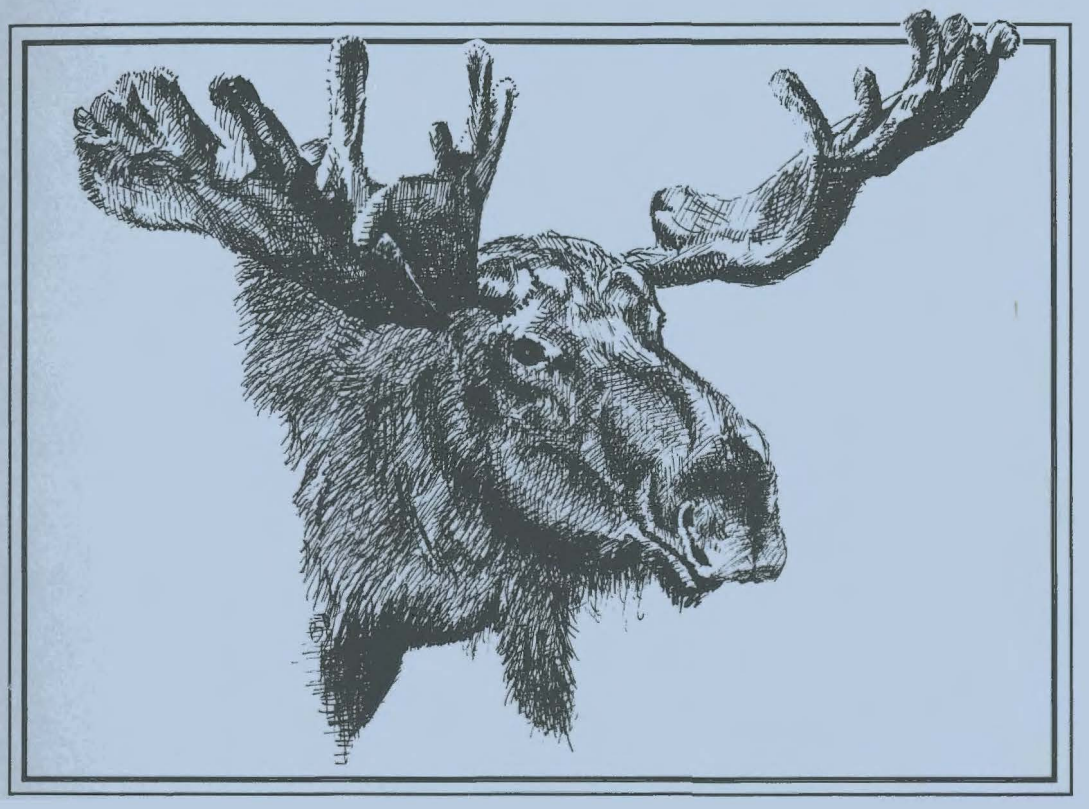
Alaska Department of Fish and Game
Division of Game
Federal Aid in Wildlife Restoration
Annual Report of Survey—Inventory Activities

MOOSE



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STATEWIDE HARVEST AND POPULATION STATUS

The status of moose populations in the state is highly variable; generally, populations in the Interior (i.e., Units 12, 19, 21, 24, 25, and parts of Unit 20) are at low levels and either stable or slightly increasing, while many populations in northwestern (Units 22 and 23) and southcentral Alaska are at higher levels and either stable or increasing. Mild winter weather was favorable to moose survival.

The reported state harvest by hunters totaled 7,497 moose (6,751 bulls, 668 cows, and 78 sex unknown). This total is 19% higher than that for last year. The harvest increased in all units except 1 and 5; however, the harvest in these two areas was down only slightly. The two highest harvest areas were GMUs 13 and 20; over 1,000 moose were taken in each one. The 1,143 moose reported taken in GMU 13 was the highest since 1970. As noted in previous years, the actual harvest is considerably greater than the reported harvest, particularly in Interior and Arctic units.

Reported harvest of moose is summarized below:

	Reported Harvest			
Unit	Bulls	Cows	Unknown	Total
1	95	0	--	95
5	54	0	--	54
6	89	63	3	155
7	58	--	--	58
9	222	13	4	239
11	49	--	--	49
12	105	--	--	105
13	1,143	--	--	1,143
14	631	270	28	929
15	637	23	33	693
16	569	115	9	693
17	201	0	0	201
18	60	0	0	60
19	460	0	0	460
20	1,051	0	0	1,051
21	505	52	0	557
22	306	101	1	408
23	139	8	0	147
24	115	0	0	115
25	164	0	0	164
26	98	23	0	121
TOTAL	6,751	668	78	7,497

Steven R. Peterson
Chief of Research

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

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

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose occur throughout Subunit 1B along major drainages and on several of the major islands of Unit 3. Few moose occur in Subunit 1A on the Unuk and Chickamin Rivers. The Unuk moose herd is indigenous, while the Chickamin herd is the result of a 1963-64 transplant from Cook Inlet and the Chickaloon Flats (Burris and McKnight 1973). Hunting seasons exist in Subunits 1A and 1B, while the season is closed in Unit 3.

The Stikine drainage population, located in southern Subunit 1B, was estimated at about 300 animals in 1983 (Craighead et al. 1984). Since 1983, winters have been mild and moose populations in the Stikine River have remained stable or have increased slightly. Subunit 1A and northern Subunit 1B populations did not change noticeably during the period. Increased sightings of moose throughout Unit 3 indicate that the island population is continuing to grow slowly. While there is a scarcity of riparian vegetation on the islands, the intensive logging of high-volume, old-growth timber that has occurred on all the islands stimulates early seral stages of vegetation that moose prefer. Experience in Thomas Bay, however, indicates that the successional vegetation created by clear-cutting in Southeast Alaska is low in nutritive value (Doerr et al. 1980). Because of this, the severity of winters is likely to be the limiting factor on moose expansion in Unit 3. Predation by bears and wolves is also likely to limit moose populations on the islands of the unit.

Population Composition

The small kill in Subunit 1B (Table 1) does not justify extensive surveys, but aerial surveys are made occasionally to monitor gross changes in sex and age ratios. Dense overstory

vegetation in Southeast Alaska reduces the sightability of moose considerably.

During a fixed-wing aircraft flight on 10 September 1986, 18 moose were sighted in the Stikine River valley. Based on this small sample, the preseason bull:100 cow ratio was 44:100 and the calf:100 cow ratio was 44:100. Winter surveys were attempted; however, because of poor flying conditions they were aborted. A 12 September 1986 flight to Thomas Bay resulted in the sighting of 7 moose. The bull:100 cow ratio was 50:50, and the calf:100 cow ratio was 33:100. During a 6 March 1987 survey when antlers were not visible, 9 moose were sighted; the calf:100 adult ratio was also 33:100. Meaningful conclusions on population composition can not be drawn from these small sample sizes.

Mortality

Subunit 1A:

No kills were reported in Subunit 1A during the 1986 season (R. Wood, pers. comm.). Entry into this hunt is by harvest ticket.

Subunit 1B South (south of Le Conte Bay):

Biologists stationed at Kakwan Point regularly visited hunting camps on the Stikine River to interview hunters and examine kills for age and antler characteristics. Based on these interviews, 50 bulls were taken on the Stikine River during 1986. An additional bull was taken at Virginia Lake south of the Stikine River drainage.

Based on the return of 218 moose-harvest report cards, unsuccessful hunters in southern Subunit 1B spent an average of 17 days in the field, compared with 10 days for successful hunters. Forty-two successful hunters returned harvest reports; 3 used airplanes, while the remainder used boats for transport. Ninety-nine percent of unsuccessful hunters used boats, and 1% used aircraft.

Approximately 200 hunters were on the Stikine River during the 1986 season: the same number as estimated in 1985. Eighty-two percent of the successful hunters returned the standard harvest report cards; the success ratio on the Stikine River based on the return of these cards was 21% (n = 200), while the success rate based on check-station data was 25% (n = 200).

No antler restrictions were imposed for the Stikine River, and 71% of the bulls examined there had palmed antlers, 13% had

forked horns (2x2), and 13% had branch-antlers; 1 bull had spikes, and 1 calf was taken. We found that 63% (15) of the bulls were yearlings; of these, five had at least 3 tines on one of their antlers and two had palmed antlers.

Because of the implementation of subsistence hunting laws in Alaska, the residency of hunters using specific moose herds is important. In 1986, 77% of the hunters interviewed were from Wrangell, 16% from Petersburg, 3% from Ketchikan, 3% from Juneau-Douglas, and the remainder from Craig, Thorne Bay, Haines, and outside Alaska. According to the harvest report cards, Wrangell residents accounted for 72% of the kill, while Petersburg residents accounted for 18%. The harvest success rates were 29% for Wrangell residents, 35% for Petersburg residents, 33% for Ketchikan residents, 40% for Juneau-Douglas residents, and 50% for the remainder.

Subunit 1B North (north of Le Conte Bay):

In the northern area, 201 registration permits were issued, and 158 (79%) of the permit holders participated in the 15-day season. The number of hunters have increased significantly since the first registration hunts in 1984 (91 hunters) and 1985 (95 hunters).

In 1982 and 1983, the northern portion of Subunit 1B (which includes the Thomas Bay area) was closed to moose hunting because of poor calf survival attributed to winter mortality. The season was reopened in 1984, and an antler restriction was implemented to restrict the harvest of bulls without limiting hunting opportunity. Since the 1984 season, a registration hunt has been in effect, and a legal bull has been defined as having at least 3 tines on at least 1 antler.

Fifteen bulls were taken in northern Subunit 1B in 1986; of these, 12 were taken in the Thomas Bay area. Elsewhere in northern Subunit 1B, 3 bulls were taken in the Farragut River drainage, the highest harvest known for that area. The lower jaws of all bulls were collected, and an incisor was examined to determine the age of the moose. Although the 3-tine antler restriction was in effect, 33% (5) of the bulls were yearlings, compared with 63% for southern Subunit 1B.

The 1986 success ratio for hunters in northern Subunit 1B was 10%, compared with 13% in 1984 and 14% in 1985. The average number of days afield by successful hunters was 4, while unsuccessful hunters reported hunting an average of 5 days. Most of the hunters (93%) used a boat to get to the hunting area, while the remainder (7%) used aircraft.

Management Summary and Recommendations

The moose kill in Subunit 1B was 65 bulls. The Stikine River harvest of 50 bulls was the highest bull kill on record. The previous record harvest was the 1957 kill of 42 bulls. The 1986 moose kill in the northern portion of Subunit 1B was 15 bulls; 613 hunter days were expended during the 2-week season. It appears that the antler regulation has not restricted the number of hunters or the hunting effort.

The 1986 regulations defined a legal bull in northern Subunit 1B as having "at least 3 tines on at least 1 antler". This provision helps to protect a segment of the bull population without restricting hunting opportunity. At its annual meeting during spring 1987, the Board of Game rejected a hunter's proposal to change the 1987 bag limit to 1 spike or fork-antlered bull. The proposal was supported by the Petersburg Fish and Game Advisory Committee, the Wrangell Fish and Game Advisory Committee, and Division staff. A regulation of this type would be a logical step in managing the moose herd in Thomas Bay. The "spike-fork" regulation has been tested in Subunit 13A with favorable results (Schneider 1987).

Some segment of the bull population in heavily hunted areas should be protected to insure herd survival, and the protection of yearlings with a 3-tine requirement accomplishes that. Younger bulls have been shown to breed later in the year than old bulls (Bubenik and Timmermann 1982); this could result in reduced calf survival during the winter. A periodic regulatory change to protect older bulls is advisable. Further, it has been demonstrated in white-tailed deer that the continued removal of the males exhibiting the best antler characteristics protects males with genetically inferior antlers (Harmel 1979). In Sweden, maximum reproduction and meat production have been achieved by heavily harvesting calves (Sylven et al. 1979). A regulation should be implemented in northern Subunit 1B that would periodically protect mature bulls in the population. Adjustment of seasonal timing could be used so that hunting occurs when bulls are not rutting and, therefore, less vulnerable.

The Thomas Bay herd is unique among the moose herds in Southeast Alaska because it occupies an area that has been heavily logged. Logging began in the early 1950's, and from 1950 to 1976 over 2,500 hectares were harvested. The Thomas Bay area is a patchwork of mature timber, muskegs, recent clearcuts, dense second-growth conifers, and crushed-rock roads. In response to hunter desires, restrictions prohibit vehicle use for hunting; however, vehicles may be used for other purposes (by permit) during stated hours.

Continued logging and road construction in Southeast Alaska pose a problem in moose management. Logging has been shown to be involved in moose population explosions in Scandinavia (Lavsund 1981; Wilhelmson and Sylven 1979) where regrowth areas are sought by moose. Peak moose numbers in British Columbia in the mid-50's and mid-60's were attributed to logging and land clearing for agriculture (MacGregor and Child 1982). However, in Ontario, the continuation of clearcutting and access provided by logging roads led to excessive moose harvest, declining populations, and closed hunting seasons in recently logged areas (Eason et al. 1981).

Past calf declines in the heavily logged Thomas Bay area were not matched by similar losses in the unlogged Stikine-LeConte wilderness during the same winter. Wolf predation in Thomas Bay may have increased because wolves use the road systems to reach and kill moose concentrated in residual unlogged stands (Bergerud 1981). Impassable stands of second-growth conifers in much of the Thomas Bay area force moose to use road systems heavily, increasing the chance of predation. It is possible that poor nutrition in the Thomas Bay area (Doerr et al 1980) contributed to calf loss during periods of deep snow. Deep snows do not seem to limit moose during most winters in the Stikine River watershed (Craighead et al. 1984).

While moose numbers in Subunit 1B and Unit 3 may temporarily increase after logging as a response to the increase in seral vegetation (Doerr et al. 1980), the development of dense second-growth spruce within 15 years will reduce moose carrying capacity and lead to a population decline. The techniques that could keep the habitat in the early seral stages of vegetation are expensive, but they may be necessary to restore the carrying capacity of the range to desirable levels. A procedure called "gap management" has been discussed by ADF&G and USDA Forest Service biologists as an experimental procedure in clear-cut areas. The technique provides openings in clear-cuts that would be kept free of conifer regrowth to provide browse for ungulates. While the method does not mitigate for the loss of old-growth habitat, it may provide benefits that are lacking in regrowth. Thomas Bay would be an excellent site to experiment with the "gap management" technique. In 1986 strategic planning for moose population management in Subunit 1B was begun by the Division of Game. The completed plan will provide direction for moose management that is consistent with public desires. The participation of the public and the Wrangell and Petersburg Fish and Game Advisory Committees was solicited in planning meetings held in these communities. Questionnaires were provided to meeting participants and mailed to hunters. An operational guide will be developed recommending specific actions to meet objectives. Personnel of the the U. S. Forest

Service are participating with Game Division in the formulation of the plan.

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Table 1. Moose harvests for Subunit 1B, 1952-86.

Year	Stikine River[a] (southern 1B) M	F	Thomas Bay (northern 1B) M	F	Total
1952	31	0	--[b]	--	31
1953	12	0	--	--	12
1954	14	0	--	--	14
1955	16	1	3	0	20
1956	30	0	2	0	32
1957	42	0	--	--	42
1958	31	0	5	1	37
1959	35	0	7	0	42
1960	39	0	5	0	44
1961	28	0	11	0	39
1962	35	0	1	0	36
1963	26	0	6	0	32
1964	29	0	6	0	35
1965	28	0	6	0	34
1966	23	0	10	0	33
1967	26	0	--	--	26
1968	28	0	--	--	28
1969	20	0	--	--	20
1970	28	0	12	--	40
1971	25	0	10	0	35
1972	8	18	5	0	31
1973	25	22	3	0	50
1974	24	1	4	0	29
1975	16	0	8	0	24
1976	21	0	16	0	37
1977	19	0	12	1	32
1978	29	0	9	0	38
1979	26	0	21	0	47
1980	33	1	17	0	51
1981	33	1	10	2	46
1982	32	0	0	0	32
1983	41	0	0	0	41
1984	41	0	11	0	52
1985	38	0	13	0	51
1986	50	0	15	0	65
Totals	980	44	228	4	1256

[a] Cow permits were issued on the Stikine in 1972 and 1973, other cows are illegal kills.

[b] Information not available.

Table 2. Residency and percentage successful of southern Subunit 1B moose hunters, 1986.

Place of residency	No. successful hunters	No. unsuccessful hunters	Total hunters	Percent success
Wrangell	28	46	74	38
Petersburg	8	11	19	42
Ketchikan	2	4	6	33
Juneau/Douglas	2	3	5	67
Thorne Bay	1	0	1	100
Out of State	1	0	1	100
Gustavus	0	1	1	0
Unknown	0	110	110	0
Totals	42	175	217	19

[a] Information collected from harvest ticket reports.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1C

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

According to limited survey information gathered for the Chilkat Range, the moose population appears in good condition, at least for the portion along the Endicott River. Although the Berners Bay population has experienced low calf production for the 2nd consecutive year, the population trend appears to be stable. A late fall survey of the lower Taku River indicated that calf production was extremely low there. While the numbers of cows have stayed relatively constant, the bull:cow ratio has remained low (5 bulls:100 cows).

Population Composition

Three separate surveys were conducted in Subunit 1C during the 1986-87 period: (1) a helicopter survey in the Berners Bay drainages on 13 November 1986, (2) a fixed-wing survey in the Chilkat Range (Endicott River-St. James Bay area) on 3 December 1986. In the Berners area, 68 moose were observed, including 15 bulls, 46 cows, and 7 calves. Sex and age ratios were 33 bulls:100 cows and 15 calves:100 cows; 10% of the herd were calves. During the Taku River survey, 45 moose were seen (2 bulls, 42 cows, and 1 calf). Sex and age ratios were 5 bulls:100 cows and 2 calves:100 cows, respectively; 2% of the herd were calves. In the Chilkat Range area, 19 moose were counted, including 3 bulls, 10 cows, and 6 calves. Sex and ages ratios were 30 bulls:100 cows and 60 calves:100 cows, respectively; 32% of the herd were calves.

Mortality

Based on hunter reports from permit hunts No. 901 (a drawing hunt) and No. 956 (a registration hunt), 30 bulls were taken

in Subunit 1C during 1986. One hundred seventy-five hunters spent 692 days hunting moose. Of the 30 moose killed, 25 bulls were taken in Hunt Area 956 (15 from the Taku River area and 10 from the Chilkat Range) and 5 bulls were taken in Hunt Area 901, the Berners Bay drainages. Only 1 nonresident hunted in Hunt 956 and was unsuccessful. Nonresidents could not apply for No. 901 permits.

In the Taku River herd unit, successful hunters killed 15 moose during 84 hunter-days (0.2). In the Chilkat Range, successful hunters killed 10 moose in 35 hunter-days (0.3), and in Berners Bay successful hunters killed 5 moose in 7 hunter-days.

Habitat Assessment

In 1981 a management study was initiated to obtain a better understanding of the carrying capacity of winter habitat for moose in the Berners Bay area. Moose were introduced into the Berners Bay area during 1958 and 1960. A formal measure of winter browse had never been made to determine a desired stocking rate for moose. An estimate of the carrying capacity is important in setting population objectives for a herd unit. Although bear predation on young calves has been suggested as a major factor reducing calf production in Berners Bay, poor habitat conditions may also cause reduced calf production, especially twinning rates. The best management approach is to first determine whether habitat conditions are limiting population productivity; predation should be examined after the habitat has been evaluated.

With the help of Wayne Regelin, Research Coordinator, Fairbanks, a sampling scheme was developed to estimate carrying capacity of the Berners Bay study area for moose. The sampling scheme consisted of 3 main components as follows:

1) Classify, map, and determine area of major habitat types;

2) Determine herbage biomass of each plant group by habitat type;

3) Determine nutritional composition of major forage species during late winter by habitat type; and

4) Determine moose food habits during late winter.

The study area was defined as the valley bottoms of the Berners, Lace, and Antler River systems and adjacent slopes to an elevation of 200 feet. Under private contract (Steve Jacoby, Juneau), the major vegetative communities were

identified, classified, and mapped using photographic techniques and methods that included field ground-truthing work. Coniferous forest stands located adjacent to and within the valley floor were described as dominated by Sitka spruce (S) or Sitka spruce and western hemlock (SH); timber volume was described in terms of net board-feet/acre (Scribner). The nonconiferous forest habitats were grouped into the following 5 vegetative types: (1) pioneer community (PC), (2) alder-willow (AW), (3) deciduous woodland (DW), (4) bog meadow (BM), and (5) sedge meadow (SM). Acreages for each vegetative type were determined.

Biomass and stem density of major shrubs and biomass of herbs were estimated only for the major shrub communities (PC, DW, and AW) in the riparian zone within the Berners, Lace, Antler, and Gilkey Rivers. Transect lines were randomly located in each habitat type (4 transects each in the DW and AW types and 2 transects in the PC type). Along each transect, 25 plots were placed systematically at 20-pace intervals. Major shrubs were enumerated at 5-m^2 plots (number of stems and average plant height of each species); biomass of herbs and minor shrubs were determined by clipping 20- x 50-cm plots at each point. Plant dimension-biomass regression equations were developed for each major shrub species by habitat type. At each point along the transects, the total height of the nearest individual of each major shrub species was recorded; then all plant material less than 2 cm in stem diameter was clipped. The leaves and woody material were separated, dried, and weighed. Regression equations using plant height as the independent variable and woody or total biomass as the dependent variable were developed. Available plant biomass for each plot was estimated using the regression equations, mean plant height, and stem density.

Information of the nutritional composition (invitro dry matter disappearance and percentage dry matter composition of nitrogen and minerals) of major shrubs during late winter was collected. This information along with data on moose diets estimated by microhistological analysis of fecal pellets collected during March 1984 will be presented at a later date.

Although the major vegetative parameters have been summarized by habitat type (Tables 1-3), a thorough discussion of the results is beyond the scope of this report. A more complete analysis of the information will be completed and presented during the next reporting period.

Management Summary and Recommendations

Information for the Chilkat Range indicates that the moose population there is in good condition, at least for the area

along the Endicott River. Hunter take appears high, relative to the number of moose observed during postseason aerial surveys. Although the wolf population is relatively high there, moose are expanding into new areas. Public complaints of aircraft being used in the taking of moose in this area has increased. Access is limited to aircraft in the upper portion of the drainage (Endicott Gap). Boats and aircraft are commonly used to access the lower portion of the river.

Of all the areas hunted in the Chilkat Range, St. James Bay receives most of the reported hunter pressure because of its protected anchorage and relatively close proximity to Juneau. Because of fluctuating water levels in the area's only major navigable creek, accessibility to the area may affect hunter success from year to year. Hunter effort is increasing on the Excursion Inlet side of the Chilkat Range as a result of the moose population expansion into this area. Moose occur on the Gustavus forelands sporadically, influenced mostly by adjacent moose areas such as Beartrack River, Bartlett River, and the upper Salmon River country with the Glacier Bay National Park where hunting is not permitted. Whether moose will increase substantially in numbers there is difficult to predict because of limited high-quality moose habitat. Local residents seem to be divided on the question of whether moose hunting should be allowed.

For Berners Bay, the management objectives of total numbers and the ratio of bulls:cows have been reached. Under current management objectives, the number of cows observed should be about 50 during sex- and age-composition surveys conducted during late fall under favorable conditions. On 13 November 1986 the number of cows counted was 46. Although management objectives for adult composition have been maintained, calf recruitment has been poor. The cause of low recruitment is not fully understood; however, bear predation and/or poor range conditions could be causes. The harvest of 5 bulls in 1987 will not likely cause an increase in population size because herd productivity is limited by calf production.

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Table 1. Composition of moose winter range, Berners Bay, Southeast Alaska.

Habitat type	Land area	
	Hectars	Acres
Pioneer community (PC)	366	904
Alder-willow (AW)	699	1,317
Deciduous willow (DW)	533	1,726
TOTALS	1,598	3,947

Table 2. Summer biomass of major shrubs by habitat type, Berners Bay, Southeast Alaska.[a]

Plant species	Plant type		
	PC	DW	AW
Aluus sinuata	983	3,755	4,462
Salax sitchensis	241	2	647
S. alaxensis	25	1	42
S. monticola	0	10	81
Populus trichocarpa	518	0	33
Subtotals	1,767	3,768	5,265
Herbs	81	424	363
TOTALS	1,848	4,192	5,628

[a] Biomass expressed as kg/ha of all plant material greater than 2-cm stem diameter.

Table 3. Stem density, percentage composition, and mean height of shrubs by habitat type, Berners Bay, southeast Alaska. Stem density expressed as stems/ha.

Plant species	PC[a]			AW[b]			DW[c]		
	Stem density	Composition (%)	Height (cm)	Stem density	Composition (%)	Height (cm)	Stem density	Composition (%)	Height (cm)
Aluus sinuata	512	48	106	2,416	59	242	838	43	257
Populus trichocarpa	416	39	125	69	2	427	8	--	--
Salix sitchensis	96	9	126	637	15	181	20	1	209
S. monticola	2	2	92	170	4	116	10	1	141
S. alaxensis	32	3	136	53	1	170	2	--	47
Rubus spectasilis	0	0	0	557	14	--	526	27	--
Sambucus callicarpa	0	0	0	94	2	--	148	8	--
Viburnum edule	0	0	0	24	1	--	0	0	--
Vaccinium spp.	0	0	0	5	--	--	0	0	
Myrieum galc	0	0	0	13	--	--	0	0	

[a] Pioneer community.
[b] Alder-willow.
[c] Deciduous willow.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 1D

GEOGRAPHICAL DESCRIPTION: Upper Lynn Canal

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27

Population Status and Trend

While the moose population in Subunit 1D is apparently stable at about 350 animals, the composition of the herd continues to change. Compared with recent years, the bull:cow ratio increased during the report period; this is partly attributable to the closure of the fall 1986 hunting season. The calf:cow ratio indicates the number of calves is increasing.

Population Composition

An aerial sex- and age-composition survey of the Chilkat Valley moose population was conducted on 1 December 1986 (Table 1). Thirty-three bulls, 93 cows, and 13 calves were enumerated in 3.5 hours of survey time. The sex and age ratios were 37 bulls:100 cows and 14 calves:100 cows, respectively; 9% of the sample were calves. Visibility conditions were fair, at best, during the survey. A substantial number of moose were missed; the majority of these were probably cow-calf groups. Thus the actual bull:100 cow ratio of the population would be lower than observed; the actual calf:100 cow ratio, higher.

During an aerial survey conducted on 13 February 1987, 203 moose were counted; 14% of the sample were calves. Excellent conditions prevailed during the effort. Results substantiated the hypothesis that calves were missed during the fall survey in a higher proportion than adult moose.

Mortality

No moose-hunting season occurred in Subunit 1D; the Board of Game closed it because of a (1) bull:100 cow ratio lower than the objective stated in the management plan and (2) an apparently low calf recruitment. During the report period, 1

moose was killed under defense-of-life-or-property provisions, 4 roadkills were documented, 2 apparent cases of starvation were noted, and 1 animal was destroyed by Department staff because of injuries sustained by the animal when 1 foot was severed by a snare. No reports of poaching were received during the report period.

Management Summary and Recommendations

In the spring of 1987 the Board of Game designated residents domiciled in Subunit 1D as the only subsistence users of the subunit's moose population. A staff-proposed quota of 15 bulls that was supported by 1 local advisory committee and opposed by the other was adopted; the hunting season was established at 1-10 September for subsistence hunters.

The 1987 season should be monitored closely to ensure no more than the quota of bulls is harvested. Both fall sex and age-composition counts and late-winter survival surveys should be conducted. To more fully use the moose herd in Subunit 1D and to approach the management-plan goal of an annual harvest of 40 moose, implementation of a limited cow harvest should continue to be explored. No changes in season or bag limit are recommended at this time.

PREPARED BY:

Bruce Dinneford
Game Biologist III

SUBMITTED BY:

Rod Flynn
Survey-Inventory Coordinator

Table 1. Moose survey data for Subunit 1D, 1982-87.

Year	No. bulls	No. cows	No. calves	Unid. sex and age	Total sample	No. bulls:100 cows	No. calves:100 cows	Percent calves in sample	Count time (hours)	Moose/ hour
1962	8	134	29	0	181	6	29	22	--	--
1963	0	0	36	157	193	--	--	19	--	--
1964	-[a]									
1965	--	--	--	--	349	41	49	21	--	--
1966	46	138	95	16	295	33	69	32	2.1	140
1967	50	173	75	0	298	29	43	25	2.8	106
1968	48	253	72	1	374	19	28	19	4.4	85
1969	23	91	31	0	145	25	34	21	2.1	69
1970	-[a]									
1971	27	170	34	0	231	16	20	15	4.9	47
1972	33	178	56	0	267	19	31	21	6.4	42
1973	30	189	45	0	264	16	24	17	4.4	60
1974[b]	30	135	41	0	206	22	30	20	6.2	33
1975[b]	--	--	30	151	181	17	00	17	4.2	43
1976	-[a]									
1977	30	186	71	0	287	16	38	25	5.8	49
1978	29	125	37	1	192	23	30	19	6.4	30
1979	15	149	36	18	218	10	24	17	4.5	48
1980[b]	-[a]									
1981[b]	--	--	38	173	211	--	--	18	4.3	49
1982[b]	--	--	29	154	183	--	--	16	4.3	43
1982[b]	34	115	51	0	200	30	44	26	4.8	42
1983[b]	--	--	19	69	88	--	--	22	5.6	16
1983[b]	16	148	47	0	211	11	32	22	5.8	36
1984[b]	--	--	11	77	88	--	--	13	3.8	23
1984	15	135	37	0	187	11	27	20	5.2	36
1985	23	155	29	0	207	15	19	14	5.5	38
1986[b]	33	93	13	0	139	36	14	9	3.5	40
1987[b]	--	--	29	174	203	--	--	14	3.8	53

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

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 5

GEOGRAPHICAL DESCRIPTION: Cape Fairweather to Icy Bay, eastern gulf coast

PERIOD COVERED: 1 July, 1986-30 June, 1987

Seasons and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Yakutat Forelands:

Survey results suggest that moose numbers may be slightly increasing. Also, an abundance of young bulls in the harvest (3 calves, 10 yearlings, and thirteen 2.5-year-olds in a sample size of 53) and an increasing average age of harvested bulls (a wide range of age classes in the harvest) further indicate a growing population. Perceived increases in the unit's wolf population indicate an expanding prey base.

Tissue samples were collected from hunter kills on a voluntary basis to assist with a study of heavy-metal contamination in moose. Seven Alaskan and several Canadian and Swedish moose herds were analyzed by researchers for cadmium concentrations. Samples from Yakutat showed the lowest kidney cadmium levels of all Alaskan populations and liver cadmium concentrations that were low as well. No threat to human health is indicated from the results.

Nunatak Bench:

Fall sex- and age-composition counts indicated a drastically reduced moose herd. This change is due, in part, to the closure of the Nunatak-Russell Fjord by Hubbard Glacier, which caused the water level to rise approximately 90 feet in "Russell Lake", inundating prime lowland moose habitat. Moose, in turn, likely emigrated to other locations in the unit.

Malaspina Forelands:

Little information is available for the moose herd in Subunit 5B, but it appears to be stable.

Population Composition

Yakutat Forelands:

Aerial sex- and age-composition surveys of the Yakutat Forelands' moose population were conducted in late November and early December 1986 (Table 1). Typical gulf-coast fall weather provided fair, at best, survey conditions. Incomplete snow cover (thus reducing contrast), scattered rain and clouds (preventing some areas from being surveyed and presenting visibility problems elsewhere), and crusted snow (making tracking difficult) contributed to the less-than-ideal conditions. Two hundred sixty moose were enumerated in 11.3 hours of survey time; 23% of the sample were calves. During the fall 1985 survey, 259 moose were counted in 11.0 hours; 16% were calves.

While the bull:100 cow ratio declined and the calf:100 cow ratio increased, compared with the 1985 survey, these ratios (20 bulls:100 cows and 36 calves:100 cows) are considered inaccurate (Table 2). Bias is attributed to weather conditions at the time of survey. The bull:100 cow and the calf:100 cow ratios are probably lower and higher, respectively, than those actually present in the population at the time of the survey. The percentage of cows with calves having twins (13%) was higher than the 1985 level (8%). No late winter surveys were conducted.

Nunatak Bench:

An 0.5-hour aerial survey, conducted on 3 December under excellent conditions, resulted in a count of only 10 moose: 5 bulls, 4 cows and 1 calf. Recent surveys in this area have accounted for about 25 animals.

Malaspina Forelands:

No surveys were conducted. Six moose in the harvest ranged from 0.5 to 3.5 years of age; the average age was 2.5 years.

Mortality

Yakutat Forelands:

Fifty-four bulls were killed in the fall permit-registration hunt that lasted only 8 days (Table 3) before it was closed by emergency order. Standing water in meadows that caused a concentration of moose where hunters had good access was one contributing factor toward rapid achievement of the quota. High winds occurring just prior to the season opening that stripped deciduous bushes of their leaves and caused increased moose movement and visibility may also have contributed to the speed of the harvest. Finally, animals emigrating from

Nunatak Fjord may have resulted in a heavier concentration of moose in some forelands areas than normal.

A total of 313 permits were issued for moose hunts on the Yakutat and Malaspina Forelands in 1986. Only 1 permit form was used this year for the Yakutat and Malaspina Forelands, making it impossible to determine where nonhunting permittees had intended to hunt. Fifty-nine permittees reported that they did not hunt, and 14 others did not respond. One hundred ninety-eight permittees hunted for a total of 658 days (mean = 3.3 days/hunter); 54 successful hunters spent a total of 131 days afield (mean = 2.4 days/hunter), and 144 unsuccessful hunters spent 527 days hunting (mean = 3.7 days/hunter).

Twenty-two (41%) moose were taken by Yakutat residents, 31 (57%) by other Alaskans, and 1 (2%) by a nonresident. Twenty bulls (37%) were killed on opening day, and by the 4th day of the season, 42 (78% of the total kill) had been taken. Twenty-four animals (44%) came from locations west of and including the Dangerous River watershed, while the remainder came from east of the Dangerous River. Successful hunters used aircraft, (33, 61%); boats (13, 24%); and highway vehicles (8, 15%) to access hunting areas.

Based on a 1986 sample, the cementum ages ranged from 0.5 to 9.5 years (mean = 3.6) (Table 4). Forty-nine percent of the sample were 2.5-year-old or younger bulls.

Information on spring bear emergence indicated that bears may have left dens later than usual. Analysis of bear scats found along Forest Highway 10 during the peak of moose-calving season documented no moose hair in the scats. No wolf-killed moose were observed or reported during the report period.

Nunatak Bench:

Five permits were issued for hunting in this area. However, because of the low number of moose observed during the December aerial survey, this area was closed to moose hunting by emergency order early in the season; no harvest occurred. No signs of natural mortality were observed or reported.

Malaspina Forelands:

Forty-two permits were issued in 1986 to people who actually hunted in Subunit 5B. Thirty-three permittees hunted unsuccessfully for 170 days (mean= 5.2 days/hunter), and 9 hunters killed moose in a total of 40 days (mean = 4.4 days/hunter). Four moose were taken in September and five in October. Eight moose were taken east of Sitkagi Bluffs, and one was harvested in the Yahtse River area at the western end of the subunit. One calf, three 2.5-year-olds and one

3.5-year-old composed the aged sample. Transportation types used by successful hunters were reported as aircraft (89%) and boats (11%).

Management Summary and Recommendations

Snowfall records from the National Weather Service office in Yakutat (Appendix A) indicate that the 1986-87 snowfall (124 inches) was 60% of the 1949-1987 average. Evidence of winter mortality was not documented, and moose likely emerged from the winter on a high nutritional plane. Reports and observations of predation during the winter were nonexistent.

At the spring Board of Game meeting, regulatory proposals were considered for (1) extending the season in Subunit 5B for 2 additional weeks, (2) closing the Nunatak Bench season, and (3) changing the Yakutat Forelands quota to 50 bulls and 10 cows. While the first two of these proposals were adopted, the cow season in Subunit 5A was not approved. Furthermore, the season in the Yakutat Forelands was modified to allow only Yakutat residents to hunt during the first week. Owing to this last development, separate permits will again be issued for the Yakutat and Malaspina hunts in 1987.

Survey results continue to suggest the following: (1) a limited cow season is biologically justified, (2) it would provide more animals for harvest, and (3) would likely improve the calf:100 cow ratio. For the first time in recent years, the local advisory committee supported a limited cow season. Under new subsistence regulations, the Board of Game was unable to find a method for facilitating such a season. Means of implementing future cow seasons should be further explored.

Because the Malaspina Forelands hunt will be 2 weeks longer in 1987, there is a greater chance for a harvest near the 25-bull quota, increasing the desirability for complete surveys in this subunit. Similarly, because of the reduced size of the Nunatak Bench herd, this area should also be surveyed. No changes in seasons or bag limits are recommended at this time.

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Table 1. Yakutat Forelands, Subunit 5A, sex and age composition, fall 1986.

Date	Location	No. bulls	No. cows	No. calves	Total moose	Percent calves	Survey time	Moose/ hour
25, 26 Nov.	Yakutat Bay - Situk River (below highway)	0	8	5	13	38.5	1.3	10.0
26 Nov.	Yakutat Bay - Harlequin Lake (above highway)	1	5	4	10	40.0	.8	12.5
29 Nov. 1 Dec.	Situk River - Dangerous River	15	81	37	133	27.8	4.7	28.3
1, 2 Dec.	Dangerous River - Italio River	14	67	13	94	13.8	2.9	32.4
3 Dec.	Alsek River - Doame River	4	5	1	10	10.0	1.6	6.3
Combined Areas	Yakutat Bay - Doame River	34	166	60	260	23.1	11.3	23.0

Table 2. Yakutat Forelands historical moose survey data, Subunit 5A, 1974-85[a].

Year	No. bulls	No. cows	No. calves	Unk sex and age	Total sample	Bulls: 100:cows	Calves: 100:cows	Percent calves	Count time (hours)	Moose/ hour
1974	21	81	29	0	131	26	36	22	5.2	25
1975	43	183	32	30	288	23	17	11	10.9	26
1976[c]	0	0	22	186	208	--	--	11	6.1	34
1977	82	198	44	10	334	41	22	13	11.1	30
1978	50	134	32	13	229	37	24	14	7.4	31
1979[c]	0	0	25	95	120	--	--	21	2.8	43
1980[d]	19	23	8	0	50	83	35	16	2.3	22
1981	93	243	65	1	402	38	27	16	15.7	26
1984[c]	0	0	83	299	382	--	--	22	11.9	32
1984[e]	90	299	60	0	379	39	26	16	12.1	31
1985[c]	0	0	26	113	139	--	--	19	5.9	24
1985[f]	50	168	41	0	259	30	24	16	11.0	24
1986	34	166	60	0	260	20	36	23	11.3	23

[a] No surveys were conducted in 1982 or 1983.
[b] All females older than calves were counted as cows.
[c] Late winter count, sex indeterminate.
[d] Situk River-Ahrnklin River only.
[e] Yakutat Bay-Alsek River only.
[f] Situk River-Doame River only.

Table 3. Yakutat Forelands moose harvest data in Subunit 5A, 1978-86.

Year	Season	Quota	No. permits issued	No. hunters	harvest[a]	Hunter success
1978[b]	15 Oct-15 Nov	25 antlered moose	165	123	28	23
1979	15 Oct-15 Nov	25 bulls	185	167	20	12
1980[c]	15 Oct-18 Oct	--	--	175	28	16
1981[c]	15 Oct-15 Nov	--	--	180	27	15
1982	15 Oct-15 Nov	50 bulls	226	199	49	25
1983[d]	15 Oct-15 Nov	50 bulls	282	235	47	20
1984[e]	15 Oct-13 Nov	50 bulls	287	230	49	21
1985[d]	15 Oct-15 Nov	50 bulls	146	129	46	36
1986[d]	15 Oct-22 Oct	50 bulls	198	198	54	27

[a] All bulls.
[b] Includes Nunatak Bench.
[c] Harvest ticket data, 1-bull bag limit.
[d] Closed early by Emergency Order.
[e] Tier II subsistence hunt, 200 permits available.

Table 4. Ages of moose killed on the Yakutat Forelands portion of Subunit 5A, 1981-86.

Age class	Number of moose in age class, by year					
	1981	1982	1983	1984	1985	1986
0.5	0	0	0	2	1	3
1.5	0	2	0	13	15	10
2.5	4	10	9	11	10	13
3.5	6	13	8	6	10	8
4.5	5	8	10	7	2	4
5.5	4	5	6	3	1	9
6.5	1	6	4	2	3	3
7.5	1	1	2	3	1	1
8.5	1	2	2	0	1	2
9.5	1	0	0	0	1	2
10.5	0	0	1	0	1	0
11.5	0	0	0	0	1	0
12.5	1	0	0	0	0	0
13.5	0	0	0	0	0	0
14.5	0	0	1	0	0	0
Totals[a]	24	47	43	47	46	53
Mean age	6.0	4.3	4.9	3.2	3.4	3.6

[a] Total kill in 1981 = 27; 1982 = 49; 1983 = 47; 1984 = 49; 1985 = 46; and 1986 = 54.

Appendix A. Historical snowfall records in Yakutat, 1948-49 to 1986-87.

Winter	No. days with "x" inches snow on ground					Total snowfall
	Trace-14	15-29	30-44	45-60	60+	
1948-49	NA					241
1949-50	NA					122
1950-51	NA					193
1951-52	84	35	41	33	3	242
1952-53	138	0	0	0	0	139
1953-54	128	53	7	0	0	190
1954-55	63	70	34	32	6	338
1955-56	83	57	22	30	21	278
1956-57	143	9	0	0	0	181
1957-58	106	2	6	8	1	121
1958-59	111	51	5	4	13	286
1959-60	119	30	23	0	0	246
1960-61	109	14	22	9	0	238
1961-62	119	47	3	6	0	207
1962-63	124	7	6	1	0	129
1963-64	160	25	7	0	0	286
1964-65	120	24	15	5	0	253
1965-66	76	62	22	20	0	219
1966-67	85	48	59	2	5	293
1967-68	115	17	0	0	0	177
1968-69	43	53	70	10	0	237
1969-70	103	5	0	0	0	130
1970-71	98	40	55	0	0	313
1971-72	48	16	21	12	119	317
1972-73	61	44	42	22	0	239
1973-74	65	75	23	0	0	178
1974-75	69	58	35	4	0	327
1975-76	16	80	85	10	0	403
1976-77	83	26	0	0	0	168
1977-78	126	31	2	0	0	124
1978-79	67	55	43	0	0	139
1979-80	101	24	2	0	0	129
1980-81	71	3	0	0	0	71
1981-82	84	81	0	0	0	175
1982-83	100	8	2	0	0	86
1983-84	99	12	0	0	0	136
1984-85	81	30	49	0	0	275
1985-86	128	14	0	0	0	166
1986-87	96	2	1	0	0	124
Average	95	34	20	6	5	208

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6A

GEOGRAPHICAL DESCRIPTION: Katalla to Icy Bay

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Population composition surveys and reported-harvest data suggest that the moose population west of Suckling Hills (Bering River and Controller Bay) has stabilized primarily because of the hunter harvest. This population peaked in 1983 when 307 moose were observed during a postseason composition survey. When this count is combined with the previous fall harvest of 42, it yields a prehunt index of 349 moose. In 1985 and 1986, the prehunt indexes were 327 and 322 before reported harvests of 48 and 68 moose, respectively. The 1986 winter moose density was estimated at 1.7 moose/mi^2; however, a complete census, including associated variances, has not been conducted. No survey data were collected east of Suckling Hills (Tsiu River), but the trend in the moose population is believed to be increasing.

Population Composition

A sex- and age-composition aerial survey was conducted west of Suckling Hills on 13 January in a Piper PA-12 under good conditions. The composition of 254 moose observed during the survey was 23 bulls, 61 cows, 71 calves, and 99 antlerless adults. Because of the late survey date, antlerless adults without calves were not identified according to sex, preventing estimates of meaningful sex ratios. Calves represented 28% of the population, a substantial improvement from 13% calves observed in the 1985 survey. The previous 7-year mean was 20% calves (Table 1).

Mortality

A minimum of 107 moose was reported killed by a minimum of 157 hunters. The reported hunter harvest is the highest recorded in Subunit 6A, and the reported individual harvests east and west of Suckling Hills were also record highs (Table 2).

Hunters killed a record high of 47 females, representing 45% of the total harvest. Two calf carcasses, killed and partially consumed by wolves, were observed during the January composition survey. No other natural-mortality data were collected.

Moose hunting in Subunit 6A was characterized by 68% hunter success; 60% and 74% hunter successes occurred east and west of Suckling Hills, respectively. Forty-two percent of the hunters were transported to the hunt area by boat; of these, 82% were successful. Thirty-seven percent of the hunters used airplanes, but they were only 56% successful. The average hunt lasted 4.0 days, while the average successful hunter killed a moose after 3.6 days. Chronologically, 2% of the harvest occurred in August, 68% in September, 23% in October, 4% in November; and 0% in December. The date for 6% of the harvest is unknown.

Management Summary and Recommendations

The hunter harvest west of Suckling Hills has stabilized the growth of that population; however, the disproportionate harvest of bulls probably caused the bull:cow ratio to decline well below a desired 30:100. The January composition survey results produced a minimum ratio of 14 antlered bulls:100 antlerless adults. The November 1985 survey produced 19 bulls:100 cows, which is thought to more accurately represent the present bull:cow ratio. The 1987 prehunt ratio of bulls:cows should approach 25:100, assuming minimal natural mortality and a 50:50 sex ratio of surviving calves. To increase the bull:cow ratio, hunters should be encouraged to harvest more females. I recommend a minimum harvest sex ratio of 1 cow:1 bull under the current population composition. This goal should be accomplished through regulation and/or hunter education.

The hunter harvest east of Suckling Hills is well below the potential sustained yield, despite the long, either-sex season (20 August to 31 December). However, interest by hunters is increasing; therefore, no further liberalizations of season or bag limits are recommended.

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SUBMITTED BY:

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Survey-Inventory Coordinator

Table 1. Comparison of 1986 post-hunting season moose sex and age composition survey results to the results from 1979-85, Subunit 6A east and west of the Suckling Hills.

	Moose west of Sucklings Hills						Moose east of Suckling Hills					
	Adults			Bulls:100			Adults			Bulls:100		
Winter	Antlered	Antlerless	Total	cows	Calves (%)	Total	Antlered	Antlerless	Total	cows	Calves (%)	Total
1979-80	33[a]	102	135	32	56 (29)	191	--	--	--	--	--	--
1980-81	42[a]	149	191	28	33 (15)	224	33[b]	53	86	[b]	23 (21)	109
1981-82	--	--	--	--	--	--	--	--	--	--	--	--
1982-83	--	--	--	--	--	--	--	--	--	--	--	--
1983-84	48[a]	180	228	27	79 (26)	307	61[a]	184	245	33	66 (21)	311
1984-85	--	--	--	--	--	--	--	--	--	--	--	--
1985-86	38	205	243	18	36 (13)	279	73	213	286	34	59 (17)	345
Mean	40	159	199	25	51 (20)	250	56	150	206	34	49 (19)	255
1986-87	23[b]	160	183	[b]	71 (28)	254	--	--	--	--	--	--

[a] Survey conducted after 15 December, bull segment probably under represented.
[b] Survey conducted after 31 December and sex ratios not comparable.

Table 2. Historical summary of reported moose harvest east and west of Suckling Hills, Subunit 6A, 1979-86.

Year	6A West			6A East			Subunit 6A		
	Male	Female	Total[a]	Male	Female	Total[a]	Male	Female	Total[a]
1969			0			0			0
1970			0			0			0
1971	0	0	3			0	0	0	3
1972			0			0			0
1973			0			0			0
1974	1	0	1			0	1	0	1
1975	5	3	8			0	5	3	8
1976	3	0	3			0	3	0	3
1977	10	1	11			0	10	1	11
1978	13	5	18			0	13	5	18
1979	23	9	32			0	23	9	32
1980	20	11	31			0	20	11	31
1981	19	6	25	3	0	3	22	6	28
1982	33	12	45	10	3	13	43	15	58
1983	37	5	42	10	3	14	47	8	56
1984	42	21	63	17	1	18	59	22	81
1985	33	15	48	17	10	27	50	25	75
1986	35	33	68	24	14	38	59	47	106

[a] Includes unidentified sex or age.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6B

GEOGRAPHICAL DESCRIPTION: Martin River

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Population composition survey data suggest that the moose population in Subunit 6B may be stable or declining slightly. Survey conditions were only fair during the March survey when 152 moose were observed, representing 11% fewer than the number observed in 1985. The mean number of adults observed during composition surveys in 1982 to 1985 was 151, but only 132 adults were observed in 1986.

Population Composition

During a March age-composition aerial survey conducted in a Piper PA-12, 132 adults and 20 calves were observed. Calves represented 13% of the population, which exceeds the 6% observed in 1985 and equals the 1979-1985 mean (Table 1).

Mortality

Fifteen hunters were issued antlered-moose permits, and 9 hunters were successful. The 3-year-old mean age of 8 bulls was equivalent to that of the 20 bulls killed in 1985. Hunters spent an average of 2.4 days on the hunt; successful hunters used an average of 1.7 days to kill their moose. Eight of the successful hunters used boats, primarily airboats, to reach their hunt area.

A brown bear guide reported finding 2 moose carcasses in April, but causes of death were undetermined. A pack of 10-15 wolves were frequently observed in the Martin River-Martin Lake area, but no wolf-killed moose were verified. No other natural mortality was reported.

Management Summary and Recommendation

During March, 14 adult female moose were captured and outfitted with radio collars by U.S. Forest Service staff involved in a research project. The objective of this project is to determine preferred seasonal habitat and food species of moose on the east and west sides of the Copper River Delta (V. Van Ballenberghe, pers. comm.).

Moose harvest by hunters has been limited by restricting hunter participation to 15 antlered-moose permits. The purpose of these hunting limitations is to attain a post-season ratio of 30 bulls:100 cows and a minimum of 150 cows in the population. Although sex composition was not determined in 1986, the total observed adult population was substantially below the desired minimum of 195 adult moose. Calf survival, which improved from 6% to 13% in 1986, is still lower than desired. Therefore, no changes to the current drawing-permit hunt are recommended.

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Table 1. Post-hunting season moose sex and age composition in Subunit 6B, 1979-1985 compared with 1986.

Year	Adults			Males:			Total
	Male	Female	Total	100 females	Calves	% Calves	sample
1979-80[a]	--	--	235	--	43	16	278
1980-81[a]	--	--	177	--	24	12	201
1981-82	56	159	215	35	24	10	239
1982-83[a]	--	--	143	--	18	11	166
1983-84[a]	--	--	147	--	32	18	179
1984-85	59	92	151	64	29	16	180
1985-86	39	120	159	33	10	6	169
Mean 1979-85	51	124	175	42	26	13	202
1986-87[a]	--	--	132	--	20	13	152

[a] Surveys conducted after 15 December provided unreliable adult sex composition.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 6C

GEOGRAPHICAL DESCRIPTION: West Copper River Delta

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Population composition surveys from 1979 to 1985 indicated a slowly increasing moose population. In 1979 and 1985, the surveys produced 124 and 194 moose, including 106 and 148 adults, respectively. No surveys were conducted in 1986.

Mortality

A minimum of 40 moose were killed by 38 hunters: 21 males and 16 females. In addition, 3 moose carcasses of unknown sex were observed in April and May. Wolves had fed on the carcasses, but the cause of death was undetermined.

Forty moose hunting permits (20 antlered and 20 antlerless) were issued. All 20 hunters holding antlered-moose permits were successful, and one antlerless-moose hunter mistakenly shot a small bull. Sixteen other antlerless-moose hunters were successful; only 1 hunter was unsuccessful. Two permit holders did not hunt. Hunters averaged 4.8 days in the field.

Management Summary and Recommendation

No population survey data were collected. However, only a few calves were observed during a March moose-collaring operation by the U. S. Forest Service (V. VanBallenberghe, pers. comm.). As a precaution, the number of permits issued to moose hunters should be reduced to avoid exceeding the annual recruitment.

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SUBMITTED BY:

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 7

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose occur throughout the intermountain valleys of Unit 7. Aerial surveys indicate that moose populations stabilized at relatively low densities about 1980 and have apparently remained at these levels through this period.

Population Composition

Fall composition counts have not been conducted since 1982 because of inadequate snow cover.

Mortality

In 1986, 408 hunters reported killing 58 bulls. Antler-spread measurements were provided for 54 bulls and are grouped as follows: 10 bulls §30.0 inches (yearlings); 21 bulls 30.0-39.9 inches; 15 bulls 40.0-49.9 inches; and 8 bulls ≥50.0 inches. Thirty-six bulls (65%) were taken during the first 5 days of the season; 19 bulls (35%), during the last 5 days.

The majority of hunters (n=402) were Alaska residents. Among residents, 275 hunters (68%) lived on the Kenai Peninsula and 227 hunters (56%) lived within Unit 7. Kenai Peninsula residents killed 30 moose (52%) in Unit 7.

Hunter transport means, in order of importance, were (1) highway vehicle, 69% (n=227); (2) boat, 12% (n=39); (3) horse, 10% (n=32); (4) airplane, 7% (n=22); (5) 3- or 4-wheeler, 1% (n=5); and other off-road vehicle, 1% (n=4). Hunters using horses had the highest success rate (31%).

Wolves, brown bears, and black bears are common in Unit 7; the effects of predation by these animals is thought to exert a

significant impact on the moose populations in this unit. However, no quantitative data exist on the level of mortality. Death from vehicle accidents is another source of moose mortality, but the magnitude has not been well documented.

Management Summary and Recommendations

Completion of surveys in a majority of the important fall moose ranges in Unit 7 remains a high management priority. Moose highway-mortality records also need to be summarized and evaluated with respect to the dynamics of moose populations.

In March 1987 the Alaska Board of Game added 10 days (11-20 September) to the moose season in Unit 7 and changed the bag limit from 1 bull to a bull having either (1) a spike or fork antler on at least 1 side or (2) a minimum 50-inch antler spread or 3 or more brow tines on either side. These changes resulted from desires to increase bull numbers and bull ratios in Subunits 15A and 15C and to standardize moose season dates on the Kenai Peninsula. The Department recommended to the Board of Game that all GMU's on the peninsula should be regulated by the same antler restrictions to avoid geographic shifts in hunting pressure. Discounting major changes in climatic or other environmental influences, the new antler restrictions are expected to initially lower the bull harvest up to 30% below the mean harvest for 1985 and 1986 (58 bulls). Then, during the next 5 to 6 years as older bulls become more numerous, the bull harvest should increase and stabilize at a point slightly less than the preregulation harvest level.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 9

GEOGRAPHICAL DESCRIPTION: Alaska Peninsula

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See hunting regulations No. 27.

Population Status and Trend

Poor snow conditions in Unit 9 during the fall composition surveys again hampered assessment of trends in moose population densities, except in Subunit 9C. In this subunit, the population appears to have stabilized at a moderate density (i.e., 0.8 moose/mi^2 in 3 trend areas), despite a significant decline in the bull:cow ratio. Elsewhere, it is believed that the serious population decline that occurred from the late 1960's to the early 1980's has abated in recent years. Continued poor calf survival in the southern portion of Subunit 9B and in Subunit 9E is preventing population growth. Very low densities and unreliable snow conditions in Subunit 9A preclude efficient surveys for monitoring trends in population size or composition. Although no surveys have been done in Subunit 9D since 1982, there is no indication that moose are increasing in number or distribution, probably because of very limited habitat and a relatively high predator:prey ratio.

Population Composition

Composition surveys in Subunit 9C (Table 1) showed a ratio of 34 bulls:100 cows, down from 51:100 in 1982. Two trend areas (Park Border and Branch River) are at or below the desired ratio of 25 bulls:100 cows. The bull moose harvest in Subunit 9C has tripled since 1982, and this increased hunting pressure is believed to have reduced the sex ratio. Survey data in the rest of Unit 9 are insufficient to evaluate the effects of increasing harvest of bulls.

Calf:cow ratios have remained stable in Subunit 9C, averaging 27:100 since 1982. During the same period, the ratio in Subunit 9E has averaged 11 calves:100 cows. It is believed that the lower calf:cow ratio in Subunit 9E is related to a

higher ratio of bears:moose, resulting in a higher predation rate. Additional surveys are needed in Subunits 9E and 9B before any conclusions can be made about changes in the composition of those moose populations.

Mortality

Hunters reported harvesting 239 moose (222 bulls, 13 cows, and 4 of unspecified sex), about the same as the 1985 harvest (Table 2). Since 1983, the harvest by local residents and other Alaskans has remained relatively stable, while the harvest by nonresidents has more than doubled (Table 3). The most dramatic increases in harvest have been in Subunits 9A, 9B, and 9C. The unreported subsistence harvest is believed to be more stable at slightly over 100 moose per year. During the past 5 years, hunter success has ranged between 39% and 46%, and nonresidents had a significantly higher success rate than Alaskan residents.

A series of mild winters have resulted in very little overwinter mortality. The most significant natural mortality is believed to be caused by bear predation on neonatal calves.

Management Summary and Recommendations

Cow moose hunting is restricted to Subunits 9C and the northern portion of Subunit 9B where calf recruitment is significantly better than elsewhere in Unit 9. Only 3 cows were reported taken outside the Naknek registration permit area. The Naknek registration hunt continues to be popular (Table 4), but poor travel conditions again reduced hunter success. Hunting regulations for antlered moose are based on maintaining bull:cow ratios of 25:100 in moderate-density areas and 40:100 in lower-density areas. In Subunit 9C the bull:cow ratio has declined steadily over the past 5 years. To prevent a further decline, the 1987 September season was shortened from 26 days to 11 days for nonsubsistence hunters and to 16 days for subsistence hunters. The December moose season was restricted exclusively to subsistence users in the Naknek drainage and Subunit 9E. Additional composition surveys are needed in Subunits 9B and 9E to further assess the impacts of increasing bull harvests on sex ratios.

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Table 1. Moose composition counts in Subunits 9C and 9E, 1982-86.

Year	Bulls: 100 cows	Calves: 100 cows	% young	n	Estimated population	Comments
Subunit 9C						
1982	51	25	12	463		
1983	46	33	14	409		
1984	42	25	15	613		
1985	--	--	--	---		
1986	34	27	17	507	500	Moose outside Katmai NP
Subunit 9E						
1982	32	9	6	212		
1983	42	14	9	617		
1984	--	--	--	---		
1985	61	9	5	106		
1986	43	11	6	230	2500	Density 0.5 - 0.7/mi^2

Table 2. Annual reported and estimated unreported moose harvest in Unit 9. 1982-86.

Year	Reported			Estimated unreported harvest	Estimated total harvest
	Male	Female	Total[a]		
Subunit 9A					
1982	3	NA	3	2	5
1983	8	NA	8	2	10
1984	14	NA	14	3	17
1985	10	NA	10	3	12
1986	19	NA	19	3	22
Subunit 9B					
1982	32	2	35	75	110
1983	43	11	54	75	129
1984	46	2	48	75	123
1985	74	1	75	75	150
1986	65	3	72	75	147
Subunit 9C					
1982	22	10	33	5	38
1983	34	4	38	5	43
1984	40	6	46	5	51
1985	63	9	72	5	77
1986	57	10	67	5	72
Subunit 9E					
1982	41	4	48	25	73
1983	73	NA	73	25	98
1984	75	NA	75	25	100
1985	87	NA	87	25	112
1986	81	NA	81	25	106

[a] Total includes moose of unspecified sex.

Table 3. Hunter residency and success in Unit 9, 1982-86.

Year	Successful				Unsuccessful			
	Local res.	Nonlocal res.	Nonres.	Total[a]	Local res.	Nonlocal res.	Nonres.	Total[a]
1982	29	29	35	118	52	85	31	186
1983	31	90	48	173	93	96	40	236
1984	31	73	75	186	68	127	35	239
1985	44	83	103	243	68	128	78	283
1986	39	74	112	240	80	116	104	308

[a] Includes hunters of unspecified residency.

Table 4. Harvest data for Naknek drainage registration permit moose hunt (#972) in Subunit 9C, 1982-86.

Year	Permits issued	Did not hunt	Unsuccessful hunters	Bulls[a]	Cows	Total
1982	88	10	--	2	12	14
1983	81	22	55	4	4	8
1984	75	21	44	6	5	11
1985	69	15	35	7	8	15
1986	78	18	45	3	10	13

[a] Registration permits are required for all antlerless moose.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 11

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose numbers are currently thought to be at a low density (0.1-0.4 moose/mi^2) throughout all but a portion of northwestern Unit 11. In 1981 a 16,000-acre area burned along the western slopes of Mount Drum and Mount Sanford within northwestern Unit 11. In this area, the increased abundance of moose is evidenced by the trend-count data from the Mount Drum/Mount Sanford, indicating a density of 0.5 moose/mi^2. Count data from this area suggest an increase in moose numbers since 1982; in 1986, 41 moose/hr. were observed, up 35% from the 5-year (1981-85) average of 30 moose/hr.

Population Composition

One hundred sixty-seven moose were counted during a November 1986 survey along the western slopes of Mount Drum and Mount Sanford. The bull:cow ratio was 78:100, similar to last year's figure of 79 bulls:100 cows. Adult bulls compose a large proportion of the bull population: 67 large bulls:100 cows, compared with 11 yearling bulls:100 cows. The calf:cow ratio was 14:100, also similar to last year's ratio of 12:100; but it is appreciably lower than the 5-year (1981-85) average of 27:100. Calf production or survival has declined substantially during the past 2 years.

Mortality

Hunters reported killing 49 moose during the 1986 hunting season. This harvest was similar to last year's take of 47 moose and the prior 5-year-mean harvest of 51 moose. One hundred ninety-seven individuals reported hunting moose in Unit 11; their success rate was 25%. In 1985, 176 hunters participated in the moose hunt in Unit 11; their success rate was 27%. Over the past 5 years, the mean number of hunters

per year has been 196, while the success rate has averaged 26%. Nonresident, local-resident, and Alaskan resident hunters killed 3 (6%), 20 (41%), and 26 (53%) moose, respectively.

Methods of transportation for successful hunters were (1) aircraft, 45%; (2) highway vehicle, 20%; (3) horse, 12%; (4) off-road vehicle, 10%; and (5) 3-wheeler, 4%. Unsuccessful hunters utilized (1) highway vehicle, 36%; (2) aircraft, 20%; (3) off-road vehicle, 13%; and (4) 3-wheeler, 11%. Successful hunters reported spending 6.1 days hunting, compared with 6.8 days for all hunters. The mean antler spread for all bulls harvested was 46.6 inches, slightly higher than the 5-year (1981-85) mean of 45 inches.

Management Summary and Recommendations

Overall, moose are expected to remain at low densities in Unit 11. Although both the total number of moose observed and the number of moose/hour increased in the Mount Drum-Mount Sanford count area since 1982, a decline in calf production or survival over the past 2 years suggests future increases in moose numbers in this area are unlikely. This decrease in the number of moose calves is thought to be a result of an increase in predation rates because of reductions (1) in the wolf harvest attributable to the elimination of land-and-shoot "trapping" and (2) in brown bear harvest attributable to the elimination of sport hunting in Wrangell-St. Elias National Park.

Currently, the only fall moose composition areas surveyed in the unit are the Mount Drum-Mount Sanford count areas. Since these areas appear to have higher moose densities than the lower Chitina Valley, additional survey areas are needed for monitoring moose numbers and trends throughout the remainder of Unit 11. A trend-count area should be established along the Chitina-McCarthy road, where a substantial demand exists for moose hunting.

Hunting pressure for moose in most of Unit 11 has remained relatively light over the past 5 years. The current harvest is composed of predominantly of large, mature bulls. Fall sex- and age-composition data collected after the hunting season showed a high adult bull:cow ratio, which indicates the current bull harvest is not restricting population growth. No changes in season dates or bag limit are recommended.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 12

GEOGRAPHICAL DESCRIPTION: Upper Tanana and White River drainages

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Compared with existing and anticipated habitat conditions in Unit 12, overall moose numbers are low. However, rutting populations in the Tok and Dry Tok River drainages (migrants from Subunit 13C) are increasing slowly; the moose population in the Robertson River drainage is also increasing, and the moose population inhabiting the north slope of the Alaska Range may be increasing. In Subunit 13C, relatively high harvests of grizzly bears and wolves are believed responsible for moose population growth. In the extreme northwestern portion of Unit 12, wolf control in adjacent areas during 1980 to 1983 has allowed the moose population there to increase. In most other areas of Unit 12, moose exist at low densities and populations are believed to be stable or declining. Moose inhabiting the Little Tok River drainage have declined noticeably in recent years owing to poor recruitment, apparently the result of high predation rates.

In recent years, the fall moose population in Unit 12 was conservatively estimated at 2,500-3,000. It now appears that Unit 12 probably supports more moose than previously believed; however, moose are still far below the carrying capacity of the unit.

Population Composition

During 14 November-3 December 1986, 36.5 hours were spent classifying 1,312 moose in and immediately adjacent to Unit 12. This compares with the classification of 1,342 moose during 37.5 hours of surveys in this area during November and December 1985. Thirty-six moose were observed per hour of survey in 1985 and 1986.

Calf:cow ratios ranged from lows of 0, 5, and 6 calves:100 cows in the Tower Bluff, Sixtymile Butte, and Cheslina-Kalukna survey areas, respectively, to a high of 31 calves:100 cows in the Dry Tok Creek survey areas; 2 other areas exhibited better calf survival, but sample sizes are extremely small. The mean calf-cow ratio for Unit 12 during fall 1986 was 22 calves:100 cows. The percentage of yearlings in the herd (both sexes) ranged from a low of 8% in the Sixtymile Butte survey area to a high of 26% in the Nabesna River-Chisana River survey area and averaged 12% throughout Unit 12. Other survey areas exhibited even lower yearling percentages, but sample sizes were small. Bull:cow ratios ranged from 22:100 in the Dry Tok Creek area to over 100:100 in the Tower Bluff and Sixtymile Butte survey areas. The mean bull:cow ratio in Unit 12 remained stable at 41:100. The observed ratio of 26 bulls:100 cows in the Little Tok River area indicated some improvement, presumably as a result of a moose-hunting closure. The observed ratio of only 25 bulls:100 cows along the north slope of the Alaska Range indicates further deterioration of the sex ratio because harvests continue to exceed recruitment of bulls.

Habitat Conditions

Again, as reported last year, few moose moved to lowland winter ranges during the mild winter of 1986-87. Habitat conditions did not change noticeably from those reported in 1986, and moose numbers are far below estimated carrying capacity throughout most of Unit 12.

Loss of moose habitat in Unit 12 is due primarily to settlement and scattered mining developments. It is not a major concern at this time. The development of a large radar site near Tok will cause additional habitat loss to moose. On the other hand, mechanical browse crushing and wildfires have improved habitat quality for moose.

Mortality

Predation by wolves, grizzly bears, and black bears is believed to be limiting moose population growth in Unit 12. Predator-prey research in the Northway-Tetlin Flats indicated that wolves were responsible for most calf moose mortalities during 1986. Wolf predation rates on moose were also determined during January and February 1987. Observed rates of natural moose mortality for both calf and adult moose appear to be high enough to stop moose population growth.

Based upon harvest reports, 403 humans hunted moose in Unit 12 during fall 1986, compared with 412 hunters during fall 1985. The reported harvest of 105 bull moose in 1986 represented a

59% increase in harvest over the 66 bull moose harvested in 1985. The noticeable increase in the harvest of moose in Unit 12 in fall 1986 is believed to have been caused by exceptionally dry weather that delayed fall moose movements from accessible lowland areas to upland rutting areas. Of the 101 successful hunters who reported their residency status, 85 were Alaskan residents. Resident hunters experienced a 23.5% rate of hunter success. Residents of Unit 12 reported a harvest of 31 bull moose (30% of the total Unit 12 harvest) and experienced an 18% success rate. One hundred seventy-seven residents of Unit 12 reported hunting moose in the unit in 1986. The actual participation in moose hunting by unit-resident hunters was probably greater than reported.

Harvest reports indicate that 37, 13, 16, 9, 7, and 1 bulls were taken in the Tok, Nabesna, Chisana, Tetlin, White, and Robertson River drainages, respectively. One bull was also harvested in the Mansfield Creek drainage. The upper Little Tok River drainage was closed to moose hunting in 1986. The greatest portion of the harvest (44%) occurred during the last week of the season ending on 20 September.

Of 95 successful hunter reporting access means, thirty-one used highway vehicles, seventeen used ORV's, sixteen used aircraft, thirteen used boats, ten used three- or four-wheelers, seven used horses, and one used a snow machine.

Based upon an analysis of access means by residency of hunters, there appears to be very little competition for moose between Alaskan resident and nonresident hunters. Of 33 nonresident hunters (only 8% of all hunters), twenty-one used aircraft or horses to reach remote areas and only twelve used highway vehicles and ORV's to hunt in more accessible areas. Only 3 nonresidents killed moose after using highway vehicles and ORV's for access. In contrast, most Alaskan residents (78%) used highway vehicles (150), boats (53), three- or four-wheelers (41), and ORV's (37) to hunt moose. Therefore, it appears that nonresidents and residents tended to hunt in different areas; residents generally hunt in more accessible areas than nonresidents.

Very few moose were killed as a result of automobile collisions during the report period, probably fewer than 5. An estimated 20-30 moose were killed by poachers. Therefore, total human-caused mortality during this report period is estimated to have been approximately 120-150 moose.

Management Summary and Recommendations

The existing strategic management goal, providing for maximum opportunity to participate in moose hunting and an optimum

harvest of moose, is not being met and cannot be met without a larger and more productive moose population.

In most of Unit 12, moose exist at low densities, and no upward population trend is evident. Moose numbers and moose harvests in Unit 12 declined drastically during 1965-1975, and seasons and bag limits were reduced accordingly. While most moose populations in Unit 12 are stabilized at low densities, moose numbers declined further during the 1980's in the Little Tok River drainage; the season there was closed in 1986, despite an increase in moose numbers in the Robertson and Tok River drainages following reductions in predator numbers. Overall, management goals for moose are not being met in Unit 12.

To prevent excessive bull moose harvests and further deterioration of bull:cow ratios, alternative harvest regimes should be considered for the north slope of the Alaska Range and Tok River areas. According to Chisana residents, the 50-inch or 4-brow-tine regulation in southeastern Unit 12 has increased numbers of mature bulls in the herd while maintaining moose hunting opportunities.

Achievement of desired increases in moose population size and productivity requires that losses attributable to predation be reduced. Existing liberal hunting and trapping regulations for grizzly bear, black bear, and wolf should be maintained. Additionally, alternative methods of reducing predation on moose should be tested, and practical techniques should be implemented as part of the overall moose management program in Unit 12. Restriction of nonresident hunting opportunities in Unit 12 would not benefit subsistence hunters significantly.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 13

GEOGRAPHICAL DESCRIPTION: Nelchina and upper Susitna Rivers

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Data obtained during 1986 fall sex- and age-composition counts show no appreciable change in population trends for the moose population in Unit 13 (Table 1). Slightly more cows and calves were observed in 1986 than in 1985, but the total number of bulls declined somewhat. The number of moose/hour increased by 3% in 1986; however, this may be a result of sampling bias, rather than an actual increase in moose density. Overall, count conditions in Unit 13 during 1986 were the most variable experienced during the past 9 years, making the recognition of population trends more difficult.

Population Composition

Moose sex- and age-composition counts were conducted in 9 count areas during 1986. A comparison of composition data collected since 1979 is presented in Table 1. The unit-wide bull:cow ratio was 27:100, an appreciable decline from last year's 32:100 but slightly higher than the 5-year (1981-85) mean of 25:100. The observed calf:cow ratio was 30:100 for the entire unit, similar to last year's 29:100 and up slightly from the 5-year (1981-85) mean of 27:100.

In the 2 count areas within the western half of Subunit 13A, the bull:cow ratio increased from 17:100 in 1984 to 26:100 in 1986. In addition, the age structure of the bull population in 13A has also been increasing since 1984. Large bulls now comprise 67% of the bulls observed, compared with only 16% in 1984; while yearling bulls now account for 23%, compared with 84% previously. The calf:cow ratio in Subunit 13A count areas increased slightly: 26:100 in 1985 to 28:100 in 1986.

Subunit 13D has only 1 count area that is surveyed. The bull:cow ratio declined from 57:100 in 1985 to 48:100 in 1986 and is appreciably below the 5-year (1981-85) mean of 54

bulls:100 cows. The calf:cow ratio was 20:100, substantially higher than both the 9:100 in 1985 and the 5-year (1981-85) mean of 12:100. Subunits 13B and 13E have bull and calf:cow ratios similar to that observed throughout the unit. Subunit 13C also has a similar bull:cow ratio, but the calf:cow ratio of 24:100 is lower than that observed throughout the unit.

Mortality

The reported moose harvest in 1986 was 1,143 for the combined sport and subsistence hunts in Unit 13. This represented 39% and 43% increases over the 1985 kill of 823 moose and the 5-year (1981-85) mean harvest of 797, respectively. This was also the highest bull harvest since 1970. Hunting pressure and hunter success rate in all Unit 13 hunts also increased in 1986. A total of 4,495 individuals reported hunting moose; the resulting success rate was 25%, up from the 23% success rate observed in 1985 when 3,576 individuals reported hunting. The mean antler size for all moose harvested in the unit was 42 inches, down from the 5-year (1981-85) mean of 43 inches.

The 1986 sport harvest was 961 moose having an antler spread greater than 36 inches or having antlers with at least 3 brow tines on at least one side, representing a 21% increase over the previous year's take of 792 such bulls. The overall success rate for 3,695 sport hunters was 26%, compared with 23% for 3,426 sport hunters in 1985. Nonresident sport hunters took 81 (9%) moose in 1986, compared with 60 (8%) in 1985. Residents of the Copper River Basin, although eligible for the subsistence permit hunt, took 51 moose, or 5% of the 1986 sport harvest. In 1985 the sport harvest by local residents was 104 moose. Sport hunters reported using the following methods of transportation: highway vehicles, 35%; off-road vehicles, 22%; aircraft and 3- or 4-wheelers, 14%; and boats, 13%. Both successful and unsuccessful sport hunters spent an average of 5.9 days afield in 1986. The mean antler width for the 986 bulls killed in the sport hunt was 44 inches, identical to the 6-year (1980-85) mean.

A registration subsistence hunt for any size bull moose was held in Unit 13 (except 13A West) during 1986. All residents of Unit 13 were eligible to obtain a permit, and registration permits were available on an unlimited basis in Glennallen and Cantwell. There were 1,079 permits issued; 179 moose were harvested by the 802 permittees that hunted, resulting in a hunter success rate of 22%. In 1985 only 31 subsistence moose were taken by 200 permittees, representing a success rate of 21% for those permittees who hunted. The most popular methods of transportation used by subsistence hunters were (1) highway vehicles, 61%; (2) off-road vehicles, 12%; (3) 3- or

4-wheelers, 10%; and (4) aircraft and boats, 7%. Subsistence hunters spent an average of 7.2 days hunting, but successful subsistence hunters spent only 5.3 days. The mean antler spread for subsistence-taken bulls was only 35 inches.

A spike-fork moose hunt was held in the western half of Subunit 13A (13A West) for the second year. The purpose of this hunt was to direct hunting pressure on smaller, yearling bulls and thus provide for an increase in the survival of larger bulls. The total reported harvest was 117 spike- or fork-antlered bulls, an increase of 67% over the reported 1985 harvest of 70 but a 32% decrease from the 1984 harvest of 171 bulls. However, in 1984 bulls with a minimum antler spread of 36 inches or 3 brow tines were legal. Under this regulation, all yearlings and most 2-year-old bulls could be taken.

Additional sources of mortality include highway accidents, poaching, and predation. Twenty-nine moose were reported killed in highway accidents. Current predation rates for wolves and bears as well as the number of poachings are unknown.

Management Summary and Recommendations

Increases in both the number of moose/hour and the total number of moose counted were again observed during fall sex- and age-composition surveys. These data suggest that in some portions of Unit 13, moose have continued to increase at a rate of between 3% and 5% annually since 1980. Calf production or survival has also increased during this same period. Factors contributing to these increases include (1) a series of mild winters, (2) restricted harvest levels, and (3) a possible decrease in predation.

The increased harvest appears to have caused a decline in the bull:cow ratio in 1986, the first observed decline since the 36-inch regulation was initiated in 1980. A decline in both the number of large and small bulls was also observed during fall composition counts. It appears that the current sport and subsistence harvests may exceed the sustainable harvest rate for bulls in Unit 13. Subunit 13D, with its lower moose density and calf recruitment, was hit especially hard. Harvests in Subunit 13D need to be monitored closely, and should a further decline in the bull:cow ratio occur, harvest reductions may be needed.

The spike-fork hunt in 13A West was established to increase the number of older bulls in this area, because high harvests of bulls under the 36-inch regulation reduced the large bull population to a point where yearling bulls predominated. After 2 years, it appears that enough hunters have accepted

this regulation to effect a reasonable harvest of spike- and fork-antlered bulls. The spike-fork regulation is beginning to achieve its objective: an increase in the number of large bulls in Subunit 13A West.

In addition to the substantial increase in the moose harvest in Unit 13 during 1986, there was also a large increase in the number of hunters in the field. One factor contributing to the increased hunting pressure and harvest was the expansion of the subsistence hunt in Unit 13. Antler-measurement data collected from subsistence-harvested bulls indicate that the mean size of all bulls harvested had an antler spread of less than 36 inches. Subsistence hunters are obviously utilizing their priority to take predominantly younger bulls, which are protected under the sport hunt, because they are more available and easier to kill. Continued high harvests of bulls smaller than 36 inches may eventually negate the effects of the 36-inch regulation and result in a decline in the bull:cow ratio that will require further restrictions on moose hunting.

A permit hunt for any size bull should be instituted in Subunit 13A West, starting in 1987; 100 permits should be issued by drawing permit. This will allow for the cropping of some larger bulls on a yearly basis. Permit numbers should be adjusted annually, based on hunter success and the large bull:cow ratio observed during fall surveys. No additional changes in season dates or bag limit are recommended.

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. Moose sex and age composition data for Unit 13, fall 1979-86.

Year	Adult bulls	Yearling bulls	Cows	Bulls: 100 cows	Calves	Calves: 100 cows	Unclassified moose	Total moose	Total hours
1979	280	133	2,594	15.9	646	24.9	0	3,653	47.6
1980	341	355	3,350	20.8	783	23.4	28	4,857	51.3
1981	455	294	3,508	21.4	1,054	30.0	0	5,311	56.4
1982	427	475	3,773	23.9	970	25.7	0	5,645	65.3
1983	417	437	3,557	24.0	887	24.9	0	5,298	56.0
1984	537	542	4,265	25.3	1,204	28.2	1	6,549	65.4
1985	700	616	4,116	32.0	1,182	28.7	0	6,614	67.9
1986	652	492	4,179	27.4	1,259	30.1	0	6,582	70.1

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14A

GEOGRAPHICAL DESCRIPTION: Matanuska Valley

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Based on very limited sex- and age-composition data and an incomplete census attempted in March 1986, the moose population in Subunit 14A is estimated at 4,000.

Population Composition

Sex- and age-composition surveys were conducted in December in 3 of 8 traditional count areas under fair conditions. The results of these surveys are shown in Table 1; data from 1982, the last year surveys were conducted in Subunit 14A, are included for comparison.

A comparison of ratios obtained during 1982 and 1986 surveys shows close similarity for count areas #1 and #8 (Table 1). However, in count area #5, the bull:cow ratio was 3 bulls:100 cows, which is considerably lower than the 22 bulls:100 cows observed in 1982. A second survey of the eastern portion of count area #5 conducted on the same day yielded 8.5 bulls:100 cows from a sample of 99 moose. Because of this difference we believed the original count for area #5 is in error and, consequently, does not reflect the area's actual ratios.

Mortality

During the general open season, 2,468 hunters reported killing 435 moose (397 bulls, 18 cows, and 20 of unknown sex). Mean antler size was 31.6 inches. In addition to the general season, 400 drawing permits were issued for taking antlerless moose in Subunit 14A. Three hundred twenty-nine permittees reported hunting; 116 cows and 3 bulls were harvested. Analysis of successful hunters indicated that 97.5% were Alaskan residents, 1.1% were nonresidents, and 1.4% were of unknown residency. When data from the general season is

counted with data from the drawing-permit hunt, 2,797 hunters reported killing 554 moose in Subunit 14A: 400 bulls, 134 cows, and 20 moose of unknown sex.

A moose movement study is being conducted in the northern half of Subunit 14A. Preliminary data indicate that many moose wintering along the Parks Highway and the Alaska Railroad tracks in the northern part of Subunit 14A are not year-round residents; they migrate to this area from Subunit 14B and 16A. Some of the mortalities caused by highway vehicles or trains should be considered when evaluating mortality for populations in Subunit 14A.

Records provided by the Department of Public Safety indicate 112 moose were killed by highway vehicles in Subunit 14A. This figure is substantially higher than the reported moose mortality by highway vehicles for the past 3 years: 94 in 1985-86, 51 in 1984-85, and 24 in 1983-84. The Department of Transportation (DOT) has been increasing the use of salt (NaCl) on state highways in winter; moose may be attracted to this readily available source and, consequently, may be compounding the highway fatality problem. Records received from the Alaska Railroad (ARR) indicate 22 moose were killed by trains in Subunit 14A. This figure compares with 4 in 1985-86 and 33 in 1984-85.

Climatic conditions during the winter of 1986-87 were characterized by warm temperatures and very little snow accumulation. This is the 4th consecutive mild winter that Subunit 14A has experienced. There were very few reports of moose mortality on their winter range. A trapper operating at Goose Bay in the vicinity of Pt. McKenzie reported finding the remains of 5 moose that are believed to have died after falling through thin ice on Goose Creek. Remains of 5 additional moose were reported by property owners living in Subunit 14A; all of these animals were found adjacent to highways and are believed to have been killed by vehicles.

Habitat

The moose population in Subunit 14A is believed to be at or near the maximum desired for the available habitat. Efforts are being made to improve and increase habitat in the Moose Creek Management Area. Approximately 800 acres have been manipulated for improved habitat since the inception of the program in 1980. An additional 70 acres are scheduled for scarification during the spring of 1987. However, these habitat gains continue to be offset by losses attributable to expanding agricultural, residential, and commercial developments.

Management Summary and Recommendations

Sex- and age-composition surveys were flown in traditional count areas #5 and #8 and the western half of count area #1. Snow and deteriorating weather conditions prevented completion of the survey in area #1 and additional count areas. Snow and poor weather conditions have made it difficult to obtain accurate sex and age data for 4 consecutive years.

The harvest of 554 moose is 18% higher than the previous 4-year mean of 470. In Subunit 14A, 2,797 individuals reported hunting; that amount is 11% above the 4-year mean of 2,520. In addition, hunter success was 19.8%, which is also above the previous 4-year mean of 18.7%. If one considers the increased number of hunters and a slight increase in success, stable sex- and age-composition data, and the unchanged season and bag limits, the harvest of 554 moose is probably an indication that the moose population in Subunit 14A is stable.

Mild winter conditions traditionally allow moose in Subunit 14A to remain on the remote summer-fall range, which is removed from human contact. The lack of contact with humans is usually reflected in a low highway-vehicle mortality for moose. The very high mortality (112 moose) experienced during this reporting period reinforces the preliminary findings of the moose movement study. That study indicates many of the moose wintering along the Parks Highway/ARR tracks migrate from Subunits 14A and 16A. A closer look should be made at the use of NaCl on state highways in the winter. If the increasing number of highway mortalities are attributed, in part, to this means of keeping highway surfaces clear and dry, then recommendations should be made to DOT for finding alternative solutions to avoid additional moose mortality.

No changes in seasons or bag limits are recommended.

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Table 1. Moose sex and age composition data in Subunit 14A, 1982 and 1986.

Year	Count area	Bulls	Cows	Calves	Total moose	Bulls: 100 cows	Calves: 100 cows	% Calves
1982	#1	29	93	38	160	31	41	24
	#5	42	192	98	332	21	51	30
	#8	22	180	48	250	12	27	19
	Total/ Means	93	465	184	742	20	40	25
1986	#1 (west half)	45	173	70	288	26	41	24
	#5	2	79	35	116	3	44	32
	#8	44	304	111	459	15	36	24
	Total/ Means	91	556	216	863	16	39	25

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14B

GEOGRAPHICAL DESCRIPTION: Willow to Talkeetna

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Although no survey data were available during this period, the moose population is estimated to be stable and at a relatively high density.

Population Composition

No composition surveys were conducted during this reporting period because of inadequate snow cover prior to 15 December. Significant antler drop in adult males occurs by mid-December, precluding the collection of accurate sex and age data after that time.

Mortality

During a 20-day hunting season, 1,224 hunters reported harvesting 243 moose: 131 bulls, 104 cows, and 8 of unknown sex. The success rate was 20%. This harvest compares to the 1985 reported harvest of 216 moose (126 bulls, 88 cows, and 2 sex unknown); the success rate was 17%. The moose hunting season and bag limit in Subunit 14B was the same in 1985.

During the winter of 1986-87, Alaska Railroad records indicate a minimum of 37 moose were killed by trains in Subunit 14B. This mortality is very high, compared with the four reported killed during the previous winter. Records obtained from the Department of Public Safety indicate 28 moose were killed by highway vehicles during this reporting period; in the previous year (1985-86) the reported kill was 5 moose. Preliminary information from a moose movement study in Subunit 14B indicates that many moose wintering along the Alaska Railroad tracks and the Parks Highway in Subunit 14B may have migrated from Subunit 16A. This study also indicates a portion of the moose inhabiting the Willow Mountain area of Subunit 14B migrate south, wintering in Subunit 14A.

The Department of Transportation has begun using a sand/salt (NaCl) mixture on the Parks Highway. The use of "table" salt may be drawing and holding moose along the highway, thereby increasing vehicle-caused mortality.

Management Summary and Recommendations

Inadequate snow cover prior to significant antler loss forced cancellation of sex- and age-composition surveys for the 2nd consecutive year. Observations of moose, in conjunction with the moose movement study and other field activities, indicate the moose population in Subunit 14B remains at a high level.

Subunit 14B experienced moderate winter conditions; a maximum depth of 26 to 30 inches of snow was recorded (per. comm. George Clagett, USDA Snow Survey Supervisor). Preliminary information from the moose movement study indicates that many moose wintering in the vicinity of the Alaska Railroad and the Parks Highway may not be year-round residents of Subunit 14B. It appears that a substantial portion of the moose wintering in the vicinity of the ARR and the Parks Highway migrate from Subunit 16A; therefore, they should be considered part of the subpopulation surveyed and managed in conjunction with the population in Subunit 16A.

Moose-hunter success in Subunit 14B increased 3% over the level recorded during the previous season (1985); however, the reported number of hunters declined 3.5%. From 1984 to 1985, the number of hunters declined by 50%. This large decline in hunting pressure from 1984 to 1985 is believed to be a result of the season reduction and bag-limit changes implemented for the 1985 season. It is believed that the moose population can support a greater harvest than the current season allows; therefore, it is recommended that hunting season dates be extended 10 days to 1-30 September with no change in the bag limit.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 14C and 7

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Despite relatively high mortality from several sources, numbers of moose appear to have increased slightly over the past 5 years. Approximately 1,600 moose presently inhabit the subunit. Excellent calf production and survival during several consecutive mild winters and minimum predation within the large Fort Richardson population are major factors contributing to the general abundance of moose.

Population Composition

Aerial composition surveys were conducted throughout most major drainages during 1986. Only Eagle River and Bird Creek were not surveyed. Staff actually counted 1,029 moose; 474 of these were found on Fort Richardson and adjacent lands. The observed bull:cow and calf:cow ratios were 39:100 and 48:100, respectively. Calves represented 25.8% of the population; in comparison, in 1982-86, the mean numbers of calves in the population was 23.2%.

Mortality

Total reported mortality (by hunting, automobiles, poaching, and trains) for the subunit was approximately 255 moose. During the fall and winter hunting seasons, 652 hunters killed 132 moose, including 100 bulls and 32 cows. Cow moose were taken during several drawing or registration-permit hunts throughout the subunit. Forty-one bulls were taken in permit hunts, and 59 bulls were taken during the general open-hunting season.

One hundred eleven moose, at least 37 of which were calves, were killed by vehicles on Subunit 14C roadways between 1 June

1986 and 31 May 1987. This compares with 92 killed by vehicles during 1985-86 and an annual mean of 103 killed during 1983-85. In addition, approximately 20 moose were killed by poachers and collisions with trains.

Management Summary and Recommendations

Excellent calf survival (1982-86 post-season mean of 47 calves:100 cows) as well as several consecutive mild winters and minimal predation have allowed the population to increase slightly, despite substantial hunting and road-kill mortality. Because of the general abundance of moose and a high bull:cow ratio, a 10-day extension of the antlerless- permit hunts and the general bull season is justified.

When severe winters inevitably return, the majority of moose will be confined to lowland wintering areas where carrying capacity is probably insufficient to support existing populations. This situation will likely bring about a substantial die-off of calves and increased road kills on the Glenn Highway and the Anchorage hillside. With these conditions, a 15-20% decline in moose numbers would be expected. Maintaining liberal bull seasons, late season hunts, and an antlerless harvest should help moderate the anticipated die-off.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15A

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The Department, working cooperatively with the U. S. Fish and Wildlife Service (USFWS), completed a February moose census in Subunit 15A using a technique developed by W. Gasaway et al. (1986) for estimating moose abundance. Moose habitat (1,278 mi^2) was divided into 104, 10- to 15-mi^2 sample units that were stratified and grouped into low, medium, and high-density moose areas. Thirty randomly selected survey units were intensely surveyed, resulting in a population estimate of 2,702 ± 262 moose wintering in the subunit. The variance was 9.7% of the population estimate (90% confidence limits). The density was 2.1 moose/mi^2 of moose habitat.

Data collected by the USFWS during 1982 suggest the number of moose wintering in Subunit 15A has declined substantially. The 1982 estimate of 4,921 moose had a variance of 30%, or ± 1,338 moose. Using the lower estimate (at 90% confidence limits) would suggest 3,041 moose were present. Both agencies agreed the lower estimate was more accurate, given the survey conditions in 1982. This suggests only a slight decline may have occurred.

Population Composition

Fall sex and age surveys could not be completed in 1986 because of unseasonably warm weather and the lack of sufficient snow cover. However, during the winter census calves composed 17.8% of the total moose observed (n=1,225).

Mortality

In September 1986, 336 moose (285 bulls, 22 cows, and 29 of unknown sex) were reported harvested by 1,979 hunters.

The 1,950 hunters that participated in the general, bull-only season killed 312 moose (281 bulls, 2 cows, and 29 unknown). Hunter success rate was 16%; 301 successful hunters were Alaska residents; of these, 261 were unit residents. Nonresidents composed only 2% (n=5) of the successful and 1% (n=15) of the unsuccessful hunters. Fifty-nine percent of the successful and 72% of unsuccessful hunters used highway vehicles, 18% used boats, and 8% used airplanes as their means of transportation to the hunting area.

A limited antlerless-moose permit hunt was also held in the fall. Thirty permits were issued, and 29 hunters reported hunting. Twenty-four (83%) of those hunting were successful, harvesting 4 bulls and 20 cows. All 29 hunters were state residents, and 20 of the 24 successful hunters were unit residents. Twenty-three successful hunters reported using highway vehicles and 1 hunter reported using a boat for transportation to the hunting areas.

Antler measurements (width at widest point) were reported for 245 moose taken in 15A. Of these, 70% (n=172) had an antler spread ≤35 inches and 5% (n=12) had an antler spread ≥50 inches.

Management Summary and Recommendations

The 85,000-acre burn, which occurred in 1969, is still providing excellent browse, and it contained the majority of the moose wintering in Subunit 15A. However, this area as well as small areas of improved habitat north of Skilak Lake only make up 10-15% of the moose habitat in Subunit 15A. The remaining moose habitat is classified as unproductive primarily because of plant succession to mature forest. In addition, moose predators, such as wolves and black bears, have remained at high levels. Therefore, it was not unexpected that the 1987 census indicated a declining trend in the moose population. Predator control would provide short-term benefits to the moose population; however, habitat enhancement is required for long-term benefits, and prescribed burning is the most feasible method of attaining them.

The 1986 harvest of 336 moose by 1,979 hunters represents the highest harvest since 1983 (when 395 were reported) and the highest number of hunters ever recorded. Harvest data has been recorded since 1967. The percentage of small bulls decreased by 5%, compared with 1985 data; however, a high percentage of small bulls in the harvest is expected for an area supporting heavy hunting pressure.

During their spring meeting, the Board of Game adopted a ADF&G proposal to limit the harvest of bulls to those with spiked or

forked antlers having a spread of ≥50 inches. Since calf production is presumed adequate, this proposal was not initiated for biological reasons; rather it was in response to the public's request for a harvest of larger bulls in 15A. To be fairly evaluated, this regulation should remain in effect for a minimum of 5 years. Permits for antlerless moose should not be issued until the declining population trend is reversed.

Literature Cited

Gasaway, W. C., S. D. DuBois, D. J. Reed, and S. J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Institute of Arctic Biology No. 22. Biological Papers of the University of Alaska.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15B

GEOGRAPHICAL DESCRIPTION: Kenai Peninsula

PERIOD COVERED: 1 July 1985-30 June 1986

Season and Bag Limit

See Hunting Regulations No. 26.

Population Status and Trend

Aerial surveys have not been conducted in Subunit 15B since 1983 because of inadequate snow conditions. Although the winters have been relatively mild since 1983, no major habitat improvements have occurred in Subunit 15B in several years. Therefore, it is believed the moose population has remained stable.

Mortality

Four hundred sixty-seven hunters reported harvesting 85 bulls, 1 cow, and 3 moose of unspecified sex in 15B West during the 1986 season. Residents accounted for 100% of the harvest, and the hunter-success rate for all hunters was 19%. Antler-spread measurements were obtained from 79 of the bulls harvested and can be grouped as follows: 41 (52%) ≤29.9 inches, 26 (33%) between 30-49.9 inches, and 12 (15%) ≥50.0 inches.

During the 1986 season, 63 of the 100 permit holders reported hunting in Subunit 15B East, and 23 bulls were harvested. Success rate for those that reported hunting was 37%. Mean antler spread was 56 inches ($\underline{n}$=21; range 42-64.5 inches). Seven of the 21 antler-spread measurements exceeded 60 inches. Three types of transportation were used by successful hunters: horses, 78% ($\underline{n}$=18); boats, 13% ($\underline{n}$=3); and aircraft 9% ($\underline{n}$=2). The extent of weather-related mortality and predation by wolves and bears is unknown.

Management Summary and Recommendations

The reported harvest of 89 moose in Subunit 15B West was the highest harvest since 1974, when the harvest in Subunit 15B East was included; the season was 42 days (20 August-30

September). The 1986 harvest also exceeded the 3-year mean of 77 moose by 13%. Habitat improvement or predator control have not occurred in this area, and the number of hunters reporting and average number of days required to harvest a moose have not changed significantly in the past 3 years. For these reasons, the increased harvest in 1986 was attributed to good hunting conditions and recent mild winters that benefitted moose survival. Harvests in adjacent subunits (15A and 15C) also had increased harvest in 1986.

The Board of Game, during their 1987 spring meeting, approved a public proposal to include Subunit 15B West in an experimental selective-harvest program proposed for Subunit 15A by the Department. The proposal for this subunit addresses harvesting specific age classes of bulls determined by antler size or number of points. Passage of this regulation will initially reduce the harvest by protecting a segment of the bull population. Population-composition surveys are recommended for 1987, if snow conditions are adequate.

The trophy bull-moose hunt in Subunit 15B East continues to provide excellent hunting opportunities and is highly popular among resident sportsmen. The harvest of 23 bulls during 1986 was well within acceptable guidelines for maintaining a minimum bull:cow ratio of 40:100. Since the objective for this area is to provide an opportunity to hunt for a large bull under aesthetically pleasing conditions, I recommend no change in season and bag limit. Maintaining the bag limit in Subunit 15B East will also serve as a control to evaluate changes in the male segment of the moose subpopulations in adjacent areas where both small and large bulls are harvested.

Summer and winter moose range on the Kenai National Wildlife Refuge in Subunit 15B continues to deteriorate because of management policies for wilderness lands that favor advanced forest succession. The Department and U. S. Fish and Wildlife Service should cooperate on habitat enhancement projects (mechanical manipulation and prescribed burnings) to improve moose habitat in the Slikok and Coal Lake areas.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 15C

GEOGRAPHICAL DESCRIPTION: Lower Kenai Peninsula

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See hunting Regulations No. 27.

Population Status and Trend

Moose are moderately abundant and probably near the ecological-carrying capacity of the maturing forest habitats in Subunit 15C. In 1983 minimum density of 5.9 moose/mi² was observed on 230 mi² of fall range. The minimum density throughout the entire subunit, however, was probably between 2.0 and 3.0 moose/mi².

Population Composition

Aerial composition surveys were not flown in fall 1986 because of a lack of snow cover.

Mortality

The reported harvest in 1986 was 245 moose: 244 bulls and 1 moose of unspecified sex. This harvest was 29% higher than the 1985 harvest ($\underline{n}$ = 174) and 18% higher than the 5-year mean of 208 in 1980-84. The establishment of the the Lower Kenai Controlled-Use Area in 1985 reduced the harvest opportunity, and it affects direct comparisons of harvest data after 1984. In 1986, 72% of the harvest occurred in the 1st half of the season (1-10 September); 28%, in the 2nd half (11-20 September). These percentages were identical in 1985, and the ratio of 1st-half:2nd-half season harvests for the combined hunting seasons in 1983 and 1984 was not significantly different ($\underline{X}^2$ = 2.34, P >0.10) (Table 1). The geographical distribution of the moose harvest during the 2nd half of the season was similar to the 1985 harvest, except for a noticeable higher kill in the Deep Creek drainage (Table 2).

In 1986, 1,151 hunters reported hunting moose in Subunit 15C; this compares to 1,075 hunters in 1985 and a 5-year mean (1980-84) of 987 hunters (range = 708-1,265). The number of

people who hunted in the Deep Creek and Anchor River drainages was 17% (n = 245) and 11% (n = 343), respectively, lower than in 1984 (pre-controlled-use regulation). The success rate for moose hunters throughout Subunit 15C was 21%. Residency of hunters was as follows: Kenai Peninsula, 88%; other state residents, 11%; and nonresidents, 1%.

The frequency of use of the various transportation types was no different in 1986 than in previous years: highway vehicle > off-road vehicle > boat > horse > airplane. However, for the 2nd consecutive year, the number of hunters that used off-road vehicles (n = 263) declined significantly, compared with 1984 (X^2 = 28.3, P <0.001).

Antler-spread information was obtained from 224 harvested bulls, and their antler size was grouped as follows: 94 bulls <30.0 inches; 74 bulls 30.0-39.9 inches; 35 bulls 40.0-49.9 inches; and 21 bulls ≥50.0 inches. The proportion of bulls having an antler spread of ≤30.0 inches declined from 48% in 1985-86 to 42% in 1986-87, while the number of bulls with an antler spread of ≥50.0 inches increased from 5% in 1985-86 to 9% in 1986-87.

Management Summary and Recommendations

In response to a declining bull-moose population in the remote portions of the Deep Creek and Anchor River drainages, the Lower Kenai Controlled-Use Area was established in 1985. The attendant controlled-use regulation prohibited hunters from using motorized land vehicles off designated highways in Subunit 15C for the purpose of transporting moose hunters, moose-hunting equipment, or moose carcasses during 11-20 September. The regulation was designed to reduce hunting pressure and the harvest of moose by sport hunters so that bull:cow ratios would gradually increase to at least 15:100. An evaluation of the Lower Kenai Controlled-Use Area regulation during the past 2 hunting seasons (1985 and 1986) follows.

Effects on Hunter Numbers and Harvests:

Examination of harvest report information (1983-1986) indicate that the controlled-use regulation failed to substantially reduce either the number of hunters or the harvest of bulls in Subunit 15C (Table 3). However, this general conclusion should be qualified by an understanding of how the regulation operated in the trail-accessible portions of the subunit.

The controlled-use regulation drastically reduced the number of hunters in the Deep Creek and Anchor River drainages during the 2nd half of the hunting season (11-20 September). During

the 2nd half of the the 1985 and 1986 seasons, I spent 4-5 days making ground observations in these 2 drainages. I did not see an off-road vehicle, and only on occasion did I here one; whereas, prior to 1985 off-road vehicles were commonly used by moose hunters. However, as a result of the ATV prohibition, the moose kill during the 2nd half of the hunting season declined from 27 to 17 moose in Deep Creek and from 15 to 8 moose in Anchor River from 1983 to 1984 (precontrolled use) to 1985-1986 (controlled use) (Table 1). However, the total season harvest did not significantly decline in these drainages because of increased harvests during the 1st half of the hunting season. This was particularly true of the 1986 season.

In 1986 the kill for the 1st half of the season was 38% higher than that in 1985; this raises the question whether Subunit 15C moose hunters were using ATVs to "pack" into their camps in the early part of the season to avoid the motorized-vehicle restriction starting on 10 September. I tested the following null hypothesis: "ratio of moose shot in Subunit 15C to the number shot in Subunits 15A and 15B during the 1st half of the hunting season was the same in 1986 as it was in 1985" (Table 2). The test was not significant ($\underline{X}^2$, 1 d.f., = 0.45, $\underline{P}$ = 0.5), meaning that the data do not offer evidence of early season "packing" by hunters using ATVs. The widespread nature of the increase in the kill for the 1st half of the season on the Kenai Peninsula and the preponderance of bulls with antler spreads in the 30.0- to 39.9-inch category (2- and 3-year-olds), suggest that many yearling bulls from the 1984 cohort were not killed by hunters in 1985 and, therefore, became available to hunters in 1986 as 2-year-olds. In addition, the 1986 yearling cohort appears to have been relatively abundant.

Effects on Hunter Transport Methods:

The controlled-use regulation caused an obvious decline in the number of moose hunters using off-road vehicles in Subunit 15C. Prior to implementation of the controlled-use regulation, the number of hunters using an off-road vehicle to reach their hunting area had grown to 400 (1984). The mean annual number of off-road vehicle users in the 1985 and 1986 seasons ($\underline{n}$ = 266) was significantly lower than in the 1983 and 1984 seasons ($\underline{X}^2$ = 19.83, $\underline{P} \leq 0.001$). The largest decline in the use of ATVs occurred in the Deep Creek and Anchor River drainages. Surprisingly, the number of hunters using horses for moose hunting in Subunit 15C increased only from 67 (1984) to 81 (1986). Hunters using highway vehicles increased from 468 to 499 over the same period of time.

It is becoming an increasingly common practice for hunters in Subunit 15C to (1) access a remote hunting area by an off-road vehicle during the 1st 10 days of the season, (2) park the vehicle at camp, (3) hunt on foot for the duration of the season, and (4) then leave the hunting area by off-road vehicle after 20 September. Continued use of this practice in the Deep Creek and Anchor River drainages may eventually increase the harvest during the 2nd half of the hunting season to levels that existed prior to the prohibition on ATVs.

Effects on the Geographical Distribution of Hunters:

The geographical distribution of hunters by major drainage during the entire 1986 season was surprisingly similar to the 1984 distribution (i.e., last year prior to the controlled-use regulation) (Table 3). Notable exceptions to this pattern were those drainages traditionally accessed by off-road vehicles, such as Deep Creek (17% decline), Anchor River (11% decline), and the lower segments of the Fox River-Sheep Creek drainage (12% decline).

Public Attitudes and Compliance:

The Lower Kenai Peninsula Controlled-Use Area was proposed by the Alaska Department of Fish and Game in 1985 and, subsequently, endorsed by the Homer, Central Peninsula, and Soldotna/Kenai Fish and Game Advisory Committees. From the regulation's inception, I felt that a majority of the local hunting public supported its purpose and implementation. However, a vocal faction of moose hunters, mostly off-road vehicle-users, complained that the new regulation unfairly discriminated against them.

Based on aerial and ground reconnaissance during the 2nd half of the season and numerous conversations with moose hunters in 15C, I am confident that most hunters complied with the controlled-use regulation in 1985 and 1986. Fish and Wildlife Protection officers cited 2 hunters in a single incident for using a motorized land vehicle to transport themselves and their hunting gear into a remote portion of Deep Creek in 1986. These were the only 2 citations issued for violations of the controlled-use regulation. I believe that a large majority of local moose hunters now favor the prohibition of off-road vehicles during the last 10 days of the season.

Effects on the Abundance of Bull Moose:

A determination of whether or not the controlled-use regulation has increased the number of bull moose and the bull:cow ratio is inconclusive. In 1985 after 1 controlled-use season, aerial surveys showed some improvement in the

bull-moose numbers in the Deep Creek and Anchor River drainages. The number of bulls counted in these drainages increased from 50 in 1982 to 70 in 1985; however, the bull:cow ratio remained at 11:100. In 1985 only 3 bulls were observed in the entire 120-mi² area between the South Fork of the Anchor River and Kachemak Bay; these data indicate no improvement in bull moose numbers in those areas with good road access adjacent to the controlled-use area.

In 1986 aerial-composition surveys were not flown in Subunit 15C because of a lack of snow cover during October and November. Implementation of antler-size restrictions on bull-moose hunting in 1987 will make it virtually impossible to determine whether the controlled-use regulation had any effect on increasing bull numbers.

Conclusions:

The Lower Kenai Peninsula Controlled-Use Area was established to reduce the bull harvests by prohibiting the use of off-road vehicles during a portion of the hunting season. The Department's experience with this controlled-use area provides some valuable insights concerning the suitability, strengths, and weaknesses of such a strategy.

It appears that restriction of motorized land transportation during just one-half of the hunting season will not substantially reduce the bull harvest in Subunit 15C because hunting pressure during the 1st half of the season resulted in a harvest near the management guideline level of 170-185 moose. It is noteworthy that no evidence of a shift in hunting pressure to the 1st half of the season was found in either 1985 or 1986. The regulation essentially created 2 separate moose seasons (i.e., 1-10 September and 11-20 September), with the greatest potential to harvest bulls occurring during the 1-10 September period when off-road vehicles can be used for hunting purposes. Actually, more than any other factor, magnitude of the season harvest is heavily dependent on the weather and trail conditions during the 1st half of the season. For these reasons, controlled vehicle-use regulations (with a split hunting season) are not generally recommended to regulate the level of big-game harvests. Controlled-use regulations may be appropriate in the following applications: (1) when it is desirable to eliminate the most efficient forms of transportation during the entire season in order to reduce hunting pressure; (2) when it is necessary to separate incompatible resource user groups; (3) when it is desirable to limit, but not completely stop, harvesting of a big-game resource during a specific time period (assuming motorized-vehicle users are a major impact group); and (4) when it is desirable to protect sensitive environments or natural

resources from the physical disturbances caused by motorized land vehicles.

If the harvest of moose is limited to certain antler sizes in 1987 (a forthcoming proposal), the public should be advised that the lower Kenai Controlled-Use Area is no longer a justifiable management tool for increasing the number of bull moose in Subunit 15C. Because the controlled-use regulation is popular among some moose hunters, the decision to maintain or eliminate the regulation should come from the public.

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Table 1. Comparison of bull-moose harvest in the 1st half of the season to that of the 2nd half in Subunit 15C, 1983-84.

Year	September bull harvests				Totals
	1-10		11-20		
	n	%	n	%	
1983	160	69	72	31	232
1984[a]	132	63	79	37	211[b]
1985[a]	120	72	46	28	166[b]
1986[a]	165	72	64	28	229[c]
Totals	577		261		838

[a] Lower Kenai Controlled-Use Area in effect during the 2nd-half of the season.

[b] 8 hunters did not specify date of kill; total harvest = 174 bulls.

[c] 16 hunters did not specify date of kill; total harvest = 245 bulls.

Table 2. Comparison of the reported harvest of bulls during the 2nd half of the season (11-20 September) by drainage in Subunit 15C, 1983-86.

Drainage	Bulls harvested								Difference between mean harvest and 1985-86 mean harvest
	1983		1984		1985 [a]		1986 [a]		
	M	%	M	%	M	%	M	%	
Tustumena Lake	7	10.1	5	6.5	11	23.9	11	17.2	+ 5.0
Ninilchik River	9	13.1	7	9.1	4	8.7	5	7.8	- 4.0
Deep Creek	25	36.2	28	36.3	12	26.1	21	32.8	- 14.5
Stariski Creek	2	3.0	1	1.3	1	2.2	4	6.2	- 0.5
Anchor River	13	18.8	16	20.8	8	17.4	8	12.5	- 6.5
Kachemak Bay	9	13.1	14	18.2	5	10.8	4	6.2	- 6.5
Fox River/Sheep Creek	3	4.3	5	6.5	3	6.5	8	12.5	- 1.0
Seldovia River	1	1.4	1	1.3	1	2.2	0	-	0.0
English Bay River	0	-	0	-	1	2.2	1	1.6	+ 1.0
Rocky River	0	-	0	-	0	-	1	1.6	0.0
Unknown	0	-	0	-	0	-	1	1.6	+ 0.5
Totals	69	100.0	77	100.0	46	100.0	64	100.0	- 27

a Lower Kenai Controlled-Use Area in effect.

Table 3. Comparison of the effects of the Lower Kenai Controlled-Use Area on hunter numbers and bull harvests (2nd-half season) in the Deep Creek and Anchor River drainages, Subunit 15C, Kenai Peninsula, 1983-86.

Drainage	Year	Number hunters	Bulls harvested	
			11-20 Sept.	1-20 Sept.
Deep Creek	1983	237	25	83
	1984	295	28	72
	1985[a]	217	12	56
	1986[a]	245	21	71
Anchor River	1983	365	13	61
	1984	386	16	50
	1985[a]	342	8	50
	1986[a]	343	8	49

[a] Lower Kenai Controlled-Use Area in effect.

Table 4. A test of the null hypotheses that harvests in the 1st half of the season was independent of the subunit in which a bull was killed in Unit 15, 1985 and 1986.

Subunit	Bull harvests, 1-10 Sept. Year 1985	1986	Total
15A and B	189	243	432
15C	120	165	285
Totals	309	408	717

H° "the ratio of moose shot in Subunit 15C to the number shot in Subunit 15A and 15B during 1-10 September was the same in 1986 as it was in 1985."

$\underline{X}^2$, 1 d.f., = 0.45, P = 0.5.

Table 5. Comparison of the geographical distribution of moose hunters in Subunit 15C by drainage before controlled-use hunts in 1983 and 1984 and during controlled-use hunts in 1985 and 1986.

	No. hunters				
Drainage	1983	1984	1985	1986	Total
Tustumena Lake	163	205	180	191	734
Ninilchik	119	106	87	105	417
Deep Creek	237	295	217	245	994
Stariski Creek	30	36	19	34	119
Anchor River	365	386	342	343	1,436
Kachemak Bay	125	147	161	144	577
Fox River/Sheep Creek	41	43	19	38	141
Seldovia River	19	10	17	8	54
English Bay River	4	1	3	5	13
Rocky River	4	2	4	6	16
Unknown	46	34	29	31	140
Totals	1,153	1,265	1,078	1,150	4,646

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16

GEOGRAPHICAL DESCRIPTION: West Side of Cook Inlet

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limits

See Hunting Regulations No. 27.

Population Status and Trend

Moose numbers in Unit 16 generally remained stable, but some areas have declined as a result of winter mortality or excessive harvest. Given the recent relatively mild winter conditions, other factors appear to be keeping the population from continued growth. The 1984-85 population census figure of 10,000 moose is now believed to be a very liberal estimate.

Population Composition

Sex- and age-composition trend surveys were conducted in November and December. Results of the 4 count areas surveyed in Subunit 16A and the 8 count areas in Subunit 16B are presented in Table 1.

Mortality

Three September hunting seasons and 2 winter hunting seasons are in effect for the mainland portion of Unit 16. The combined reported harvest was 687 moose (567 males, 111 females, and 9 sex unknown) by 2,165 hunters. For the 3rd year, the hunting pressure during the September seasons declined (1984, 2,737; 1985, 2,132; and 1986, 2,079 hunters). The harvest by area and season is presented in Table 2.

This level of harvest, although comparable to that of most recent years, is significantly higher than that reported for the 1985-86 regulatory year (496 moose). The increased harvest represents higher hunter success during the September seasons. The winter permit hunts were limited to residents of the hunt area, and those combined harvests increased the total harvest by only 14 moose. The unit continues to be hunted primarily by Alaskan residents; nonresidents composed only 4%

of the hunters during the fall seasons. Winter mortality appeared to be limited to a few areas and losses were minimal.

Management Summary and Recommendations

Data from the fall sex- and age-composition surveys in Subunit 16A were generally comparable to those of recent years. In Subunit 16B there may be a declining trend in both bull:cow ratios and calf:cow ratios in the past 3 years. However, given the variables present in aerial-survey techniques, the trend may be a factor of sampling bias. The observed fall calf:cow ratios have been below 30 calves:100 cows in recent years; if reproductive success remains at this lower level, animals lost to hunting, predators, accidents, or winter mortality may not be replaced. Existing bull:cow ratios in all areas are adequate for breeding, but continued declines could have an impact on hunter success and hunt quality. Only in the Redoubt Bay area, where the hunting season was half the length of the general season in Subunit 16B, was an improved bull:cow ratio recorded.

Harvest continues to be unevenly distributed in the unit. In Subunit 16A, the Petersville Road, Parks Highway, Kroto Creek, and Moose Creek areas provide most of the kill. In Subunit 16B, the Yenlo Hills, Alexander Creek, 20 Mile Slough, Beluga Lake, Lake Creek, and the Yentna River are major areas with substantial harvest. Because some of these areas have human year-round residents, the localities are also important subsistence harvest areas, and the combined fall and winter seasons provide the potential for overharvesting resident moose.

Fall sex- and age-composition survey areas were originally established in alpine areas where moose were easily observable. The September harvest, however, comes primarily from lower forested areas where existing aerial-survey techniques are inefficient. Studies utilizing telemetry equipment have shown that sex- and age-composition data gathered in alpine areas may not be representative of moose at lower elevations. Because hunting pressure has been concentrated in nonsurveyed areas, the available data base may not reflect the actual status of the subpopulation providing the harvest. The need for valid population data is greatest along the waterways that serve as major transportation corridors and that often have permanent human residents. Although the fall hunting pressure declined in Subunit 16B, harvest pressure is shifting to alpine survey areas where moose are more abundant. Decreases in both harvest and hunting pressure have occurred in many traditional "lowland" hunting areas as moose in these areas became harder to locate. Antlerless moose in these areas should be protected during the fall season to maximize the

reproductive success of local resident moose and allow numbers to increase.

Winter seasons were designed to capitalize on the movement of nonlocal moose to the winter range and to spread the harvest across the widest possible segment of the population. If winter hunting seasons are held prior to the arrival of migratory moose, the local resident moose population that was heavily hunted in September also provides the kill during the late season. This scenario occurred during the winters of 1984-85 and 1985-86, and although the harvest was small, it is still additive. When combined with winter mortality, this harvest contributed to a decline in some local moose populations. During the winter of 1986-87, the season was opened only after migratory moose arrived on the winter range. Hunter success for both hunts 981 and 982 was high because moose were more readily available than in the past. Winter hunts should be held only when mixed stocks of moose are present, even though some hunters express dissatisfaction with having to wait for the later season opening. With the greater number of migratory moose present, antlerless moose can continue to be taken with only minimal impact on the resident subpopulation.

The September seasons on mainland Unit 16 should be restricted to bulls only. In Subunit 16A, the season could be extended to 30 September to coincide with the closing dates in adjoining areas. Winter hunting seasons for local residents should remain on permits and be opened only after migratory moose have moved on to the winter range.

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Table 1. Moose sex and age ratios in Game Management Unit 16, 1986.

Count area	Males:100 females	Calves:100 females	Twins:100 females w/calves	Moose/ hour	Sample size	Count time (hours)
Subunit 16A						
NE Dutch Hills	50.0	27.8	0.0	21.3	32	1.5
NW Peters Hill	45.0	41.2	10.2	97.6	244	2.5
SW Dutch Hills	34.2	27.6	10.5	69.6	123	1.8
SW Peters Hills	32.9	28.8	5.0	118.0	118	1.0
Subunit 16A						
Means	39.6	33.9	8.6	76.4	517	6.8
Subunit 16B						
Lone Ridge	54.2	30.2	0.0	56.2	177	3.2
Redoubt Bay	26.7	16.4	14.3	36.9	209	5.7
Sunflower Basin	28.7	25.3	15.8	134.0	134	1.0
Upper Camp Cr.	63.3	20.0	0.0	94.3	55	0.6
Fairview Mt.	34.7	20.7	3.3	194.2	233	1.2
Yenlo East	33.3	24.3	11.1	155.2	331	2.1
Alexander Cr.	11.3	21.8	10.7	103.1	189	1.8
Mt. Susitna	32.0	32.0	14.3	22.2	41	1.9
Subunit 16B						
Means	31.7	22.8	8.6	78.7	1,369	17.4
Unit 16						
Means	33.7	25.6	8.6	77.9	1,886	24.2

Table 2. Moose harvest by area, season, and number of hunters in in Unit 16, 1986-87.

Area	Season	Bulls	Cows	Unk. sex	Total	No. hunters
16A	1-20 Sep.	161	1	0	162	715
16B-Redoubt Bay	1-15 Sep.	17	3	0	20	57
16B-Remainder	1-30 Sep.	356	81	8	445	1,247
16B-Hunt 981	2-15 Jan.	13	13	0	26	34
16B-Hunt 982	15-28 Jan.	17	13	0	30	52
16-Unspecified	Sep.	3	0	1	4	60
Totals		567	111	9	687	2,165

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 16B

GEOGRAPHICAL DESCRIPTION: Kalgin Island

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limits

See Hunting Regulations No. 27.

Population Status and Trend

At the end of the 1986 hunting season, sport hunters had reduced the density of moose on the island to an estimated 1 moose/mi^2. Winter mortality is believed to have further reduced the population. The estimated precalving population for 1987 is 10-12 individuals.

Population Composition

Two winter aerial surveys were conducted on the island. On 26 November 1986, 11 moose (2 bulls, 5 cows, and 4 calves) were observed under poor survey conditions. On 10 February 1987, 8 adult moose and no calves were observed under good survey conditions.

Mortality

Only 6 moose (2 males and 4 females) were harvested by 58 hunters during the fall season. Additionally, hunters reported finding the remains of 3 winter-killed moose from the previous winter. Mortality also occurred during the 1986-87 winter, as evidenced by the absence of any calf sightings during the February survey.

Management Summary and Recommendations

The carrying capacity for moose on Kalgin Island remains low because the habitat has not recovered from overuse by the moose during the late 1970's. The evidence of mortality in the past 2 mild winters indicates that, even at the reduced population level, moose numbers exceed the winter carrying capacity. Vegetative recovery for nonprimary forage species like blue berry and salmon berry has occurred, but preferred winter browse species like willow and young birch trees are nearly absent. Winter survival of an individual moose is dependent upon body fat acquired during the summer and autumn

and the continued availability of ground-level forage during the winter. At the existing density, forage recovery is expected to continue, but recovery of critical winter forage species will be slow. If the moose density is allowed to increase, the population could retard forage recovery or even reverse it. Given the availability of existing winter forage, moose would not be expected to survive on the island if a winter with prolonged snow depths exceeding 2 feet were to occur.

Kalgin Island moose are an introduced species, but no natural predators occur on the island. Sport hunting must be employed to regulate moose numbers if vegetative recovery is to be continued. Unfortunately, with reduced numbers of moose, hunter success has declined and interest in hunting on the island has waned. Hunter numbers declined from 234 in 1985 to only 58 in 1986, and the harvest declined from 19 to 6 moose. This trend is expected to continue, even given liberal season and bag limits. Because of the difficulties and costs associated with reaching the island, few people will hunt there, unless the opportunities to bag a moose are high.

Experience has shown that, even under moderate moose densities and liberal season and bag limits, hunters have had difficulties in taking moose. The island has extensive stands of alders and mature spruce with a devils club understory. These conditions contribute to poor hunter success, because moose utilize vegetation to successfully avoid hunters. Hunters on foot using traditional methods and means cannot eliminate moose from the island. This was demonstrated during the 1985 season when a density of 10 hunters (241 hunters) per square mile were only able to take about half (19 moose) of the population.

The quantity and quality of browse must be improved if the moose are to survive a winter with prolonged deep snow. Because of the low density of moose and poor hunter success, it is not likely that "traditional" sport hunters will be able to maintain a low moose density. Moderate winter stress may regulate numbers in any given year by limiting survival to the healthiest individuals. Mild open winters, however, may allow short-term population increases that could set vegetation back, unless compensated by hunter harvest. Hunting regulations for the island should encourage maximum harvest by liberalizing hunting opportunity. Experience has shown that the possibility of an overharvest is unlikely, but if that were to occur, it could only enhance browse recovery.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 17

GEOGRAPHICAL DESCRIPTION: Northern Bristol Bay

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

No early records of moose densities exist for Unit 17. Observations in the early 1970's indicate that moose were relatively scarce throughout much of the unit. Moose populations in the Nushagak and Mulchatna River watersheds were assumed to be stable at low densities in 1976, when the entire moose population for Subunit 17B and Unit 9 north of Egigik was estimated to be about 1,500 moose. Concentrations were reported in the Tikchik Lakes and upper Mulchatna-Chulitna Rivers areas.

Moose populations in most areas of Unit 17 have been increasing since the early 1980's because of mild winters, low predation, and high calf survival during 1983 and 1984. Late fall-early winter surveys were flown during this reporting period in several areas of Unit 17 where record-high numbers of moose were observed.

A census of that portion of the Mulchatna River drainage upstream from and including the Chilchitna River was conducted 10-14 February 1987. The census area comprised 1,615 mi^2 and was subdivided into 3 strata containing 137 sample units. Thirty-nine sample units were censused, and results indicate an overall density of 0.74 moose/mi^2 (±20.9%). During this census, 374 adults and 57 calves were observed, yielding 13.2% calves in the population.

Population Composition

Three count areas were flown during this reporting period, in addition to the census in Subunit 17B. Count-area surveys were completed between 27 December and 2 January because of lack of snow earlier in the winter. During 8.7 hours of aerial survey, 455 moose were observed: 178 bulls, 65 cows,

71 calves, and 141 adults of unidentified sex. Most notable were the results from Sunshine Valley; the minimum calf:cow ratio was 78:100. This area has consistently had calf:cow ratios in excess of 70:100 since 1983.

Mortality

A total of 585 hunters reported taking 201 moose in Unit 17. All were reported to be males. Of these, 53 were taken during the registration hunt, and 148 were taken during the regular open season. Unit residents took 51 (96%) of the moose taken during the registration hunt and 64 (42%) of those taken during the regular season. Nonresidents did not kill any moose during the registration hunt but took 45 (30%) during the regular season.

The chronology of the harvest was as follows: July, 1 (0.5%); August, 27 (14.0%); September, 127 (67.5%); October, 4 (2.0%); November, 0; December, 3 (2.0%); January, 15 (8.0%); unknown, 11 (6.0%). The December season was extended by emergency order through January 10 because of poor hunting conditions through December.

Harvest rates within the age classes of adult males have not changed appreciably during the past 5 years. The average antler size in the harvest this year was nearly identical to the 1985-86 season, when 50% of the bulls taken had an antler spread greater than 50 inches.

Management Summary and Conclusions

Trend counts have limited value in Unit 17 because of (1) low moose densities over large geographic areas and (2) frequently inadequate snow conditions. Weather conditions can be quite variable between years and frequently cause major shifts in habitat use. These changes in use make comparison of survey results difficult. To acquire necessary population data for management, increased emphasis should be placed on periodic census estimates in portions of the unit.

Survey conditions were variable in the area covered in the upper Subunit 17B census. Areas along the upper Mulchatna and Chilikadrotna Rivers were windblown, and some sample units had very little snow cover; however, conditions in the hills along the Little Mulchatna River, the Bonanza Hills, and the northern drainages of the Mulchatna River were very good. Overall, the sightability was less than desirable, but the consensus of observers was that the density of the sample area was unlikely to be greater than 0.9 moose/mi^2. The observed density was significantly lower than previous density estimate

of 1.2 to 1.5 moose/mi² based on number of moose seen during a previous stratification flight.

Unlike the preceding several years, hunting pressure did not increase significantly during this reporting period. Competition between unit residents and nonresidents along the upper Nushagak and lower Mulchatna Rivers remains high, however, causing some conflict between user groups. Board of Game actions in March 1987, which gave highest preference to unit residents and the lowest preference to nonresidents, may help alleviate some of this conflict.

Use of ATV's by guides and outfitters as a secondary means of transportation for their fly-in hunters has increased slightly over that of the previous reporting period (1985-86). Unit 17 has numerous access points for hunters, and use of ATV's to provide additional access cannot be justified biologically. ATV use should be discouraged because it is incompatible with other recreational uses of the area.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 18

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The moose population in Unit 18 is confined primarily to the Yukon River drainage upriver of St. Marys and the Kuskokwim River drainage upriver of Bethel. Prior to 1950, moose were only occasionally seen on the Yukon-Kuskokwim Delta. Although moose are presently much more common than observed in the past, their densities are still extremely low, compared with habitat availability. We believe the population in Unit 18 numbers approximately 500-800 moose in the Yukon drainage and 100-200 in the Kuskokwim drainage. Most of the animals residing in the unit appear to be highly migratory, and some undoubtedly are recent immigrants from Subunits 19A and 21E. A cow radio-collared in 1986 near the village of Shageluk (Unit 21E) was relocated in May 1987 on the Andreafsky River drainage near St. Marys. Although extensive habitat is available for further colonization of Unit 18 and moose densities in Units 19A and 21E are presently very high, heavy hunting pressure and other mortality factors effectively limit population growth.

Population Composition

Fall composition surveys were not conducted in Unit 18 because of inadequate snow cover. Because of staffing shortages, only one winter survey from Ohogamiut to Russian Mission on the Yukon River was conducted (Table 1). Since snow depths were moderate during 1986-87, more moose were observed in riparian areas along the Yukon River, compared with the previous winter that was characterized by little snow.

Mortality

Hunting remains the most significant source of moose mortality in Unit 18. The moose population is heavily utilized by local residents, and we estimate the harvest equals or exceeds 15%

of the population size annually. During the 1986-87 open season, 171 hunters reported a harvest of 60 moose. The 1986-87 harvest was slightly higher than the 1985-86 harvest of 52 moose, although substantially lower than the record 1981 harvest of 82 moose. Fifty-four moose were reported taken during the September 1986 season and six during the February 1987 season. Fifty percent of the harvest (30 moose) was reportedly taken from along the Yukon River upstream of Mountain Village. Seventeen percent of the harvest (10 moose) was reported from the Archuelinguk and Andreafsky Rivers north of the Yukon. The Tuluksak, Kisaralik and Kwethluk drainages of the Kuskokwim River accounted for an additional 18% of the reported harvest.

The number of people who reported hunting moose in Unit 18 declined from 221 in 1985-86 to 171 in 1986-87. Conversely, the number of people who reported hunting in adjacent Subunits 19A and 21E has increased markedly in the last several years. Many residents of Unit 18 are aware that hunting opportunities are significantly better in Subunits 19A and 21E. As one consequence, moose hunting in the central Kuskokwim region of Subunit 19A has recently become an allocative issue between the residents of Unit 18 and Subunit 19A.

The reported harvest of moose in Unit 18 does not reflect the actual harvest; rather, it reflects only the harvest of those hunters who choose to operate within the regulatory system. The percentage of local residents conforming to pertinent regulations (hunting seasons, licenses, harvest tickets) is increasing, but the out-of-season and unreported harvest, particularly in the Kilbuck Mountains, may equal the legal harvest. Moose of both sexes are taken throughout the year in Unit 18, although only bulls are legal. The out-of-season harvest, however, probably has declined with the advent of the February season. We estimate the 1986-87 unitwide harvest, including the unreported harvest, is approximately 100 moose.

During September 1986, ADF&G and U.S. Fish and Wildlife Service staff operated a check station for the 2nd consecutive year at the mouths of Twelve-mile and Paimiut Sloughs on the Yukon River. Voluntary cooperation with the check station located near the border of Unit 18 and Subunit 21E was good. During the fall season, 152 hunters in 72 boats stopped at the check station; nearly all of these hunters were residents of Unit 18. Thirty-three moose taken from an area extending from the Iditarod River (Subunit 21E) to Twelve-mile Slough (Unit 18) were brought to the check station. Based on tooth samples (n=23), average age of the moose was 3.8 years; average antler width was 43 inches. The moose processed at

the check station were primarily young bulls in good condition.

Weather conditions during the fall season were characterized by periods of windy and rainy weather. Moose-rutting activity in the vicinity of the check station began approximately September 20, but most hunters were afield only during the first 3 weeks of September. Seventy-five percent of the harvest occurred during the first 3 weeks of September. Based on hunters contacted at the check station, the success rate was approximately 50%; an average of 5 days was required for a hunter to obtain a moose. Residents in Unit 18 reported an overall success rate of 30%.

In contrast to the previous summer, no sick or dying moose were observed or reported during the summer of 1986. Winter snowfall in 1985-86 was relatively light. Little lowland flooding occurred during spring 1986, and midsummer mosquito outbreaks were moderate. Calf production along the Yukon in early fall 1986 was observed to be good (33-38% calves).

The winter hunting season occurred on February 1-10 for the 2nd consecutive year. Interest in the bulls-only winter season was high, and many hunters participated. Considerable snowmachine traffic was observed proceeding from coastal villages up the Kuskokwim River and from Kuskokwim villages to the Yukon River in the vicinity of Ohogamiut. Moose were relatively concentrated in some areas along the Yukon River, especially on islands with cottonwood stands between Ohogamiut and Paimiut. We believe, however, that excessive harvest did not occur. Because snow depths were moderate to light during February, moose were not confined to riparian areas, as was observed occasionally in previous years. Only 5 moose were reported harvested in the February season. Informed sources indicated that 12 moose were actually harvested during the season along the Yukon River and approximately four more were taken from the foothills of the Kilbuck Mountains. Aerial patrols in the vicinity of Paimiut during the February season suggested that most moose were in close cover visible only from the air. Only those moose traversing open areas or frozen sloughs appeared vulnerable to hunters. Staff concerns about the effect of the February season on the moose population were lessened under these conditions.

As reported in past years, local residents accounted for most of the moose harvested in Unit 18. Only 5% of the reported harvest was taken by nonlocal hunters. Boats were the mode of transportation most frequently used by successful hunters (71%). Other reported modes of transportation used by successful hunters were snowmachines (10%), aircraft (8%), and highway vehicles (6%). All successful, nonresident hunters

used aircraft. Because harvest reporting is poorer in the winter than in the fall, we suspect that snowmachines were used to obtain a larger percentage of the actual moose harvest.

We have no information indicating whether predation by either wolves or bears was a significant source of moose mortality in Unit 18 during 1986-87. Snow cover was relatively light during most of the winter. Several moose were reported killed by wolves in Subunits 19A and 19B, but none were reported killed by wolves in Unit 18. Lack of snow hindered grizzly bear predation in moose yards during spring in the Kilbuck Mountains. In the Andreafsky and Kilbuck Mountains, grizzly bears probably outnumber moose, and predation by bears, particularly on calves, may have a significant impact on moose population growth. Black bear predation on moose calves along the Yukon River has been documented in Subunit 21E and may be important in Unit 18. We believe, however, that human harvest is the most important mortality factor influencing moose populations in Unit 18.

Management Summary and Recommendations

The heavy out-of-season harvest, particularly of cows and calves, is the most serious moose management problem in Unit 18. Although compliance with seasons and regulations has improved markedly in the past 5 years, the moose population density is at such a low level in most of the unit that any harvest of cows and calves adversely affects population growth. Approximately three-quarters of the Yukon drainage and all of the Kuskokwim drainage are not significantly utilized by moose. A lack of alternative ungulate resources, a poorly developed cash economy, and a high density of people and villages along the major rivers complicate the problem considerably. Additional public education and enforcement efforts are recommended, particularly during the late-winter period.

Staff should continue to closely monitor the February hunting season. Interest in the season is high, particularly among the Yukon River villages. Because most bulls lose their antlers prior to February, we remain concerned that some cows are inadvertently mistaken for bulls and shot. The harvest during February 1987 was not great, however, so the problem this year was probably not significant. Snow depths during February were light to moderate, and moose did not concentrate along the Yukon River. However, during a winter characterized by deep snow, many more moose than normal would winter along the Yukon River, and the harvest of cows could potentially be high enough to adversely impact the population.

Since Unit 18 contains a very healthy grizzly bear population, we remain concerned about the impact of this bear population on the low-density moose population. In the Andreafsky and Kilbuck Mountains, bears are probably more numerous than moose. Although we believe that bears probably do not take a large number of moose, the few they take in combination with hunting mortality may be enough to adversely impact the growth of a low-density population.

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Table 1. Winter composition counts in Unit 18, Yukon River, 1983-87.

Area	Year	Adults	Calves	Percent calves	N
Yukon River (Ohogamiut to Russian Mission)	1983	6	1	14	7
	1984	15	7	32	22
	1985	33	21	39	54
	1986	6	5	45	11
	1987	30	15	33	45

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 19

GEOGRAPHICAL DESCRIPTION: Upper and Middle Kuskokwim River drainages

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Because there was no area biologist stationed in Unit 19 during much of the reporting period, few data were collected on the status or composition of the moose population. However, some data were collected by the area biologist in Bethel.

Snow accumulations over most of Unit 19 were low to moderate, except for reports of deep, crusty snow in the upper Holitna River-Titnuk Creek drainages that was associated with apparent increased winter mortality and wolf predation. However, winter weather apparently did not contribute to substantial die-offs. Consequently, the moose population in Unit 19 probably remained stable during this reporting period.

Three surveys totaling 3.1 hours were conducted in the moose wintering areas in Subunit 19A during February and March 1987. The first of these, conducted 5 February on the Aniak River between its confluence with the Kuskokwim and the mouth of the Salmon River, yielded 42 moose observations (33.6 moose/hour). On 2 March the Holitna River was surveyed for 1.3 hours from its mouth upstream to the Kulukbuk Hills; 319 moose were observed (249 moose/hour). On 2 March an additional 0.6 hours were spent on the lower Hoholitna River drainage, where moose were seen at a rate of 91.8 moose/hour. Because survey area boundaries were not well defined, comparisons of these data with that of previous years are not possible.

Population Composition

Of the 3 winter surveys conducted in Subunit 19A during early 1987, the Aniak River area harbored the greatest percentage of calves (26%). The Holitna and Hoholitna River drainage

surveys yielded 17% and 15% calves, respectively. A late winter 1986 survey in Subunit 19A indicated that calves composed 11% of the herd, indicating a slightly increased calf production during this reporting period. However, in surveys conducted prior to 1985, calf percentages ranged from 22% to 26% of the surveyed populations.

Mortality

Although harvest by hunters remained high in 1986, the moose population appeared to have stabilized or slightly declined from levels of the past 3 years. The reported harvest of 460 moose was somewhat lower than the record harvest of 1984-85 (567) but slightly above the previous 5-year mean of 428.

Success rates throughout the unit have remained high, with 855 hunters spending 6,043 days afield. Over half the hunters were successful (53.9%), averaging 6.9 days afield. This success rate is not significantly different from the previous 5-year mean.

An analysis of reported antler sizes was conducted using historical data to see if changes in antler size had occurred. In 1986, 318 bulls harvested in Unit 19 by Alaska residents had a reported mean antler spread of 42.8 inches. Nonresidents reported the harvest of 114 bulls with a mean antler spread of 54.1 inches. Antler-spread data from 1980 through 1986 indicated mean antler size did not change significantly during that time period ($P \geq 0.05$).

Of 781 hunters who reported their residence, roughly a quarter were from within the unit (Table 1). Nonresident, alien hunters composed only 2.3% of the hunters in 1986, continuing the downward trend since 1980. The large influx of hunters from Unit 18 observed during the 1980-85 period did not occur in 1986. Only 15% of those hunting in Subunit 19A were from Unit 18, a decline of 43% from the previous year.

Chronology of the harvest has remained relatively stable during the past 7 years. Of 423 moose in 1986 for which date of kill was provided, 396 (93.6%) were taken in September. In addition, 1, 12, 1, and 13 moose were harvested in August, October, November, and February, respectively. As in the previous 6 years, bulls composed over 95% of the reported harvest.

Some of the apparent increase in reported harvests over the past 3 years may be due to increased compliance with reporting requirements. Department personnel, Fish and Wildlife Protection officers, and federal agency personnel (U.S. Fish and Wildlife Service and U.S. Bureau of Land Management) have made

efforts to contact hunters in villages, stressing the need for accurate harvest information. At this time, members of most villages appear to be more willing to report their hunting activities than they were previously.

The magnitude of the mortality attributable to factors other than hunter harvest has not been well documented. Because wolf and brown and black bear populations appear to be well established, they contribute to mortality of moose in Unit 19. Accounts of high wolf predation on moose in the upper Holitna River-Titnuk Creek drainages were received during spring 1987. Apparently, snow conditions were conducive to increased incidence of wolf predation. If these conditions persist, this increased mortality will probably lead to reduced moose populations. Sporadic, seasonal flooding of calving areas may also contribute to low recruitment in some years. However, early spring 1987 was generally warm and dry--conditions which seem to favor production and early calf survival.

Management Summary and Recommendations

A continuing effort should be maintained to stress to local hunters the importance of documenting their success rates and kill locations for proper game management. Continued news briefs in local media outlets appear to be having the desired effect and should be continued.

Establishment of survey areas with definable boundaries and use of reliable survey techniques should be adopted in selected areas of Unit 19. Both fall composition count areas and spring recruitment-survival areas should be delineated and surveyed on an annual basis. Statistically sound population and trend estimates can be gathered once this scheme has been implemented.

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Table 1. Numbers of hunters by location of residence utilizing Game Management Unit 19 during the period 1980 through 1986.

Residency	Year						
	1980	1981	1982	1983	1984	1985	1986
GMU 19	180	249	192	245	287	228	190
GMU 18	52	76	92	182	202	199	114
Alaska-railbelt	202	198	183	186	216	190	205
Alaska-Kenai Peninsula	28	23	19	25	38	42	40
Alaska-other areas	21	13	18	25	30	16	28
Nonresidents	128	141	125	131	202	185	186
Nonresident aliens	64	47	16	33	16	8	18
Unspecified	11	4	42	13	23	9	0
Total	686	751	687	840	1,014	877	781

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20A

GEOGRAPHICAL DESCRIPTION: Tanana Flats, central Alaska Range

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The most recent estimate of 8,100 moose in Subunit 20A was derived from a 1982 census in the Tanana Flats and a 1984 census of the Alaska Range foothills. Since 1984, population trends in 20A have been estimated from changes in densities observed in established trend-count areas.

It is not unequivocally certain that moose densities obtained from high-intensity surveys over small areas consistently reflect overall population trends. However, during several years of rapid population growth (1978-84), densities derived from trend counts tracked population increases. Census results suggested a 15% mean annual growth rate in the moose population in Subunit 20A from 1978 through 1984. Similarly, trend-count data indicated a 14% mean annual increase in densities. Increases among individual count areas ranged from 11% to 16%. Therefore, it seems likely that recent declines in trend-count densities in the northeastern Tanana Flats and central foothills may reflect changes in those subpopulations. An unequivocal statement that moose numbers have stabilized or are declining is not warranted by the available data, but the period of rapid growth experienced between 1978 and 1984 has apparently ended.

Population Composition

Three trend areas in Subunit 20A were surveyed during fall 1986: the northeastern Tanana Flats, the northcentral Tanana Flats, and the eastern foothills. The overall bulls, calves, and yearlings (two times the yearling-bull count) per 100 cows ratios were 38, 34, and 21, respectively.

The 7 established trend areas in Subunit 20A have, in some cases, been surveyed intermittently. Available data collected

since 1984 suggest low bull:cow ratios and low calf:cow ratios exist in the southwestern foothills and in the northeastern Tanana Flats. Moderate bull:cow and calf:cow ratios exist in the eastern foothills. High bull:cow ratios and moderate calf:cow ratios exist in the central foothills and northwestern Tanana Flats. Available data since 1984 are summarized in Table 1.

Of 269 cows classified during November 1986 composition counts, only 1 had twins. Since 1982 the incidence of twins among cows with calves has averaged only 6% on fall counts. To investigate the possibility of low twin production, aerial surveys were flown from 20 to 23 May on the northeastern Tanana Flats. Survey timing coincided with the onset of the main birth pulse; however, 2 single calves were observed during a survey for short yearlings (11 months old) on 13 May. At each sighting, the cow was circled repeatedly until a reasonable attempt had been made to determine the presence of a 2nd calf; the calf's age was estimated based on its mobility. Surveys were continued until 50 cows with calves had been sighted.

Only 5 twin sets were observed (10% twinning). Among the 30 cows with calves estimated to be less than 1 day old, 3 (10%) had twins. These data suggest low production of twins may significantly contribute to the low incidence of twins observed during fall composition surveys. The relative impact of predation, disease, or other mortality factors on neonates remains unknown.

Documented twinning rates among North American moose range from 3% to 70% (Table 2). Nutritional status of the cow prior to ovulation has commonly been cited as a primary factor affecting incidence of twinning among moose (Edwards and Ritcey 1958; Franzmann 1978). Franzmann and Schwartz (1985) felt the differences in twinning rates in the 1947 burn (22%) and the 1969 burn (70%) on the Kenai Peninsula were indicative of differences in habitat quality. However, range condition has not been evaluated in Subunit 20A or in surrounding areas. Presently, attributing the apparent low production of twins to deficiencies in either range or animal condition in 20A is premature.

Mortality

Moose hunter success was 32% in Subunit 20A during 1986; 1,312 hunters reported taking 420 bull moose. Harvests during 1984 and 1985 were 390 and 360 bull moose, respectively. Distribution of harvest and hunting pressure and hunter success among residency classes are given in Tables 3 and 4.

Hunter access patterns were similar to previous years. Boats or aircraft were used by 63% of the hunters; three-wheelers, by only 7%. The highest success rate (42%) was experienced by hunters using aircraft for transportation.

Overall harvest levels in Subunit 20A appeared to be less than annual recruitment. Twenty-seven percent of the bulls observed on fall surveys were classified as yearlings; 19% of the harvested bulls were "yearlings" (i.e., having antler spread ≤30 inches). However, the degree to which hunters select larger bulls in Subunit 20A is unknown. In addition, large bulls may be more vulnerable to hunting than yearling bulls during the early phases of the rut. Therefore, the percent of yearling bulls in the harvest is not necessarily an accurate reflection of overall exploitation. The most concentrated hunting pressure in Subunit 20A occurs in the northeastern Tanana Flats. In that 750-mi² area, 442 hunters reported taking 132 bull moose during 1986. Despite that high harvest, there has been no clear shift in the distribution of antler-size classes among the reported harvest (Table 5). In a closed system, the proportion of small bulls in the harvest would be expected to increase if harvests exceeded annual recruitment. Data on moose movements indicate the northeastern Tanana Flats is not a closed system. The movement of bulls from adjacent, lightly hunted areas of Subunit 20A immediately prior to and during the rut may account for the sustained harvest of larger antlered bulls in the northeastern Tanana Flats. Harvest data show a tendency for increasing harvest rates in Subunit 20A beginning in mid-September at a time that coincides with increased movement of mature bulls.

Aerial surveys of the Tanana Flats were conducted between 12 and 14 May 1987 to determine overwinter mortality between 6-month-old calves and short yearlings (11 months old). Timing of the survey in early May was such that most short yearlings were accompanied by their mothers; 10 lone animals were classified as yearlings. Short-yearling:cow ratios were 26:100. An overall estimate of the November 1986 calf:cow ratio among subpopulations contributing to the moose surveyed during May 1982 on the Tanana Flats (lower Salcha, eastern foothills, northeastern Tanana Flats) was 25 calves:100 cows. This value was virtually identical to the May 1987 short-yearling:cow ratio (26:100), suggesting low overwinter mortality of calves. Movement of some moose onto the Tanana Flats during early May and their emigration during fall confounds comparison of spring short-yearling data with the data from the previous November. However, substantial overwinter, predator-caused calf mortality should be reflected by spring, short-yearling:cow ratios, because winter-range

densities of predators on the ranges of all contributing populations are similar. There is no reason to suspect differential predation for any subpopulation at this time.

I think overwinter calf mortality is higher than that suggested by these available data. Even though winter 1986-87 was mild and did not significantly contribute to moose mortality in Subunit 20A, wolf predation has been shown to be a potentially significant mortality factor among moose in Subunit 20A (Gasaway et al. 1983). Wolf numbers were reduced beginning in 1976 but have increased substantially since control efforts ceased in 1982. The current estimate is 200-230 wolves in Subunit 20A, based on aerial surveys, trapper interviews, and monitoring changes in radio-collared packs. It equals the density in Subunit 20A before wolf populations were reduced in 1976.

Specific predation rates in Subunit 20A are unknown, but the impacts of wolf predation on moose are probably greater on the Tanana Flats than in the foothills of the Alaska Range where alternate prey (caribou) are also available. Relatively high densities of black bears also occur on the Tanana Flats. They may be an important source of neonate mortality, but the impact of black bears on Interior moose populations is undocumented.

Management Summary and Recommendations

Rapid growth of moose numbers in Subunit 20A occurred between 1978 and 1984, following the Department's successful efforts to reduce wolf numbers beginning in 1976. Presently, estimates are 8,000-9,000 moose. Numbers now appear stable but are below the management objective of 12,000.

Data suggest that poor yearling recruitment is the primary factor limiting population growth at this time. Wolf numbers have increased to precontrol levels and are probably an important source of mortality on young moose throughout Subunit 20A. The degree to which black bears contribute to low calf:cow ratios on the Tanana Flats is unknown.

The sex and age composition of moose in Subunit 20A is not homogeneous. Lowest bull:cow ratios occur in the heavily hunted area on the northeastern Tanana Flats, in the western foothills, and southwestern mountains. Migratory patterns of moose within Subunit 20A and between Subunits 20A and 20B confound interpretation of sex and age data.

Harvest and hunting pressure have increased in Subunit 20A. A further increase in hunting pressure is expected during the next 2 years, as the military increases its troop numbers at

Fort Wainwright. Harvest during 1986 was up 16%, and hunter numbers were up 8% over 1985 levels. To stabilize the harvest, hunting seasons for 1987 were reduced by 10 days in the Tanana Flats and by 5 days in the Yanert River drainage and western foothills.

Subunit 20A is the most important area for moose hunters in Interior Alaska. Gasaway et al. (1983) effectively described the population dynamics of the population through its most recent growth phase. However, since that publication, wolf numbers and hunting pressure have increased, and habitat changes have probably occurred as browse species have aged. Concurrent with these changes, moose population growth has slowed.

A management goal of providing maximum opportunity to hunt moose with a stable population objective of 12,000 moose and minimum bull:cow ratios of 30:100 has been established for Subunit 20A. Moose numbers now appear to be stabilizing at approximately 70% of the population goal. Fifteen to 20-day bull seasons currently allow the maximum opportunity to hunt bull moose. As a result, bull:cow ratios have declined to below 30 bulls:100 cows in portions of Subunit 20A. During the next reporting period, the potential effect of various antler restrictions will be considered. Antler restrictions on the harvest may allow continued maximum opportunity to hunt while reducing the bull harvest and maintaining bull:cow ratios above 30:100.

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Table 1. Summary of the November moose composition values, Subunit 20A.

Area represented	Trend area	Total bulls: 100 cows	Calves: 100 cows	Percent small bulls	Percent calves	N	Year data collected
NE Tanana Flats	Bear Creek	25	22	9	15	199	1986
W. Foothills	Windy Creek	23	30	2	19	186	1985
SW Mountains	Moody Creek	32	22	9	14	105	1985
Yanert Valley	Moose Creek	19	15	6	11	107	1984
NW Tanana Flats	Tatlanika River	56	41	4	21	53	1986
Central Foothills	Japan Hills	60	38	9	19	332	1985
E. Foothills	100 Mile Creek	33	39	6	23	184	1986

Table 2. A sample of reported twinning rates among North American moose, 1951-83.

Year	Percent twins	Method	Area	Reference
1959-73	4-48	In utero	Elk Island National Park, Alberta	Blood 1974
1984	52	Marked sample post parturition	GMU 20E - Alaska	Boertje et al. 1985
1970-77	$\bar{x}$ = 45	Aerial survey post parturition	GMU 9E - Alaska	Faro and Franzmann 1978
1951-56	3-30	In utero	Newfoundland	Pimlott 1959
1977-78	22	Aerial survey post parturition	1947 burn Kenai Peninsula	Franzmann and Schwartz 1985
1982-83	70	Aerial survey post parturition	1969 burn Kenai Peninsula	Franzmann and Schwartz 1985

Table 3. Moose hunter success in Subunit 20A by residency, 1986.

Residency	No. successful hunters	Total hunters	Percent success
Unit residents	303	1,030	29
Other Alaskan residents	53	136	39
Nonresidents	51	105	49
Unspecified	13	41	32

Table 4. Moose harvest, number of hunters, and percent success by drainage, Subunit 20A, 1986.

Drainage	Harvest	No. of hunters	Percent success
Tanana River and unknown	12	78	15
Nenana River	55	173	32
Totatlanika River	48	155	31
Tatlanika River	8	11	73
Wood River	84	216	39
Tanana Flats	139	458	30
Little Delta River	23	81	28
Delta Creek	23	53	43
Delta River	12	31	39
Yanert River	16	56	29
Totals	420	1,312	32

Table 5. Distribution of harvest among antler-size classes, northeastern Tanana Flats 1983-86.[a]

Year	<30 inches	30-39.9 inches	40-49.9 inches	50+ inches	Total harvest
1983	21%	37%	26%	16%	114
1984	15%	39%	23%	23%	124
1985	20%	33%	23%	24%	142
1986	27%	30%	25%	18%	132

[a] Harvest data from Uniform Coding System units 501-4, 506.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20B

GEOGRAPHICAL DESCRIPTION: Fairbanks and central Tanana Valley

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The moose population estimate in Subunit 20B was 6,600 animals during the reporting period. Generally, the moose population throughout the subunit has probably increased; in western Subunit 20B it has definitely increased, and we expect it to continue growing as long as the harvest and wolf:moose ratio remain low. In contrast, moose population growth in central Subunit 20B has slowed, and poor recruitment in recent years may result in a population decline. In eastern Subunit 20B, the upstream half of the Salcha River is showing signs of an increasing moose population, while the downstream half has stabilized or may be declining.

Population Composition

Two trend areas were surveyed in western Subunit 20B during November 1986 (Table 1). One hundred four moose were counted in the Tatalina River trend area. The bull:cow ratio was 29:100 and the yearling bull:cow ratio was 11:100, which gives a minimum yearling ratio of 22 yearlings:100 cows. Calf production measured at 6 months of age was reasonably good at 39 calves:100 cows.

A sample of 50 moose was classified in the lower Tolovana River. The bull:cow ratio in this admittedly small sample was high (77:100), as would be expected in an area where harvest is light. In November calf recruitment to 6 months of age was measured, producing a ratio of 50 calves:100 cows. From the yearling bull ratio of 9:100 cows, yearling recruitment in this sample was estimated at a minimum of 18 yearlings:100 cows. The 42% overwinter survival of this cohort is considered low. Because the winter (1986-87) was mild, the-higher-than-expected mortality at 6 to 18 months of age may reasonably be attributed to predation by wolves that were

not removed until April of 1986. During a survey of Subunit 20B during fall 1986, only 16 moose were observed in the Goldstream trend area (Table 1); two of these were medium-sized bulls and over half of the cows had calves.

Two trend areas were surveyed along the Salcha River in eastern Subunit 20B (Table 1). The heavily hunted Ninetyeight Creek trend area had a low bull:cow ratio (23:100) and a low ratio of yearling bulls:100 cows (8:100). Yearling bulls composed 50% of the harvest in the lower Salcha River and the area east of Eielson Air Force Base. Because of the high harvest of yearling bulls before surveys were flown, the yearling bull:100 cow ratio represented an underestimation of recruitment, which was believed poor. The calf:cow ratio was fair (23:100). The lightly hunted North Fork trend area had a good bull:cow ratio (45:100) and good yearling bull recruitment (13:100 cows). The calf:cow ratio at 6 months of age was only fair (25:100).

Mortality

According to harvest reports, 309 bulls were harvested by 2,009 hunters: a success rate of 15%. The harvest, number of hunters, and success rate have remained at these levels for 4 years. Nine moose were harvested in the Minto moose registration hunt by 59 subsistence hunters (Table 2) from Minto and Nenana. These local users have reported taking only half of the designated quota for the past 2 years. Nineteen moose were harvested by bow and arrow in the Fairbanks Management Area. This harvest has steadily increased since 1982, when 8 archery hunters were taking moose. Distribution of the moose harvest in Subunit 20B is shown in Table 3.

Yearling bulls with antler spreads measuring $\leq$30 inches composed 35% of the harvest; 48% of the antlers measured 31-54 inches, and 16% measured $\geq$50 inches. The Fish and Wildlife Protection Division reported 8 known poachings. Accidental road-kills accounted for 72 moose, and 7 additional moose were killed by trains.

Management Summary and Recommendations

The moose population in western Subunit 20B is increasing, but the density is still below the management goal of 4,000 animals. Central and eastern moose populations in Subunit 20B probably will stabilize at moderate levels below our management goals. If moose numbers increase as anticipated in western Subunit 20B, the population goal of 10,000 moose can probably be attained without further predation-control activities. However, the contribution from the remainder of the subunit will diminish over time. Present harvest levels in

central and eastern Subunit 20B probably cannot be maintained. A larger harvest will eventually be possible from western Subunit 20B.

Although the overall hunter-reported harvest is at an acceptable level of less than 5%, bull:cow ratios remain lower than desired in accessible areas. The management goal for this area is 35 bulls:100 cows. If the goals are to be achieved, the ratio can be attained by reducing the bull harvest and increasing calf-survival rates.

The accidental road-kill remains high. The Department of Transportation has shown an interest in working on a solution to this problem, and ADF&G should actively offer its help and support. Following the successful prescribed burn in Beaver Creek (Subunit 25C) this year, we should select suitable areas in Subunit 20B for future prescribed burning.

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Table 1. Sex and age composition of moose surveyed in Subunit 20B, fall 1986.

Trend area	Total bulls: 100 cows	Small bulls: 100 cows	Percent small bulls	Calves: 100 cows	Calves: 100 cows ≥2 yr	Percent calves	Sample size
Lower Tolovana	77	9.1	4	50	55	22	50
Tatalina	29	11.2	6.7	39	44	23	104
Goldstream	22	0	0	56	56	31	16
Ninetyeight Creek	23	7.6	5.2	23	25	16	230
North Fork Salcha	45	12.7	7.5	25	28	15	227
Subunit 20B Total	35	9	6	30	33	18	663[a]

[a] Includes moose seen adjacent to the survey area.

Table 2. Summary of Registration Hunt #985, 3-18 September 1986 and 10 January-28 February 1987.

Place of residency	Successful		Unsuccessful		Did not hunt		Total	
	Fall	Winter	Fall	Winter	Fall	Winter	Fall	Winter
Minto	6	1	26	6	11	8	43	15
Nenana	1	0	23	2	29	1	53	3
Fairbanks[a]	1	0	2	0	1	0	4	0
Total	8	1	51	8	41	9	100	18

[a] Regulations required that permittees be domiciled in either Nenana or Minto.

Table 3. Distribution of bull moose harvest in Subunit 20B, 1986.

Area	Number of moose	Percent of total
Chatanika River	39	13
Chena River	101	33
Eielson area	18	6
Goldstream Creek	16	5
Manley area	10	3
Bonanza Creek, Nenana	14	5
Salcha River	59	19
Tatalina River	7	2
Tolovana River	32	10
Unknown	13	4
Total	309	100

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20C

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The moose population remains stable at a low density in the southern and eastern sections of Subunit 20C. Yearling recruitment was good along the eastern edge of the Kuskokwim Mountains during the reporting period. No information is available on the moose population status or trend in the northern section of Subunit 20C.

Population Composition

Three sample units were surveyed in the Minchumina trend area during late December (Table 1). Seventy moose were counted, indicating ratios of 110 bulls:100 cows and 33 yearling bulls:100 cows. There were only 23 calves:100 total cows and 50 calves:100 cows over 2 years of age.

During winter 1986, Denali National Park biologists conducted a moose census in 3,871 mi^2 of the northern half of the park. They calculated an average of 0.5 moose/mi^2. Of the 515 moose observed during the census, there were 76 bulls:100 cows, 10 yearling bulls:100 cows, and 22 calves:100 total cows.

Mortality

According to harvest tickets from Subunit 20C, 105 bull moose were killed by 203 hunters, representing a success rate of 52%. The harvest was up 28%, and the total number of hunters was down by 33% from the previous year. Ninety-seven percent of the harvest was by resident hunters, while nonresidents accounted for only 3% of the harvest.

All moose hunters spent an average of 5.9 days afield, while successful moose hunters spent an average of 5.3 days afield.

Moose hunters harvested 35 moose using boats for transportation, 29 using airplanes, and 26 using off-road vehicles or three-wheelers.

Yearling bulls with antler spreads of ≤30 inches accounted for 11% of the harvest; 49% and 40% of the harvest were bulls with antler spreads between 31 and 49 inches and ≥50 inches, respectively.

The heaviest harvest came from the Kantishna River, Nenana River, and Lake Minchumina areas with 28%, 19%, and 17%, respectively (Table 2).

Management Summary and Conclusions

Most management effort should be concentrated around Lake Minchumina, the lower Kantishna, and along the eastern side of Subunit 20C. These areas receive the majority of the hunting pressure because of their proximity to human populations and accessibility. Moose composition surveys should be increased in Subunit 20C, and wolf surveys should be conducted.

If the moose population is to increase, wolf numbers must be reduced to and maintained at a ratio of 1 wolf:50 moose. Wildfires should be allowed to burn in unpopulated areas to add more available moose habitat. The short, bulls-only season should not be liberalized until the density of moose increases substantially in Subunit 20C.

PREPARED BY:

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SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

Table 1. Moose sex and age composition in Subunit 20C, 1986.

Trend area	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Sample
Minchumina	110	33	23	70
Denali	76	10	22	515

Table 2. Distribution of moose harvest in Subunit 20C, 1986.

Location	Harvest
Tanana River	13
Chitanana River	2
Cosna River	3
Zitziana River	5
Kantishna River	28
Nenana River	19
Savage River/Upper Teklanika River	14
Lower Teklanika River	3
Lake Minchumina	17
Unknown	1
Total Subunit 20C	105

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20D

GEOGRAPHICAL DESCRIPTION: Central Tanana Valley

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The status of moose in Subunit 20D has changed little since last year. The population north of the Tanana River is estimated at approximately 1,300. About 1,900 moose occur south of the Tanana River.

North of the Tanana River, the moose population appears to be slowly declining. South of the Tanana River, and especially west of the Johnson River, the population appears to be increasing.

Population Composition

One thousand moose were observed during 32.5 hours of survey in mid- to late November 1986 (Table 1). Most of the survey effort was concentrated in the southern portion of the subunit. Only the Billy Creek highlands were surveyed in the northern portion of the subunit.

In the southwestern portion of the subunit, where the population is believed to be increasing, the bull:cow ratio has been generally declining. The 1986 data indicated 29 bulls:100 cows in this area, compared with an average of approximately 36:100 for the 6 preceding years. This is the lowest bull:cow ratio observed since 1977. Calf ratios (37 calves:100 cows) remain moderate. There were 10 yearling bulls:100 cows among the moose sampled. Yearling bulls composed 6% of the population, which was the lowest occurrence observed since 1977.

South of the Tanana River and east of Johnson River, a sample size of 292 moose revealed 54 bulls:100 cows, 10 yearling bulls:100 cows (6% of the herd), and 18 calves:100 cows (11% of the herd). Predation is believed to limit calf survival

and yearling recruitment. These figures have changed little since 1984.

In the Billy Creek highlands, which encompass portions of Subunits 20D and 20E, 1986 data show that the bull ratio continues to be high (77 bulls:100 cows). However, only 1% of the moose observed were yearling bulls; this suggests very poor recruitment. The high bull:cow ratio probably exists because no harvest was reported from Billy Creek, and only 7 moose were harvested from adjacent Sand Creek. Yearlings composed 8% of the population in 1985 and have averaged almost 8% since 1981.

Calf survival to 6 months of age has been poor for several years, averaging 18 calves:100 cows over the past 6 years. Calf survival in 1986 remained poor (17 calves:100 cows).

Mortality

The extent of natural mortality is unknown, but the population composition data indicate poor production and/or heavy predation are occurring in the northern portions of the unit.

Moose hunters reported harvesting 138 moose in 1986. This is the largest harvest on record since the present boundaries of Subunit 20D were established in 1980. It also includes the largest number of bulls harvested (76) from the southwest portion of the unit since 1964, when 110 bulls were taken.

North of the Tanana River, harvest declined from 71 in 1985 to 51 in 1986. The average harvest from 1981 through 1986 was 55 bulls. South of the Tanana River and east of the Johnson River, 10 bulls were harvested in 1986, representing a slight increase from that of the 2 preceding years and a slight decrease from the 6-year average of 12 bulls.

The proportion of successful hunters residing within Subunit 20D has been increasing since 1983. In 1983, 57% of the successful hunters were residents of the subunit; in 1986, 88% were residents. Harvest by nonlocal hunters has been declining in number as well as proportion.

Small, all-terrain vehicles (ATV's) have been increasingly used by successful hunters, especially in the southwest part of Subunit 20D. In 1986 nearly 1 in 3 successful hunters took moose with that transportation means, while in 1982 and 1983, no successful hunters used them. Improved availability of three- and four-wheeled ATV's may be contributing to higher harvests.

Seventy-three percent of the moose measured and reported by hunters from the southwest portion of the subunit had antler spread measurements under 40 inches. Small antler sizes have composed a high proportion of the reported harvest in this portion of the subunit in recent years, suggesting a relatively young-aged population, high harvest rate, or both. Other mortalities are as follows: 15 moose from road kills, three from poaching, and one from unknown causes.

Habitat

A wildfire in late May 1987 burned approximately 43,000 acres southeast of Delta Junction. The area burned was largely covered with black spruce, but it was partially forested with aspen and poplar that resulted from a mid-1950's burn. These stands had grown beyond the reach of moose. It is too early to determine whether the black spruce portions will convert to deciduous forest. However, cursory observations of the fire's intensity and the burned aftermath suggest that considerable type-conversion may occur, similar to the 1950's burn. Enhancement of the old 1950's burn for moose should be significant, since this area has a large shrub component that will quickly send up new shoots after the fire kills the above-ground growth.

Management Summary and Recommendations

Although no surveys were conducted in much of the northern part of the subunit, there is no reason to believe that the declining trend in moose numbers there has reversed. The moose populations south of the Tanana River are increasing and have provided the increase in harvest noted for the subunit.

Future management efforts should be directed at (1) documenting the sources of mortality in the population north of the Tanana River, (2) reducing those mortality sources where significant numbers of additional moose can be used for harvest or other purposes, and (3) avoiding excessive harvest as part of a larger regulatory scheme.

It has become apparent that population estimation procedures used in Subunit 20D in recent years do not permit accurate assessment of moose population trends. Count areas are evidently too small to accommodate normal variations in moose movements from year to year. A priority for moose management in southwestern 20D should be to develop a means to monitor the trend of the population. A moose population estimation survey should be done. This will allow calibration of future trend-monitoring efforts and indicate population size in relation to the established population objective of 1,600-2,400 moose.

Browse reconnaissance in the southwest portion of the subunit suggests that moose populations have not yet reached the carrying capacity of the range. The May 1987 burn southeast of Delta Junction should add over 50 mi^2 of new browse to the winter range base. A concurrent decline in agricultural tillage in the Delta area is resulting in even more browse for moose.

These factors should permit a safe increase in the moose population beyond the 1,600-2,400 level suggested in the southwestern moose management plan for Subunit 20D. However, the effect that an area-wide increase in moose numbers would have on human welfare should be considered. A larger moose population will increase the risk of moose-vehicle collisions, crop depredations, and property damage. I recommend increasing the overall moose population but reducing or stabilizing the moose population in the immediate Delta Junction-Fort Greely area. This could be accomplished by a permit-controlled, either-sex moose hunt in a portion of the Delta Junction management area.

Lastly, the size of the Delta Junction Management Area could be reduced with little risk to the moose population. This would increase recreational and subsistence hunting opportunities. In particular, the eastern boundary of the management area could be moved west, and the southern boundary could be moved north.

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Wayne E. Heimer
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Table 1. Sex and age composition of the moose population in Subunit 20D, 1986.

Area[a]	Bulls: 100 cows	Percent yearling bulls	Calves: 100 cows	Calves: 100 cows >2 years	Twins: 100 cows w/calves	Percent calves	Total sample
20D North[b]	77	1	17	17	9	9	138
20D Southeast	54	6	18	20	0	11	292
20D Southwest	27	6	42	46	3	25	570
Subunit total	44	5	30	32	3	17	1,000

[a] Subunit 20D is divided into north and south by the Tanana River; southeast (SE) and southwest (SW) by the Johnson River.

[b] Billy Creek highlands only.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20E

GEOGRAPHICAL DESCRIPTION: Fortymile, Charley, and Ladue River drainages

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose exist at low density in Subunit 20E (0.2 moose/mi^2), and the population is believed to be stable. Given present ratios of grizzly bears and wolves to moose, moose populations are not expected to increase. Moose numbers and annual harvests are far below those in the 1960's and early 1970's. With observed browse-use rates of less than 5%, moose numbers are far below carrying capacity.

Population Composition

During 14-24 November 1986, 701 moose were classified in 21.3 hours of survey time (29 moose/hour); this is the same number of moose observed per hour of survey as in 1985. Observed calf survival of 27 calves:100 cows was the highest in recent years, but it is still considered low.

Yearlings composed 12% of the sample, equaling the mean survival observed since wolf control was initiated in 1981 but exceeding the mean of 7% observed before wolf control began. While wolves have returned to near precontrol numbers, there are many more caribou and possibly more moose than existed prior to wolf reductions.

Conservative harvests of bull moose since 1981 have apparently had little adverse effect upon moose numbers or the sex ratio. Overall, the bull:cow ratio in Subunit 20E was 80 bulls:100 cows in 1986. Of 276 bulls classified, 124 (45%) were large, mature animals; 112 (41%) were medium bulls estimated to be 2-5 years of age; and 40 (14%) were yearlings.

Habitat Conditions

Observed browse use in Subunit 20E is less than 5%, indicating a moose population far below carrying capacity. Much of the

subunit is characterized by early to midseral vegetation types, riparian communities, and subalpine-mixed brush fields. The fact that most of the subunit was afforded limited and modified fire-suppression levels in the Alaska Interagency Fire Management Plan/Fortymile area will assure near-natural disturbance of habitat in the future that will benefit the area's moose populations.

Mortality

Predation on moose of all ages by grizzly bears, wolves, and black bears is preventing moose population growth in Subunit 20E. Because moose density has declined so much in relation to the numbers of predators, grizzly bear predation is now significant on adult moose as well as calves. Wolf predation is the most significant mortality factor affecting moose during winter months.

Two hundred thirty-three Alaskan resident hunters reported hunting moose in the area in 1986, compared with the 226 that reported hunting in 1985. Nonresident hunters may not hunt moose in Subunit 20E. Forty-six bull moose were reported taken: a hunter success rate of 20%. This compares with a reported harvest of 49 moose in 1985. Eleven bulls were taken from the northern portion of the subunit where the season was extended to 25 September, and 35 bulls were taken during the 1-10 September season in the remainder of the area. The Mosquito Fork drainage received the greatest hunting pressure (86 hunters) and provided the greatest harvest (18 bulls). Local hunters took 23 bulls or 50% of the reported harvest; the local resident-hunter success rate was 20% for the 114 local hunters reporting.

Management Summary and Recommendations

Providing maximum opportunity to participate in hunting moose and an optimum harvest of moose are management goals that are not being met. Moose numbers declined in Subunit 20E during 1965-1975, stabilizing at a low density. The number of moose observed per hour of survey increased after wolf control was conducted (1981-83), indicating that the moose population decline may have been stopped. Moose numbers may now be increasing very slowly in response to wolf control, heavier grizzly bear harvests, and an increasing caribou herd to buffer predation on moose. Moose are still too few in number and lack the productivity to meet stated management goals; nonresident hunters cannot legally hunt moose in Subunit 20E. Moose numbers are currently far below the habitat's carrying capacity, and recent moose harvests are less than one-third of historical harvest levels.

I recommend that moose hunting regulations remain conservative, bear and wolf harvesting regulations remain liberal, and methods of reducing predation rates on moose be investigated and implemented as part of a comprehensive moose management program in Subunit 20E.

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SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 20F

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

No surveys were conducted in Subunit 20F during 1986. As stated in last year's report, density-stratification flights over a small portion of Subunit 20F indicated that moose exist at low densities. In the small area stratified last year, 90% of the sample units had densities less than 1 moose/mi^2. The quality of moose habitat throughout the subunit appears to be poor, except in riparian zones along major drainages. Reasons for the low moose density are unclear. Survey data in recent years have been insufficient to detect changes in population size and trend.

Mortality

During 1986, 129 hunters reported taking 34 moose in Subunit 20F. Hunting pressure was 47% higher and harvest was 52% greater than in 1985. The previous 5-year-mean harvest was 21 moose, and reported participation averaged 95 hunters. Distribution of the harvest among drainages is given in Table 1.

Twenty percent of all reporting hunters were residents of Subunit 20F, including residents of Livengood and Manley; they reported taking 32% of the harvest (Table 2). Fifty-eight percent of reporting hunters were from Fairbanks. Only 3 nonresident hunters (2%) reported; only one was successful. Four moose were reported killed during the November season: one by a resident of Subunit 20F and three by Fairbanks residents.

Reported antler spread for 17 (50%) of the harvested bulls was greater than 50 inches, while only 4 (12%) bulls with less than a 30-inch antler spread were reported. Bulls with antler

spreads of less than 30 inches are usually considered yearlings. Presence of 12% yearling bulls in the harvest usually does not indicate a heavy harvest of yearlings; however, a low percentage of yearlings in the harvest could result from poor recruitment.

Forty-six percent of the hunters reported using boats for transportation, 20% used highway vehicles, and only 3% (4 hunters) reported using aircraft. The remaining 31% of the hunters either failed to report transportation type or used other means.

Management Summary and Recommendations

Overall moose densities indicate that the quality of the habitat is probably not limiting through a density-dependent nutritional mechanism. Other factors such as predation and unreported hunting undoubtedly contribute to the chronically low moose densities in the central Yukon drainages.

Reported harvest and hunting pressure increased during 1986; however, the high proportion of large antlered bulls in the harvest indicates the reported harvest of bulls is not excessive. Recognizing that a low percentage of yearling bulls in the harvest could be an indicator of low recruitment, the possibility exists that low recruitment may manifest itself in lowered antler sizes in the future.

Local residents have composed 17-29% ($\bar{x}$ = 20) of the total reporting hunters since 1983 and have accounted for 29-47% ($\bar{x}$ = 37) of the harvests. Success rates for local residents averaged 42% from 1983 through 1986, while other hunters experienced an average of 17% success. The substantially higher success rate by local hunters may be a function of the greater mobility and experience under local conditions and/or a tendency of unsuccessful local hunters not to report.

Local residents have proposed creation of controlled-use areas in the southern portion of Subunit 20F to prohibit the use of aircraft for transportation of moose hunters. Such restrictions are inconsistent with the management goal of providing maximum opportunity to hunt and do not appear necessary, given the low currently reported use (3% of reporting hunters) of aircraft.

The Yukon-Tanana moose management plan calls for maximum opportunity to participate in hunting moose. Increase in hunting opportunity will first require that the relative significance of habitat quality, predation, and unreported harvest in limiting population growth be identified. Regulation changes will be implemented during 1987 to limit

opportunity for nonlocal harvest. Nonlocals will be excluded from the winter season. Also, local hunters will be favored by a change in winter-season dates from 1 November-10 December to 1-10 December. This change should allow more reliable access by local hunters.

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Table 1. Distribution of moose harvest in Subunit 20F among major drainages, 1986.

Drainage	Harvest
Tozitna River	4
Hess Creek	11
Other Yukon drainages	8
Tanana River	10
Unknown	1
Total harvest	34

Table 2. Distribution of harvest tickets among residency classes in Subunit 20F, 1983-86.

Year	Successful				Unsuccessful				Total hunters
	Local[a] residents	Other Alaska residents	Nonresidents	Unknown residency	Local[a] residents	Other Alaska residents	Nonresidents	Unknown residency	
1983	8	17	0	0	17	62	4	3	111
1984	7	8	0	0	11	70	1	1	98
1985	8	10	3	0	7	57	2	1	88
1986	11	22	1	0	15	77	2	1	129

[a] Local residents include residents of Subunit 20F and residents of Livengood and Manley.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNITS: 21A and 21E

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Because no ADF&G personnel were stationed at McGrath during much of this reporting period, few data were collected. However, 3 small winter surveys were conducted by Department biologists on the lower Innoko and the Yukon River near Holy Cross. During those surveys, 360 moose were observed during 2.25 hours of survey time (160 moose/hour). Because count-area boundaries were not well defined and survey techniques were not consistent with earlier work, no statistically sound historical comparisons could be made and little can be said about population status and trend. Last year was difficult for moose because of the weather, but conditions improved during this report period.

Population Composition

Three aerial surveys were conducted on the Paimiut and Twelvemile Sloughs as well as on the lower Innoko River drainage in August and September 1986 by the ADF&G biologist stationed in Bethel. The moose population appeared to have increased over the previous year. Many cows with single calves were observed, cows with 2 calves were reportedly common, and 1 set of triplets was observed. This was in marked contrast to 1985, when there was virtually no calf survival.

From 3 winter surveys conducted in Game Management Subunit 21E during this reporting period, 75 calves were observed among a total of 360 moose (21% calves). Because the surveys were conducted after antler drop had occurred (5 February), no bull:cow ratios were obtained.

Mortality

In Subunit 21A, 126 moose (all males) were reported harvested by 174 hunters (72% success). About half of the successful hunters used airplanes; one-third used boats; and the remainder used ATV's, snow machines, or three-wheelers to access their particular hunting areas. Ninety-four percent of the moose were taken in September; October and November harvests were at 4% and 2%, respectively. All hunters (both successful and unsuccessful) spent an average of 6.6 days afield. Reported residence of moose hunters in Subunit 21A showed that over half (93 of 174) were urban residents from the Alaska railbelt or Kenai Peninsula; one-fourth (44) were not Alaska residents. Game Management Unit 18 contributed only 12 hunters (7%). Eleven residents of GMU 21 reported hunting in Subunit 21A; however, it is suspected that harvest reporting remains extremely poor among members of villages in the subunit. Reported mean antler spread for 122 moose from the subunit was 48.4 inches.

In Subunit 21E, 112 moose (101 bulls and 11 cows) were reported taken by 143 hunters (78% success). Seventy-five percent of these hunters used boats as a primary means of access; snow machines and airplanes were of secondary importance. September harvests accounted for over 80% of the moose taken; 15% of the harvest occurred in February. The remainder of the harvest occurred in October. Poor reporting from the 4 villages located in Subunit 21E continued. Forty-three hunter reports were received for the 1985-86 season, but it was suspected that 200-250 moose were taken by members of those 4 villages (Grayling, Anvik, Shageluk, and Holy Cross). In 1986-87 reports were received from only 42 hunters. Of the hunters reporting, 40% were from GMU 18, a substantial decline from last year's report of 56%. Residents of Subunit 21E composed 29% of those hunters reporting, up slightly from last year. Overall, 78% of the hunters reporting from Subunit 21E were from rural areas of the state. Like Subunit 21A, average antler spread of 96 bulls taken from the subunit was 48.4 inches.

Management Summary and Recommendations

Efforts should continue in both subunits to encourage reporting of harvests. Accurate harvest information is needed to adequately manage the moose populations.

Easily defined, repeatable survey areas should be delineated where accurate trend information can be gathered on an annual basis. A moose census should be conducted in the Paradise Controlled Use Area. Radio-tracking studies should be

continued to obtain additional movement and dispersal information on the area's moose.

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SUBMITTED BY:

Wayne E. Heimer
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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21B

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The moose population in a 1,556-mi² portion of the Nowitna River in Subunit 21B has declined by 44% over the last 6 years. The population estimated from the 1987 census was 783 moose ± 191 (90% confidence level). This was down from the 1980 estimate of 1,390 moose ± 373 (Table 2). These 2 estimates are significantly different at the 95% confidence level (two-tailed Student's t-test). The population decline has averaged 7% per year since 1980. This decline has also been noted by local residents. Residents of Ruby have seen fewer moose along their road during all times of year than in the past.

Population Composition

Composition data were obtained by classifying moose observed during the population-estimation survey (Table 3). These data indicated that the bull:cow and calf:cow ratios were good, but yearling recruitment was poor. Poor winter survival of calves has been a chronic problem for the Nowitna moose population.

Mortality

The reported harvest of 79 bull moose was slightly higher than the 9-year average of 71 moose. Fifty-one moose were taken on the Nowitna River, 6 were taken on the Ruby Road, and 22 were taken elsewhere in the subunit. The harvest along the Ruby-Poorman Road has declined during the past 6 years from a high of 16.

The subunit has a high population of wolves and black bears. The estimated wolf population has risen from 50-70 in 1980 to

100-120 in 1986. Predators are probably killing a substantial portion of the moose population annually.

Management Summary and Recommendations

The population-estimation survey conducted during this report period confirmed that the moose population has declined since 1980. The 1986 population estimate suggests the number of moose has declined at a real rate of about 7% per year.

I think wolf predation of moose may be a major factor in the decline. Wolf numbers have doubled since 1980, and calf survival during winter has declined, despite normal snow depths in most years except 1985. Contributing factors to the failure of the 1985 calf cohort were a severe winter and predation by black bears during the weeks following calving. However, bull:cow ratios have remained high, even though hunting has been restricted to bull moose. Hunting is probably not a major factor contributing to the population decline.

The management objective for the subunit is to maximize the production of moose. Area residents are highly dependent on moose to meet their food requirements, and portions of the subunit have a long history of recreational moose harvest by other residents of the state. The present regulations are designed to meet this objective; however, if the decline cannot be stopped by regulating predator numbers, a reduction in the hunting opportunity must occur.

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SUBMITTED BY:

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Table 1. Population estimates for the lower Nowitna River drainage, November 1986 moose census.

Low strata			Medium strata			High strata		
SU#	Area mi²	No. moose	SU#	Area mi²	No. moose	SU#	Area mi²	No. moose
11	12.5	2	36	15.2	15	35	13.5	67
73	12.5	0	51	13.0	21	41	12.9	14
21	15.6	0	152	12.8	22	30	11.7	19
67	10.0	0	160	12.7	0	32	13.7	18
169	14.2	0	52	10.8	13	28	12.5	28
163	13.8	0	107	11.7	5	91	12.4	33
			26	14.3	21	27	12.0	12
	78.6	2	180	17.5	0			
			42	13.0	13		88.7	191
			12	10.6	1			
			6	13.2	11			
			7	16.1	29			
			82	17.4	0			
			89	11.7	6			
			54	11.3	25			
			45	12.5	19			
			29	12.0	18			
				225.8	219			

	Low strata	Medium strata	High strata	Combined
Sample size (n)	6	17	7	30
Total stratum area (mi²)	1018.8	448.5	88.7	1556
Total possible SU's	82	35	7	124
Density (moose/mi²)	0.025	0.97	2.15	
Population estimate (T)	26	435	191	651
Variance (T)	636	3377	0	4013
C.I.% of population estimate 90% level				24%
Sightability correction factor				1.20
Corrected population estimate				783
C.I.% of population estimate 90% level				24%
Upper limit				592
Lower limit				974

Table 2. Population estimates for lower Nowitna River drainage (revised area), November 1980 moose census.

Low strata			Medium strata			High strata		
SU#	Area mi²	No. moose	SU#	Area mi²	No. moose	SU#	Area mi²	No. moose
165	17.7	1	45	12.5	4	29	12.0	18
9	12.7	2	8	12.7	0	152	12.8	21
77	10.7	2	10	14.0	18	44	10.7	19
2	13.7	7	160	12.7	15	31	10.4	10
163	13.8	4	175	15.4	14	26	14.3	36
162	14.1	1	66	9.2	3	51	13.0	29
57	6.2	2	67	10.0	5	42	13.0	16
107	11.7	6	174	11.1				
24	11.9	3	58	12.4	1		86.2	149
			89	11.7	5			
	112.5	28	108	11.4	29			
				133.1	97			

	Low strata	Medium strata	High strata	Combined
Sample size (n)	9	11	7	27
Total stratum area(mi²)	531	712.9	312.1	1556
Total possible SU's	42	56	23	121
Density(moose/mi²)	0.25	0.74	1.73	
Population estimate ($\hat{T}$)	132	524	539	1196
Variance ($\hat{T}$)	839	19112	3026	22978
C.I.% of population estimate 90% level				26%
Sightability correction factor				1.16
Corrected population estimate				1389
C.I.% of population estimate 90% level				26%
Upper limit				1763
Lower limit				1016

Table 3. Moose composition during November censuses in Subunit 21B.

Year	Bull: 100 cow	Yearling bull%	Calves: 100 cows ≥2 yrs	Calves: Percent calves	Sample size
1980	46	6	39	19	280
1986	38	3	40	22	423

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21C

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose density in the Meloztina River drainage is low, but the population is thought to be stable. No surveys were conducted in the subunit during the report period.

Mortality

Thirty-four hunters reported taking 29 bulls from the Melozitna River and none from the Dulbi River. All hunters used aircraft for transportation. Only 1 hunter was a resident of the subunit. There are no communities in the subunit. No data were available on natural mortality, but there are 4-6 wolf packs (50-60 wolves) in the subunit. Grizzly bears are also numerous.

Management Summary and Recommendations

The management objective for the subunit is to provide for the recreational use of game populations. The moose populations in the subunit are low, and natural mortality prevents the populations from increasing. Although the number of hunters is low, better survey data are needed to aid management decisions. A stratification survey of the subunit should be conducted to ascertain moose distribution, relative abundance, and areas for future trend surveys.

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MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 21D

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

The moose population along the Koyukuk and Yukon Rivers was stable during the reporting period. Observed early winter densities along the Yukon River lowlands ranged from 2.5 to 3.5 moose/mi^2. Densities along the Koyukuk River lowlands ranged from 2.8 moose/mi^2 near Koyukuk village to 4-6 moose/mi^2 in the Three Day Slough area. In areas away from the riparian lowlands, early winter moose densities were low, averaging about 0.3 moose/mi^2. Extrapolation of densities observed during early winter counts to areas of similar habitat suggest that approximately 3,000 to 4,000 moose live in Subunit 21D.

Population Composition

Aerial surveys were conducted at Three Day and Ruby Sloughs during early winter 1985 (Table 1). The bull:cow ratio at Three Day Slough was unchanged from the previous year; however, the percentage of yearling bulls was low. The calf:cow ratio was the highest recorded in 10 years. The large number of calves increased moose density at Three Day Slough to 7.8 moose/mi^2. Density averaged 6 moose/mi^2 in 1985.

Movements

In a cooperative study (ADF&G & USFWS), 20 moose were radio-collared in October 1984 in the Three Day Slough area. Four additional moose were collared in April 1986 to replace 4 moose that had been killed by hunters. At the start of the report period, 12 cows and 8 bulls were carrying operational

radio collars. The moose were relocated at approximately 2-month intervals for a total of 7 times.

Twelve cow moose moved an average of 2.5 miles (range 0.75-10.0, $\underline{n}$ = 81) between tracking flights during October-April over the last 3 years. In the same period, 11 bulls moved an average of 4.4 miles between tracking flights (range 0.1-21.5, $\underline{n}$ = 78). During May-September, cows moved an average of 11.1 miles (range 0-34.5, $\underline{n}$ = 86) and bulls moved an average of 12.4 miles (range 0.5-62.5, $\underline{n}$ = 55).

The collared moose exhibit some variety in migration patterns. The movement patterns of 2 cows and 1 bull were not consistent from year to year (Table 2). In some years these 3 moose migrated out of the lowland area, yet in other years these same moose remained in the lowlands and were defined as residents. Six cows and 3 bulls were consistently migratory during the summer (Table 2, Figures 1 and 3), and 1 bull was consistently migratory during winter (Table 2, Figures 2 and 4). Six moose (3 bulls and 3 cows) were year-round residents. The moose that were migratory returned to the same areas each year but did not have a consistent schedule for the start of their movements. In 1985 the moose did not migrate until July; in 1986 they were in their summer areas by May; and in 1987 migration took place in June. There was no relationship between cow movements and calving.

Mortality

The harvest of antlerless moose was allowed during both of the 1986-87 hunting seasons (September and February). According to harvest-ticket returns, 159 bulls and 22 cows were reported taken during the September season. One radio-collared adult bull was shot in the Three Day Slough area during this season.

A moose hunter check station was operated 18 miles upriver from the mouth of the Koyukuk River during September. Of the 229 hunters who stopped at the station, 140 were unit residents, 80 were state residents from outside the unit, and 9 were nonresidents. Antler measurements and incisor teeth were collected from 101 of the 111 moose checked.

The 2nd season was conducted as Registration Permit Hunt #988. Seventy-eight permits were issued, and 11 bulls and 19 cows were harvested. The number of permits issued and the resultant harvest were as follows for each place of residence: Galena, 52 permits issued, 20 moose taken; Ruby, 13 issued, 4 taken; Nulato, 7 issued, 2 taken; Koyukuk, 5 issued, 1 taken; and nonsubunit residents, 3 issued, 3 taken.

An additional 20 moose were believed taken during the winter either illegally or for funeral potlatches. Thus the total human-related take from Subunit 21D during the reporting period was about 231 moose.

Radio-telemetry data indicate that nonhunting mortality among adult moose is low in the Three Day Slough area. None of the radio-collared adult moose have died from predation. However, observations of calves associated with radio-collared cows suggest that mortality among young moose is high.

The 1st relocation flight was made in early June of each year following calving, and the number of calves observed are presented in Table 3.

Winter 1984-85 was difficult for moose, and deep snow resulted in spring flooding. Either few calves were born that spring or those calves born survived poorly. Winters 1985-86 and 1986-87 were mild and should not have resulted in poor calf production. Production in 1986 was good among radio-collared cows but poor overall. In 1987 calf production for radio-collared cows was lower than but comparable to the overall calf production in Three Day Slough; reasons for this are unknown.

Four of the 8 calves associated with radio-collared cows in June 1986 disappeared during the following 11 months and were presumed to have died. One calf disappeared during summer, and 3 others disappeared during midwinter.

Management Summary and Recommendations

As moose populations along the riparian lowlands in Subunit 21D are high and stable, they are able to adequately support current hunting seasons. The high moose densities observed in the lowland areas do not occur in the upland areas; consequently, harvests should not be increased.

Recruitment of yearling moose to the adult segment of the population was expected to be poor in May 1987. Early winter surveys in 1985 and 1986 indicated poor survival among this cohort (initially as calves and then as yearlings). Unusually deep snow during winter 1984-85 and subsequent spring flooding were believed responsible for the poor production and/or high initial mortality among this cohort. The presence of more normal calf:cow ratios during early winter 1986 surveys suggests that recruitment from the next cohort should improve.

The management objectives for the subunit are to provide for maximum opportunity to hunt moose and to produce a maximum moose harvest. Area residents are highly dependent on moose

to meet their food requirements. Nonlocal hunters also harvest moose in areas where moose numbers are sufficient. The present regulations meet these objectives.

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Table 1. Moose trend area surveys in Subunit 21D, November 1986.

Location	Bull: 100 cows	Yearling bull %	Calves: 100 cows ≥2 yrs.	Percent calves	Density moose/mi^2	Area (mi^2)	Sample size
Three Day Slough	39	4	46	23	7.8	83.3	650
Ruby Slough	27	0	42	25	1.9	58.4	113

Table 2. Migration status of moose collared in the Three Day Slough area, Subunit 21D, October 1984 to June 1987.

Cow collar number	1985	1986	1987	Bull collar number	1985	1986	1987
1	-	M-S	R?	4	-	R	R
2	-	R	R	11	M-S	M-S	?
3	-	R	R	14	M-S	M-S	R?
12	M-S	M-S	M-S	15	M-W	M-W	M-W
13	R	R	R	18	M-S	M-S	D
16	M-S	M-S	M-S	19	M-S	D	D
17	M-S	M-S	M-S	21	R	R	R
20	M-S	M-S	?	22	R	R	R
27	M-S	M-S	M-S	23	M-S	D	D
28	M-S	M-S	M-S	24	M-S	D	D
29	M-S	R	M-S	25	M-S	R	?
30	R	M-S	R				

M = migrant
R = resident
S = summer
W = winter
D = dead

Table 3. Moose calves observed with radio-collared cows in June, Three Day Slough area, Alaska.

Year	No. cows ≥2 yrs	No. cows ≥2 yrs with calves	Percent cows w/calves	Incidence of twins among cows w/calves
1987	12	4	33	25
1986	12	8	67	0
1985	7	2	29	0

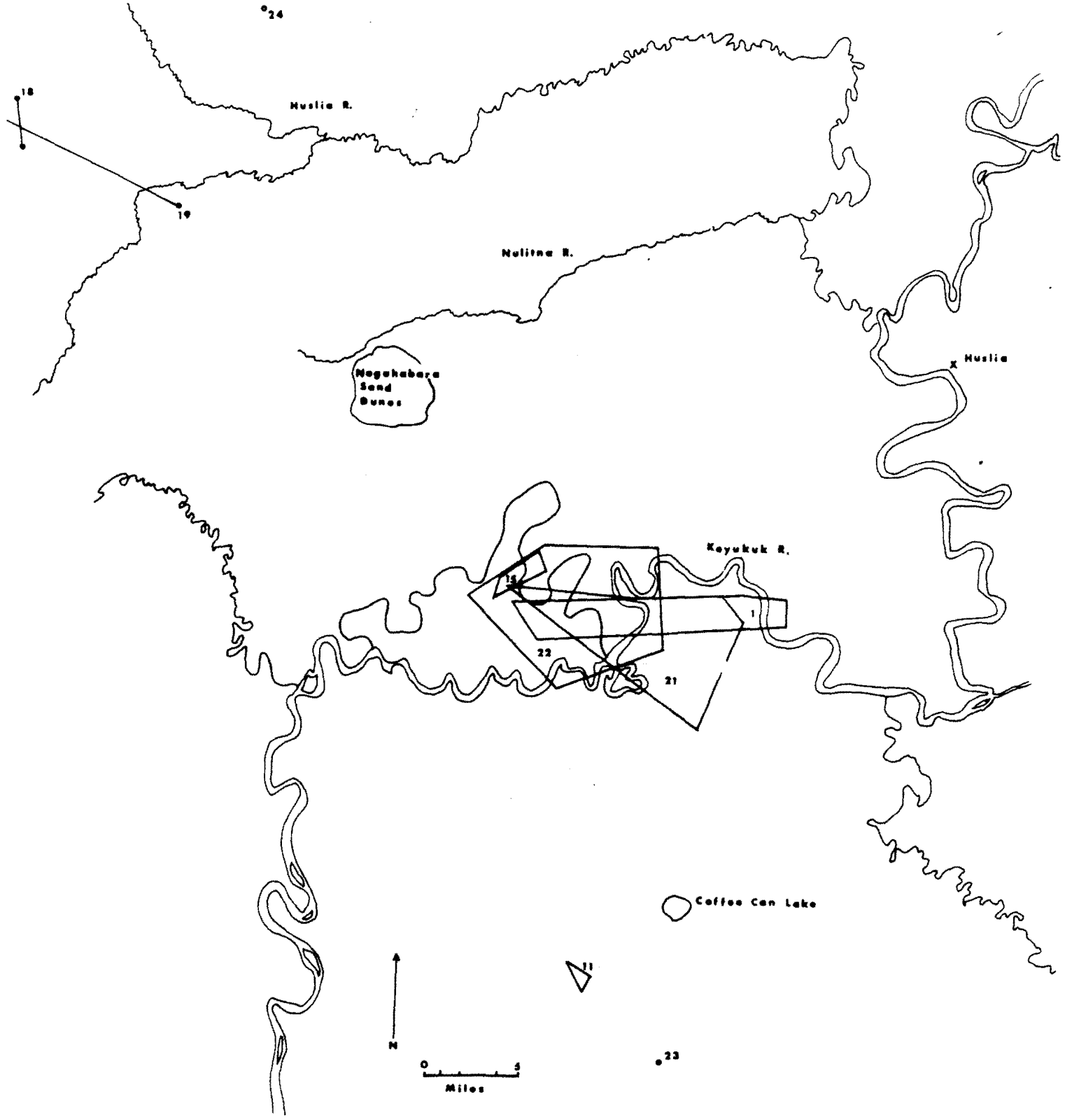

Fig. 1. Summer movements (May-Aug) of collared male moose, Three Day Slough area, Subunit 21D, 1984-87. Locations marked by moose numbers or polygons illustrating maximum movements.

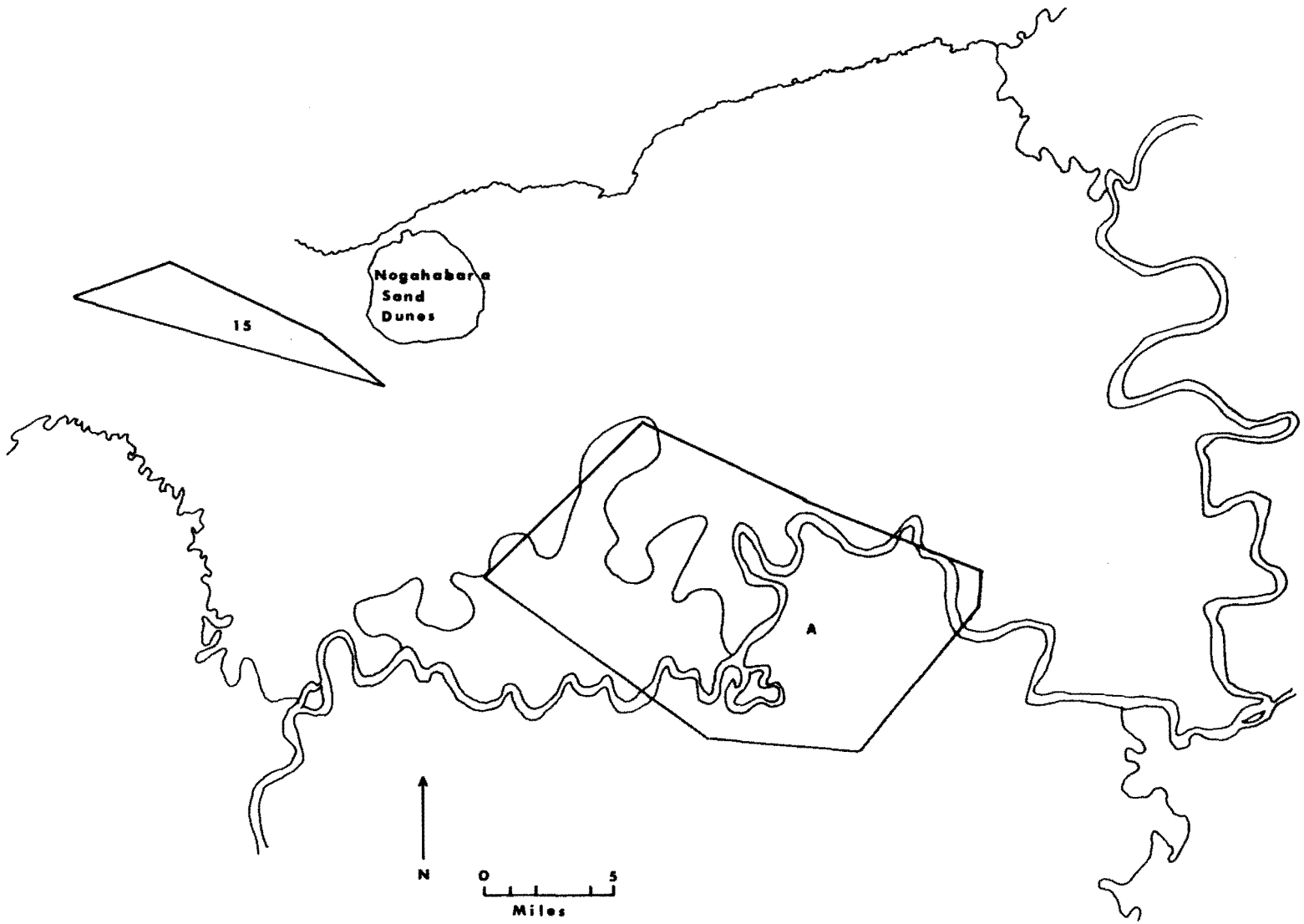

Fig. 2. Winter movements (Nov-Apr) of collared male moose, Three Day Slough area, Subunit 21D, 1984-87. Polygons illustrate maximum movements. Number refers to individual moose. A = collective movements of moose numbers 4, 11, 14, 18, 19, 21, 22, 23, and 24.

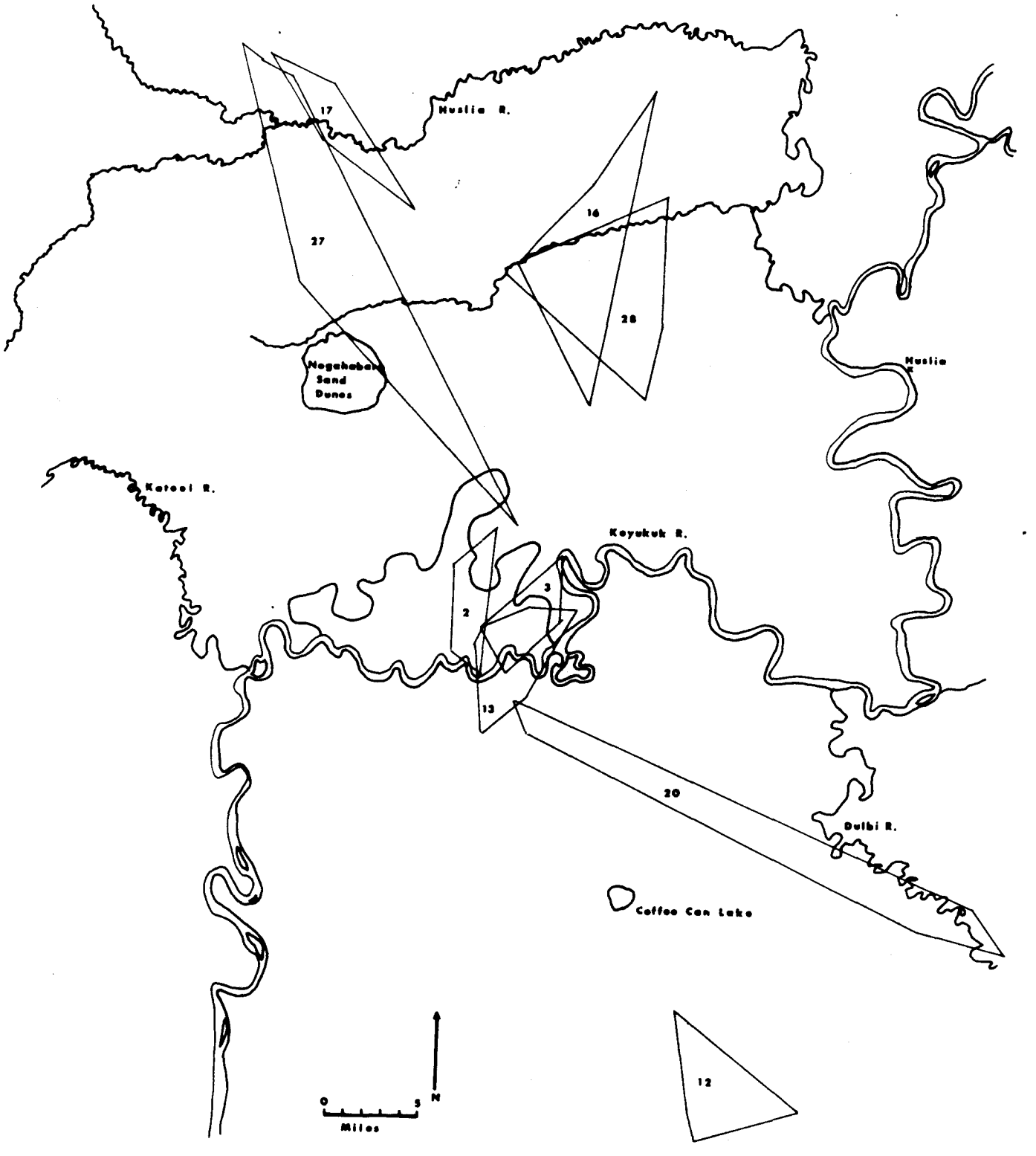

Fig. 3. Summer movements (May-Aug) of collared female moose, Three Day Slough area, Subunit 21D, 1984-87. Polygons illustrate maximum movements.

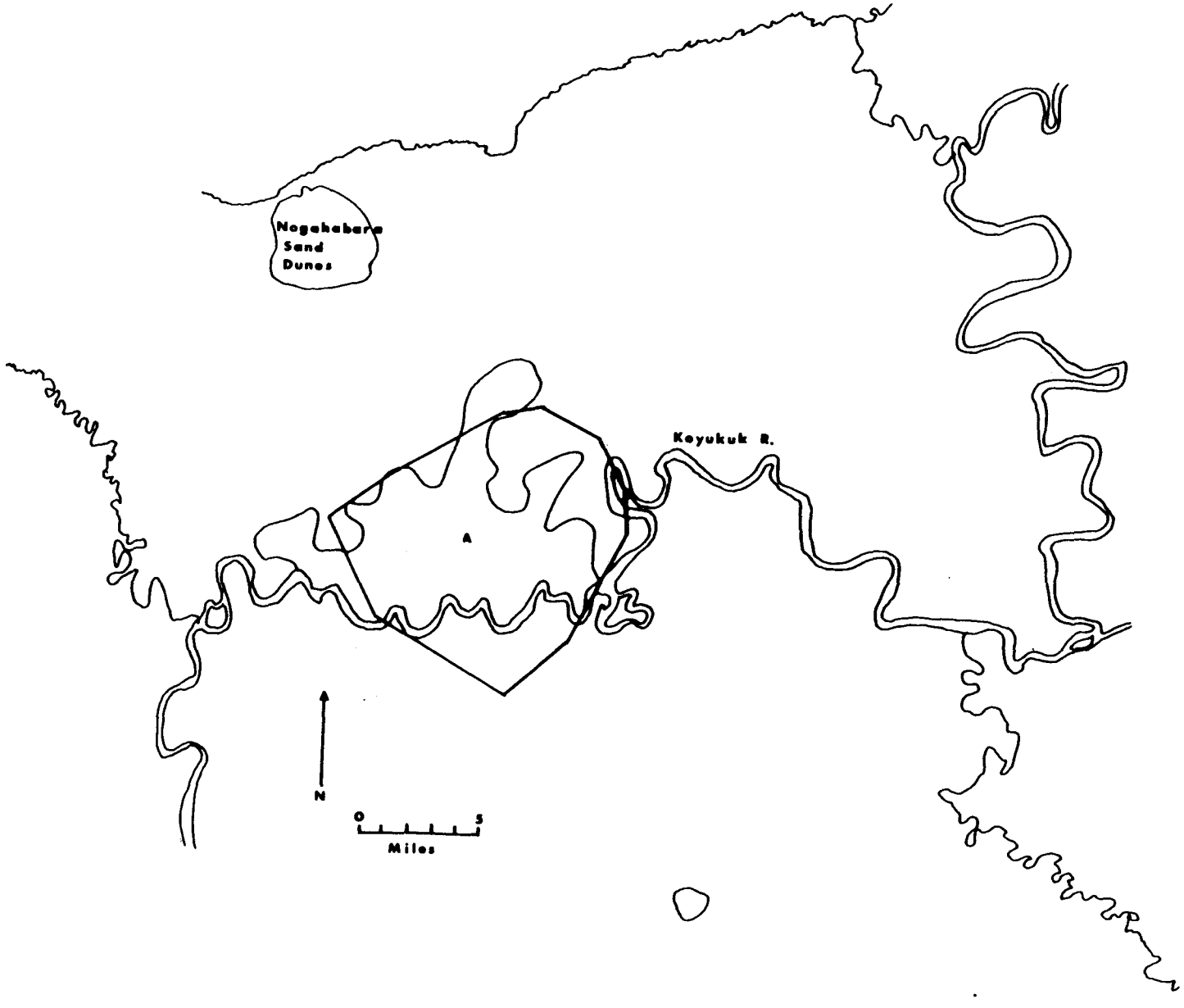

Fig. 4. Winter movements (Nov-Apr.) of collared female moose, Three Day Slough area, Subunit 21D, 1984-87. Polygon illustrates maximum movements. A = collective movements of moose numbers 2, 3, 12, 13, 16, 17, 20, 27, and 28.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 22

GEOGRAPHICAL DESCRIPTION: Seward Peninsula

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulation No. 27.

Population Status and Trend

Historical records indicate that moose were absent from Unit 22 prior to 1930. Immigrants, presumably from areas east and north of the Seward Peninsula, are thought to have begun populating the area during the 1940's and 1950's. By the late 1960's, moose had expanded into most of the suitable habitat in the area. During the next two decades, moose numbers increased dramatically. Although data are scanty, the moose population in Unit 22 is currently thought to number 3,260-4,150 animals (Grauvogel 1986).

Numbers of moose on the winter range of the central Seward Peninsula (primarily the Kuzitrin and Agiapuk drainages) may now be at or above carrying capacity. Densities in other portions of the Unit are lower, however, and appear to be stable or increasing slightly.

Population Composition

Because of inclement weather conditions (lack of snow, low ceilings, and fog), meaningful fall composition surveys were not conducted in Unit 22 during the reporting period.

A census in the western portion of Subunit 22B (Niukluk and Fish River drainages) was conducted during March 1987. Following techniques described in Gasaway et al. (1986), approximately 490 mi^2 (23%) of the 2,100 mi^2 census area were surveyed during a 1-week period. The population estimate for the census area was 1,894 moose. Confidence intervals around the population estimate were as follows: (1) at the 80% confidence level ($\pm$ 18.8%), 1,538-2,249 moose; (2) at the 90% confidence level ($\pm$ 24.4%), 1,431-2,356 moose; (3) and at the 95% confidence level ($\pm$ 29.5%), 1,335-2,452 moose. The

estimated percentage of calves was 11.5%. Confidence intervals around this calf percentage were as follows: (1) at the 80% level (± 21.2%), 9-14%; (2) at the 90% level (± 27.7%), 8-15%; (3) and at the 95% level (± 33.7%), 8-15%. The estimated density of moose in the census area was significantly higher than previously estimated by Grauvogel (1986). However, the percentage of calves for the census area was similar to estimates provided by Grauvogel. Inclement-weather conditions following the census prevented completion of additional surveys during the remainder of spring.

Mortality

The reported moose harvest during 1986-87 is 408 animals (306 bulls, 101 cows, and 1 of unknown sex) (Tables 1 and 2). The current harvest is the highest on record, surpassing by 3 moose the previous record harvest reported in 1983. Hunter success this year was also high; 46% of reporting hunters harvested a moose. As in two out of the past 3 seasons, Subunit 22D produced much of the 1986-87 harvest (Tables 1 and 3).

During the reporting period, 892 harvest tickets were issued. Of the 408 successful hunters who reported, 337 (83%) were residents of Unit 22, 32 (8%) were other Alaskan residents, 26 (6%) were nonresidents, and the remaining 13 (3%) were of unspecified residency. Antlerless-moose permits were issued to 677 hunters during the season (Table 4); of these, 122 hunters were successful in harvesting antlerless moose (101 females and 21 antlerless bulls).

Additional data obtained from returned harvest tickets indicate that snowmachines, highway vehicles, and boats were the most popular methods of transportation (Table 5). Other modes of transportation were off-road vehicles, ATV's, aircraft, and, in one case, horses.

The highest number of moose were harvested during September (Table 3). I attribute this high harvest to (1) the short season in Subunit 22C, which is only open for the first 2 weeks of September; (2) weather, which was cooler than the previous month; (3) an increased number of road hunters; (4) good boating conditions; and (5) optimum moose-movement patterns. A harvest pattern has emerged during recent years consisting of heavy harvest from the road and river systems during September through early October. The harvest subsequently drops during November and December but increases again in Subunit 22B during January when snow conditions are favorable for the use of snowmachines. Another increase in hunting activity occurs during late March in Subunit 22E (the only area open at this time) when Shishmaref residents traditionally harvest most of their moose.

Studies have never been conducted on the Seward Peninsula to determine natural mortality rates; however, Grauvogel (1984), reported that mortality rates among adult radio-collared moose in Subunit 22D were 4.5% for bulls and 8.4% for cows. Since wolf and grizzly bear densities are thought to be significantly higher in Subunits 22A and 22B, natural mortality rates in these subunits probably exceed those estimated for Subunit 22D.

Three moose (1 adult cow and 2 calves) are known to have been taken illegally during the hunting season. In one instance, an individual supposedly incorrectly identified a calf as a yearling. In another instance, it was not clear to the hunter that the taking of cows accompanied by calves is prohibited.

Numerous individuals each year fail to return their harvest report cards, in spite of repeated reminder letters. Although most successful hunters return these cards, presumably some individuals who did not report were successful in taking a moose. Based on this assumption, I estimate that an additional 20 moose can be added to the known harvest of 408 animals.

Another source of unreported moose harvest may result from poor compliance with regulations, particularly in rural villages. When village population is compared with the actual number of moose harvest tickets issued, it appears unlikely that every person who hunts moose obtains a harvest ticket. If this is indeed the case, and conversation with local residents supports this theory, an additional harvest of 20-30 moose can easily be added to the current reported harvest. Therefore, the total hunter harvest of moose in Unit 22 during the reporting period is approximately 450-460 animals.

Management Summary and Recommendations

Although moose utilized most of the available habitat in Unit 22 by the mid-1960's, an interest in hunting did not really occur until the early 1970's (Table 2). Although the current reported harvest of 408 moose is the highest on record, the size of the harvest during the last 4 years has remained relatively stable.

Subunit 22D has proven to be the most successful hunting area in 3 of the past 4 years. Harvest from the road corridor of Subunit 22D during the fall continues to account for approximately 50% of the annual harvest. These high harvests may be depressing total moose numbers; general conversations with local residents indicate that moose are not as abundant on these road systems as they were 5-10 years ago.

Harvest data indicate that the late January harvest of moose in Subunit 22B has increased substantially during the past 3 years; many of the moose harvested during this period are females that are taken primarily by Nome residents utilizing snowmachines as a mode of transportation.

Limited moose composition data indicate a gradual decline in bull:cow ratios and calf production in much of Unit 22. Increased harvest in recent years, particularly of females, in Subunits 22B and 22D prompted the Department to propose a reduction in the antlerless season in Subunit 22B and the eastern portion of Subunit 22D. This proposal, which was accepted by the Board of Game and the local Advisory Committee at their spring meetings, reduced the current antlerless season from 3½ months to just the month of December.

The census conducted in the western portion of 22B is the only comprehensive census conducted in Unit 22. Although the density of moose in the area was considerably higher than previously estimated by Grauvogel (1986), the percentage of calves was consistent with his recent survey data.

I believe the following points need to be addressed if future management decisions in Unit 22 are to be based on sound biological information and if concerns regarding declining calf numbers and reduced bull cow ratios are to be answered:

1. Moose continue to be harvested by individuals who do not obtain harvest tickets or fail to return their harvest report cards. Efforts to increase compliance with existing regulations need to be increased. This can be accomplished by increasing our contact with the public, explaining the need for compliance with current regulations, and by increasing enforcement effort, particularly in the villages.

2. A census is needed in Subunit 22A. Limited data currently indicate that moose densities in this area are low and predation and hunting mortality are high in relation to annual recruitment.

3. Calf production in Subunit 22B appears to have dropped dramatically in recent years. A calf mortality study is needed to provide insight into this reduction.

4. A census is needed in Subunit 22D. Annual harvest continues to increase in this area. Sound data on population size, composition, and production are needed.

5. Trend-count areas should be established in all subunits.

Literature Cited

Gasaway, W. C., S. D. Du Bois, D. J. Reed, and S. J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biol. Pap. Univ. Alaska. No. 22. 108pp.

Grauvogel, C. A. 1984. Seward Peninsula moose population identity study. Alaska Dep. Fish and Game. Fed. Aid in Wildl. Rest. Final Rep. Proj. W-22-2. Job 1.29R. Juneau. 93pp.

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Table 1. Moose harvest in Unit 22 by Subunit, 1986-87.

Subunit	Bulls	Cows	Unknown	Total
22A	27	0	0	27
22B	97	45	1	143
22C	32	0	0	32
22D	133	44	0	177
22E	17	12	0	29
Totals	306	101	1	408

Table 2. Historical moose harvest in Unit 22, 1969-86.

Regulatory year	Males	Females	Unknown sex	Total harvest	Hunters[a]	Percent success
1969	69	1	2	72	182	40
1970	70	0	1	71	139	51
1971	59	0	1	60	168	36
1972	44	0	0	44	99	44
1973	103	32	1	136	317	43
1974	149	72	1	222	479	46
1975	136	0	2	138	389	35
1976	186	51	3	240	611	39
1977	151	88	5	244	457	53
1978	198	97	2	297	596	50
1979	193	75	2	270	760	36
1980	156	71	1	228	492	46
1981	225	72	1	298	696	43
1982	244	100	0	344	904	38
1983	291	82	32	405	1,292	31
1984	298	91	6	395	1,086	36
1985	279	92	3	374	876	43
1986	306	101	1	408	892	46

[a] Minimum known number of hunters.

Table 3. Chronology of moose harvest in Unit 22, 1986-87.

Subunit	Month									Totals
	August	September	October	November	December	January	February	March	Unknown	
22A	7	14	--	--	5	--	--	--	1	27
22B	10	34	20	10	12	55	--	--	2	143
22C	--	32	--	--	--	--	--	--	0	32
22D	26	74	49	12	8	6	--	--	2	177
22E	1	6	0	0	2	2	3	15	0	29
Totals	44	160	69	22	27	63	3	15	5	408

Table 4. Antlerless permit data in Unit 22 by Subunit, 1986-87.

Permit area	Permits issued	Did not hunt or report	Unsuccessful hunters	Successful hunters	Antlerless bulls	Cows
22B	97	41	33	23	7	16
22D	66	20	37	9	2	7
22B-D[a]	466	104	287	74	9	65
22E	40	15	10	15	3	12
22D-E[a]	8	1	6	1	0	1
Totals	677	181	373	122	21	101

[a] Permits issued for 2 Subunits.

Table 5. Mode of transportation used by moose hunters during 1986-87.

Subunit	Mode of transportation								Totals
	Aircraft	Horse	Boat	3 or 4 wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unknown	
22A	2	1	67	4	11	0	1	12	98
22B	11	0	40	7	85	15	57	30	245
22C	0	0	14	1	0	2	29	13	59
22D	21	0	72	29	19	26	193	79	439
22E	0	0	13	0	24	0	0	6	43
22Z	1	0	0	0	0	0	3	4	8
Totals	35	1	206	41	139	43	283	144	892

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 23

GEOGRAPHICAL DESCRIPTION: Kotzebue Sound

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Survey data and observations reported by Department staff during the past year suggest that the moose population in Unit 23 has remained stable since the last reporting period. We have noted continued heavy browsing of winter forage in the Noatak River drainage. However, no obvious signs of population declines associated with heavy browse use have been noted. Although the number of twin short-yearling pairs observed in the lower Noatak River drainage dropped from 7 in 1986 to 4 in 1987, the overall number of short yearlings observed remained essentially unchanged at 85 in 1986 and 86 in 1987. We have not verified whether other drainages in the unit show similar signs of heavy browsing.

Population Composition

Fall surveys were conducted in the Tagagawik and middle Noatak River drainages during November 1986 (Table 1). Results of the Tagagawik River survey were compared with results of a survey conducted during the previous spring in the same 175-mi^2 count area. During the spring survey, 243 moose composed of 12.7% short yearlings were observed, and 264 moose composed of 20.8% calves and 9.8% yearlings were observed during the fall survey. The increase in calf numbers observed during the subsequent fall survey may reflect increased reproductive success; however, it more likely indicates prewinter survival of calves and would not include losses from overwinter mortality that would be reflected by spring survey data. The increase in calf numbers may also reflect differences in spring and fall cow/calf distribution. Data collected in the Tagagawik drainage during future spring and fall surveys will be compared with existing data to determine possible trends.

A fall survey was conducted for the first time in a 166-mi² trend-count area established along the Noatak River in the vicinity of Sivukat Mountain and the Kelly River (Table 1). The majority of the moose observed during the survey were in mountainous terrain located several miles inland from the Noatak and Kelly Rivers. However, by mid- to late December, most of the moose had moved out of the mountains into riparian habitat. In one instance during early February, we observed more than 40 moose in an area estimated to be less than 0.5 mi² at the mouth of the Kelly River.

Results of a survey conducted for the 2nd consecutive spring in a 250-mi² portion of the lower Noatak River drainage are similar to results of the initial survey conducted in the same area last year (Table 2). In 1986, 425 moose were observed during the survey, and 392 were observed in 1987. Short yearlings constituted 20% of the 1986 total and 22% of the 1987 total.

The entirety of a 151-mi² trend-count area established on the lower Kobuk River was surveyed during spring 1987 for the first time since it was established 2 years ago (Table 2). During spring 1986, only 80 mi² of the count area were surveyed before inclement weather prevented its completion. In comparing only the data from the 80-mi² portions surveyed during both 1986 and 1987, we recognized some noticeable differences: 84 moose were observed during 1986, compared with 186 moose during 1987. Survey times during the 2 years were nearly identical: 6 hours in 1986 and 5.9 hours in 1987. No twins and 17 single short yearlings were observed in 1986, compared with 8 sets of twins and 32 single short yearlings observed in 1987. The population in 1986 and 1987 consisted of 23% and 26% short yearlings, respectively. These data and observations reported by Kobuk River residents indicate that the moose population along the lower Kobuk River is healthy and may even be growing. However, these conclusions must be qualified by the fact that snow depths during the 1987 survey were substantially greater than during the 1986 survey. It is possible that moose distribution was influenced significantly by this difference in snow depths. The density of moose in the lower Kobuk River is presently estimated at 1.9 moose/mi².

Two surveys were conducted in the Buckland River drainage during spring 1987. The survey of a newly established 131-mi² trend-count area near Bear Creek resulted in a total count of 28 moose (0.21 moose/mi²). Short yearlings constituted 25% of the moose observed. The second survey was conducted along a stretch of the Buckland River that was approximately 40 miles long. Moose observed within 0.25 mile of riparian vegetation adjacent to the river were included in the count. Seventy-two moose were counted, of which 20.8% were short yearlings.

Density was estimated at approximately 1.8 moose/mile of river.

Mortality

One hundred forty-seven moose were reported harvested from Unit 23 during the 1986-87 season. Alaska residents from communities outside of Unit 23 reported a harvest of 45 moose, down from 53 in 1985-86 and 62 in 1984-85. Nonresidents took 46 moose, up from 31 in 1985-86 and down slightly from 49 in 1984-85. Kotzebue residents reported a harvest of 26 moose, and residents from all other communities in Unit 23 reported taking 23 moose. An additional 7 moose were harvested by hunters of unknown residency.

The reported harvest of 49 moose by residents of Unit 23 is probably much lower than the actual harvest. Quimby and James (1985) estimated that the harvest reported by residents of Unit 23 represented only 14-24% of their actual harvest. These percentages indicate that the actual harvest by these residents probably lies somewhere between 204 and 350 moose. Although this is higher than in the estimated harvest of 158-271 moose in 1985-86, we believe it is well within the sustained-yield capabilities of the population.

The reported harvest of 147 moose was composed of 139 males and 8 females. Fifty-seven percent of the harvest (84 moose) came from the Noatak River drainage, and 24% (35 moose) was reported from the Kobuk River drainage (Table 3). Overall, 48% of the 94 resident hunters were successful, and 71% of the 46 nonresident hunters were successful.

Antler sizes of bulls harvested in Unit 23 during the 1986-87 season ranged from 16 to 68 inches ($\bar{x}$=46.8 inches, SD=11.3, n=130). Nearly half (49%) of the bulls had antler spreads ≥50 inches (Table 4).

Aircraft, boats, three-wheelers, snowmachines, off-road vehicles, highway vehicles, and a horse were all used by moose hunters. Aircraft and boats were used mostly by successful hunters. Sixty-seven percent of the aircraft users were successful, while 48% of the boat users were successful. Fourteen percent of the reporting hunters (37) did not indicate their method of transportation.

Management Summary and Recommendations

Department personnel continued in their efforts to inform local residents of the usefulness of harvest data for management purposes. Despite these efforts, however, harvest reporting rates remain low. In an attempt to resolve this

problem, we will continue to discuss this problem with local residents.

As reported last year, browse in the Noatak River drainage appears to be heavily utilized. Although this may result in lowered carrying capacity for moose in the Noatak River drainage, we presently have no information indicating that this is the case. The Alaska Board of Game, acting on a proposal that we submitted last year, lengthened the moose season in the Noatak and Buckland River drainages from December 31 to March 31. Given the possible high numbers of moose in the lower Kobuk River drainage, it may be appropriate to similarly liberalize the season in that area. Prior to making any recommendations, however, we need to establish and survey trend-count areas along the middle and upper Kobuk River. Once this is done, we will be in a better position to make objective management decisions regarding the moose in this drainage.

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Table 1. Moose trend count surveys conducted in GMU 23 during fall 1986.

Date	Drainage	Area (mi^2)	Time (hrs)	Bulls/ 100 cows	Calves/ 100 cows	Yearlings/ 100 cows	Percent calves	Moose/ mi^2	Total sample
11/22/86	Tagagawik	175	7.3	45	38	18	21	1.5	204
11/23/86	Middle Noatak	166	8.6	44	38	27	21	1.3	211

Table 2. Moose trend count surveys conducted in GMU 23 during winter, 1986 and 1987.

Date	Drainage	Count area (mi^2)	Search time (hrs)	Adults	Short yearlings	Percent short yearlings	Moose/ mi^2	Total sample
02/12/87	Lower Noatak	250	14.3	306	86	22	1.5	392
04/07/86	Lower Noatak	250	10.2	340	85	20	1.7	425
03/03/87	Lower Kobuk	151	9.5	200	85	30	1.9	285
04/20/87	Buckland/ Bear Creek	131	3.9	21	7	25	0.2[b]	28
04/20/87	Buckland	40[a]	1.8	57	15	21	1.8[b]	72

[a] Refers to linear miles.

[b] Refers to moose/mile of river.

Table 3. Location and number of moose reported killed by hunters in GMU 23, 1986-87.

Drainage/ area	Males	Females	Total	% Hunter success
Noatak River	80	4	84	57
Kobuk River	32	3	35	47
Selawik River	14	0	14	78
Northern Seward Peninsula	10	1	11	55
Unknown	3	0	3	--
Total	139	8	147	55

Table 4. Antler sizes of bull moose reported killed by hunters in GMU 23, 1986-87.

Unknown	Under 20 in.	20-29.9 in	30-39.9 in.	40-49.9 in.	50-59.9 in	Over 60 in.
9	1	8	28	29	49	15
(6%)	(1%)	(6%)	(21%)	(22%)	(38%)	(11%)

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 24

GEOGRAPHICAL DESCRIPTION: Koyukuk River above Dulbi River

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose are numerous on the Koyukuk River lowlands in the southern one-third of Unit 24, and the population appears stable. Observed densities from 2 trend areas averaged 3.6 moose/mi^2 in November 1986. Densities are lower (0.3 moose/mi^2) in the middle one-third of the unit, which includes the Kanuti Controlled Use Area and Kanuti National Wildlife Refuge. This area is thought to contain 600 to 900 moose, and the population is probably declining. In the northern one-third of the unit, which includes the Gates of the Arctic National Park and Preserve, densities are moderate, ranging from 1.0 to 1.6 moose/mi^2 during early winter. Moose numbers are presently stable.

Population Composition

In the southern one-third of the unit, USFWS staff conducted a moose survey in the newly established Batza Slough trend count area (Table 1) near Hog River in the Koyukuk National Wildlife Refuge. The results indicated low calf numbers, very poor yearling recruitment from last year, and a bull:cow ratio of 39:100. The area has high numbers of both black and grizzly bears and wolves; it is also an area that is rarely hunted. Radio-telemetry studies in Subunit 21D have shown that some moose from the Three Day Slough area move seasonally to the southern part of Unit 24 (see the Subunit 21D report for further discussion of these movement patterns).

USFWS staff conducted moose surveys at 4 locations within the Kanuti Refuge in the middle portion of the unit. The results (Table 1) indicated good calf numbers, low yearling survival, and high bull:cow ratios. The low number of yearlings (a 14% recruitment rate) indicated that the population was probably declining. Overall, the bull:cow ratios were excellent. The

unusually high bull:cow ratio observed in the Kanuti Canyon trend-count area probably occurred because moose counted in this area in November are subject to illegal cow harvests throughout the year. Browse plants in the Kanuti Refuge are not heavily utilized, and habitat is not limiting moose population growth at present moose densities. No surveys were conducted near the Haul Road or in the northern one-third of the unit.

Mortality

Hunting seasons in Unit 24 are diverse, reflecting the various moose densities and consumptive-use patterns present in the unit. The reported harvest was 115 moose; this total included 105 taken during the fall season, one taken in December, five taken in March, and 4 moose for which the date of kill was unknown. An additional 60 moose were probably harvested out of season and not reported.

The Dalton Highway continued to attract hunters; 107 hunters reported using it to access hunting areas within 15 miles of the road. Forty-three moose were reported taken. Since the road opened to the public in 1981, the number of moose taken annually in the corridor has steadily increased from a harvest of 15 in 1981 to 43 in 1986.

Management Summary and Recommendations

Unless trends change, the Koyukuk Controlled Use Area should be maintained to keep the moose harvest in the southern one-third of the unit at its present low level. Moose mortality in the middle one-third of the unit should be reduced to allow the population to expand. Browse-availability surveys indicated that food is plentiful and underutilized. Illegal hunting of cow moose is probably compounding the problem in a portion of the area. Hunting pressure in the Dalton Highway area should be monitored, and more trend areas should be established.

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SUBMITTED BY:

Wayne E. Heimer
Survey-Inventory Coordinator

Table 1. Moose trend area surveys in Unit 24, November 1986.

Location	Bull: 100 cow	Yearling bull %	Calves: 100 cows ≧2 yrs	Percent calves	Density moose/mi^2	Area (mi^2)	Sample size
Kanuti Canyon[a]	173	12	58	12	0.84	69.9	59
Sithylemenket Lake[a]	58	3	33	17	0.38	95.3	36
Nolitna Creek[a]	63	2	62	27	0.94	52.0	49
South Fork[a]	33	0	50	27	0.22	48.9	11
Batza Slough[b]	39	2	17	8	1.25	52.9	66

[a] Kanuti National Wildlife Refuge.
[b] Koyukuk National Wildlife Refuge.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 25

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

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose surveys were completed only in Subunit 25D during this report period. Historical data and observations from the remainder of the unit suggest that moose densities were low (0.1-0.5 moose/mi^2) and populations generally stable.

In a cooperative effort by the Alaska Department of Fish and Game (ADF&G) and the U.S. Fish and Wildlife Service (USFWS), three trend-count areas were surveyed in the portion of Subunit 25D east of Fort Yukon. Observed moose density increased in 1 area by 0.29 moose/mi^2, decreased in another by 0.61 moose/mi^2, and did not change in a 3rd area. These differences are believed to be due to distribution differences rather than actual changes in the population. Overall, the population is probably stable at approximately 2,100 moose (1984 estimate).

In the portion of Subunit 25D west of Fort Yukon, the ADF&G and USFWS cooperated to reassess moose distribution patterns, establish new trend-count areas, and estimate population size. The 6,219-mi^2 area was first stratified into 10-20-mi^2 sample units of high, medium, and low moose densities, based upon the number of moose observed in individual units during a brief overflight with a Cessna-185 aircraft. Selected units from each stratum were then intensively surveyed (≥4 min/mi^2) with a Piper PA-18 to estimate actual moose densities. Mean densities obtained from the intensive survey of sample units were then extrapolated to the respective strata to generate a moose population estimate for the entire area.

Approximately 1,500 moose were present in Subunit 25D (West) during November and early December 1986: an average density of 0.23/mi^2. Similar procedures produced a comparable estimate of 750 moose in 1983, or about 0.10 moose/mi^2. However, since variability between sample units was very high, meaningful confidence intervals could not be calculated for these estimates. Other analyses, described elsewhere in this report, suggest conditions were good for population growth, and it seems likely that the upward trend indicated by these 2 surveys is real.

Population Composition

In Subunit 25D (East), 170 moose were classified in 3 trend areas (Table 1). Both calf and yearling recruitment were moderately good: 15% and 12% of the population, respectively. However, a comparison of 1986 data with data from prior years showed that 1986 recruitments were below average (Table 1). If this continues and the harvest by hunters remains at current levels, moose numbers will decline.

One hundred fifty-two moose were classified in Subunit 25D (West) during 1986 (Table 2). Twenty-seven calves were observed per 100 cow moose, suggesting that calf recruitment at 6 months was poor, compared with prior years. However, survival of the previous calf cohort to 18 months of age was good: 23 yearling bulls:100 cows. Calves and yearlings composed 13% and 22% of the population, respectively.

This population probably has been growing. Prior surveys have indicated high recruitment of calves 18 months of age (Table 2), and radio-telemetry studies have indicated high adult survival as well. However, the anticipated poor recruitment of the 1986 cohort will likely slow population growth.

Mortality

Harvest tickets and permit reports returned by hunters provided a good indication of the moose harvest in all subunits, except Subunit 25D where most of the harvest was illegal and therefore unreported. Harvest ticket and permit returns indicated 160 (43%) of the 376 hunters reporting from the unit killed a moose. Classification of hunters by residency revealed that most moose (69) were taken by Alaskans who were not local residents of Unit 25 (Table 3). Subunit 25D had the largest harvest of 54 moose in the unit, and Subunit 25A was second with 47; Subunits 25C and 25B had harvests of 32 and 27 moose, respectively. Four moose were reported taken from Unit 25, but no subunit was identified.

Subunits 25C and 25D had the greatest number of hunters (108 and 138, respectively) and the lowest success rates (30% and 39%, respectively) (Table 4). Hunting pressure was high in these areas because they are accessible from population centers. Subunit 25D can be reached by boat from 7 of the 8 villages in Unit 25 and from both the Dalton and Steese Highways via the Yukon River. Subunit 25C is accessible to hunters from the Fairbanks area via the road system. Hunter success was probably lower in this area because of a combination of low moose densities, relatively large numbers of hunters, and low effort per hunter.

The magnitude and characteristics of the reported harvest were mostly unchanged, compared with previous years. The exception was Subunit 25A, where harvest increased by 16 over the 1985 total. Over the past 5 years, the harvest has gradually increased from a low of 20 in 1981 to the current high of 47. I expect additional increases in Subunit 25A, because resource-use opportunities in this area are receiving nationwide publicity. Most of Subunit 25A lies within the Arctic National Wildlife Refuge and, therefore, is part of the current resource planning controversy surrounding that area.

The unreported harvest in Subunit 25D was estimated at 95 moose. This estimate was based upon observations of kill sites, reports made to the Division's area office in Fort Yukon, and the number of households in each community. The sex and age composition of illegally taken moose was largely unknown. However, the high bull:cow ratios observed in heavily hunted areas suggested that the illegal kill must include at least 50% cows.

Natural mortality among moose in Subunit 25D (West) is being assessed through a joint ADF&G-USFWS radio-telemetry study. Results of this study indicate that natural mortality rates among animals older than 6 months were 7%. Of the 60 radio-collared moose, 2 yearlings, 1 calf, and 1 cow have died. Three were known wolf kills; the remaining moose was killed by either wolves or a bear. Composition of the radio-collared animals included (1) 13 cow/calf associations (13 cows with 14 calves), (2) 1 calf, (3) 13 yearlings, (4) 7 bulls, and (5) 12 cows without calves.

Management Summary and Recommendations

Generally, moose populations throughout most of Unit 25 were stable at low densities. The exception was Subunit 25D (West), where numbers were likely increasing. Neither the magnitude nor the characteristics of the reported harvest changed much from last year in most of the unit. The

exception was Subunit 25A, where the legal harvest increased significantly.

Radio-telemetry data from Subunit 25D (West) indicated that natural mortality was low (4 moose) among 60 moose older than 6 months. However, wolf predation was the cause of 3 of these deaths.

All available data suggest that moose numbers have increased and that the population objective has been achieved. Moose management strategy in this area should be reevaluated. Trend areas in Subunit 25A should be surveyed. No current information is available from that subunit to evaluate the impact of increasing harvest on the moose population.

A management plan should be formulated for Subunit 25D (East). It will require a significant commitment of Department resources to involve the local public in the planning process and to continue surveys for population monitoring. It will also require establishment of moose population objectives and harvest levels that will reconcile the reality of moose productivity with local desires for increased hunting opportunity. In addition, the problem of illegal harvests must be discussed and resolved.

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Table 1. Moose sex and age ratios for Subunit 25D (East) during fall 1981-86.

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent yearlings	Percent calves	Sample size
1981	108	29	58	22	22	64
1982	86	27	50	24	21	52
1983	--	--	--	--	--	--
1984	76	12	44	10	20	226
1985	--	--	--	--	--	--
1986	84	13	34	12	15	170

Table 2. Moose sex and age ratios for Subunit 25D (West) during fall 1983-86.

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent yearlings	Percent calves	Sample size
1983	93	27	72	20	27	79
1984	--	--	--	--	--	--
1985	98	35	53	28	21	108
1986	78	23	27	22	13	152

Table 3. Residency of successful hunters and total harvest of moose in Unit 25, 1986-87 season.

Subunit	Local resident[a]	Nonlocal Alaska resident	Nonresident	Unspecified	Total
25A	4	22	16	5	47
25B	9	10	3	5	27
25C	1	25	0	6	32
25D (West)	15	0	0	0	15
25D (East)	23	10	1	5	39
Unspecified	1	2	1	0	4
Total	53	69	21	21	164

[a] Resident of Unit 25.

Table 4. Number of moose hunters, hunter effort, percent success, and most important means of transport in Unit 25, 1986-87 season.

Subunit	Total hunters	Hunter[a] effort	Percent success	Most important means of transport
25A	72	5.8	65	Aircraft
25B	58	6.4	47	Boat
25C	108	4.2	30	Highway vehicle
25D (West)[b]	46	6.9	33	--
25D (East)	92	5.3	42	Boat

[a] Average days hunted.
[b] Registration permit hunt.

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNIT: 26A

GEOGRAPHICAL DESCRIPTION: Western Arctic Slope

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

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

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

Colville River late-winter trend counts conducted during 1970-87 are reported in Table 1. In 1987, the 700 moose counted under excellent survey conditions represent a 2% increase above the mean of the 12 previous counts conducted since 1970 and a 10% increase above the mean of the previous 5 counts (incomplete 1983 count excluded). The late-winter trend data collected during the past 12 years suggest that the population of Subunit 26A is either stable or growing slightly. However, the proportion of short yearlings in the population declined sharply from 1986 to 1987. Of the 700 moose observed in 1987, only 10% were short yearlings, compared with 22% in 1986. The sample size, a less reliable indicator of population condition, also declined significantly from 866 to 700 during the same period.

Population Composition

Fall composition surveys were flown in October 1986; 339 moose were observed. Composition ratios were 47 bulls:100 cows and 18 calves:100 cows. Both ratios have declined since 1983 when 188 moose were observed and composition ratios were 54 bulls:100 cows and 38 calves:100 cows. A smaller area was surveyed in 1983.

Mortality

The harvest for all of Unit 26 was nearly stable; 112 moose were harvested in fall 1985 and 121 in fall 1986. Of 173 hunters who reported hunting in Unit 26 during 1986, 70% were successful (Table 2). The number of participating hunters increased from 166 in 1985.

In Subunit 26A, the reported harvest of 52 moose during fall 1986 is 20% less than reported for 1985 (Table 3). Hunting pressure in Subunit 26A also decreased by 19% from the previous year, but the success rate did not change significantly.

Most of the reporting hunters (77%) in Subunit 26A were Alaska residents (Table 4). Hunters living on the Arctic Slope accounted for 36% of the reported harvest; this is the fourth consecutive year that reported resident harvest in Subunit 26A has increased. An additional 26% of the 1986 hunters came from the Fairbanks area, and 15% were from elsewhere in Alaska. Of the 45 moose for which antler measurement records are available, 21 (47%) had an antler spread of at least 50 inches (Table 5; two (4%) had antler spreads ≥60 inches.

In addition to the 52 moose that were reported harvested, an estimated fifteen more were harvested in Subunit 26A but not reported. The total estimated harvest for the Subunit is 67 moose. This harvest represents 4-5% of the 1,429-1,786 moose inhabiting the subunit at the time the last unit-wide survey was conducted in 1984.

Mortality not caused by hunters was probably significant for this population during the reporting period. The percentage of short yearlings observed in late-winter surveys declined from 22% in 1986 to 10% in 1987, suggesting higher-than-normal mortality for calves born in 1986. The cause of this decline cannot be identified, although a calf crop failure of similar magnitude occurred in 1981 (Table 1). Predation is one probable cause that cannot be ruled out at this time. During the past 2 years, wolf activities appear to have increased in the drainages that we routinely count. Grizzly bears also appear to be relatively abundant.

Management Summary and Recommendations

Hunters probably harvested no more than 5% of the moose population in Subunit 26A during the reporting period. No maximum allowable harvest has been identified for moose in Subunit 26A; this needs to be determined as soon as possible. Any such estimate must consider the special circumstances of a population that has recently expanded onto the Arctic Slope and is at the northern range limit for moose in Alaska.

It is important to develop a moose management plan for both Unit 26 and Subunit 26A. This plan should recognize both the characteristics of moose populations and the needs of moose hunters in those areas. Particular attention should be given to identifying and preserving, where possible, the characteristics of moose hunting that are unique to the Arctic Slope. In developing such a plan, it is vital to solicit meaningful public participation, especially from residents of the unit.

During late winter surveys conducted in 1987, the most significant observation in Subunit 26A was the low percentage of short yearlings in the population. Although reported hunting pressure in the subunit was relatively low at 4-5% of the estimated population, several factors may complicate management efforts in future years. First, increased hunting pressure in adjacent Subunit 26B required the implementation of season and bag-limit restrictions in 1987-88 for nonsubsistence hunters, and spillover hunting pressure in Subunit 26A could occur. Second, the subsistence hunting season was increased by 1 month for all of Unit 26 beginning in August 1987. Currently, the proportion of the harvest in Subunit 26A attributable to North Slope residents has been steadily increasing. Third, predation by wolves and grizzly bears may be a significant source of additional mortality.

No changes in hunting seasons and bag limits are recommended at this time. However, continued surveillance of the moose population will be given a higher priority. Hunter contact flights will be flown in August and September 1987 during the peak of the season. A fall composition survey is also planned. Data on wolf density in the Colville River area will be available by spring 1988. If the population appears to show continued problems with recruitment, we will propose regulatory restrictions on hunting.

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Table 1. Colville River trend counts: Anaktuvuk River, Chandler River, and Colville River between Anaktuvuk and Killik Rivers, 1970, 1974-81, and 1983-86.

Year	Total moose	Adults	Calves	Calf % of herd
1970	750	523	227	30
1974	544	458	86	16
1975	556	386	170	31
1976	650	494	156	24
1977	802	632	170	21
1978	767	623	144	19
1979	644	536	108	17
1980	841	676	165	20
1981	639	594	45	7
1983[a]	315	268	47	15
1984	756	590	166	22
1985	757	613	144	19
1986	866	678	188	22
1987	700	627	73	10

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

Table 2. Moose hunter success in Unit 26, 1977-86.

Season	Harvest	Hunters	Success rate (%)
1977	36	48	75
1978	46	81	57
1979	90	108	83
1980	89	132	67
1981	99	145	68
1982	60	102	59
1983	51	76	67
1984	73	97	75
1985	112	166	67
1986	121	173	70

Table 3. Reported moose hunter success in Subunit 26A, 1982-86.

Year	Harvest	Sex			Hunters	Success rate (%)
		M	F	Unk		
1982	38	31	7	0	54	70
1983	37	30	7	0	50	74
1984	50	42	7	1	66	76
1985	65	50	15	0	99	66
1986	52	46	6	0	80	65

Table 4. Residence of reporting hunters in Subunit 26A, 1983-86.

Year	North Slope		Fairbanks area		Elsewhere in Alaska		Outside Alaska		Totals
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	
1983	4	(9)	18	(40)	7	(16)	16	(36)	45
1984	12	(19)	26	(41)	16	(25)	10	(16)	64
1985	29	(30)	29	(30)	16	(16)	24	(24)	98
1986	29	(36)	21	(26)	12	(15)	18	(23)	80

Table 5. Antler spread (inches) of moose harvested in Subunit 26A, 1983-86.

Year	Less than 20	20-29	30-39	40-49	50-59	60+	Totals
1983	0	1	9	4	9	3	26
1984	1	2	7	13	12	5	40
1985	0	3	5	8	21	8	45
1986	0	3	8	13	19	2	45

MOOSE

SURVEY-INVENTORY PROGRESS REPORT

GAME MANAGEMENT UNITS: 26B and 26C

GEOGRAPHICAL DESCRIPTION: Central and eastern Arctic Slope

PERIOD COVERED: 1 July 1986-30 June 1987

Season and Bag Limit

See Hunting Regulations No. 27.

Population Status and Trend

Moose populations have been slowly increasing in Subunits 26B and 26C. However, increasing harvest trends in Subunit 26B may be adequate to limit growth of those populations. During the current reporting period, surveys were conducted by U.S. Fish and Wildlife Service and ADF&G personnel in October 1986 and March 1987, respectively.

More moose (267) were counted on the Kongakut River in October than in any previous survey (previous high 239 in November 1984). In contrast, moose numbers were down considerably on the Canning and Kavik Rivers: 139 and 55, respectively, compared with highs of 201 in October 1985 for the Canning and 96 for the Kavik in April 1985. These changes cannot be explained by recruitment or mortality factors. Eighty-three moose were counted on the Kavik in March 1987, 28 more than were seen the previous November. The higher count could only result from shifts in moose distribution or from increased survey efficiency. Much of the variation in moose counts over past years is probably due to similar factors.

Table 1 shows numbers of moose counted in various drainages in Subunit 26B during October 1986 and March 1987. Survey coverage of many drainages differed between the 2 surveys, as indicated in the footnotes to the table. In the March survey, 517 moose were observed. If we assume that most of the 201 moose counted on the Ivishak and Shaviovik Rivers during October were not counted elsewhere in March and if we consider that the Itkillik drainage was not counted in either survey, then the total count for Subunit 26B would be at least 700 and likely exceeds 800 moose. This is higher than the minimum population estimate of 700 moose stated in last year's report, and I think it reflects increased counting efficiency,

although the population may have grown somewhat. There are probably about 500 moose in Subunit 26C.

Population Composition

Fall composition counts indicated 49.7% cows, 15.2% calves, 30.4% adult bulls, and 4.7% yearling bulls in Subunits 26B and 26C. There were 31 calves:100 cows and 71 bulls:100 cows. In the spring counts there were 14.1% calves.

Mortality

The 1986 reported harvest for Subunit 26B was 46 bulls and 13 cows; 14 hunters were unsuccessful. The harvest for Subunit 26C was 6 bulls and 4 cows; 10 hunters were unsuccessful. The harvest in 26C was similar to that of previous years, except that 3 more cows were taken. The significant take in 26B increased about 60% over 1985. This increase in 1986 occurred mainly in more remote areas and probably resulted from the presence of outfitters offering air transport away from the Dalton Highway.

Alaska residents took 50% of the reported harvest in Subunit 26B and 90% in 26C. All unsuccessful hunters were Alaskan residents. Mean antler spread was 52 inches in 26B: 54.3 inches for moose taken by airborne hunters and 44.7 inches for moose taken by hunters using road access. Mean antler spread was 48.3 inches in Subunit 26C. Mean antler-spread measurements were lower by 8 inches in Subunit 26C and by 4.7 inches in remote areas of 26B. Mean antler spread among moose taken using road access was 5.8 inches higher than in 1985, but take of antlerless bulls late in the season increased from 3 to 5. Harvest of moose increased by 7 moose in both units combined. I think this reflects a change in the type of hunter using the area. Increasingly easy access has made the area more popular with resident hunters hunting primarily for meat rather than trophies.

Management Summary and Recommendations

Moose populations in Subunit 26C remain very lightly harvested: about 2% of the estimated population. In contrast, reported harvest from Subunit 26B is now about 7% of the estimated moose population in 26B; the total harvest, including poaching and unreported take during the legal season, may approach 10%. Recruitment in recent years has averaged about 15-16%. Current harvest rates combined with natural mortality are probably approaching the point of stabilizing the moose population, at least in 26B, and the trend has been for increasing harvest. The eastern Arctic

Slope should no longer be treated as a remote area with poor access. Reductions in the resident and nonresident seasons for 1987 will shorten the season to 1-30 September and the bag limit to 1 bull moose only. Off-road vehicle restrictions, formerly unenforceable, have been incorporated into the hunting regulations and are now enforceable. This should eliminate the late-season harvest by hunters using snow machines. Restricting take to bulls only will ensure that the reproductive base of the population is not at immediate risk, even though interest in and access to the area will likely continue to increase. The populations of these subunits apparently exist on limited winter ranges. Predation is thought to be low, and some consideration should be given to range condition.

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Table 1. Moose counts by drainage in Subunit 26B, 1986-87.

Drainage	No. moose counted	
	October[a]	March[b]
Kuparuk	--	140
Toolik	--	50
Sagavanirktok	6[c]	38
Accomplishment	21[d]	9
Ribdon	7	20
Lupine	30	16
Ivishak	172	--
Echooka	72	80[c]
Shaviovik	39	0
Juniper	96[e]	81
Kavik	55	83

[a] Surveys flown by U.S. Fish and Wildlife Service.
[b] Surveys flown by ADF&G.
[c] Lower portion of drainage not surveyed.
[d] Includes Section Creek.
[e] Includes Fin Creek.

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