation. Apparently, the major increase in number of bulls under the 36-inch regulation has been realized. Future management should be oriented toward increasing the number of older bulls in the population.

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APPENDIX A. Moose and age composition counts, November 1981.

Bulls/ 100 cows	Yrlg. bulls/ 100 cows	Calves/ 100 cows	Moose/ hour	Total sample
21.4	8.4	30	56	5,311

APPENDIX B. Classification of bulls based on antler size, November 1981.

Inches							Total
	<29 (yrlg.)	29-35	36-39	40-49	50-59	60+	
No. bulls	294	303	26	78	44	4	749

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14A

GEOGRAPHICAL DESCRIPTION: Matanuska Valley

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 20

One moose, provided that antlerless moose may be taken by drawing permit only. 150 permits will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.

Population Status and Trend

The increasing density of moose observed during composition surveys and relatively high recruitment suggest the moose population in the Matanuska Valley is increasing.

Population Composition

Composition surveys were flown in 4 of 8 historical trend areas under excellent snow and weather conditions. An additional trend area was established and flown in the vicinity of the proposed Point McKenzie Agricultural Project. Survey results are shown in Appendix A.

Mortality

Harvest ticket reports indicated 358 bull moose were killed by 2,005 hunters. The number of hunters increased by 270 from the previous season. The success rate of hunters (18%) was below the 9-year mean of 21.2%. An additional 67 antlerless moose were killed by 150 permit holders. An analysis of successful moose hunters shows 94.8% were residents, 1.7% were nonresidents, and 3.6% were of unknown residency. Successful hunters spent an average of 4.4 days hunting.

A review of the records of Department of Public Safety indicated that 72 moose were killed by highway vehicles during winter 1981-1982.

Management Summary and Recommendations

Composition surveys, flown in early December, produced some of the highest bull:cow and calf:cow ratios on record. These ratios, obtained under near ideal conditions, are believed a truer representation of the Subunit 14A moose herd than those obtained under fair to poor conditions encountered during the past 3 years. The observed bull:cow ratio of 22 bulls:100 cows was the highest recorded since 1953 with the exception of the 24 bulls:100 cows observed in 1964. The calf:cow ratio, 47 calves:100 cows, was the highest since 1968. These high ratios are believed a reflection of the mild winters during the past 3 years.

Analysis of the antler size of harvested bulls shows 78% were <40 inches; only 10% exceeded 50 inches. The harvest of predominately small antlered males is believed to indicate that hunting pressure is allowing few bulls to mature to the older age classes. If hunting pressure continues to increase, it may be necessary to consider restrictions to limit the harvest of bull moose.

The moose population is believed near or at the maximum desired. Efforts are being made to improve and expand moose habitat in the Moose Creek moose management area. But gains realized in that area will be offset by losses to expanding agricultural and residential development such as in the Point McKenzie and Fish Creek areas.

The continued disproportionate harvest of bull moose could again change the bull:cow ratio to the levels experienced in the late 1950's and 1960's. Low bull ratios can cause a large spread in the breeding period with subsequent late-born calves, which are believed highly susceptible to winter mortality. To avoid this and to help stabilize the population at its present level, the harvest of females should be increased to closely approximate the level of the bull harvest. This can best be accomplished through expansion of the present antlerless moose permit system. It is therefore recommended the number of antlerless permits be increased from 150 to 400.

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APPENDIX A. Moose sex and age ratios in Game Management Unit 14A, 1981.

Count area	Males/100 females	Calves/100 females	Incidence of twins/100 females w/calves	Animals/ hour	Sample size	Count time (hours)
1	34.3	44.2	9.6	66.6	573	8.6
5	8.3	59.4	5.6	43.5	161	3.7
7	21.3	56.9	18.1	56.4	310	5.5
8	13.1	41.3	11.8	80.6	508	6.3
McKenzie	27.6	40.2	6.1	50.3	146	2.9
Totals					1,698	27.0
Means	22.0	46.6	11.1	62.8		

MOOSE
SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14B

GEOGRAPHICAL DESCRIPTION: Willow to Talkeetna

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 30

One moose, provided that antlerless moose may be taken by drawing permit only. 100 permits will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.

*Dec. 15-Feb. 15

One moose by drawing permit only. 50 permits will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.

* A 2-week season within this period will be held by Commissioner's announcement.

Population Status and Trend

Based on the 1981 survey data, which demonstrate high calf productivity and survival and high moose density, the moose population appears to be increasing.

Population Composition

A composition survey was flown in that portion of Subunit 14B above timberline between Willow Creek-Peters/Purchase Creek, and the south fork of Montana Creek. Weather and snow conditions were considered good for this survey (Appendix A).

Mortality

A total of 126 bulls were killed by 675 hunters for a success ratio of 18.7%. An additional 21 cows were killed by 100 drawing permit holders. A late-winter permit hunt for the taking of 50 antlerless moose was held from January 29 through February 12 and 42 moose (17 bulls, 21 adult cows, and 4 female calves) were killed. Of the remaining permittees, 1 was unsuccessful and 7 did not hunt.

The average age (determined by the tooth cementum annuli method) of moose harvested during the winter permit hunt was 6.0 years for males and 7.7 for females, excluding calves. These ages compare to 7.0 and 9.6 years for males and females, respectively, harvested the previous winter. Of 18 adult females checked for pregnancy, 17 were found to be pregnant with an in utero ratio of 1.53 calves:cow. The remaining adult female had aborted.

Records obtained from the Department of Public Safety indicated that 15 moose were killed by highway vehicles during this reporting period. Observations along the Alaska Railroad tracks indicate 9 moose were killed by trains during the winter.

Management Summary and Recommendations

Composition surveys were conducted only in the alpine areas between the southern boundary of Subunit 14B and the south fork of Montana Creek. There were 887 moose classified with bull:cow and calf:cow ratios of 46.3:100 and 31.5:100, respectively. Bulls and unaccompanied cows are believed to frequent higher terrain than cows with calves, so resultant ratios may be biased toward bulls and against family groups. If this is correct, fall calf survival may be greater than the observed 31.5 calves:100 cows.

Winter 1981-82 was the 3rd consecutive winter of mild temperatures and low snow accumulation. This allowed moose to remain at higher elevations, normally considered summer range. Failure to utilize traditional low elevation winter range was reflected in the low mortality caused by automobiles and trains. The mild weather has resulted in no known winter mortality.

With relatively high recruitment, the moose population is believed to be increasing, and harvests should be increased to prevent overutilization of winter ranges. We recommend a fall either-sex season for that portion of Subunit 14B lying east of a line parallel to and 3 miles east of the Parks and Talkeetna Highways. We also recommend an antlerless drawing permit hunt for the remainder of the Subunit.

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APPENDIX A. Sex and age composition survey flown in Subunit 14B.

Males/ 100 females	Calves/ 100 females	Incidence of twins/100 females w/calves	Animals/ hour	Sample size	Survey time (hours)
46.3	31.5	12.6	140.8	887	6.3

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14C and 7 Within the Placer and Portage River Drainages

GEOGRAPHICAL DESCRIPTION: Anchorage Area

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 7, the Placer River drainages and that portion of Placer Creek (Bear Valley) outside the Portage Glacier closed area and Unit 14C within the Twentymile River drainages	Sept. 1-Sept. 20	One moose by drawing permit only. 20 permits for antlered moose and 30 permits for antlerless moose will be issued. See 5AAC 81.055 and separate drawing permit hunt supplement.
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Unit 14C Fort Richardson Management Area	Jan. 1-Feb. 28	One moose by drawing permit only. 35 permits will be issued. See 5AAC 81.055 and separate drawing permit hunt supplement.
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Remainder of Unit 14C**	Day after Labor Day-Sept. 20	One bull
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**See exceptions in 5 AAC 81.250(6), (7), (11), and (12).

Population Status and Trend

Calf production and winter survival have been at near-maximum levels during the past 3 years, mainly as a result of 3 successive 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

During aerial surveys conducted in the fall, 796 moose were counted. Approximately 45% of these moose were seen in the Fort Richardson-Elmendorf area. A ratio of 43 bulls:100 cows was

obtained, equaling the highest bull:cow ratio since Subunit-wide surveys were initiated (1966). Fifty-one calves:100 cows were also observed, comparable to the 1979-80 mean of 47 calves:100 cows.

The mean age of 47 road-killed and 30 hunter-killed cow moose was 4.3 years, clearly representing a young, growing population. Small sample size precluded compilation of meaningful age data on bull moose.

Mortality

There were 37 antlerless moose, 83 antlered moose, and 2 moose of unknown sex killed by sport hunters within the Subunit. The antlerless moose were taken under the drawing permit system from Fort Richardson and the Portage hunt areas. Twenty-five bulls were also taken from these same areas under permit, and the remainder were taken during a general open season within other portions of the Subunit. Excluding those taken on Fort Richardson, the bull harvest was 100% above the 1976-80 mean of 34 bulls. Excluding the Fort Richardson hunt, 290 persons reported hunting moose for a success rate of 30%. In the Fort Richardson hunt, 34 of 35 permittees took moose.

An additional 91 moose (approximately 30 were calves) were killed by vehicles on Subunit 14C roadways between June 1, 1981 and May 31, 1982. This compares to a mean of 74 killed on local highways during previous reporting periods from 1977-1980. The increase in vehicle-related deaths was attributable to the relative abundance of moose and the rapidly increasing number of motor vehicles on Anchorage area roadways. A significant portion of this mortality (42%) occurred during December through February when darkness and slippery roads created hazardous conditions for both motorists and moose.

The total reported mortality for the Subunit was 213 moose.

Management Summary and Recommendations

Despite substantial mortality, the population appears to be increasing slightly as a result of excellent calf production and survival. I recommend continuation of the existing open season and the permit hunts at Portage and Fort Richardson. I also suggest additional archery hunts in specified areas closed to the discharge of high-powered rifles.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15A

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 20

One bull

Population Status and Trend

Moose surveys were conducted in the 1969 burn and Mystery Creek crushed areas by the U.S. Fish and Wildlife Service. These areas are apparently providing suitable browse for moose, and the populations are increasing. However, these 2 areas total only one-third the acreage encompassed by the 1947 burn which has reached the end of its productive life as a source of browse.

There are few areas in Subunit 15A which contain good winter browse; however, mild winters since 1979 increased survival rates which have resulted in a slight increase in the overall moose population.

Population Composition

Moose composition surveys were not conducted in Subunit 15A by the Department during 1981. However, the U.S. Fish and Wildlife Service surveyed 6 of the 13 count areas and classified 576 moose. The resultant ratios were as follows: 19 bulls:100 cows, 38 calves: 100 cows, and 12 sets of twin calves:100 cows with calves. Calves represented 24% of the sample, suggesting a moderately high early-winter calf survival.

Mortality

Harvest reports indicated 1,511 hunters killed 277 bulls and 1 cow. Hunter success was 18%. Alaskan residents accounted for 97% of the successful and 99% of the unsuccessful hunters.

Reported kill locations plotted on a map (not shown) indicated the majority of the harvest came from the area burned in 1969. Sixty-three percent of all bulls taken had an antler spread <35 inches (yearlings); 6% had an antler spread of >50 inches.

Management Summary and Recommendations

The harvest of 278 moose by 1,511 hunters represents a significant increase in harvest (18%) and hunting effort (19%) when compared to 1980. When compared to historical harvest data, the

1981 harvest was the highest since 1972, the last year both antlered and antlerless moose seasons were held. The most logical reason for the increased harvest is increased calf survival, resulting from improved habitat due to the 1969 burn and a series of mild winters since 1979. However, increased public awareness of the expanding moose population in the area burned during 1969 has concentrated hunting effort in that portion of the Subunit.

In light of the overall deteriorating quality of moose habitat and the abundance of predators (wolves and black bears), it is unlikely the moose population will reach its potential population size without some form of habitat manipulation. The current level of harvest with a bulls-only season has resulted in an unbalanced ratio of bulls to cows; however, this proportion of bulls has proven adequate in several studies to assure normal pregnancy rates in females.

PREPARED BY:

SUBMITTED BY:

Ted H. Spraker
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Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15B

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 15B East, that portion of Unit 15B east of a straight line from the mouth of Shantatalik Creek, on Tustu- mena Lake, to the head of the west- ernmost fork of Funny River; east of Funny River from the head of its westernmost fork to the Kenai National Moose Range boundary eastward from Funny River to the Kenai River and west of Skilak River and Glacier	Sept. 1-Sept. 30	One antlered moose by drawing permit only; provided that antlered moose must have a minimum antler spread of 50 inches or 3 brow tines on 1 side of antler. 50 permits will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.
Unit 15B West, the remainder of Unit 15B	Sept. 1-Sept. 20	One bull

Population Status and Trend

One of 3 count areas in Subunit 15B West and 4 of 5 count areas in Subunit 15B East were surveyed in November 1981. Statistics derived from these surveys are adequate to indicate moose population trends.

Data show that recruitment of calves born in 1981 was exceptionally high in Subunit 15B West. Moderate snow conditions during the winter appeared to have resulted in high calf survival.

In contrast, reduced calf production and/or survival during the 1st 6 months of life resulted in low recruitment in Subunit 15B East.

Population Composition

A total of 129 moose was counted in Subunit 15B West during an aerial survey conducted in November 1981. Composition was as follows: 14 total bulls:100 cows, 5 yearling bulls:100 cows, and 70 calves:100 cows. The relatively low bull:cow ratios observed during this survey conform to the pattern seen in previous years. However, the number of calves (39) observed is unusually high. A total of 492 moose was also counted in November in Subunit 15B East. Composition was as follows: 78 total bulls:100 cows, 26 yearling bulls:100 cows, and 26 calves:100 cows. The high bull:cow ratio observed in this population was in part due to the antler size regulations which protect young bulls. The recruitment of calves was the lowest documented anywhere on the Kenai Peninsula in 1981.

Mortality

Hunters harvested 48 bulls in Subunit 15B West. Residents accounted for 85% (41) of the harvest. The hunter success rate was 18%. Antler spread was obtained from 45 of these bulls and can be grouped as follows: ≤ 29.9 inches (23), 30-49.9 inches (21), and ≥ 50 inches (1).

Thirty-eight of 50 permittees reported hunting in Subunit 15B East. A total of 14 bulls was killed, yielding a success rate of 37%. Mean antler spread was 56.15 inches ($N = 11$), and the largest antler spread was 63.25 inches. The primary transportation means of successful hunters were as follows: horse (7), boat (5), and airplane (2).

The extent of weather-related mortality and predation by wolves and brown bear on moose in Subunit 15B was unknown.

Management Summary and Recommendations

Recruitment of calves into the Subunit 15B West moose population improved. Subsequent high winter survival of the calf cohort should have stimulated significant population growth. This increased recruitment is apparently the result of a series of exceptionally mild winters on the Kenai Lowlands, which began in 1979. The current ratio of 15 bulls:100 cows remains at an acceptable level; no changes in season or bag limit were recommended.

The Subunit 15B East moose population appears stable. The present harvest (14) is probably an underutilization of the trophy bulls present, as indicated by the high bull:cow ratio. Therefore, an increase in the number of permits was recommended. In addition, split seasons were recommended in order to maintain the quality of this trophy hunt.

Winter and summer moose ranges in Subunit 15B continue to deteriorate due to management policies of the Kenai National Wildlife

Refuge which favor advanced forest succession. Specific recommendations for long-term moose habitat rehabilitation and maintenance were made by Division of Game staff at a U.S. Fish and Wildlife Service-sponsored planning meeting. These recommendations included the integrated use of mechanical crushing techniques, fire management, and timber management to produce a greater sustained yield of forage biomass on 600,000 acres.

It remains to be seen whether these alternatives will be incorporated into the master refuge planning document. Completion of the planning process is scheduled for late 1982.

PREPARED BY:

SUBMITTED BY:

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Leland P. Glenn
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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15C

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 1-Sept. 20

One bull

Population Status and Trend

The moose population in Subunit 15C is low. The primary reasons appear to be a lack of adequate winter habitat and predation by wolves and black bears.

Population Composition

Due to lack of adequate snow cover, surveys were not conducted over a large enough portion of Subunit 15C to compare population trend information.

Mortality

Harvest reports indicated that 222 bulls, 1 female, and 2 moose of unspecified sex were killed by 922 hunters. These data suggest that 24% of all hunters were successful. Harvest and hunting effort for 1981 are higher when compared to 1980 (165 moose taken by 708 hunters).

Fifteen of the 922 hunters (2%) who reported hunting were nonresidents; 3 killed moose. Fifty-seven percent of the bulls taken had an antler spread <35 inches; 12% had a spread $\geq$ 50 inches.

Management Summary and Recommendations

The harvest and number of hunters showed a significant increase, compared to the past 7 years. Favorable weather during the hunting season and increased calf survival during winter 1980-1981 may have contributed to the increase in harvest. A moderate harvest of wolves the previous winter may have also increased the number of bulls available to hunters.

Moose and predator (wolf and black bear) populations in Subunit 15C are thought to be similar to populations in the 1947 burn area of Subunit 15A. If so, predator control could offer short-term increases in the moose population (Franzmann and

Schwartz 1979). However, habitat improvement is needed for long-term moose population manipulation. Burning would be the most desirable habitat improvement technique, but borough, Federal, Native, and other private lands are so interspersed with State lands that burning is not feasible.

No changes in season or bag limits were recommended.

Literature Cited

Franzmann, A. W., and C. C. Schwartz. 1979. Kenai Peninsula moose calf mortality study. Alaska Dep. of Fish and Game. Fed. Aid in Wild. Rest. Final Rep. Proj. W-17-10 and W-17-11, Job 1.24R. Juneau. 20pp.

PREPARED BY:

SUBMITTED BY:

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Game Biologist III

Leland P. Glenn
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16

GEOGRAPHICAL DESCRIPTION: West Side of Cook Inlet

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 16A	Sept. 1-Sept. 20	One moose, provided that antlerless moose may be taken by drawing permit only. 150 permits will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.
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Unit 16B, except Kalgin Island	Sept. 1-Sept. 30	One moose, provided that antlerless moose may be taken only from Sept. 10-Sept. 16.
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Kalgin Island (See separate report)

Population Status and Trend

The moose population in Subunit 16A appears to be healthy and stable. The moose population in Subunit 16B has recovered from extensive winter kills experienced in the late 1960's and early 1970's.

Population Composition

Composition surveys were flown in early December in the Peters-Dutch Hills and Kroto Creek areas of Subunit 16A, and in the Susitna-Beluga Mountain, Sunflower Basin, Lone Ridge, and Redoubt Bay areas of Subunit 16B. Survey results are shown in Appendix A.

Mortality

In Subunit 16A, harvest reports indicated 192 moose (188 males, 2 females, and 2 of unknown sex) were killed by 966 hunters for a 20% success rate. An additional 30 females were killed by 150 permit hunters. A breakdown of residency of successful nonpermit hunters shows 97.9% were residents, 1.6% were nonresidents, and the remaining 0.5% were of unknown residency.

In Subunit 16B, a total of 439 moose (378 males, 60 females, and 1 of unknown sex) were reported killed by 1,345 hunters, for a 32.6% success rate. A breakdown of residency of successful hunter reveals that 86.1% were residents, 12.1% were nonresidents, and the remaining 1.8% were of unknown residency.

Management Summary and Recommendations

Composition surveys were completed in 3 of 6 count areas in the Peters-Dutch Hills region of Subunit 16A, and 479 moose were classified. The bull:cow ratio increased from 31.2 bulls:100 cows in 1980 to 43.7 bulls:100 cows. The calf:cow ratio increased from 32.6 to 40.6 calves:100 cows. The incidence of twin calves:100 cows with calves was 9.5 in 1981, versus 10.2 in 1980. There were 76 moose observed/hour of surveying.

The Kroto Creek area was also surveyed, and 184 moose were counted. The bull:cow ratio was 52:100.

The results of composition surveys indicated the moose population in Subunit 16A was healthy and increasing. The high reproductive rate and high bull:cow ratio suggested that the moose harvest could be increased.

Four traditional count areas were surveyed in Subunit 16B. Bull:cow ratios and the number of moose observed/hour in these areas were similar to 1980, with the exception of fewer moose/hour observed in the Lone Ridge area. This change was attributed to an expansion of the Lone Ridge survey area, rather than a decrease in the number of moose. The calf:cow ratio of these 4 areas combined increased substantially from 17.6 calves:100 cows in 1980 to 29.7 calves:100 cows. However, the incidence of twin calves:100 cows with calves decreased from 10.9 (1980) to 6.5 (1981).

Both hunting pressure and harvest increased for the 2nd straight year and are approaching the levels recorded in 1970-73, when 70-day seasons and 1 moose of either-sex bag limits were in effect.

Subunit 16B supports a large number of moose. Due to poor access throughout most of the Subunit, the moose herd is experiencing only a moderate harvest. We recommend increasing the antlerless moose season.

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Nicholas C. Steen
Game Biologist II

APPENDIX A. Moose sex and age ratios in Game Management Unit 16, 1981.

Count area	Males/100 females	Calves/100 females	Incidence of twins/100 females w/calves	Animals/ hour	Sample size	Count time (hour)
Subunit 16A						
Peters-Dutch Hills	43.7	40.6	9.5	76.4	481	6.3
Kroto Creek	52.1	38.5	8.8	122.7	184	1.5
Subunit 16A Totals Means						
	45.9	40.1	9.3	85.3	665	7.8
Subunit 16B						
Susitna-Beluga Mtn.	39.2	35.0	5.9	39.7	546	13.7
Sunflower Basin	43.5	20.4	3.1	98.0	539	5.5
Lone Ridge	43.0	37.2	10.4	24.5	373	15.2
Redoubt Bay	22.7	29.2	9.5	31.7	421	13.3
Subunit 16B Totals Means						
	37.0	29.7	7.2	39.4	1,879	47.7
Unit 16 Totals Means						
	39.2	32.2	7.8	45.8	2,544	55.5

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16B

GEOGRAPHICAL DESCRIPTION: Kalgin Island

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limits

Unit 16B, Kalgin Island	Sept. 1-Sept. 30	One moose by drawing permit only. 10 permits for antlered and 10 permits for antlerless moose will be issued. See 5 AAC 81.055 and separate drawing permit hunt supplement.
	Dec. 15-Feb. 26 (Hunt announced by emergency order Dec. 8, 1981)	One moose by registration permit only, provided that the season will be closed by field announcement when 30 adult cows or a total of 70 moose have been taken.

Population Status and Trend

The moose population on Kalgin Island was high. Prior to the December registration hunt, 141 moose were counted, giving a density of 6.4 moose/mi² on the island.

The Kalgin Island moose population is young and increasing rapidly. The mean age of adults in the harvest was 2.6 years; ratios of calves:100 cows and twin calves:100 cows with calves were 65:100 and 27:100, respectively.

Population Composition

A composition survey was flown on November 5, 1981. Data from this survey were compared to data from a December 1980 survey (Appendix A).

Mortality

Fifteen hunters killed 10 moose (6 males and 4 females) during the September 1981 drawing permit hunt; 203 hunters killed 70 moose (37 males and 33 females) during the emergency registration hunt that commenced on December 15 and closed on January 20, 1982.

Management Summary and Recommendations

In the late 1950's, the Department of Fish and Game released moose calves on Kalgin Island. Moose hunting commenced in 1969 and continued through the 1978-79 season. Concerns of Kenai-Soldotna residents of few moose remaining on the island and a lack of survey data led to the closure of moose hunting in 1979 and 1980. A survey conducted in December 1980 revealed 70 moose. Based on this survey, a permit drawing hunt was approved for September 1981; 10 moose were killed. In November 1981, another survey was conducted; 141 moose were observed. Biologists then examined the habitat and estimated the island could support 30-40 adult moose. Due to these findings, an emergency registration hunt was approved with a recommended quota of 70 moose or 30 adult cows. Seventy moose were harvested, of which 26 were adult cows.

Because of the rapid growth potential of the Kalgin Island moose population and the lack of predators, coupled with the difficult access and dense vegetation, a registration permit hunt was recommended for next year. A registration hunt will allow for an adequate harvest to reduce the population to 30-40 adults.

PREPARED BY:

SUBMITTED BY:

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APPENDIX A. Comparison of composition surveys between winter 1980 and winter 1981.

Date	Bulls	Cows	Calves	Total count	Bulls/ 100 cows	Calves/ 100 cows	Incid. of twins/100 cows w/calves
12/20/80	16	34	20	70	47	59	27
11/5/81	42	60	39	141	70	65	27

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 17

GEOGRAPHICAL DESCRIPTION: Bristol Bay

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 17A	No open season	One bull
Unit 17B	Sept. 5-Sept. 15 Dec. 10-Dec. 31	
Unit 17C, that portion including the Iowithla drainage and Sunshine Valley	Sept. 5-Sept. 15	One bull
Remainder of Unit 17C	Sept. 5-Sept. 15 Dec. 10-Dec. 31	One bull

Population Status and Trend

Low densities and a generally declining trend in the Unit 17 moose population have been documented in recent survey-inventory reports. Densities in most portions of the Unit are too low for standard survey techniques to provide reliable population trends. Except in Sunshine Valley, where the population appears relatively stable, none of the areas of moderate density have had sufficient data to establish population trends. General observations and reports from residents of the Unit indicated that mild winters from 1978 to 1981 may have slowed population declines in most of the Unit and that populations in some of the remote portions of Subunit 17B may have increased.

Population Composition

One fall sex and age composition count was flown in Subunit 17C. However, a Cessna 185 rather than a Super Cub was used, and results were not considered comparable to those of 1980.

Three areas in Subunit 17B, the Koktuli River, upper Mulchatna River, and the Chilikadrotna River, were surveyed for the 1st time in winter 1982. Except for the small sample along the Chilikadrotna River, winter surveys indicate relatively high calf survival (Appendix A).

Mortality

The reported harvest from 209 hunters was 76 moose (all males), a 15% decline from 89 moose reported taken the previous year. The average annual reported harvest since 1970 is 55 moose. Harvest data do not accurately reflect the true harvest level as a large portion occurs out of season and is unreported.

Of the successful hunters who reported their kills, 71% were residents, 22% were nonresidents, and 7% were of unspecified residency. Residents of the Unit took 47% of the reported moose harvest. Because residents of the Unit are responsible for nearly all the unreported kills, the actual percentage of moose taken by local residents was substantially higher.

Winter snow depths reached a maximum of 56 inches, as recorded by the Dillingham FAA weather station. While there were no indications of large losses due to winter mortality, moose appeared to be in poor condition by late April. Snow depths on many wintering areas were sufficient to induce moose to migrate closer to villages along the Nushagak River than is customary, and the incidence of poaching during March and April appeared higher than normal. The Department of Public Safety, Division of Fish and Wildlife Protection investigated 4 moose poaching incidents during these months, and 19 additional illegal kills were informally reported.

Management Summary and Recommendations

The moose season in Subunit 17A was closed during this reporting period. Residents of this Subunit reportedly took a minimum of 12 moose from the area in spite of the closure. While most residents of the Subunit are aware of the closed season, it may take several years before there is sufficient respect for regulations in this area for the closure to become effective.

The September season in the remaining portions of the Unit opened 5 days earlier in 1981, and most residents reacted favorably to the change, expressing their desire to have it open even earlier to avoid taking bulls in rut. No illegal female moose were reported taken during the September season.

A census of the major portion of Subunit 17C where most subsistence utilization occurs was planned for this reporting period but was not accomplished due to poor survey conditions. A census of this area should be the 1st priority during 1982-83.

A cooperative effort will be made between the Game and Subsistence Divisions and the Nushagak and Iliamna Advisory Committees to educate local residents about the regulatory process and the need for regulations.

PREPARED BY:

SUBMITTED BY:

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Appendix A. Results of winter moose surveys in Unit 17, northern Bistol Bay, 1982.

Area	Date	Adults			Total adults	Lone calves	Total calves	Total moose	% calves in herd	Count	Moose/ hour
		w/0	w/1	w/2						time (hour)	
Sunshine Valley	1/5/82	31	4	2	37	1	9	46	19.6	.8	57.5
Upper Mulchatna	1/13/82	32	13	2	47	0	17	64	26.6	1.1	58.2
Chilikadrotna	1/13/82	15	1	0	16	0	1	17	5.9	.5	34.0
Kemuk Mountain	1/18/82	15	4	2	21	0	8	29	27.5	.4	72.5
Koktuli River	3/29/82	34	9	1	44	0	11	55	20.0	2.1	21.4

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 18, that portion north and west of a line from Cape Romanzof to Mountain Village, and west of (but not including) the drainage of the Andreafsky River	Sept. 1-Sept. 20	One bull
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Remainder of Unit 18	Sept. 1-Dec. 31	One bull
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Population Status and Trend

Although moose densities in Unit 18 are still well below carrying capacity, populations appear to be either stable or slowly increasing in most areas of the Unit. Populations along the Yukon River and associated drainages were thought to be at higher than normal during fall; however, densities observed during late winter and spring appeared to be similar to levels observed during past winters. Populations along the Kuskokwim River and associated drainages appeared stable in number with no reported change in status from the 1980-81 report.

Population Composition

Aerial composition counts were conducted in November and December 1981 along the Yukon River from Pilot Station to Paimiut, and along the Kisaralik River (Appendix A). Because this is the 1st year the Department has conducted fall moose surveys in Unit 18, comparisons concerning composition cannot be made with past years. Due to a small sample size, inferences were not made concerning data collected from the Kisaralik drainage. Although the Yukon River population was likewise low in density (12 moose/hour), the sample size is large enough to make inferences concerning composition. Initial fecundity appears to be excellent (84 calves/100 cows). Of particular interest is the high twinning rate (54 sets of twins/100 cows with calves). Because the population was heavily hunted, the high bull:cow ratio (55 bulls:100 cows) is probably more a reflection of the

hunting practices of the local populace rather than an indication of low mortality in the bull segment. Cows and bulls are probably taken in proportion to availability, rather than just bulls as hunting regulations require.

Late-winter and spring composition counts were conducted at several locations along the Yukon River (Middle Mouth and between Russian Mission and Paimiut) and along the Eek, Andreafsky, Reindeer, and Chuilnak River drainages (Appendices B, C). The Eek River is a tributary of the Kuskokwim; Andreafsky, Reindeer, and Chuilnak are tributaries of the Yukon. Although we planned to conduct counts in neighboring Subunit 21E along the Yukon River for comparative purposes, weather and time constraints prevented our doing so. The density in all count areas was extremely low, averaging 4 moose/hour (range 0-19 moose/hour). No moose were seen during the surveys of the Eek, Reindeer, and Yukon River-Middle Mouth drainages. From a total sample of 26 adults and 19 calves, there were 42% calves and 27 incidences of twins/100 cows with calves. Because all the surveys except the Andreafsky River count were conducted in late March and early April and no bulls were observed, migration off the river by bulls and lone cows may have already begun. Thus, valid comparisons of percent calves between fall 1981 and spring 1982 could not be made. However, a decrease from 54 sets of twins/100 cows with calves to 27 sets of twins indicates that mortality among at least the twin calves may have been substantial. Because the sample sizes for the winter/spring counts are small, all conclusions concerning calf mortality and recruitment should be viewed as tentative and regarded with caution.

Results of the spring 1982 survey of the Yukon River (Russian Mission to Paimiut) are similar to results of surveys conducted in the same count area in past years (Appendix C). Although the total number of moose observed was less in 1982 than 1980 or 1981, the moose/hour observed appears to have remained relatively constant. The percent of calves observed in the herd has apparently increased. Because the 1982 count was conducted a month later than the 1980 or 1981 counts and bulls and lone cows may have already begun to disperse off the river, the figure of 35% calves in the sample may be high and not directly comparable to the 1980 or 1981 figures. The fact that no bulls and relatively few lone adults were observed in the 1982 sample would certainly lend credence to this belief. As mentioned above, the sample sizes in all these counts are small, and conclusions should be regarded with caution.

Mortality

The most significant source of moose mortality in Unit 18 was hunting. The reported harvest from the 1981 fall season was 77 bulls and 1 cow. An additional 4 moose were killed by poachers. Forty-seven moose were reported taken from the lower Yukon drainage, 26 from the lower Kuskokwim drainage, and 9 from

unknown areas. Since an unknown percentage of the actual harvest comes from illegal hunting in late winter and spring, the reported harvest of 82 moose represents a minimum estimate. The actual harvest is estimated to exceed 150 moose.

The reported kill of 82 moose is the largest harvest reported to date in Unit 18. The reported moose harvest for the 1980 season was 48, compared to 1979 (12) and the 1979 to 1978 (48). We believe that several factors contributed to this increase in reported harvest. Most local residents contend that the number of moose they observed in the fall was the highest they have seen for many years. Since we have fall composition data for only 1 year, this observation could not be substantiated. Increased compliance with the harvest ticket requirement is perhaps the most significant factor contributing to an increase in reported harvest. Department personnel have made a concerted effort in the last 2 years to increase public awareness of their reporting responsibilities. Such efforts appear to have paid off in an increased level of compliance.

Two hundred twenty-one hunters reported hunting, compared with 145 for the 1980 season, 33 for 1979, and 133 for 1978. As in past years, most of the harvest was reported to be taken by residents of Unit 18 (Appendix D). Although the harvest reported by non-Unit residents has increased in recent years (14% of the total reported harvest for 1981), we believe competition with local residents was minimal. Most of the nonlocal hunters used aircraft during the fall in the Kilbuck Mountains, an area largely inaccessible by local hunters using boats.

A complaint Department personnel commonly hear from local residents concerns increased competition from hunters using aircraft. Although the number of moose reported taken by hunters utilizing aircraft has risen in the last several years (14% of the 1981 reported harvest, Appendix E), we believe the problem is more perceptual than real. As mentioned above, most local and nonlocal hunters utilizing aircraft reported hunting in areas largely inaccessible by hunters using boats. The only area in Unit 18 with enough moose to attract hunters using aircraft and accessible by boat lies within the Kalskag Controlled Use Area, an area now off limits to aircraft.

As in past years, most of the reported harvest (81%) occurred in September (Appendix F). Between 1978 and 1981, the percentage of the harvest occurring in September has been fairly consistent, varying between 75 and 85%. Most local hunters who were serious about harvesting a moose concentrated their hunting efforts in September.

Very little is known concerning the relative significance of predation as a source of moose mortality in Unit 18. Although grizzly bears are quite common, they are most abundant in the Andreafsky and Kilbuck Mountains. Neither area supports sizable numbers of moose. Although some moose and their calves are

probably taken by grizzly bears, the extent of such predation is unknown. Although densities of wolves are extremely low in Unit 18 (a maximum of 4/year have been sealed since 1971), they tend to be sighted in areas with sizable numbers of moose. The effect of predation on moose by wolves is believed slight.

Management Summary and Recommendations

Illegal harvest of moose by hunters using snowmachines in late winter and spring continues to be a problem in Unit 18, particularly along the Yukon River. Although most hunters are aware of current hunting regulations, economic and other related circumstances make moose too valuable to pass up when sighted. Efforts by Department personnel to inform hunters of the depressed status of the moose population should be increased. More enforcement effort is recommended as well.

The level of compliance with the harvest ticket requirement has increased significantly in the last 2 years, particularly among the Yukon River villages. The Department should continue its work in the villages to improve compliance with harvest ticket regulations.

Relatively little is known concerning the seasonal movements and distribution of moose in Unit 18. Because they are heavily hunted the entire year, their patterns of movement and distribution are likely to be quite different from what is known of moose populations in other areas of the State. Replicate aerial surveys should be conducted in designated areas during late fall through spring to learn more about the seasonal distribution of moose.

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APPENDIX A. Unit 18 moose composition counts, fall 1981.

Area	Bulls/ 100 cows	Calves/ 100 cows	% calves	Incid. of twins/100 cows w/calves	Sample size	Moose/ hour
Yukon R. (Pilot Station to Paimiut)	55	84	35	54	117	12
Kisaralik	74	25	13	--	8	4

APPENDIX B. Unit 18 moose composition counts, winter/spring 1981.

Area	Total adults	Total calves	% calves	Incid. of twins/100 cows w/calves	Total moose
Chuilnak R.	2	4	50	--	6
E. Fork Andreafsky R.	2	--	--	--	2
Yukon R. (Russian Mission to Paimuit)	22	15	41	--	37
Total sample	26	19	42	27	45

APPENDIX C. Moose composition counts from the Yukon River-Russian Mission to Paimiut, 1980-82.

Area	Total adults	Total calves	% calves	Total moose	Moose/hour
February 1980	38	11	22	49	15
February 1981	27	12	31	39	18
March 1982	22	15	35	37	19

APPENDIX D. Unit 18 moose harvest by residency (percent), 1978-81.

Residence category	Year			
	1981	1980	1979	1978
Unit 18 resident	67 (86)	39 (81)	8 (67)	43 (90)
State resident (nonlocal)	3 (4)	4 (8)	0	0
Nonresident	8 (10)	4 (8)	3 (25)	0
Unknown	0	1 (2)	1 (8)	5 (10)

APPENDIX E. Unit 18 moose harvest transportation method, 1978-81.

Transport category	Year			
	1981	1980	1979	1978
Boat	58 (73%)	37 (82%)	7 (58%)	40 (83%)
Snowmachine	7 (9%)	2 (4%)	1 (8%)	6 (13%)
Aircraft	11 (14%)	6 (13%)	4 (33%)	0
Highway ("Walking")	3 (4%)	0	0	2 (4%)

APPENDIX F. Unit 18 moose harvest by month, 1978-81.

Month of kill	Year			
	1981	1980	1979	1978
September	65 (81%)	40 (83%)	9 (75%)	41 (85%)
October	7 (9%)	5 (10%)	2 (17%)	1 (2%)
November	2 (3%)	1 (2%)	0	0
December	6 (8%)	2 (4%)	1 (8%)	6 (13%)

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 19

GEOGRAPHICAL DESCRIPTION: Middle and Upper Kuskokwim Drainages

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 19A	Sept. 1-Sept. 25 Nov. 20-Nov. 30 Feb. 1-Feb. 10	One moose; however antlerless moose may be taken only from Nov. 20-Nov. 30, and from Feb. 1-Feb. 10.
Unit 19B	Sept. 1-Sept. 30	One bull
Unit 19C	Sept. 1-Oct. 10	One bull
Unit 19D, that portion which includes all drainages of the Kuskokwim River, upstream from and including the drainages of South Fork Kuskokwim River	Sept. 10-Sept. 25	One bull
Remainder of Unit 19D	Sept. 1-Sept. 30 Nov. 15-Nov. 30	One bull

Population Status and Trend

The moose populations in Subunits 19A and 19C appear to have stabilized. No surveys were conducted in Subunit 19B.

The moose population in Subunit 19D remains considerably below levels recorded in the late 1960's and early 1970's. Population levels in the eastern portion of the Subunit are particularly depressed and are likely to remain so until efforts are initiated to improve the habitat and reduce wolf numbers. Counts in the remainder of the Subunit indicate a slowly increasing population.

The Bear Creek burn near Farewell is becoming excellent moose habitat. Moose that normally frequent the foothills between the

Swift River and Farewell may now be using the Bear Creek burn in fall and winter.

Population Composition

Survival of 1981 calves to early winter was excellent in Subunit 19A (Appendix A); a relatively high incidence of twins was observed during November surveys. Overwinter survival of 1980 calves was fair, except for the Hoholitna River where long yearlings composed only 8% of the population. Bull:cow ratios remain excellent, although the influence of bulls-only hunting is clearly evident in the Hoholitna survey data.

Based on a limited sample, calf survival and yearling recruitment of moose in portions of Subunit 19C near the Hoholitna drainage were low and similar to rates of calf survival and yearling recruitment found along the Hoholitna River in Subunit 19A (Appendix B). Data from the northeast portion of the Subunit suggest good calf survival through fall and good recruitment of the previous year's calves. Bull:cow ratios are very good, suggesting a lightly exploited population.

Overall, data for Subunit 19D indicate good calf survival and yearling recruitment (Appendices C, D). However, overwinter survival of 1980 calves in the Kuskokwim Hills and Candle Hills was poor. Despite improved recruitment in the Upper Kuskokwim Controlled Use Area on the North Fork of the Kuskokwim River, moose density remains low. Habitat in this area is old and unproductive; however, habitat is probably not limiting at current population levels. Continued good recruitment should eventually somewhat increase moose density.

Mortality

The reported 1981 harvest of 369 moose is identical to the 1980 take for Unit 19. Hunter numbers (753), however, increased from 1980 (689) which lowered 1981 hunter success to 49%.

Modified Subunit boundaries for the 1981-82 regulatory year expanded Subunit 19B and reduced the other 3 Subunits. The following comparisons of 1980 and 1981 harvest are based on boundaries implemented in July 1981.

In Subunit 19A, 78 moose (including 14 females) were reported taken by 199 hunters. Residents of Subunit 19 took 58% of the moose. Other Alaskan residents took an additional 28% of the harvest. Subunit 19A residents had a 44% success rate compared to the overall success rate of 39% for hunters in Subunit 19A. Nearly 25% of the hunters were from Unit 18, and they had a 24% success rate. Only 20 nonresidents (including 6 aliens) reported hunting in Subunit 19A. Forty-seven percent of the hunters reported using boats as their transportation means. Hunters from

southcentral Alaska, other states, and foreign countries used aircraft for transportation to their hunting areas.

Nonlocal hunters directed most of their hunting effort toward Subunit 19B. Nonresidents, aliens, and residents of southcentral Alaska composed 89% of the hunters. Only 8 hunters from Unit 19 reported hunting in Subunit 19B. This area was favored by air taxi operators from southcentral Alaska. Eighty-two percent of the hunters reported using aircraft. The reported harvest of 78 moose in 1981 was down from the 103 reported from the same area in 1980. Nearly all of this reduced harvest was due to reduced effort by aliens who took only half as many moose in 1981 as they did in 1980.

Nonresidents and southcentral Alaska hunters were also active in Subunit 19C where they composed 84% of the hunters. Nine Unit 19 residents reported hunting in 19C. The reported harvest of 147 moose was similar to the harvest reported in 1980. The number of hunters remained relatively stable (86 in 1981 and 78 in 1980).

The Subunit 19D harvest increased from 82 in 1980 to 104 in 1981. Hunter numbers (185) increased proportionally, and hunter success (56%) remained unchanged from 1980. Most hunters (59%) were residents of Subunit 19D. Of the remainder, 17 hunters were nonresidents or aliens, 26 hunters were from southcentral Alaska, and 14 hunters were from Unit 18. Hunter choice of access reflected the preponderance of local residents participating in the hunt. Sixty-nine percent of the hunters used boats as their means of transportation.

Management Summary and Recommendations

Moose hunting in Unit 19 can be divided into 2 distinct categories: heavy local use along the river systems in Subunits 19A and 19D, and fly-in hunting in the mountainous portions of Subunits 19B and 19C. The overlap between the 2 groups of hunters is minimal, and the present Subunits can be managed for each group of users. Based on field observations in fall 1981, air taxi operations were probably the greatest single factor affecting hunter distribution, moose harvest, and hunter ethics in Subunit 19B. Unfortunately, some operators seem to have little regard for anything other than financial remuneration. Surveillance of their operations should be continued to improve the salvage of the meat of moose taken in Subunit 19B.

The status of moose populations in Unit 19 varies. Parts of Subunits 19A and 19D show improvements while other areas appear stable after having declined in the past. The Bear Creek burn near Farewell is developing into prime winter range, which moose from parts of Subunit 19C have apparently started using.

Moose population levels in the eastern portion of 19D remain depressed--probably a reflection of poor habitat, illegal harvest, and high predator abundance.

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APPENDIX A. Moose sex and age ratios derived from aerial survey data in Subunit 19A, November-early December 1981.

Area	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls in herd	Calves/ 100 cows	Calves/ 100 cows >2 yrs	Sample size
Aniak River	91	14	6	56	65	230
Hoholitna River	32	9	4	60	65	90
Holitna River	58	20	9	58	72	97
Combined data	68	14	6	57	67	417

APPENDIX B. Moose sex and age ratios derived from aerial surveys in Subunit 19C, November 1981.

Area	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls in herd	Calves/ 100 cows	Calves/ 100 cows >2 yrs	Total moose
Tonzona to Fare- well Foothills	138	31	12	29	45	128
Swift River to Fare- well Foothills	92	8	4	33	36	27
Bear Creek Burn	60	40	20	40	67	20
Combined data	119	29	11	31	44	175

APPENDIX C. Moose sex and age ratios derived from aerial surveys in Subunit 19D, November 1981.^a

Area	Bulls/ 100 cows	Yrlg. bulls/ 100 cows	% yrlg. bulls in herd	Calves/ 100 cows	Calves/ 100 cows >2 yrs	Total moose
North Fork Kuskokwim R. (Controlled Use Area)	59	36	20	27	43	41
Nixon Fork and Takotna R.	53	17	9	28	34	206
Kuskokwim Hills-Candle Hills	55	2	1	38	39	95
Combined data	48	15	8	31	36	342

^a Some of the data for the Controlled Use Area were collected October 19, 1981.

APPENDIX D. Late winter moose survey data from Subunit 19D, February-March 1982.

Area	Moose	% calves in herd	Moose/ hour
North Fork Kuskokwim River (Controlled Use Area)	146	25	20
Takotna River	71	23	51
Kuskokwim River	257	23	76

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20A

GEOGRAPHICAL DESCRIPTION: Tanana Flats and Central Alaska Range

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 20A, that portion draining into the south bank of the Tanana River north of the Fairbanks North Star Borough southern boundary (south line of T7S Fairbanks meridian), and between the east bank of the Little Delta River and the west bank of the Wood River	Sept. 5-Sept. 25	One bull
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Remainder of Unit 20A	Sept. 5-Sept. 15	One bull
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Population Status and Trend

Based upon 1978 census data and annual sex and age composition/population trend surveys, an estimated 4,500-5,000 moose occupy Subunits 20A and adjacent 20C east of the Nenana River. Except for the Japan Hills area, moose density was relatively low in most portions of the foothills but high on the central Flats. Density on the central Flats was 1.8 moose/mi², but only 1.5/mi² in the foothills.

The Subunit 20A moose population is increasing by 7% annually; however, the areawide rate of increase varies. The population is increasing by 15% annually in areas of effective wolf control, primarily the Tanana Flats; the rate is lower in the foothills.

The Yanert River population consists primarily of old animals because of recent consistently low recruitment. Although this moose population is probably slowly increasing, total numbers are low and may decline as old-age animals die.

Although range surveys in portions of Subunit 20A indicate browse is currently adequate, a large proportion is overmature. Preferred species are being replaced by spruce and other nonbrowse species. Consequently, carrying capacity, particularly in the Flats, is declining.

Population Composition

Sex and age composition/trend survey data indicated calf survival was high on the Tanana Flats and Alaska Range foothills (Appendix A). Yearling survival in the Flats was significantly higher than in the foothills, probably a reflection of relative wolf densities.

Bull:cow ratios declined in the Subunit but are still considered high. The decline was most pronounced in the Japan Hills section, although the bull ratio also declined in the Tanana Flats.

Mortality

Harvest ticket data indicate 200 moose were harvested in Subunit 20A during the 1981 season, a 31% increase over 1980. The hunting season in the Tanana Flats between Wood and Little Delta Rivers was 10 days longer than the remainder of the Subunit and accounted for one-third of total harvest. Although the longer season did not appear to attract increased hunting effort, many hunters took advantage of the longer season and hunted later when success was likely to be higher.

Resident hunters took 83% of the 20A harvest and composed 88% of the 706 participating hunters. A success rate decline (28% from 33% in 1980) accompanied a 60% increase in hunter numbers.

Assuming yearling bull moose antler spread measurements are <30 inches, yearlings composed 18% of the harvest according to harvest ticket data. The mean antler size of 43 inches for bulls taken in 1981 was similar to antler spread recorded during the 1979 and 1980 seasons.

Management Summary and Recommendations

The Subunit 20A moose population is continuing to increase, primarily as a result of wolf control. Simultaneously, area harvest is also increasing. However, habitat limitations prevent a sustained population increase. Mediocre browse conditions in many parts of the area will restrain ultimate population density, probably within this decade. Range rehabilitation, either through prescribed burning or decreased wildfire suppression, should be encouraged and implemented to achieve long-term moose management goals.

Wolf populations should be monitored, and control exerted when and where warranted.

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APPENDIX A. Moose composition counts, Subunit 20A, fall 1981.

Subunit 20A overall				
Bulls/ 100 cows	Calves/ 100 cows	Calves/ 100 cows >2 yrs	% calves in herd	% yearlings in herd
58	41	48	21	20
Subunit 20A (by area)				
	Calves/100 cows >2 yrs		Yearlings/100 cows >2 yrs	
Flats	58		58	
Foothills	35		45	

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20B

GEOGRAPHICAL DESCRIPTION: Fairbanks and Central Tanana Valley

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limits

Unit 20B, that portion north and east of the Trans- Alaska pipeline lying between Nordale Road on the west and Transmitter Site Road-Grange Road on the east, and south of the Chena Hot Springs Road between Mile 6 and Mile 20.5	Sept. 5-Sept. 15	One bull by bow and arrow only
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Unit 20B, that portion of Gold- stream drainage (see Hunting Regulation Booklet No. 22 for specific description)	No open season	
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Unit 20B, that portion within the Minto Management Area	Sept. 5-Sept. 10 Nov. 10-Nov. 15	One bull by registration permit only; 15 bulls may be taken. See 5 AAC 81.055 and separate permit hunt supplement.
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Remainder Unit 20B	Sept. 5-Sept. 15	One bull
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Population Status and Trend

Moose density in the Chena and Salcha drainages showed a slight increase from the low levels of the mid and late 1970's. Based on trend count surveys in November 1982, densities were 1.4 and 1.3 moose/sq mi for these respective areas. Both moderate calf

survival and yearling recruitment of moose annually moving from Subunit 20B to the Tanana Flats wolf control area for calving and summering may be responsible for the Chena and Salcha area increase. Moose in the upper portion of the Goldstream valley are increasing rapidly due to low predator numbers in this urban-suburban area. Moose density on the Minto Flats and the Chatanika River drainages may have stabilized at a low level, although little data are available.

Population Composition

Fall sex and age composition surveys were flown on Minto Flats and in the Goldstream, Chena, and Salcha drainages (Appendix A). The bull:cow ratio remained high in Subunit 20B; calf survival was good, especially in the Goldstream drainage. The Minto Flats sample size was too small to generate accurate population composition data.

Mortality

The 1,050 reporting hunters harvested 154 bulls during 1981 in Subunit 20B; hunter success was 15%. Hunter and harvest increases can be attributed partly to the expansion of Subunit 20B to include the Salcha and Tolovana River drainages. All drainages, except the Salcha and Chatanika Rivers, had a substantial increase in harvest and an increase in hunter success. Harvest distribution is shown in Appendix B.

Yearling bulls composed 23% of the reported harvest based on antler spreads of <30 inches. Successful hunters spent an average of 4.3 days afield. Resident hunters constituted 88% and 71% of the successful and unsuccessful hunters, respectively.

Eighty-four of the 100 permits allocated for the Minto Management Area were issued. Of the 57 permittees who returned their permits, 40% hunted and took 6 bulls, 31% did not hunt, and 29% did not indicate whether they hunted or not.

According to Fish and Wildlife Protection Division records, an additional 57 moose were accidentally killed on roads in Subunit 20B. Other sources of mortality include an unknown amount of predation from approximately 25 wolf packs in the Subunit and a minimum estimate of 40 moose taken illegally by poachers.

Management Summary and Recommendations

Moose densities in Subunit 20B remain below carrying capacity. The wolf control program should be continued to allow the moose population to increase. Habitat rehabilitation through controlled burning and reduced suppression of wildfire will also be necessary.

With the high bull:cow ratio and slight increase in the overall population, an expanded bull harvest could be permitted. In addition, an antlerless hunt should be proposed to stabilize the

rapidly growing upper Goldstream moose population before overuse of the winter range occurs.

Fall sex and age composition surveys should be flown in the Chatanika River drainage. An expanded composition survey should be conducted on the Minto Flats to obtain a more useful sample size.

Calving grounds for the Goldstream and Chatanika drainages should be located to intensify area management.

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APPENDIX A. Moose survey data for Subunit 20B, fall 1981.

Location	Bulls/ 100 cows	Calves/ 100 cows >2 yrs	% calves	% yrlg.	Moose/ hour	Sample size
Chena River	53	63	26	12	12	202
Goldstream Cr.	50	164	40	32	32	45
Salcha River	49	58	23	26	33	110
Minto Flats	92	44	14	28	10	29
Totals	54	68	26	20	16	386

APPENDIX B. Distribution of 1981 moose harvest in Subunit 20B.

Area	No. moose
Chatanika River	24
Chena River	64
Goldstream valley	7
Minto Flats	6
Salcha River	16
Tanana River	16
Tatalina River	10
Tolovana River	8
Unknown	3
Total	154

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20C

GEOGRAPHICAL DESCRIPTION: Kantishna, Cosna, and Nenana River
Drainages

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 5-Sept. 15

One bull

Population Status and Trend

Moose populations are increasing within and adjacent to the Subunit 20C wolf control area along the Nenana and Totatlanika River drainages. Moose in the Cosna and Kantishna drainages and the remainder of Subunit 20C may have stabilized at a low level, but sample sizes in past surveys have been inadequate. Moose densities of 2.2 and 3.4 moose/sq mi were recorded for Windy and Moody Creek trend areas during November 1981, respectively. These 2 areas contain some of the best upland moose habitat in the Subunit; densities elsewhere are considerably lower, especially on the flats to the north and west. Trend count areas have not been established in less productive habitat in western Subunit 20C.

Population Composition

Moose surveys were conducted in Windy Creek, Moody Creek, and Denali National Park (Appendix A). Windy Creek data indicated poor yearling recruitment; however, initial survival of 1981 calves was good. Moody Creek continued to show fair calf and yearling survival. Denali National Park surveys reflect a very low, declining moose population.

Mortality

In 1981 when Unit 20 boundaries were changed, Subunit 20C was reduced in size and now includes that portion of Unit 20 west of the Totatlanika River. The entire Subunit was open for moose hunting, including the Yanert Fork of the Nenana River closed since 1978.

The 800 reporting hunters had a 22% success rate and harvested 174 bulls, a 74% increase over 1980. Yearlings composed 18% of the harvest based on antler spreads of <30 inches. Successful hunters averaged 4.5 days afield. Resident hunters constituted

84% and 94% of successful and unsuccessful hunters, respectively. Reported harvest distribution is shown in Appendix B. Poaching and predation are thought to be substantial mortality factors in Subunit 20C, but specific data are unavailable.

Management Summary and Recommendations

Data suggest the moose population in eastern Subunit 20C is slowly increasing. Although calf survival through early winter is generally good, substantial overwinter calf loss hinders eventual population recovery. Predation by wolves is probably responsible for low recruitment. Nevertheless, recent hunting success and harvest levels have improved markedly and further indicate population growth. Present bull:cow ratios are good.

Available data indicate moose density is low west of the Nenana River.

Unless developed for agriculture, the 171,000-acre Dune Lake burn area will probably result in substantially improved browse conditions. However, since browse availability is probably not responsible for present low moose numbers, habitat rehabilitation will not result in population increase. Trend count areas should be established in western 20C to determine moose densities and provide a basis for future evaluation. If sufficient sample sizes can be generated from these counts, the resulting composition data will provide insight to calf survival and yearling recruitment. Predator abundance and distribution should be assessed if recruitment is poor.

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APPENDIX A. Fall 1981 moose survey data for Subunit 20C.

Location	Bulls/ 100 cows	% yrlyg. in herd	Calves/ 100 cows >2 yrs	Calves/ 100 cows	Total sample
Windy Creek	31	4	59	57	96
Moody Creek	41	16	30	26	142
Denali Natl. Park ^a	30	6	17	16	258
Combined	33	10	28	26	496

^a Data provided by National Park Service.

APPENDIX B. Distribution of Subunit 20C moose harvest, fall 1981.^a

Location	Moose harvest
Lake Minchumina	9
Cosna River	10
Kantishna River	19
Ferry area	11
Healy area	38
Totatlanika River	15
Nenana River	29
Teklanika River	6
Yanert River	22
Total	159

^a Fifteen kill locations were not specifically reported.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20D

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Subunit 20D* Sept. 5-Sept. 15 One bull

*Portions of GMU
20D are open to
hunting by regis-
tration permit
only. Refer to
regulation book-
let and permit
hunt supplement
for additional
details.

Population Status and Trend

Game Management Subunit 20D was expanded on July 1, 1981 to include all drainages north of the Tanana River from the mouth of the Robertson River to Banner Creek. For convenience in reporting on the moose populations, the Subunit may be divided at the Tanana River into 20D North and 20D South. A further division into 20D Southwest and Southeast may be made at Johnson River.

A population survey in GMU 20D South during November 1981 produced a population estimate of 902 moose with a 34.5% confidence interval at the 90% confidence level. This suggests that the moose population numbers between 591 and 1,214 animals. A more precise estimate proved unattainable due to substantial moose movements that occurred after poor weather delayed survey efforts.

The survey area was divided into 3 strata based on moose distribution during a preliminary overflight. Subsequent sampling within these strata indicated moose densities of 0.3, 0.9, and 1.5 moose/sq mi in the low-, medium-, and high-density areas, respectively. The high-density strata composed 12% of the survey area and included timberline shrub areas, regrown burns, and fallow fields. The low-density strata composed 65% of the survey area and consisted primarily of old growth spruce forest where browse is generally unavailable. Few moose were found in cultivated fields. Instead, moose were concentrated in uncultivated strips left between farmed parcels.

Earlier population estimates had been derived by applying densities obtained for other, similar habitats to Subunit 20D South. However, the 1980 estimate of 998 moose for the same area suggests that this and similar earlier estimates may have been nearly correct. In general, the 20D South moose population appears to have gradually increased since the early 1970's and has now stabilized.

Increased observations of moose since the late 1970's have led most residents of the area to conclude that the moose population has increased. However, survey data suggest that an increase of the magnitude that would be noticed by the public has not occurred. Alternate explanations for the observed phenomenon of more moose in the Delta-Clearwater area are that 1) moose displaced from the Delta Agricultural Project may have moved into this area; or 2) moose habitat may be improving as farms in the Clearwater area are abandoned and grow into fall moose browse.

Although survey data for GMU 20D North are scant, the population there is believed stable or slowly declining. Extrapolation of density data from similar adjacent areas suggests that this population numbers about 800 moose.

Population Composition

Composition data for Subunit 20D South were derived from the population estimate survey. These data show a marked contrast between number of moose found in the mountains and number of moose found on the flats during early winter (Appendix A). Overwinter calf survival in the mountainous portion was extremely poor, presumably because of predation by wolves and bears. Wolf survey data suggest that wolves may be largely responsible; however, since a sizable portion of calf loss occurs during the summer following calving, bears could also be partially responsible. Both initial calf survival and overwinter survival to yearling age were considerably better among moose found on the flats during November which suggests that this segment of the population had spent most of its time in areas where predation was less. Most likely this means that many of these moose are year-round residents in the lowlands where grizzly bears are few and wolf predation relatively low. The foregoing suggests that in Subunit 20D South moose may be declining in the mountainous areas and increasing in the lowlands.

A composition survey was conducted during late October in the Billy Creek drainage in eastern Subunit 20D North. The survey revealed a population with 63 bulls/100 cows. Yearling bull and calf survival were poor; these segments composing 6% and 10% of the population, respectively. Total sample size was 69 animals, and 30 moose/hour were recorded.

Mortality

A total of 102 moose were reported killed in Subunit 20D during the 1981 hunting season. Of that total, 44 were killed in GMU

20D Southwest during the registration permit hunt that was closed after 3 days. The 428 permits issued in this area in 1981 were the largest number issued since the permit hunt was started in the early 1970's. Approximately 85% of the permittees hunted; 12% were successful.

Most of the hunting effort occurred in the vicinity of Fort Greely where nonresident military personnel may hunt without State hunting licenses. The greatest success per unit effort occurred in the foothills south of Delta. The poorest success was in the extreme eastern end of the permit area.

Two-year-old bulls composed the largest part of the harvest in 20D Southwest, and the average age of bulls taken was between 3 and 4 years of age. Reduced loss to predators and relatively heavy hunting pressure on bulls in recent years probably account for the harvest of young moose.

In the portion of GMU 20D east of the Johnson River (20D Southeast), 15 moose were reported harvested. Most moose were taken by hunters on foot or from vehicles on or near the Alaska Highway. Most of this area is within the Macomb Plateau Controlled Use Area where the use of motorized vehicles for hunting is proscribed. Most of the 13 Unit 20D Southeast antlers measured by hunters were in the 40-49 inch class, which is larger than those reported for other portions of the Unit. I think most of these moose were 4-6 years old. Predation presumably has been high on recent calf crops in this segment of the population because of the high density of wolves present in the area. As a result, few young moose were available to hunters. Hunting in recent years may have been sufficient to remove the few older bulls which have accrued during a long period of poor recruitment.

North of the Tanana River in GMU 20D, hunters reported taking 45 moose. Most were taken in the Goodpaster drainage. Boats were the most popular transportation mode and were used by 46% of those successful hunters reporting transportation. Hunters utilizing off-road vehicles accounted for 22% of the reported harvest. Most of the ORV use occurred in the vicinity of Shaw Creek Flats. Most antler sizes reported by hunters were in the 30-39 inch size class.

A total of 14 moose are known to have died from causes other than hunting (Appendix B).

Habitat

An initial habitat reconnaissance was conducted in Subunit 20D Southwest in spring 1982. This preliminary work suggests that additional moose can be supported in this portion of the Subunit, but that new habitat must be created soon to take over for the aging burns that constitute much of the best-quality habitat.

A substantial portion of the lowlands in 20D Southwest has been, or will be, converted from wildlife habitat to farmland. I expect that large-scale agriculture will impact moose abundance and distribution in the area. Preliminary observations during the population estimate survey suggest that moose avoid the open grain fields, since moose were observed in either uncultivated areas between fields or in areas left fallow. Work is presently underway to assess the impact of agricultural developments on moose populations in this area. However, it seems clear that the impact on moose will largely be determined by the nature of the farming effort. Large-scale farming that leaves no fallow fields or forest strips between grain fields will probably have an adverse impact on moose.

Management Summary and Recommendations

Data from the population estimate survey in 20D South should be used to revise trend count areas, so they more accurately depict population trend and composition. It is especially important to upgrade composition data for the eastern portion of the Subunit to evaluate the effect of wolf control in that area.

Composition data for 20D North would be desirable; however, with the present low density, a sufficient sample size cannot be obtained with the search intensity required to obtain reliable results. Trend count areas should be established in typical habitat types, in hunted portions of this area, to provide density information from which population trend may be detected.

The composition data in this report suggest that the mountainous portion of the 20D South moose population is limited by predation. Wolf data from this area indicate that wolves may be exerting most of this pressure on moose. If we are to provide for an optimum harvest, as suggested by the Alaska Wildlife Plans, this limiting factor must be reduced. Wolf control efforts begun in 1979 should be continued in the Subunit.

The composition of the moose population in 20D Southwest should be closely monitored to ensure that adequate recruitment is maintained. As long as hunting is concentrated in this area, wolf control efforts should be structured to keep predation to a minimum. Consideration should be given to developing ways to more widely distribute the moose harvest. In addition, if more were known about moose movement patterns in the area, it might be possible to time hunting seasons so the harvest is borne by segments of the population that can best support it.

Moose habitat is being lost as agricultural development and residential expansion occur. In addition, productive habitat in old burns is aging and will become less useful in the future. Habitat monitoring should be continued and enhancement efforts begun so that when the moose population begins to expand, it will not be limited by habitat before reaching the desired population size.

Operational plans should be developed for GMU 20D Southwest, 20D North, and 20D Southeast.

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APPENDIX A. Sex and age composition of GMU 20D South moose population, 1981.

Area	Bulls/ 100 cows	% yrlg. bulls	Calves/ 100 cows	Calves/ 100 cows >2 yrs	Incid. twins/ 100 cows w/calves	% calves	Total sample
Flats	26	9	47	55	16	27	140
Mountains	18	3	22	23	0	16	70
Combined	23	7	37	42	12	23	210

APPENDIX B. Summary of known nonhunting mortality, Subunit 20D, July 1981-June 1982.

Cause of death	Cow		Bull adult	Unknown sex			Total
	Adult	Unknown age		Calf	Yrlg.	Unknown age	
Road kill	2	2	1	0	1	2	8
Poor condition ^a	2	0	0	0	0	0	2
Predation	0	0	0	1	0	0	1
Poaching	0	0	1	0	0	0	1
Unknown	1	0	0	1	0	0	2
Totals	5	2	2	2	1	2	14

^a One of the 2 moose was discovered in a drifted-in ravine where she had fallen into the snow and was unable to extricate herself. Analysis of bone marrow fat content indicated only 8% fat. The 2nd moose had malformed incisors. Her stomach was full of grasses and other poor-quality foods.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20E

GEOGRAPHICAL DESCRIPTION: Fortymile, Charley, and Ladue River
Drainages

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

No open season

Population Status and Trend

Moose densities in the Subunit are extremely low and are likely declining, except for in the 3,000-mi² southwestern portion where substantial wolf reductions were accomplished during winter 1981-82.

A moose population estimation survey conducted in the southwestern portion of the Subunit during October 1981 indicated an overall density of 0.2 moose/mi² and a population of 630 ± 140. A Subunit-wide population of 1,400-2,000 moose was estimated by extrapolation of census data to other areas which were stratified but not censused.

Population Composition

Because the October 1981 population estimate survey encompassed most areas normally surveyed in Subunit 20E, standardized composition surveys were not conducted except in the Ladue River area. However, the 55 hours of intensive aerial search completed during the population estimate survey produced composition figures considered superior to those obtained during standard surveys. The census area encompassed most areas normally surveyed. Survey results are presented in Appendix A.

Mortality

Wolf and grizzly bear predation are suspected as the primary mortality factors in the Subunit. Fall 1982 moose surveys in areas with and without wolf reduction should provide an indication of the significance of wolf predation on Subunit populations. The wolf:moose ratio in southwestern Subunit 20E was altered from 1 wolf:9 moose to 1 wolf:23 moose through the removal of 47 of 74 area wolves in winter 1981-82. The extent of grizzly predation is presently unknown.

At current low moose densities, habitat is not a limiting factor. Spring 1982 browse utilization surveys revealed only 2.5% of available annual growth had been consumed during winter 1981-82.

Poaching continues to be a problem of unknown magnitude in the area, particularly along the Fortymile River during the summer gold mining season. The estimated annual illegal take in the Subunit (presently closed to moose hunting) is approximately 20-30 moose.

Management Summary and Recommendations

The moose population in Subunit 20E is estimated at 1,400-2,000 and is believed slowly declining in the northern and eastern portions (outside the wolf reduction area). Wolf control will be initiated in southeastern Subunit 20E during winter 1982-83, and further reductions will be continued in the southwestern portion.

A short, 10-day bulls-only season will be held during fall 1982. A liberalized season and bag limit for grizzly bears--a known moose predator in the area--will also begin this fall. The moose harvest is expected to be low due to low moose densities in easily accessible areas.

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SUBMITTED BY:

David G. Kelleyhouse
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Oliver E. Burris
Regional Management Coordinator

APPENDIX A. Moose sex and age ratios calculated from composition data obtained during the population estimate survey in Subunit 20E, October 1981.

Area	Bulls/ 100 cows	Small bulls/ 100 cows	Small bull % in herd	Calves/ 100 cows	Calf % in herd	Total moose
SW 20E ^a	88	15	7	20	10	546 (est.)
Ladue River ^b	52	12	7	28	16	90

^a Population estimate survey.

^b Standardized composition survey.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20F

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

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Sept. 10-Sept. 20

One bull

Nov. 1-Nov. 10

Population Status and Trend

Little population data are available on the Subunit 20F moose population. Results of the few aerial surveys attempted have been inconclusive because of low moose density and the resulting small sample size. A 33-mi² section of upper Hess Creek surveyed during early December 1981 produced a sample of only 11 moose and a calculated density of 0.3 moose/mi². A stratification flight conducted a few days earlier indicated this area contained a denser than average moose population compared with other parts of Subunit 20F.

Populations throughout the Subunit are believed to be generally low and essentially static. In general, habitat is low-quality, consisting mainly of extensive black spruce or mature hardwood stands. Willow appears to be confined mainly to riparian sections and old burns. Casual observations suggest that habitat is not currently limiting moose populations. Another factor, possibly predation, may be restricting the population to its current low level.

Population Composition

No data have been collected during this report period.

Mortality

Harvest ticket data disclosed 27 moose were taken by 109 individuals in Subunit 20F during the 1981 season (20 during September and 7 in November). Only residents hunted. Areas producing the largest harvests include the Manley-Tofty area and Hess Creek, where 7 and 11 moose were taken, respectively. The remaining harvest came from other scattered locations.

Assuming that yearling bull moose antler spread is ≤ 30 inches, yearlings composed 7% of the harvest according to hunter reports. The mean moose antler spread was 43 inches, the Unit 20 average.

Out-of-season hunting and consequent unreported harvest are believed substantial in Subunit 20F.

Management Summary and Recommendations

The Subunit moose population is low and probably stable. Virtually all hunting is by State residents, but the 25% hunter success is only average compared to the rest of Unit 20. Habitat is not believed responsible for present low moose numbers. Predation by wolves and grizzly bears may be limiting calf survival and subsequent recruitment. Only 7% of the 1981 harvest was comprised of yearlings, which indicates low recruitment.

If recruitment substantially improves, habitat will then become a major limiting factor. Range rehabilitation, either through burning or decreased wildfire suppression, should be encouraged and accomplished.

Predation effects should be examined and minimized, if necessary. Increased efforts should be made to systematically gather baseline data on moose population size, composition, recruitment, and trend.

The Subsistence Division should obtain data regarding the magnitude of unreported harvest.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21A

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

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Sept. 5-Sept. 30	One bull
Nov. 1-Nov. 30	

Population Status and Trend

The Subunit 21A moose population appears stable; however, few surveys were conducted.

Population Composition

Composition data collected during November 1981 surveys (Appendix A) show adequate bull:cow and calf:cow ratios. The calf percentage further indicates a population able to sustain present mortality.

Mortality

Reported hunter take in the upper Nowitna was 24 moose, with all but 1 taken during September. In the Innoko drainage, 80 moose were reported harvested; only 2 were taken during the November season.

Wolf predation continues to be the largest source of moose mortality in the Subunit. The Nowitna River portion still supports 60-70 wolves in 5-8 packs. The wolf:moose ratios are between 1:26 and 1:35, which usually result in a stable moose population if other mortality is not excessive. Rainfall in February 1982 produced severe conditions, but the impact of these conditions on the moose population is unknown.

Management Summary and Recommendations

Moose populations in Subunit 21A appear stable; however, trend surveys were not extensively done. Trend surveys should be conducted every other year in selected areas; at least 1 composition survey should be conducted along the Innoko drainage yearly. Special attention should be paid to calf survival to see

if the February 1982 rainfall increased mortality. No changes in the current hunting seasons are recommended. The September harvest appears stable, and the November harvest minimal.

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APPENDIX A. Fall 1981 counts, Subunit 21A.

Area	Bulls/ 100 cows	Calves/ 100 cows	% calves	% yrlyg.	Sample size
Gaines Creek	211	40	7	13	30
Foothills north of					
Innoko River	144	66	15	11	26
Innoko River	62	49	20	9	215
Data combined all areas	79	50	18	10	271

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21B

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

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 5-Sept. 25

One bull

Population Status and Trend

A November 1980 population estimate survey conducted in the Nowitna River area produced an estimate of 2,386 ($\pm 10\%$) moose. No further surveys have been conducted, but the population appears stable.

Mortality

The reported Subunit harvest was 72 bulls and 1 cow. Fifty-four moose were taken in the Nowitna drainage; 2 moose were harvested in the Yukon drainage near Tanana; 2 moose were killed along the lower Melozitna; and 15 moose, including the 1 cow, were taken along the Ruby-Poorman Road. The boundary between Subunits 21B and 21D is the Ruby-Poorman Road, and successful hunters in this area did not specify on which side of the road (which Subunit) moose were taken. Hence, all moose killed along the road have been included in the 21B harvest figures.

Previous registration permit restrictions in the Nowitna section of the Subunit were eliminated this hunting season. However, the Department maintained a hunter check station at the mouth of the Nowitna to gather data on the ages of moose harvested and residency of hunters. The station checked 138 hunters, 8 of which hunted in the upper Nowitna. All successful hunters, except 1, later mailed their moose harvest tickets, indicating the public relations value of the station. Both the number of hunters and the number of moose killed increased slightly from 1980 (Appendix A).

Age data were obtained from incisor teeth collected from 34 male moose in 1980 and 48 male moose in 1981 (Appendix B). Assuming nonselective hunting, these data show poor recruitment of males in the past 2 years. The lack of bulls older than 5 years indicates a heavy harvest in past years.

Management Summary and Recommendations

The moose population appears stable, but recruitment is poor. The present season is adequate to fulfill hunter needs and to sustain the moose population.

It is recommended that trend areas established in 1980 be surveyed every other year, and that new trend areas be established on the Ruby-Poorman Road. The value of the Nowitna River check station was demonstrated by the harvest data gathered and the positive public relations incurred. If budgetary restraints preclude a fully manned station, at least 1 mobile moose hunter check should be done during the season using a riverboat.

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APPENDIX A. Subunit 21B hunter residency and success rate, 1979-81.

	No. hunters (%)			No. successful			% success rate		
	1979	1980	1981	1979	1980	1981	1979	1980	1981
Fairbanks	108(54)	49(58)	67(49)	40	33	42	37.0	67.4	62.7
Yukon River villages	68(34)	26(31)	46(33)	12	5	5	7.6	19.2	10.9
Other Alaskan towns	14(7)	6(7)	15(11)	5	1	3	35.7	16.7	20.0
Nonresidents	11(5)	4(5)	10(7)	4	2	5	36.3	50.0	50.0
Totals	201	85	138	61	41	55	30.3	48.2	39.9

APPENDIX B. Age classes of male moose harvested in Subunit 21B, September 1980-81.^a

Age	1980		1981	
	<u>N</u>	%	<u>N</u>	%
1	2	5.9	2	4.2
2	5	14.7	8	16.6
3	9	26.5	15	31.2
4	8	23.5	7	14.6
5	3	8.8	7	14.6
6	1	2.9	4	8.3
7	3	8.8	1	2.1
8	0	0.0	1	2.1
9	1	2.9	1	2.1
10	1	2.9	0	0.0
11	0	0.0	0	0.0
12	0	0.0	2	4.2
13	1	2.9	0	0.0
Totals	34	99.8	48	100.0

^a Includes 6 moose harvested in the 21A portion of Nowitna River in 1981.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21C

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

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 5-Sept. 25

One bull

Population Status and Trend

The Subunit 21C moose population appears stable, but only incomplete surveys have been conducted since 1978. In each survey, less than 20 moose have been observed on the valley floor; however, each observer indicated seeing tracks of more moose on the valley sides.

Mortality

No data are available on natural mortality, but the drainage has substantial wolf and grizzly bear populations.

Hunters reported taking 25 moose in Subunit 21C, all from the Melozitna River drainage. All hunters used aircraft for transportation into the area. Since the Subunit boundary on the Dulbi River is unclear, moose reported taken by hunters using boats on the Dulbi River in Subunit 21C were attributed to the Subunit 21D harvest.

Management Summary and Recommendations

Permanent population trend areas are needed and should be surveyed yearly until trends in the Subunit are established. The Subunit boundary in the Dulbi River area needs adjustment from its present location upstream to Cottonwood Creek, the farthest navigable point for boats during September.

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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: July 1, 1981-June 30, 1982

Season and Bag Limit

Sept. 5-Sept. 25
Mar. 1-Mar. 10

One moose, provided
that antlerless moose
may be taken only from
Sept. 21-Sept. 25 and
Mar. 1-Mar. 10.

Population Status and Trend

The riverine areas of Subunit 21D have supported high moose densities for many years; the moose population is currently healthy and possibly expanding. Surveys during 1981 indicate calf:cow ratios have nearly doubled since last surveyed in 1979. Where moose congregate during winter, forage species (especially *Salix alaxensis*) are heavily browsed but still abundant in adjacent areas along the Yukon and Koyukuk Rivers.

Four moose trend count areas were established in the most heavily hunted areas in Subunit 21D. These areas are Dulbi River, Three Day Slough, Big Island (Ruby Slough-Yuki River), and Squirrel Creek (south of Koyukuk on the Yukon River). The areas are typical of the Middle Yukon-Koyukuk River floodplain meadows, which are fringed with willow and support extensive white spruce. Trend counts (Appendix A) show moose are dense in these floodplain areas. Search intensity was lower than 4 min/mi² but was sufficient to locate the majority of moose present because of the openness of floodplain meadows. The trend areas are not representative of the majority of the Subunit, either in habitat or moose density.

Population Composition

Early winter survey results show good bull:cow ratios, excellent calf:cow ratios, and good overwinter survival of yearling males in the herd (Appendix B). The calf:cow ratio for Big Island (Ruby Slough) was 115:100, nearly the highest figure ever recorded for Interior moose.

Two late-winter surveys were conducted in February 1982 to assess the impact of unusual weather conditions on the moose population

(Appendix C). Rain had caused an ice crust to form on the 2-3 foot snowpack, and increased mortality was expected. However, survey results were inconclusive and contradictory. Part of the count area included the Squirrel Creek trend area where the calf percentage was 15% in the fall and yet 32% in February. This apparent disparity probably resulted from increases in sightability as females migrated to the river because of ice crust conditions. Near Three Day Slough, many moose were probably in heavy spruce cover, resulting in low sightability and biased data.

Mortality

The 1981-82 hunting season was split into 2 periods, both allowing antlerless harvest. In September, 128 bulls and 9 cows were harvested. Although the overall Subunit bull:cow ratio was 50:100, the cow kill during the antlerless portion of the September hunt did not exceed the bull harvest. Numerous hunters interviewed during the period indicated they were actively seeking females. However, during the period September 21-25, females represented only 50% of the moose harvested (22 bulls, 11 cows). The high bull harvest results from accelerated bull activity with the onset of the rut as well as increased psychological pressure on hunters to shoot the 1st available animal during the brief season. Fish and Wildlife Protection enforcement efforts substantially increased local reporting.

The number of moose harvested during the September season could be twice the reported take. However, increased enforcement effort has increased compliance with reporting requirements.

The March portion of the season was shortened by 5 days, and all areas within 1 mile of the Yukon River between Koyukuk and Ruby were closed by emergency order on March 1, 1982. Weather in February was thought to have concentrated the moose in willows along the Yukon, and a thick ice crust on the snow had effectively restricted their mobility. Reports were received of some related ice-caused injuries.

During the 5-day season, 30 bulls and 12 cows were harvested. A local assistant was employed to gather harvest information, including the extraction of front teeth for aging. This method successfully increased the percentage of harvest reports received. Nearly all successful moose hunters submitted reports. The reported March harvest was entirely by Subunit residents. One advantage of a hunt during a snow machine-only period is that geographic areas (and presumably moose populations) hunted are different during the September season. Approximately 12 moose were poached during the winter.

Management Summary and Recommendations

Moose populations in Subunit 21D appear stable and sufficient to support the current season. Trend areas must be monitored yearly, and a moose hunter check station should be established on

the Koyukuk River to more accurately monitor the harvest. The current level of enforcement effort by the Division of Fish and Wildlife Protection should be continued.

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APPENDIX A. Search intensities and moose densities for Subunit 21D trend count areas, November 1981.

Trend area	Area (mi ²)	Survey effort (min/mi ²)	Moose/mi ²
Squirrel Creek	43	1.5	2.2
Dulbi River	33	3.2	3.8
Big Island	51	1.8	2.0
Three Day Slough	109.5	2.2	3.6

APPENDIX B. Subunit 21D composition counts, November 1981.

Area	Total bulls/100 cows	Yrlg. bull % in herd	Calves/100 cows >2 yrs	Incidence of twins/100 cows w/calves	Calf % in herd	Total sample
Dulbi River	52	10	41	4.5	18	128
Three Day Slough	31	6	41	9.0	22	398
Big Island (Ruby Slough)	94	13	115	5.0	29	103
Squirrel Creek	93	21	64	8.0	15	95
Kaiyuh Flats	86	10	75	9.0	23	51

APPENDIX C. Subunit 21D moose composition counts, February 1982.

	Adults	Calves	% calves	Moose/ hour
Yukon River (Galena to Koyukuk)	182	86	32	182
Three Day Slough	61	16	20	34

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: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Sept. 5-Sept. 30

One bull

Nov. 1-Nov. 30

Population Status and Trend

No surveys were conducted in the Subunit during the report period; however, past data have indicated a healthy, probably increasing moose population.

Mortality

Eighty-two harvest tickets were submitted by successful Subunit 21E moose hunters. However, during a riverine moose hunter check, the St. Marys' biologist concluded few area license vendors had harvest tickets and many local residents hunted without tickets. Unreported harvest is estimated at 2-3 times that reported. Only 7 moose were reported taken during November, while 75 were taken in September.

Management Summary and Recommendations

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

Trend areas or composition surveys should be established and flown annually.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 22

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 22A	Aug. 1-Jan. 31	One bull
Unit 22B	Aug. 1-Jan. 31	One moose; antlerless moose may be taken by permit only from Sept. 15-Jan 31. See 5 AAC 81.055 and separate permit hunt supplement.
Unit 22C	Sept. 1-Sept. 10	One bull
Unit 22D	Aug. 1-Dec. 31	One moose; antlerless moose may be taken by registration permit only from Sept. 10-Dec. 31. See 5AAC 81.055 and separate permit hunt supplement.
Unit 22E	Aug. 1-Mar. 31	One moose; antlerless moose may be taken by registration permit only from Sept. 15-Mar. 31. See 5AAC 81.055 and separate permit hunt supplement.

Population Status and Trend

Historical records indicate moose did not occur in Unit 22 prior to 1900. During the mid-1930's, a few moose moved into 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 of the suitable habitat, and subpopulations increased dramatically in a number of drainages. Moose numbers in the central Seward Peninsula exhibited the greatest growth and appeared to be near or above winter range carrying capacity. In the western and southern portion of Unit 22, densities were much lower, and moose appeared stable or were increasing only slightly, even though range was not a limiting factor. Changes in population status from 1980-81 were minor.

Population Composition

Aerial surveys were conducted in Subunits 22B and 22D during November and December of 1980 and 1981 to determine population composition and productivity. Three major drainages were surveyed: the Kuzitrin River, an area with relatively high harvests throughout the area; the Niukluk/Fish River, an area with high, localized harvest in the western portion but a low harvest in the east; and the American/Agiapuk River, an area with a relatively low harvest. The results of the composition surveys are shown in Appendix A.

The lowest bull:cow ratios occurred on the Kuzitrin in 1980 when 30:100 cows were observed. However, the following year the observed ratio increased to 63:100 cows. It is unlikely the bull ratio actually increased from 30 to 63 in 1 year because the bull harvest in the Kuzitrin drainage was higher in 1981 than the year before. If anything, a decrease in the bull ratio would be expected. The reason for the great discrepancy between years is speculative, but can probably be attributed to sampling error and differences in the distribution of sexes in the count area between years.

Bull ratios in the American and Fish River drainages ranged from a low of 50 bulls:100 cows to a high of 64 bulls:100 cows. These 2 drainages have had relatively high bull counts since surveys were first initiated and have remained consistently high because of low harvests and poor access. Calf production was uniformly high in all count areas, averaging 23% of the fall moose population in 1980 and 27% in 1981.

During the past decade, spring surveys have been conducted on 2 or more drainages in Unit 22 to determine population size and annual recruitment. Surveys were conducted only in portions of Subunits 22B and 22C during 1982 (Appendix B).

Short yearlings composed 21% of the population in the Fish River drainage and 30% of the moose population in Subunit 22C. During the last 5 years, short yearling recruitment has averaged about 20% throughout Unit 22. The continued high survival rate reflects low densities of predators and relatively mild winters. The lowest recruitment was observed in the eastern portion of Fish River area where short yearlings composed 12% and 14% of the population in the spring of 1980 and 1982, respectively. Two or more packs of wolves have recently inhabited the area, and predation may, in part, account for the lower yearling recruitment.

Poor snow conditions in the spring of 1981 and 1982 precluded extensive aerial surveys which are needed to make accurate population estimates. The last comprehensive counts were done in the spring of 1979 and 1980 when 1,025 and 1,279 moose, respectively were seen in the Kuzitrin and Agiapuk drainages. Based on

these data, I estimated that the Subunit 22D moose population numbered 1,300-1,400; Unit 22 itself contained 2,000-2,500 moose.

From 1973 through 1981, incisor teeth were collected from moose to assess changes in the age structure of the population. The percentages of moose in age classes 1 through 8+ are given in Appendix C. Because of biases in the sample (hunter selectivity and others), there are inherent dangers in a strict interpretation of the appendix. However, the data indicate trends that have important management implications. From 1973 through 1977, the percentage of yearling bulls in the population slowly declined from a high of 44% to a low of 17%. Then in 1978, yearling bulls jumped to 37% of the sample. The percentage of yearling bulls in the sample remained near this level for 4 consecutive years (1978-81). The reason for the decline and subsequent return to higher levels is not known but was thought to be 1 or a combination of the following 3 conditions.

1. The samples were too small and not representative of the true age structure of the population.
2. Changes in calf survival were influenced by variable winter conditions.
3. In some years yearlings were more vulnerable to hunters because of different environmental conditions.

The age data suggest that bulls >8 of age are becoming more predominant in the age structure of the population. In 1973, bulls >8 years of age were absent, but in the 1977 and 1978 sample, 5-9% of the population were in this category. The data indicate the percentage of bulls in the >8-year-old category decreased during 1979-1981. This probably did not occur in the moose population. I believe samples from these years were biased. A number of large antlered bulls were killed by transient and late-season hunters, but hunters from these groups often failed to turn in a moose jaw.

Moose were rare on the Seward Peninsula 20 years ago. As the population increased in size and expanded into new areas, 2 trends would be expected: 1) production of calves and survival of yearlings would decline (due to increased competition), and 2) old-age classes would be more prevalent in the population. The age data suggest that both of these trends have occurred, although perhaps not uniformly throughout Unit 22. As a general statement, however, the age data show the moose population is still relatively young and is maintaining relatively high rates of production and survival.

Mortality

Hunting was undoubtedly the major source of moose mortality in Unit 22. The hunting seasons were the longest in the State ranging from 5 to 8 months. The reported kill (from the return

of harvest reports) was 266 moose. However, this figure does not include every moose taken by hunters. An additional 31 successful hunters killed moose on their antlerless moose permit, but the event was not recorded on a harvest report. At least 1 successful hunter returned a harvest report after the cut-off date for tabulating data on the computer run. The minimum reported harvest from all sources was 298 moose, the highest recorded harvest on record. During the last 6 years, the average annual harvest has been 263 moose and has ranged from 228 to 298. Three factors were probably responsible for the high success during the 1981-82 season: 1) increased interest and participation by locals to take moose, 2) favorable weather conditions during September and October and a lack of snow which allowed use of the road system through November, and 3) mild winter temperatures during January and February which encouraged hunters to spend more time in the field. The composition of the harvest was 225 bulls (76%), 72 cows (24%), and 1 animal of unspecified sex.

Every year a number of hunters fail to report taking their moose even though it is a requirement under the 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 685 antlerless permits issued, only 371 were returned without prodding. Approximately 2 weeks after the expiration date, 314 reminder letters were sent to all those who were delinquent. From this mailing, we received 209 replies and determined that 137 hunters were unsuccessful, 62 did not hunt, and 10 had taken a moose (5% success rate, 10/209). Subsequently, we mailed a certified letter to the remaining 105 nonrespondents. This mailing produced 58 replies indicating that 37 hunters were unsuccessful, 18 hunters did not hunt, and 3 killed a moose. Using the data from the 2 mailings, the minimum success rate was determined to be $5\% \left(\frac{10 + 3}{209 + 58} \right)$. Hunters who

obtained antlerless permits were generally more cognizant of their responsibilities under the game regulations because they had more personal contact with Department employees. Thus, a success ratio of 5% is probably minimal for all moose hunters who failed to turn in a harvest report. From license vendor records, we know that at least 1,400 moose tickets were issued in Game Management Unit 22. The State computer run tabulated 664 successful and unsuccessful hunters who reported, and I estimate there were an additional 220 people who did not hunt (30% of 736). This leaves approximately 516 hunters (1,400 - 884) whose status is unknown. Assuming a minimum success rate of 5%, I estimate an additional 25 moose were killed that were not reported ($.05 \times 516$).

Hunters from rural villages probably accounted for another source of unreported moose mortality. Comparing village population figures with the number of moose tickets issued by vendors in the rural areas, it was apparent some hunters entered the field without a moose harvest ticket in their possession. In a few villages, less than 10% of the adult population acquired harvest tickets. From conversations with village residents, case histories filed by enforcement officers, and other sources of harvest information, it appeared "unlicensed" hunters killed at least 10-25 additional moose. Using all sources of data from reported and unreported harvest, I estimate the total kill numbered 325-350 moose.

Based on the reported harvest, 52% of the total kill occurred in Subunit 22D (the central Seward Peninsula), principally in the drainages of the Kuzitrin, Kougarok, and Pilgrim Rivers. A well maintained gravel road traverses most of this area in a north-south direction providing ready access for Nome's 2,500 residents. A high percentage of the people who live in Unit 22 are avid hunters, and the immediate area adjacent the road system was subjected to heavy hunting pressure during the snow-free months.

Nome residents spent thousands of man-hours driving the roads in search of a legal moose. Successful hunters reported spending a minimum of 5,329 days hunting moose in Unit 22. Nearly one-half of this time (2,553 days) was spent in Subunit 22D. Despite the meager road system in Unit 22, road hunters using highway and off-road vehicles accounted for 44% of the harvest. The next most preferred hunting method was boats, used by 23% of the successful hunters. Snowmachines were used 23% of the time, aircraft 11%, and 4% was unspecified.

Access during the snow-free months played a dominant role in the chronology of the harvest. During the 1st 10 weeks of the regular hunting season when it was feasible to use vehicles and/or boats, hunters took 65% of the annual harvest (181 moose). During the next 12 weeks (beginning October 9), 26% of the harvest was taken (74 moose). The remaining 9% of the harvest occurred during the last 2 months of the spring season (February 1-March 31, 1981).

The antlerless moose season opened September 15 in Subunit 22B, 22D, and 22E and, depending on the area, remained open as long as March 31. During this 28-week period, 685 antlerless permits were issued; approximately 400 were obtained in the 1st 4 weeks of the season. The large number of antlerless permits issued (compared to the human population base) was testimony to the demand by the hunting public to participate in a moose hunt.

The antlerless permit harvest by Subunit, sex, and hunter residency are given in Appendices D and E. Hunters took 65 cows (down from 71 and 76 cows the previous 2 seasons). However, 62 bulls were also harvested, of which 42 were antlered. The antlerless permit hunt was largely a "local" hunt. Residents

from Nome harvested 63% of the moose; 94% of the moose were taken by Unit 22 residents alone. Other Alaskan residents and nonresidents obtained 70 antlerless permits but took only 8 moose (6% of the harvest).

Adding all other reported moose from the Unit, nonresidents and non-Unit residents took only 8% of the harvest or 23 of 298 moose. These 2 groups of hunters regularly used aircraft as an aid to hunting, making them highly visible while in the field. Nonaircraft owners who wish to take a moose have expressed alarm over the increasing competition from "outside hunters" who use aircraft. However, the data show the absolute number of hunters is small, and competition to date does not appear excessive.

Management Summary and Recommendations

Moose were virtually absent from the Seward Peninsula 50 years ago. A few immigrants from the east probably established the initial colonizing stock 30-40 years ago. During the past decade, aerial surveys have shown a substantial increase in the moose population. Subunits 22B and 22D experienced the most dramatic growth during the 1970's which 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 revealed a gradual decline in bull:cow ratios in heavily hunted areas, but relatively stable and high bull ratios in unhunted populations. Bull:cow ratios should be carefully monitored over the next few years, especially in Subunit 22D.

Analysis of age data over a number of years indicates that a gradual increase in the older age cohorts has occurred, but the population is still represented by a high percentage of young animals. Overall, the moose population is maintaining high rates of production and survival.

At the present time, predators are not a major source of mortality but appear to be increasing. When the moose population increased, the major trend was for hunters to take an increasing number of moose. If predators become more abundant, this trend may change.

Because moose populations are experiencing high annual recruitment and competition on winter range is often keen, long hunting seasons are desirable in most areas. However, as the harvest escalates and as environmental conditions change, precise harvest information becomes a necessity. Before reminder letters were sent, over 50% of the hunters failed to respond voluntarily.

Hunters holding moose harvest tickets and antlerless permits should be sent reminder letters to assess the success rate of nonrespondents. An increase in information is also needed, especially in the rural villages, where residents are failing to acquire harvest tickets.

The antlerless permit should be retained because it provides a level of positive control not available through harvest tickets. However, it should be implemented only in those areas where cows are sufficiently available to warrant a season. When a desired cow harvest is obtained 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 by aircraft and snow machines. Seasons and bag limits should be critically reviewed in all Subunits on an annual basis.

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APPENDIX A. Results of aerial surveys conducted in Subunits 22B and 22D, winters of 1980 and 1981.

Drainage/year	Bulls/ 100 cows	% yrly. bulls in herd	Calves/ 100 cows	% calves in herd	Moose/ hour	Total sample
American/Agiapuk						
1980	61	11	45	22	19	101
1981	59	9	56	26	17	142
Kuzittrin						
1980	30	4	45	25	74	243
1981	63	8	58	26	25	198
Niukluk/Fish						
1980	64	7	43	21	40	297
1981	50	6	59	28	20	192

APPENDIX B. Results of surveys in portions of Subunits 22B and 22C, 1982.

Drainage/ river	Total adults w/o ca	Total adults w/1 ca	Total adults w/2 ca	Total adults	Total calves	% calves in herd	Total sample
22B Niukluk/ Fish River	132	28	9	169	46	21	215
22C 5 small drainages	24	7	4	35	15	30	50

APPENDIX C. Age structure (%) of the annual Unit 22 moose harvest, 1973-1981.

Year/sex	Age (years)								Sample size
	1	2	3	4	5	6	7	8+	
1973, bulls	44	15	23	7	3	4	4	0	73
1974, bulls	33	26	15	8	10	2	4	2	94
1975, bulls	23	32	10	17	7	5	4	2	87
1976, bulls	24	37	20	9	3	3	1	3	124
1977, bulls	17	22	16	14	8	9	5	9	98
1978, bulls	37	23	15	10	6	3	1	5	100
1979, bulls	34	21	11	18	7	5	1	3	91
1980, bulls	37	35	8	5	3	7	1	4	76
1981, bulls	31	30	19	8	8	2	0	2	106
Total									849
Means	31	26	15	12	6	4	2	4	
1974-78, cows	23	16	15	13	6	7	5	15	223
1979-81, cows	26	25	14	8	4	2	5	16	116

APPENDIX D. Unit 22 antlerless permit harvest by residency status, 1981-82.

Residency	Permits issued	Successful	Harvest		
			Antlered bulls	Antlerless bulls	Cows
Nome	514	80	33	12	35
Other Unit 22	101	39	5	7	27
Other Alaska	64	7	3	1	3
Nonresident	6	1	1	0	0
Totals	685	127	42	20	65

APPENDIX E. Unit 22 antlerless permit harvest by hunt number, 1981-82.

Hunt No. (Subunit)	Permits issued	Harvest		
		Antlered bulls	Antlerless bulls	Cows
956 (22B)	267	11	15	9
955 (22D)	362	31	26	9
954 (22E)	56	0	24	2
Totals	685	42	65	20

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 23

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limits

Unit 23, that portion of the Seward Peninsula west of and including the Kiwalik drainage	Aug. 1-Mar. 31	One moose; antlerless moose may be taken only from Sept. 15-Mar. 31.
Unit 23, Buckland River drainage only	Aug. 1-Dec. 31	One bull
Remainder of Unit 23	Aug. 1-Dec. 31	One moose; antlerless moose may be taken only from Sept. 15-Oct. 31.

Population Status and Trend

No changes were evident since the previous reporting period. Calf production and recruitment, as observed during late winter moose surveys (Appendix A), ranged from 12% to 39% and averaged 25.8% for all areas surveyed. The reported harvest of moose increased 57% over 1980, but was still considerably below estimated sustainable harvest rates for the Unit. Snowfall was light during winter 1981-82, but the weather was colder and windier than recent winters. Spring 1982 was very late, cold, and wet during the normal calving period. Moose herds throughout the Unit either remained stable or increased slightly since the previous report.

During the winter, 2 moose trend count areas were established and surveyed to provide a basis for determining future changes in moose populations in important areas in Unit 23. It is anticipated that 6-12 of these areas will eventually be established on key ranges and surveyed on a regular basis.

The lower Noatak trend count area is located south of Noatak village, extends from the west bank of the river to the continental divide between tributaries of the Noatak River and Kilikmak and Jade Creeks, and encompasses 145 mi². Approximately 26 mi² of the count area along the west bank of the Noatak is riparian habitat comprised of large stands of willow and alder.

It includes some open stands of white spruce, numerous sloughs and lakes and was classified (after surveying) as a high-density area. The remainder of the area (117 mi²) is approximately 90% open tundra and 10% riparian streamside willow, with some stands of spruce or deciduous brush on hillsides. It was classified as a low density area.

The high-density area was searched at an intensity of 5.5 min/mi², and 57 moose were observed for a density of 2.2 moose/mi². The low-density area was searched at an intensity of 0.8 min/mi², and 10 moose were observed for a density of 0.09 moose/mi². Combining both areas resulted in an average search effort of 1.66 min/mi² and an average moose density of 0.47 moose/mi². Sixty-seven moose were observed (16.9 moose/hour), and calves composed 22.3% of the sample. No attempt was made to determine a sightability correction factor. However, it is believed that the majority (90% or more) of the moose present were observed.

The lower Kobuk trend count area is located on the Kobuk River between the villages of Kiana and Noorvik. The area encompasses about 85 mi² and consists of 3 habitat types. The southern 32 mi² is mainly riparian shrubland and is part of the Kobuk River floodplain. Immediately to the north is a 20 mi² area of upland tundra devoid of trees or shrubs except for riparian vegetation along a few north-south flowing creeks. The remaining 34 mi² of the trend count area is a south-facing mountain slope 250-2,000 ft in elevation and is well timbered with stands of spruce and birch up to the 1,200-1,500 ft.

The riparian shrubland was searched at an intensity of 4.0 min/mi²; 26 moose were observed for a density of 0.8 moose/mi². The upland forest area was also searched at 4.0 min/mi², and 8 moose were observed for a density of 0.2 moose/mi². Less effort was required to search the open tundra because of nearly unrestricted visibility, and 1 moose was observed for a density of 0.05 moose/mi². For the entire count area, the search effort averaged 3.6 min/mi², and moose density averaged 0.4 moose/mi². Thirty-five moose were observed (7 moose/hour). Calves composed 22.9% of the sample.

No sightability correction factor was determined for any of the habitat types. However, it was felt that 75-90% of the moose in the shrubland habitat and 50-75% of the moose in the forest habitat were observed.

During traditional late-winter composition surveys of the lower Noatak and lower Kobuk areas (Appendix A), calves composed 36.0% and 39.6% of the moose observed compared to 22.3% and 22.9%, respectively, during the more intensive trend count surveys. These data suggest that the traditional-type surveys may be biased toward the observation of calves in greater proportion than they exist in the population as a whole.

Population Composition

Fall survey conditions were poor for the 3rd consecutive year in Unit 23. Two surveys were conducted under marginal conditions with poor results. During a November 21, 1981 survey of the Noatak Valley, 71 moose were observed (18.9 moose/hour), including 11 bulls, 38 cows, and 22 calves (28.9 bulls/100 cows; 57.9 calves/100 cows). On November 20, 1981, 53 moose were tallied in the Selawik River drainage (13.8 moose/hour) including 6 bulls, 32 cows, and 15 calves (18.8 bulls/100 cows; 46.9 calves/100 cows).

Late-winter moose composition counts were conducted in those portions of the Noatak and Kobuk drainages that were surveyed in 1981, in 4 other drainages that were surveyed in 1981, and in 4 drainages that had not been surveyed for 2 or 3 years (Appendix A). Survey conditions were adequate in many areas by mid-February, but moose were never as concentrated as in previous years due to an unusually light snow pack. Approximately 50% fewer moose were observed in the areas that were surveyed last year (Appendix A), but this is not indicative of any decrease in the population. Survey conditions remained poor all winter in the majority of the Selawik River drainage, and no surveys were attempted in this area.

Observed calf percentages ranged from a low of 12.3% along the Goodhope River to a high of 39.6% in the lower Kobuk survey area and averaged 25.8% for all areas surveyed in 1982.

Mortality

Harvest figures for the 1981-82 season were obtained from hunter reports and reminder letters. Hunters reported taking 176 moose in Unit 23 compared to 112 moose in the 1980-81 season (Appendix B). In addition, 5 moose (including a cow and calf, a bull, and 2 moose of unknown sex and age) were poached.

As in past years, the Kobuk and Noatak drainages sustained most of the hunting pressure and harvest and accounted for a combined take of 140 animals. Most of the moose (91%) were taken during August and September. Only 15 moose were reported taken after October 3, and only 1 moose was taken after January 1 in the portion of the Unit that remained open until March 31, 1982.

Three hundred twenty-nine people reported hunting in Unit 23, and 53.5% were successful. Resident hunters had a success ratio of 47.7% ($N = 115$), while nonresidents had the best success ratio (82.9%; $N = 47$) of any group. Hunters utilizing aircraft as a mode of transportation were more successful (75.7%; $N = 103$) than boat hunters (55.2%; $N = 143$). Only 11 hunters reported utilizing snowmachines to hunt moose, and 7 were successful.

Unit residents took 39.8% of the reported harvest (70 moose). Other Alaskan residents took 25.6% (45 moose), and nonresident and alien hunters took 22.1% (39 moose). Hunters of undetermined residency took the remainder of the reported harvest (12.5%; 22 moose).

Management Summary and Recommendations

Populations of moose remain near optimum levels in many areas in Unit 23. Calf survival rates in the areas surveyed were adequate to support present harvest rates except on the Kobuk delta, where the harvest may exceed recruitment.

The reported moose harvest increased substantially over the previous year for reasons which are not readily apparent. Previously, the harvest had been declining in Unit 23. Caribou, which are the meat animal preferred by local hunters, were not as available along the Noatak and Kobuk Rivers during September as in recent years, and this may have resulted in a larger-than-normal harvest of moose.

Two trend count areas were established and provided some insight into the bias which may exist in traditional late-winter surveys. The densities of moose in several habitat types in the Noatak and Kobuk valleys were estimated. The legal harvest and poaching of moose from the Kobuk drainage downstream from Kiana is probably greater than recruitment into this population. The Kobuk River habitat could support 2 or 3 times the number of moose present, and restrictions on the taking of moose in this area should be imposed. No other changes in seasons or bag limits are recommended.

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APPENDIX A. Late-winter moose composition counts in GMU 23, 1982.

Area	% calves	Moose/hour	Total moose
Lower Noatak	36.0	47.3	189
Middle Noatak	23.8	63.8	386
Lower Kobuk	39.6	23.2	54
Middle Kobuk	32.5	52.3	157
Upper Kobuk	26.3	21.9	76
Buckland River	25.5	28.4	98
Kugruk River	23.5	43.7	51
Goodhope River	12.3	48.8	57
Wuluk and Kivalina	20.8	25.1	48
Overall Unit 23	25.8	42.0	1,116

APPENDIX B. Unit 23 reported moose harvest after reminder letters, 1981-82.

Area	Bull	Cow	Unidentified	Total
Wuluk-Kivalina	2	0	0	2
Noatak	61	7	0	68
Kobuk	65	6	1	72
Selawik	15	0	0	15
Seward Peninsula	8	0	0	8
Unknown	9	2	0	11
Totals	160	15	1	176

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 24

GEOGRAPHICAL DESCRIPTION: Koyukuk River Drainage North of and
Including Dulbi Slough

PERIOD COVERED: July 1, 1981-June 30, 1982

Seasons and Bag Limit

Unit 24, the drainage of the Koyukuk River downstream from and including the Indian River drainage	Sept. 5-Sept. 25 Mar. 1-Mar. 10	One moose; provided that antlerless moose may be taken only from Sept. 21- Sept. 25 and Mar. 1-Mar. 10.
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Remainder of Unit 24	Sept. 5-Sept. 25	One bull
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Population Status and Trend

No surveys were conducted during the reporting period, and only 1 inconclusive survey was conducted in 1980-81. Consequently, population trend information is unavailable. However, relative densities of moose in the Huslia area appeared high. Sixty moose were observed in a 10-min flight with a Cessna 180.

Mortality

One hundred thirty-four moose were reported taken from Unit 24 during the split season. Hunters took 116 bulls in September. Four bulls and 14 cows were reported in March; however, the actual harvest during March was 30. Only local residents participated in the March hunt.

Management Summary and Recommendations

Trend areas should be established, and more frequent composition surveys conducted.

Moose densities in southern Unit 24 are adequate to provide moose to hunters over an extended season. Little is known about moose populations in the northern part of the Unit.

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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: July 1, 1981-June 30, 1982

Seasons and Bag Limits

Unit 25A, that portion of the Sheenjek River drainage upstream from Last Lake	Sept. 10-Sept. 20	One bull
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Remainder of Unit 25A	Sept. 5-Sept. 25	One bull
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Unit 25B, that portion draining into the north side of the Yukon River upstream from the Kandik River	Sept. 10-Sept. 30 Nov. 1-Nov. 15 Dec. 15-Dec. 31	One bull
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Remainder of Unit 25B	Sept. 10-Sept. 30 Nov. 1-Nov. 15	One bull
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Unit 25C	Sept. 5-Sept. 15	One bull
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Unit 25D	Sept. 10-Sept. 20 Nov. 1-Nov. 10	One bull
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Population Status and Trend

Areas established to estimate moose population status and trend were surveyed for the 2nd successive year in Subunits 25A and 25D. No data were obtained for the rest of the Unit, but population composition surveys in Subunits 25B and 25C indicate stable, low-density populations.

Trend areas in Subunit 25A are located in the western portion of the Unit on the Middle Fork of the Chandalar River and in the eastern portion on the upper Sheenjek River. The areas on the Chandalar River indicate that moose populations are low and are possibly declining (Appendix A). This decline was most severe in the downriver trend area and has probably been occurring for at

least the last 3 years, as evidenced by previous surveys in the drainage. The upper Sheenjek trend area was newly established in fall 1981; therefore, no 1980 data are available for comparison. However, the density was the highest in Unit 25, and population composition surveys from previous years indicate stability.

Eleven trend areas were surveyed during fall 1981 in Subunit 25D. Comparative data from fall 1980 are available for only 5 of these areas. These data suggest very low moose densities and declining moose populations in most of the Unit. The notable exception is Mardow Lake in eastern 25D which has an increasing population and a density higher than any other area surveyed in Subunit 25D. Accessibility is by aircraft only, which limits hunting pressure in this area.

Six of the trend areas in Subunit 25D were also surveyed in March 1982 to determine if there is an influx of winter migrants from surrounding uplands. Comparisons between fall and winter data indicate no influx occurs because no significant change in density was detected. However, this conclusion is tentative because winter 1981-82 was considered relatively mild. A severe winter could produce different results.

Population Composition

Surveys for population status and trend also generated most of the composition data. However, it was often necessary to combine several trend areas to obtain adequate sample sizes for composition calculations. Sample sizes were sometimes increased by search flights of low intensity in favorable habitat.

Composition data for Subunit 25A are consistent with population trend data. Calf survival was poor on the Middle Fork of the Chandalar River, as it has been for several years (Appendix B). Improved yearling recruitment during 1981 probably helped the situation somewhat but evidently was insufficient to reverse the downward trend. Both calf survival and yearling recruitment were good on the upper Sheenjek River and appear adequate to maintain a stable population.

Moose management in Subunit 25A is directed toward maintaining a few large bulls. Bull:cow ratios in all survey areas are adequate.

Subunit 25C had poor calf survival. However, yearling recruitment was good and may improve chronic low density. Sampling bias and very light harvesting of bulls in the survey areas may be responsible for very high bull:cow ratios.

Composition data for Subunit 25D are inconsistent with population trend results. Population composition is characteristic of an

increasing herd, whereas the trend appears downward. Calf production, survival, and recruitment are all good. However, mortality factors unreflected in these population parameters are effectively removing more than the net annual production, causing population decline. A clue to 1 mortality source is found in the atypically high bull:cow ratio in a population supposedly hunted under a bulls-only season. A substantial illegal kill of cow moose is suggested. Another potential mortality source is nonselective wolf predation.

Habitat is an insignificant factor influencing the Subunit 25D moose population and is not reflected in the composition parameters by lower values for calf survival and twinning. Composition data were generated from moose observations in intensively searched population trend areas and are unlikely the result of sampling error bias. Moreover, the parameters do not substantially change when observations from the increasing subpopulation at Mardow Lake are subtracted.

Mortality

Little reliable mortality information is available for Unit 25. Data from harvest tickets are incomplete because most harvest by Unit 25 residents is not reported through the harvest ticket system. Illegal hunter kills are often reported to the area office, but the sources vary in reliability and verification is often impossible. Magnitudes and sources of nonhunting mortality are largely conjecture.

Harvest ticket returns indicated 114 moose were taken in Unit 25 by 301 hunters (Appendix C); the success rate was 38%. Forty moose were harvested from Subunit 25B, and the remaining harvest was equally distributed among the other 3 Subunits. Locations of 8 kills were unspecified.

Local hunters reported taking 27% of the total harvest; other Alaska residents harvested 51%; and non-Alaskans harvested 18%. Residency was unspecified for 4% of the total kill. Airplanes and boats were the 2 most common transportation methods for all successful hunters, 35% and 36% of transport, respectively (Appendix D).

Illegal kill of moose by local residents is probably a significant source of mortality. Individuals reported 16 moose were taken illegally in Subunit 25D and 19 taken out-of-season in 25B--probably less than half the total illegal kill. Cows dominated this out-of-season harvest. Moreover, aircraft were allegedly involved in taking 9 of the 16 kills reported in 25D. This use of aircraft is an alarming increase in hunting efficiency in that Subunit because it allows hunters to locate what few animals remain and remove them from a population already at dangerously low density.

Wolf predation is probably another significant source of mortality in various areas. Observations of wolf packs during late winter 1981 in western Subunit 25D indicated sufficient wolves to remove 244 moose annually. This loss may not be reflected in composition parameters because the low-density population may not allow prey selection by wolves. Incidental observations made during moose surveys on the Middle Fork of the Chandalar River in Subunit 25A indicate wolves are abundant and could contribute to chronically poor calf survival and recruitment.

Management Summary and Recommendations

Moose density is low in most of Unit 25, and the population trend varies from stable to declining. Special attention should be directed toward the western portion of Subunit 25A and Subunit 25D because both these areas have low-density, declining moose populations. In western Subunit 25A, a wolf survey is needed to evaluate the role of predation; further restrictions on human harvest also need consideration. In 25D, an intensive management program should be initiated because the viability of the moose population is endangered. This magnitude of effort is justifiable because small villages in the Subunit are dependent upon moose as a primary food source for which no reasonable substitute exists.

The management program for Subunit 25D should encompass 4 major activities: survey, harvest quantification, enforcement, and education. The following surveys should be conducted: moose population trend areas, wolf population numbers, and browse use and availability. The latter effort is necessary to test the current assumption that habitat is not a factor in the population decline. Harvest quantification should involve documenting the magnitude of nonlocal take and encouraging local hunters to report harvest. Enforcement should be increased by stationing a Fish and Wildlife Protection officer in Ft. Yukon. (Currently, a Protection Officer is assigned to Ft. Yukon but operates out of Fairbanks.) The education effort should be aimed at enlisting the cooperation of local people. Village meetings should be held to explain harvest tickets and reports, moose population status and trend, and impacts of illegal killing of cows. These meetings should also be viewed as an opportunity to learn village needs for moose and village opinions on what direction management should take.

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APPENDIX A. Raw data of moose density/sq mi in Unit 25, 1980-82.

Subunit	Location	Nov. 1980	Nov. 1981	Feb. 1982
25A	Middle Fk. Chandalar R. (upper)	0.40	0.32	--
	Middle Fk. Chandalar R. (lower)	1.50	0.43	--
	Upper Sheenjek R.	--	1.47	--
		$\bar{x} = 0.95$	$\bar{x} = 0.74$	--
25D	Gushiate Lake	0.19	0.13	--
	Martin Island	0.63	0.41	--
	Lone Mountain	0.63	0.00	--
	Mardow Lake	1.01	1.20	--
	Beaver Slough ^a	--	0.11	0.17
	Birch Creek Slough ^a	--	0.50	0.40
	Canvasback Lake ^a	--	0.09	0.06
	Crazy Slough ^a	--	0.43	0.55
	Yukon River ^a	--	0.04	0.25
	Sheenjek River (lower) ^a	--	0.08	0.08
	Negrohead Mountain ^a	--	--	0.63
		$\bar{x} = 0.62$	$\bar{x} = 0.30$	$\bar{x} = 0.31$

^a Data supplied by Roger Kaye, U.S. Fish and Wildlife Service, Yukon Flats National Wildlife Refuge.

APPENDIX B. Moose sex and age ratios for Unit 25, fall 1981.

Subunit	Area	Bulls/ 100 cows	Calves/ 100 cows	Incidence of twins/ 100 cows w/calves	% calves	% yrlg. Bulls	Sample size
25A	Middle Fork Chandalar River	82	15	25	7	14	68
	Upper Sheenjek River	70	33	13	16	12	110
25C	Bull and Trail Creeks	109	23	0	10	28	81
25D	Yukon Flats ^a	108	63	33	23	20	103

^a Data supplied in part by Roger Kaye, U.S. Fish and Wildlife Service, Yukon Flats National Wildlife Refuge.

APPENDIX C. Kill location and residency of successful hunters in Unit 25, fall 1981.

Subunit	Local	Nonlocal Alaska resident	Nonresident	Unspec.	Total harvest
25A	2	8	10	0	20
25B	20	11	5	4	40
25C	3	21	1	0	25
25D	5	13	3	0	21
Unspecified	1	5	1	1	8
Totals	31 (27%)	58 (51%)	20 (18%)	5 (4%)	114

APPENDIX D. Transportation methods used by successful hunters in Unit 25, fall 1981.

Subunit	Airplane	Horse	Boat	Snow machine	Off-road vehicle	Highway vehicle	Unspec.
25A	13	1	5	0	0	0	1
25B	11	0	25	2	0	0	2
25C	1	2	0	0	11	11	0
25D	13	0	6	1	1	0	0
Unspecified	2	0	5	0	1	0	0
Totals	40 (35%)	3 (3%)	41 (36%)	3 (3%)	13 (11%)	11 (10%)	3 (3%)

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26

GEOGRAPHICAL DESCRIPTION: Arctic Slope

PERIOD COVERED: July 1, 1981-June 30, 1982

Season and Bag Limit

Unit 26	Sept. 1-Dec. 31	One moose
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Population Status and Trend

Over the last 3 decades, moose populations 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. The greatest wintering densities occur on the central Colville River and its tributaries.

Unitwide aerial surveys were conducted in 1970 and 1977. Moose distributions were similar in both years, and about 1,500 moose were observed during each survey. Annual spring surveys of the Colville River and its tributaries between the Anaktuvuk and Killik Rivers were conducted from 1974 to 1981. During this time, the adult segment of the population appears to have increased from 400 to 600 animals. However, recruitment to short yearlings declined from a high of 37% in 1975 to 20% in 1980 and then dropped precipitously to 7% in 1981. No spring survey was conducted in 1982, although observations in Subunits 26A and 26B indicated that recruitment was substantially higher than in 1981.

Population Composition

No information was obtained during the reporting period. For results of previous surveys, see Coady (1981).

Mortality

The reported harvest for Unit 26 was 99 moose (Appendix A). As in past years, the majority of the harvest came from Subunit 26A. However, 37 animals were harvested in Subunit 26B compared to 16 in 1980 and 20 in 1979. Hunter success rates for the last 5 years ranged from 57 to 83% (Appendix B). Although the success

rate was fairly stable during this period, the number of hunters obtaining and returning harvest tickets and the size of the reported harvest have tripled since 1977.

Fifteen of the moose reported in 1981-82 were harvested by Unit 26 residents: 14 from Barrow and 1 from Kaktovik. The remaining hunters came from Fairbanks (39), other areas of the State (21), and from outside of Alaska (24).

No information on natural mortality was available for the 1981-82 reporting period.

Management Summary and Recommendations

At its spring 1982 meeting, the Board of Game closed the moose season in that portion of Subunit 26B within 2 mi of the Dalton Highway. The Subunit 26B moose harvest has been increasing annually, and prior to this action, a potential for excessive harvests along the Dalton Highway existed. It was feared that small local populations would be extirpated, destroying the opportunity for motorists to view moose.

Annual spring surveys of the Colville River and its tributaries should be continued, and it should be determined whether the low recruitment to short yearlings observed in 1981 was a unique event or whether it was the beginning of a trend. Previous browse surveys have indicated heavy use of the annual production of preferred food items. Hedging is common, and an inverse relationship between total adults and recruitment can be observed from 1975 to 1980 (Coady 1981). On the other hand, the rate of multiple births has not declined over the past 5 years (Coady 1981). Because ovulation rates are indicative of nutritional condition in moose, the high twinning rate suggests that the Colville population is not greatly exceeding the carrying capacity of its habitat.

If the low 1981 recruitment was the result of range overuse, then the population will decline if the harvest remains at current levels. However, if low recruitment in 1981 was an isolated phenomenon, then the population should remain stable, even with moderate hunting pressure. In the absence of more information, no harvest reduction is recommended at this time. However, a late-winter season in a portion of the Colville River drainage would distribute hunting pressure more evenly because virtually all moose would be accessible to hunters at that time.

Literature Cited

Coady, J. W. 1981. Moose survey-inventory progress report. Pages 179-184 in R. A. Hinman, ed. Annual Report of Survey-Inventory Activities. Alaska Dep. Fish and Game. Fed. Aid in Wild. Rest. Part II, Vol. XII. Proj. W-19-1 and W-19-2, Job 3.0, 1.0, and 12.0. Juneau. 229pp.

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APPENDIX A. Unit 26 moose harvest by Subunit, 1981-82.

Subunit	Sex		Total
	M	F	
26A	45	10	55
26B	29	8	37
26C	1	0	1
Unknown area	5	1	6

APPENDIX B. Unit 26 moose hunter success, 1977-1982.

Season	Harvest	Hunters	Success rate (%)
1977-78	36	48	68
1978-79	46	81	57
1979-80	90	108	83
1980-81	89	132	67
1981-82	99	145	68