Moose

Management Report

of Survey-Inventory Activities
1 July 2001–30 June 2003

Cathy Brown, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation
December 2004

Photo by Randy Rogers, ADF&G

Please note that population and harvest data in this report are estimates and may be refined at a later date.

If this report is used in its entirety, please reference as: Alaska Department of Fish and Game. 2004. Moose Management Report of Survey-Inventory Activities 1 July 2001–30 June 2003. C. Brown, editor. Juneau, Alaska. If used in part, the reference would include the author's name, unit number, and page numbers. Authors' names can be found at the end of each unit section.

Funded through Federal Aid in Wildlife Restoration Grants W-27-5 and W-33-1, Project 1.0

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MOOSE MANAGEMENT REPORT

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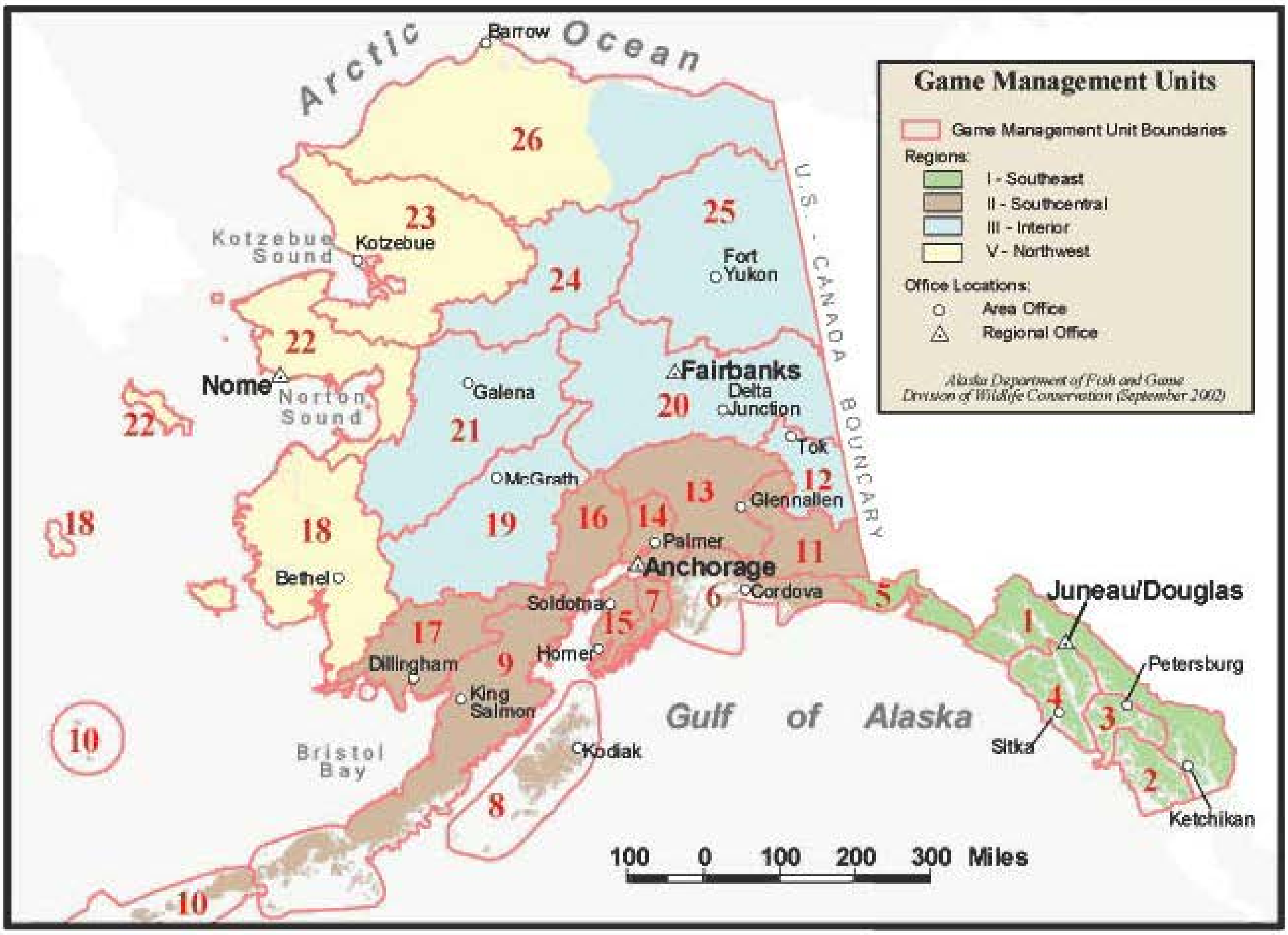

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 1A (5300 mi^2) and 2 (3600 mi^2)

GEOGRAPHIC DESCRIPTION: That portion of Unit 1 lying south of Lemesurier Point, including all drainages into Behm Canal and excluding all drainages into Ernest Sound. Unit 2: Prince of Wales Island and adjacent islands south of Sumner Strait and west of Kashevarof Passage.

BACKGROUND

Most of the Unit 1A moose population is localized in the Unuk River drainage and appears stable. Heavy timber in a narrow valley with braided river channels makes moose observation difficult. The best population estimates are based on track densities and distribution in fresh snow complementing aerial surveys. Good habitat is limited and moose numbers are low. The harvest is sporadic, ranging from 0-8 per year. Unit 1A moose are believed to be *Alces alces andersonii,* and likely emigrated from interior British Columbia via the Unuk River valley.

The U.S. Forest Service (USFS) prepared a vegetative type map of the Chickamin River valley, resulting from 1962 and 1963 field investigations (Burris 1964). The study suggested that sufficient forage was present to support moose. Measuring boards were installed to determine snow depth to ascertain if winter conditions were suitable for moose. The Chickamin supported a few moose before supplemental transplants in 1963 and 1964. These moose were captured on the Chickaloon Flats near Anchorage (Burris 1964). A short-term increase followed the release and several bulls were harvested during open hunting seasons. Chickamin moose populations subsequently declined and we have received no reports of moose there in recent years; recent aerial surveys suggest no moose remain there. Moose are occasionally reported from other parts of Unit 1A including Revillagigedo Island, along both sides of the Cleveland Peninsula, and along the south end of the mainland near the Portland Canal.

Although present-day rumors suggest that moose occurred sporadically on Prince of Wales Island in Unit 2 as far back as the 1940s, ADF&G received its first plausible report of moose in the unit in 1987 when USFS staff reported a cow and calf near Snakey Lakes. During fall 1991 a cow moose was struck by a highway vehicle near Control Lake. In June 1993 a USFS employee photographed a cow moose walking along the 30 Road, located roughly 0.5 miles south of Ratz Harbor. One bull was poached near Hollis in fall 1996. Additional reports indicate that a population of moose, of unknown size and composition, inhabits the central portion of Prince of Wales Island. Currently there is no open moose hunting season in Unit 2.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The following moose management objectives for Unit 1A are based on biological data and input from the public.

	Plan Objective	2001	2002
Post-hunt numbers	35	Unknown	Unknown
Annual hunter kill	3	3	2
Number of hunters	20	25	23
Hunter-days of effort	90	95	104
Hunter success	15%	12%	8%

METHODS

Aerial moose surveys are flown each winter (December–February) when weather and snow conditions become favorable.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Data are insufficient to make a quantitative determination of Unit 1A moose population trends during the past 5 years. However, moose populations appear to be stable at a low density and carrying capacity is also estimated to be low. Healthy brown bear, black bear, and wolf populations probably account for substantial mortality in this area, particularly on calves.

Increasing reports of moose in Unit 2 may indicate a growing moose population, or simply be a function of increased human access into once remote areas. No population data are available for Unit 2.

Population Composition

Only a few thorough Unuk River moose surveys have ever been completed. Crude population estimates are based on track density and distribution rather than relying only on the number or composition of moose observed. A complete survey was flown under ideal light and snow conditions during February 2001. A total of 16 moose were observed during 1 hour of flying, enumerating 11 cows, 3 bulls, and 2 calves. Additional track distribution in fresh snow suggested the total moose population is 35-50 moose within the Alaska portion of the drainage.

A survey during February 2000 along the Chickamin drainage under ideal survey conditions confirmed there are no moose remaining in the area.

Distribution and Movements

Moose are not restricted from moving between Canada and the United States along mainland drainages. However, moose have never been marked or collared in this area, and consequently we know little about their seasonal movement along the Unuk. Some of the best habitat along the Unuk River occurs upstream in Canada and likely supports a significant number of moose outside of Unit 1A. There are no geographical barriers in this area and consequently some of the moose undoubtedly move freely between the borders.

MORTALITY

HARVEST

Season and bag limit	Resident and nonresident hunters
Unit 1A	15 Sep–15 Oct (General hunt only)
One bull by registration permit only	
Unit 2	No open season.

Board of Game Actions and Emergency Orders. No regulatory changes were made by the Board of Game during this report period. However, the Federal Subsistence Board adopted a regulation during its 2002 meeting that extends the moose season in Unit 1A by 9 days. The regulation took effect September of 2003 and allows federally qualified hunters to take one moose during 6 September–15 October.

Hunter Harvest. The Unit 1A 8-year mean harvest is 3 bulls (Table 1). Three moose were harvested during 2001, and 2 were taken in 2002. The average antler spread for the 3 bulls in 2001 was 30 inches. In 2002 the average antler spread was 28 inches.

Permit Hunts. During fall 2001, 40 individuals obtained Unit 1A moose registration permits, of which 25 hunted (Table 1). Similarly in 2002, 45 hunters registered and 28 hunters reported going afield. This was similar to the long-term average ($\bar{x}$ = 23, range 20–45).

Hunter Residency and Success. Unit 1A moose hunters continue to be primarily Ketchikan and Metlakatla residents. Several of these hunters own cabins on the Unuk River. During this report period all successful hunters were Ketchikan residents (Table 2). Total hunter days were much lower during this report period than previous years, probably due to poor weather conditions during the hunting seasons.

Harvest Chronology. The 3 moose harvested during 2001 were taken during the first week of the season. However, during 2002 the harvest was split between the second and fourth week of the season (Table 3).

Transport Methods. Most hunters used boats to access the Unuk River in 2001 and 2002 (Table 4). Several hunters typically use small aircraft to locate moose from the air the day before hunting, but use boats to access the hunting area.

OTHER MORTALITY

The extent of wolf, black bear, and brown bear predation on adult and calf moose in Unit 1A is unknown.

CONCLUSIONS AND RECOMMENDATIONS

Access is difficult to the small Unit 1A moose population on the Unuk River drainage and the hunt attracts only a few hunters, most of whom are local residents. Due to limited suitable habitat, carrying capacity is low. Most moose harvested are young bulls with relatively small antlers, which have historically averaged about 30 inches in width. Hunter harvest is not a likely factor in limiting this moose population. Winter weather, snow conditions, and abundant predators including both black and brown bears and wolves are likely limiting the moose population. Consequently, we do not expect moose numbers to exceed current levels.

The Unit 1A registration permit provides accurate hunt-based data. The hunter harvest has been average while hunter effort during this report period was lower compared to recent years. Poor weather and the slowly declining economy in southeast Alaska are likely to blame for the low hunter effort along the Unuk.

We will continue to gather information about this moose population, and we anticipate additional proposals to the Federal Subsistence Board to further favor federally qualified rural residents.

We will continue to document Unit 2 moose sightings, and we recommend that Unit 2 remain closed to moose hunting.

LITERATURE CITED

BURRIS, O.E. 1964. Alaska wildlife stocking. Alaska Department of Fish and Game, Federal Aid in Wildlife Restoration Progress Report. Project W-11-D-1, Juneau.

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Please cite any information taken from this section, and reference as:

Porter, B. 2004. Unit 1A and 2 moose management report. Pages 1–8 *in* C. Brown, editor. Moose management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

Table 1 Unit 1A moose harvest data by permit hunt, regulatory years 1993 through 2002

Hunt	Year	Permits issued	Did not hunt	Unsuccessful hunters	Successful hunters	Harvest Males	(%)	Females	(%)	Unk	(%)	Total harvest
RM022	1993	62	17	42	3	3	(100)	0	(0)	0	(0)	3
	1994	81[a]	33	41	6	6	(100)	0	(0)	0	(0)	6
	1995	78	33	43	2	2	(67)	1[b]	(33)	0	(0)	3
	1996	63	27	32	4	4	(100)	0	(0)	0	(0)	4
	1997	59	27	28	4	4	(100)	0	(0)	0	(0)	4
	1998	53	24	26	3	3	(100)	0	(0)	0	(0)	3
	1999	34	14	19	1	1	(100)	0	(0)	0	(0)	1
	2000	51	24	26	1	1	(100)	0	(0)	0	(0)	1
	2001	40	15	22	3	3	(100)	0	(0)	0	(0)	3
	2002	45	17	21	2	2	(100)	0	(0)	0	(0)	2
	Average	54	23	30	3	3	(100)	0	(0)	0		3

[a] One permit not returned
[b] Illegal cow kill

Table 2 Unit 1A moose hunter residency and success, regulatory years 1993 through 2002

Year	Successful					Unsuccessful					
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Total hunters
1993	3	0	0	3	(7)	39	3	0	42	(93)	45
1994	4	2	0	6	(13)	39	2	0	41	(87)	47
1995	2	2	0	2	(4)	36	6	1	43	(96)	45
1996	4	0	0	4	(11)	27	5	0	32	(89)	36
1997	3	1	0	4	(13)	27	1	0	28	(87)	32
1998	3	0	0	3	(10)	24	2	0	26	(90)	29
1999	1	0	0	1	(5)	16	3	0	19	(95)	20
2000	1	0	0	1	(4)	26	0	0	26	(96)	27
2001	3	0	0	3	(12)	22	0	0	22	(88)	25
2002	2	0	0	2	(4)	34	9	0	43	(96)	45
Average	3	1	0	3	(8)	29	3	0	32	(92)	35

[a] Local resident hunters reside in Unit 1A.

Table 3 Unit 1A moose harvest chronology, regulatory years 1993 through 2002

Year	15–21 Sept	(%)	22–28 Sept	(%)	29 Sept–5 Oct	(%)	6–15 Oct	(%)	*n*
1993	0	(0)	0	(0)	1	(33)	2	(67)	3
1994	1	(17)	1	(17)	0	(0)	4	(66)	6
1995	1	(50)	0	(0)	1	(50)	0	(0)	2
1996	2	(50)	0	(0)	0	(0)	2	(50)	4
1997	1	(25)	0	(0)	2	(50)	1	(25)	4
1998	2	(67)	0	(0)	0	(0)	1	(33)	3
1999	1	(100)	0	(0)	0	(0)	0	(0)	1
2000	1	(100)	0	(0)	0	(0)	0	(0)	1
2001	3	(100)	0	(0)	0	(0)	0	(0)	3
2002	0	(0)	1	(50)	0	(0)	1	(50)	2
Average	1	(51)	0	(3)	0	(13)	1	(19)	3

Table 4 Unit 1A moose harvest percent by transport method, regulatory years 1993 through 2002

Year	Harvest percent by transport method										
	Airplane	(%)	Boat	(%)	Highway vehicle	(%)	Off-road vehicle	(%)	Unk	(%)	*n*
1993	1	(33)	2	(67)	0	(0)	0	(0)	0	(0)	3
1994	1	(17)	5	(83)	0	(0)	0	(0)	0	(0)	6
1995	0	(0)	2	(100)	0	(0)	0	(0)	0	(0)	2
1996	1	(25)	3	(75)	0	(0)	0	(0)	0	(0)	4
1997	0	(0)	4	(100)	0	(0)	0	(0)	0	(0)	4
1998	2	(67)	1	(33)	0	(0)	0	(0)	0	(0)	3
1999	0	(0)	1	(100)	0	(0)	0	(0)	0	(0)	1
2000	0	(0)	1	(100)	0	(0)	0	(0)	0	(0)	1
2001	0	(0)	3	(100)	0	(0)	0	(0)	0	(0)	3
2002	0	(0)	2	(100)	0	(0)	0	(0)	0	(0)	2
Average	1	(14)	2	(46)	0	(0)	0	(0)	0	(0)	3

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 1B (3000 mi^2)

GEOGRAPHIC DESCRIPTION: Southeast Alaska mainland, Cape Fanshaw to Lemesurier Point

BACKGROUND

HABITAT DESCRIPTION

Isolated populations of moose (*Alces alces*) occur in Unit 1B and are believed to be the *andersonii* subspecies. They migrated from interior British Columbia via the Coast Range and the Stikine River valley around the turn of the 20th century.

Moose occur in several areas of Unit 1B, with concentrations near Thomas Bay and along the Stikine River. Suitable habitat adjacent to Bradfield Canal has not been colonized, but moose do occur around Virginia Lake, Mill Creek, and Aaron Creek. LeConte Glacier and Bay divide Unit 1B for moose management purposes north and west of the Stikine River.

The Thomas Bay moose population is isolated from populations in Canada by the Coast Mountains. These moose occupy an area that was heavily logged from the late 1950s through the early 1970s. The Thomas Bay moose population may decline significantly as conifer regrowth in clearcuts matures and reduces forage production.

Moose inhabiting the Alaska portion of the Stikine drainage represent the westernmost tip of a mainland population emanating from Canada. The Alaska portion of this population was estimated at 300 animals in 1983 (Craighead et al. 1984). Since 1983 most winters have been mild and the moose population, based on harvest records and subjective impressions, appeared to increase until 1989.

HUMAN USE HISTORY

Moose are indigenous but recently established in Unit 1B. Since the mid-20th century, isolated populations of moose on the American side of the Stikine River valley and at Thomas Bay have been hunted for food and trophies.

Regulatory history

From 1959 to present, the Stikine River moose season has generally been from 15 September through 15 October with a one-bull limit. From 1972 to 1974, however, the harvest of antlerless moose was allowed by permit only. From 1990 to 1992 a harvest ticket was required to hunt moose on the Stikine, and since 1993 a registration permit (RM038) has been required. Antler restrictions were implemented on the Stikine in 1995, defining a legal bull as having a spike-fork, 50-inch antler spread, or 3 or more brow tines on at least 1 side.

From 1959 to 1981 the Thomas Bay season was bulls-only and typically 31 days long, 15 September through 15 October. Since 1978 the use of motorized land vehicles to hunt moose has been prohibited at Thomas Bay. From 1980 to 1994 the moose season was from 1 through 15 October. Since 1984 a registration permit has been required to hunt moose, and antler restrictions were implemented defining a legal bull as having a spike, fork, or at least 50-inch antlers. In 1993 the antler restriction was amended to include bulls with 3 or more brow tines on at least 1 side. Since 1995 the season has been 15 September through 15 October.

Action by the Board of Game effective 1 July 1995 put all of Units 1B and 3 and that portion of Unit 1C south of Point Hobart under one registration permit hunt (RM038). A legal moose for this registration permit hunt is a bull with spike/fork or 50-inch antlers or 3 brow tines on at least 1 antler.

Historical harvest patterns

Average annual harvest of Stikine River moose from 1952 through 1959 was 26. During the 1960s the average harvest was 28, during the 1970s it was 26 and in the 1980s it was 39. The 1971 and 1972 harvests included 18 and 22 cows, respectively. During the 1990s the average annual harvest was 18; however, in 1994 the moose season was closed by emergency order in that portion of Unit 1B south of LeConte Bay and Glacier due to a lack of mature breeding bulls in the population, and in 1995 the last week of the season (the first year antler restrictions were implemented on the Stikine River) was closed by emergency order due to the high percentage of illegal moose taken.

The average annual harvest of bulls from Thomas Bay during the 1950s was 5, in the 1960s it was 8, in the 1970s it was 10, in the 1980s it was 18, and in the 1990s the annual harvest of bulls was 21. A scarcity of calves prompted closure of the season in 1982 and 1983.

Historical harvest locations

The vast majority of moose harvested in the unit are taken either from in the Stikine River drainage or at Thomas Bay. In recent years the distribution of moose in Unit 1B appears to be expanding, fed by source populations on the Stikine and at Thomas Bay.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The following moose management objectives for Unit 1B are based on biological data and input from the public.

Stikine River

	Plan Objective	2001	2002
Post-hunt numbers	300	N/A	N/A
Annual hunter kill	30	17	15

Number of hunters	250	168	145
Hunter-days of effort	1,750	1,198	1,290
Hunter success	12%	10%	8%

Thomas Bay

	Plan Objective	2001	2002
Post-hunt numbers	200	N/A	N/A
Annual hunter kill	20	15	11
Number of hunters	160	113	113
Hunter-days of effort	675	794	788
Hunter success	12%	13%	13%

METHODS

Late winter surveys were flown along the Stikine River valley. Hunters and harvested moose were checked in the field during the Stikine River and Thomas Bay hunts. Field data were used to reconcile written hunter reports. Since 1997 hunters in Unit 1B have been asked on registration permits to report the number of moose (by sex and age class), wolves, and bears they observed during the hunting season.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In 1983 the Stikine River population was estimated at 300 moose and increasing (Craighead, et al. 1984). Post-1983 harvest levels and subjective impressions suggested the Stikine population slowly increased and then began to decrease in 1988. The percentage of calves surviving to late winter declined from 1980 to 1989 and remained low until 1994. In 1995, 1996, and 1998 the percentage of calves surviving to late winter increased to 18%, 22%, and 24%, respectively (Table 1). Hunters took 57 bulls in 1988, and the kill dropped each succeeding year to a low of 3 in 1994 (taken under a federal permit; the state season was closed by emergency order in 1994).

The Thomas Bay population was estimated at 180 moose in the late 1970s (ADF&G files, Petersburg). Based on anecdotal reports and observed habitat utilization the current population is probably larger.

The Thomas Bay population in northern Unit 1B now appears to be stable at a high density. The Stikine River population, although increasing from 1994 through 1999, now appears to be stable and at moderate density.

Population Composition

Table 1 shows the results of all Stikine River valley surveys since 1991. Dense coniferous forest, variable snowfall, and inclement weather make adequate surveys difficult. No attempt was made to differentiate between bulls and cows, but adults and calves were differentiated during late winter aerial surveys.

Information on the number of moose observed by hunters on registration hunt reports provides some of the limited information on population composition in the unit. In 2001 a total of 281 hunters reported observing a total of 2049 moose in Unit 1B, including 802 bulls, 889 cows, and 358 calves, for a bull-to-cow ratio of 90:100, and a calf-to-cow ratio of 40:100. In 2002, 258 hunters reported observing a total of 1252 moose, including 466 bulls, 494 cows, and 292 calves, for a bull-to-cow ratio of 94:100, and a calf-to-cow ratio of 59:100.

Distribution and Movements

Moose have been observed crossing Dry Straits between Farm Island on the Stikine River delta and Mitkof Island. At low tide this strait can be crossed easily and moose are reported to move in both directions. Radio telemetry of Stikine moose found no evidence of extensive seasonal migration (Craighead et. al., 1984). Rutting surveys in 1995 and 1996 identified Dry Wash, Andrew Island, and Barnes Lake as important rutting areas on the Stikine River. Moose appear to be well distributed in the Alaska portion of the Stikine River valley and Thomas and Farragut bays. Moose seem to be absent from the Bradfield Canal area, although several river valleys appear to have suitable habitat.

MORTALITY

Harvest

Season and Bag Limit	Resident and nonresident hunters
Unit 1B	15 Sep–15 Oct (General hunt only except in Stikine Drainage)
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on 1 side by registration permit only	

Game Board Actions and Emergency Orders. No Board of Game actions were taken or emergency orders issued regarding Unit 1B moose during the report period.

Hunter Harvest. In 2001 the unitwide harvest was 32 moose and in 2002 it was 26. In 2001, 168 hunters harvested 17 moose on the Stikine portion of Unit 1B. In 2002, 145 hunters harvested 15 moose in the Stikine River drainage (Table 2). In 2001, 113 hunters (Table 3) harvested 15 moose at Thomas Bay, including 2 from Farragut Bay. In 2002, 113 hunters harvested 15 moose at Thomas Bay, including 3 from Farragut Bay.

Hunter Residency and Success. During this report period, 100% of all successful hunters on the Stikine River were Petersburg or Wrangell residents (Table 4). The overall success rate for Stikine River moose hunters was 10% in 2001 and 8% in 2002.

Petersburg residents continued to dominate the Thomas Bay and Farragut Bay moose hunts (Table 5). During this report period, 100% of all successful hunters at Thomas Bay and Farragut Bay were Petersburg residents. The overall success rate for Thomas Bay and Farragut Bay moose hunters was 13% in 2001 and 2002.

Harvest Chronology. Harvest chronology for Unit 1B moose has varied. In general, most bulls are killed during the first half of the season and the success rate declines throughout the season (Table 6). In 2001, the largest percentage of the annual harvest at Thomas Bay occurred during the fourth and first weeks of the season, respectively. The largest percentage of the annual harvest on the Stikine occurred during the fourth and first weeks of the season, respectively.

In 2002 the largest percentage of the annual harvest at Thomas Bay occurred during the first and third weeks of the season, respectively. The largest percentage of the annual harvest on the Stikine occurred during the first week followed by third and fourth weeks, which had identical harvests. Most hunters are in the field early in the season, and except for weekends, effort tends to drop off as the season progresses. Inclement weather does not appear to slow hunting effort early in the season.

Guided Hunter Harvest. No guided hunts are currently offered in the unit.

Transport Methods. With the exception of one hunter who reported using an airplane for access, during the report period all successful Unit 1B hunters reported using boats to reach the areas they hunted (Table 7). Motorized land vehicles are prohibited for moose hunting in the Thomas Bay hunt and the Stikine Wilderness. Motorized land vehicles may be used in Thomas Bay for any purpose except moose hunting.

Other Mortality

Wolves, black bears, and brown bears are moose calf predators, and wolves and brown bears take adult moose. The extent of predation on these moose herds is unknown, but it appears that in some years few calves are recruited into the Stikine herd.

HABITAT

Assessment

Moose populations at Thomas Bay responded favorably to the initial increase in available browse resulting from extensive clearcut logging between 1958 and 1975. Since that time the dense, closed-canopy forests resulting from natural regeneration of second growth stands has reduced available understory browse vegetation.

In 1991 the U.S. Forest Service (USFS) cleared a 100-acre plot along the Patterson River to investigate the feasibility of improving moose habitat. Regrowth has been browsed heavily during the summer, leaving little winter forage in this area.

Stikine River moose range lies mostly within the USFS Stikine/LeConte Wilderness area and the Stikine drainage. Moose habitat in this area, identified by Craighead et. al. (1984), is designated wilderness and cannot be artificially manipulated for improvement. Nineteen transects were surveyed in 1984 to determine the condition and availability of moose winter browse in the

Stikine River corridor (Craighead et. al. 1984). The transects were revisited in June 1991 and in June 1997. Preferred browse species were identified as willow (*Salix* spp.) and red osier dogwood (*Cornus stolonifera*). The total percent of available browse that was heavily utilized in June 1997 included 62.2% *Salix* spp. and 63.9% *Cornus* spp. (Elze and Posner 1997). In 1991 the percentage in the heavy use category was 15.8% for *Salix* spp. and 13.8% for *Cornus* (Stoneman 1992). In 1997 the majority of plants recorded were in the heavily used category compared to 1991 when most plants were in the zero to moderately used categories (Stoneman 1992).

In April 2003 the area biologist accompanied Region I research staff to Thomas Bay and the Stikine River to conduct preliminary assessments of browse utilization. A visual assessment of browse conditions at Thomas Bay revealed excessively high utilization rates, indicating that moose may be at carrying capacity. Browse utilization on the Stikine River appeared to be less intense indicating that moose are probably below carrying capacity along the river corridor.

Enhancement

It is estimated that precommercial thinning of second-growth stands will extend the habitat value of clearcuts for an estimated 20–30 years. In March 1997 ADF&G implemented a plan to enhance moose habitat on state land at Thomas Bay. Phase 1 of the plan called for reopening 10 miles of logging roads that were impassable due to dense vegetative growth and downed trees. Road-clearing operations were completed in June 1998. Phase 2 of the plan called for treating 380 acres of dense second growth primarily by precommercial thinning and partial strip clearing. The thinning of 4 second-growth units totaling 380 acres was completed in October 1998.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Thomas Bay moose populations responded favorably to the initial increase in available browse resulting from extensive clearcut logging between 1958 and 1975, but the dense, closed canopy forests caused by the natural regeneration of second-growth stands is decreasing the amount of available browse. As a result the quality of the habitat has been declining. The loss of habitat and the resulting decline in available food is of great concern to biologists and hunters. Left untreated, the young, second-growth conifer stands will shade and eventually eliminate understory browse vegetation, further reducing moose-carrying capacity. The only way to prevent further decline of moose habitat will be to institute habitat manipulation procedures.

For genetic or environmental reasons moose in the unit do not develop antler configurations that are predictable relative to age; therefore, some modification of the existing antler restrictions may be justified. Moose in the unit rarely achieve 50-inch antler spreads, and in Thomas Bay in particular the population appears to contain a surplus of sublegal bulls in excess of that needed to ensure timely breeding of cows.

CONCLUSIONS AND RECOMMENDATIONS

None of the Stikine management objectives were met in 2001 and 2002. Hunter-days of effort decreased from the previous report period. Hunter success was only slightly below the management objective in 2001 but fell well short of the objective in 2002. We believe the Stikine moose population was increasing from 1994 until 1999, but it now appears to be stable at moderate density.

During this report period, the Thomas Bay moose harvest was below the management objective. The number of hunters increased slightly from the previous report period but still failed to meet the management objective in either 2001 or 2002. Hunter-days of effort also increased from the previous report period, and exceeded the objective during this report period. 2001 and 2002. Hunter success exceeded the management objective in both 2001 and 2002. The Thomas Bay moose population currently appears stable at a high level.

We recommend Units 1B and 3, and the extreme southern portion of Unit 1C continue to be managed by a common registration permit hunt. We also recommend that for the time being, the season dates remain from September 15 through October 15 with a bag limit of one bull with spike/fork or 50" antlers or at least 3 brow tines on one antler. Because moose found in Units 1B and 3 do not display antler characteristics that are predictable relative to age, some modification of the existing antler restrictions or lengthening of the season may be justified in the future.

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Table 1 Unit 1B Stikine area aerial moose surveys, regulatory years 1991 through 2002

Yr month/day	Adults	Calves	(%)	Unidentified	Total moose	Moose/hour
1991						
03/03[c]	6	0	(0)	0	6	18
1992						
12/19[a]	59	12	(16)	2	73	21
03/25[a]	73	7	(9)	0	80	34
1993						
02/10[a,d]	46	4	(8)	0	50	39
1994						
03/02	34	0	(0)	0	34	
04/08	30	1	(3)	0	31	
1995						
02/25	76	17	(18)	0	93	26
1996						
3/08	122	35	(22)	0	157	47
1997						
	No data	-	-	-	-	-
1998						
2/24	103	32	(24)	0	135	44
1999	No data					
2000						
2/17[e]	2	2	(50)	0	4	4
3/22	9	2	(18)	0	11	8
6/11	11	7	(39)	0	18	9
2001						
2/7	3	2	(40)	3	8	8
2002						
3/14[f]	71	5	(7)	0	76	31
6/16	21	8	(38)	0	29	19

[a] Helicopter survey.
[b] River stage high, full leaf out in lower river, moose not visible.
[c] Helicopter survey aborted due to weather.
[d] Farm Island to 15 Mile Island only, then abandoned due to weather.
[e] Poor survey conditions on lower river, US/Canada boarder to Kakwan Point only
[f] Some older calves may have been classified as adults

Table 2 Unit 1B (Stikine) moose harvest, regulatory years 1991 through 2002

Year	Hunter harvest reported					
	M	(%)	F	(%)	Unk.	Total
1991	24	(96)	1	(4)	0	25
1992	18	(95)	1	(5)	0	19
1993	14	(100)	0	(0)	0	14
1994[a]	3	State season closed by	emergency order			3
1995	5	(100)	0	(0)	0	5
1996	18	(100)	0	(0)	0	18
1997	17	(100)	0	(0)	0	17
1998[b]	24	(100)	0	(0)	0	24
1999	20	(100)	0	(0)	0	20
2000	14	(100)	0	(0)	0	14
2001	17	(100)	0	(0)	0	17
2002	15	(100)	0	(0)	0	15

[a] Taken under federal permits; state season closed by emergency order.

[b] Includes 1 DLP and 2 illegal kills.

Table 3 Unit 1B (Thomas and Farragut bays) moose harvest, regulatory years 1991–2002

Year	Hunter harvest reported						
	M	(%)	F	(%)	Illegal	Unk.	Total
1991	15	(100)	0	(0)	0	0	15
1992	27	(96)	1	(4)	1	0	28
1993	27	(100)	0	(0)	0	0	27
1994	11	(100)	0	(0)	0	0	11
1995[a]	15	(100)	0	(0)	0	0	15
1996[b]	24	(94)	1	(6)	0	0	25
1997	18	(100)	0	(0)	0	0	18
1998	24	(100)	0	(0)	1	0	24
1999	20	(100)	0	(0)	2	0	20
2000	6	(100)	0	(0)	0	0	6
2001	14	(100)	0	(0)	1	0	15
2002	10	(100)	0	(0)	1	0	15

[a] Includes one moose harvested in Port Houghton.

[b] Includes DLP.

Table 4 Unit 1B (Stikine) moose hunter residency and success, regulatory years 1991 through 2002

	Successful						Unsuccessful						
Year	Local[a] resident	Nonlocal resident	Non-resident	Unk.	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Unk.	Total	(%)	Total hunters
1991[b]		1	1	0	25	(12)	146	34	5	5	190	(88)	215
1992	16	2	0	1	19	(8)	183	24	3	1	211	(92)	229
1993	14	0	0	0	14	(10)	121	6	0	0	127	(90)	141
1994[c]	23	State season closed by emergency order			3								
1995	5	0	0	0	5	(4)	91	6	0	0	97	(96)	102
1996	18	0	0	0	18	(14)	105	7	0	0	112	(86)	130
1997	16	1	0	0	17	(12)	117	8	0	0	125	(88)	142
1998	23	1	0	0	24	(13)	154	9	0	0	163	(87)	187
1999	18	2	0	0	20	(11)	147	18	0	0	165	(89)	185
2000	13	1	0	0	14	(8)	137	12	2	0	151	(92)	165
2001	17	0	0	0	17	(10)	134	14	3	0	151	(90)	168
2002	11	0	0	0	11	(8)	126	7	1	0	134	(92)	145

[a] Residents of Petersburg and Wrangell.

[b] Unsuccessful hunter data expanded to correct for nonreporting hunters.

[c] Three moose taken under federal permits.

Table 5 Unit 1B (Thomas and Farragut bays) moose hunter residency and success, regulatory years 1991 through 2002

Year	Successful					Unsuccessful					
	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Total hunters
1991[b]	14	1	0	15	(12)	96	12	0	108	(88)	123
1992[b]	25	2	1	28	(25)	77	6	0	83	(75)	111
1993[b]	26	1	0	27	(20)	103	4	1	108	(80)	135
1994	11	0	0	11	(9)	108	9	0	117	(91)	128
1995	14	1	0	15	(11)	108	8	0	116	(89)	131
1996	23	2	0	25	(16)	107	15	1	123	(84)	148
1997	18	0	0	18	(12)	116	11	1	128	(88)	146
1998	23	1	0	24	(19)	91	12	0	103	(81)	127
1999[c]	19	1	0	20	(19)	79	8	0	87	(81)	107
2000	6	0	0	6	(6)	91	5	2	98	(94)	104
2001[b]	15	0	0	15	(13)	92	5	1	98	(87)	113
2002	15	0	0	15	(13)	90	8	0	98	(87)	113

[a] Residents of Petersburg and Wrangell.

[b] Includes illegal kill.

[c] Includes 2 illegal kills.

Table 6 Unit 1B moose harvest chronology, regulatory years 1993–2002

Area	Year	15–21 Sept.	22–28 Sept.	29 Sept.–5 Oct.	6–15 Oct.
Thomas Bay	1993	0	0	19	8
	1994	0	0	9	2
	1995	8	3	2	2
	1996	11	5	3	6
	1997	5	4	6	3
	1998	9	6	5	4
	1999	5	4	7	4
	2000	3	2	1	0
	2001	3	2	2	8
	2002	7	1	4	3
Stikine	1993	5	1	4	4
	1994	State season closed by emergency order			
	1995	3	1	0	1
	1996	6	6	2	4
	1997	7	3	3	4
	1998	12	5	3	4
	1999	6	3	4	7
	2000	3	1	5	5
	2001	6	2	2	7
	2002	6	1	2	2

Table 7 Unit 1B successful moose hunter transport methods by area, regulatory years 1991–2002

Area	Year	Airplane	Boat	Highway vehicle	3- or 4-wheeler	Horse	Other	Total
Thomas Bay	1991	1	14	0	0	0	0	15
	1992	0	27	0	0	1	0	28
	1993	4	23	0	0	0	0	27
	1994	1	9	0	0	0	1	11
	1995	3	11	1	0	0	0	15
	1996	0	25	0	0	0	0	25
	1997	0	18	0	0	0	0	18
	1998	2	22	0	0	0	0	24
	1999	1	18	0	0	0	1	20
	2000	0	6	0	0	0	0	6
	2001	0	15	0	0	0	0	15
	2002	0	11	0	0	0	0	11
Stikine	1994		state season closed by EO					
	1995	0	5	0	0	0	0	5
	1996	2	16	0	0	0	0	18
	1997	0	17	0	0	0	0	17
	1998	2	22	0	0	0	0	24
	1999	0	20	0	0	0	0	20
	2000	0	14	0	0	0	0	14
	2001	1	16	0	0	0	0	17
	2002	0	14	0	0	0	0	15

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 1C (7600 mi^2)

GEOGRAPHICAL DESCRIPTION: That portion of the Southeast Alaska mainland from Cape Fanshaw to the latitude of Eldred Rock.

BACKGROUND

Moose are relative newcomers to many parts of Southeast Alaska, with many of the populations becoming established in the early to mid 1900s. Some areas, such as the Gustavus Forelands, did not have moose present until the 1960s. It is likely that coastal mountains inhibited the movement of moose into these areas. Once moose discovered these unexploited areas, the presence of high quality habitat led to rapid expansions of new populations. In 3 of the 4 moose management areas in this subunit, moose moved in naturally, while in one area they were introduced.

Taku River: The arrival date of moose in the Taku River drainage is not documented, but Swarth (1922) states that a moose was killed at the mouth of the Stikine River "some years" prior to 1919. If moose appeared at the same time on the Taku (which is a reasonable assumption given the proximal location and similar ecological makeup), then presumably they first occurred in the lower part of the river near the turn of the century. In 1960, ADF&G biologists observed 38 moose along the Taku River, and 27 moose were harvested there that year. Based on communications with Canadian biologists who conduct aerial surveys in the upper Taku, it appears likely that moose from Alaska migrate into Canada during winter. This explains the low winter aerial survey numbers we see on the Alaska side of the border.

Moose occur on the Whiting and Speel rivers south of the Taku. These animals may have originated from the Taku herd, or may have migrated into the Whiting drainage from the Canadian mainland. In recent years moose and their sign have been seen regularly in the Port Houghton area. These moose probably moved across the Fanshaw Peninsula from the Farragaut Bay/Thomas Bay population to the south.

Berners Bay: This moose population is one of the most popular herds to hunt in the Juneau area, but did not occur naturally. Fifteen calves from the Anchorage area were released in Berners Bay in 1958, and a supplemental release of 6 more calves occurred in 1960. In June 1960, 3 cows with a single calf each were observed, indicating that cows had bred at about 16 months of age. The first limited open season was held in 1963, when 4 bulls were killed. Since that time, the annual harvest has ranged from 5 to 23 animals. Managing the Berners Bay moose herd has been a challenging task for ADF&G. The geography of the area allows for little to no immigration or emigration, resulting in a closed population with limited habitat. Because of this, ADF&G has used a variety of hunts, changing the harvest from bulls only to bulls and cows, in an attempt to balance the herd's sex ratio and limit the population size within the carrying capacity of the habitat. The use of a habitat capability model as well as moose browse surveys in the early 1980s helped shape the present management strategy of keeping the post-hunt population at no more than 90 moose observed during aerial surveys to assure the herd does not exceed a level the habitat can support.

Chilkat Range: Moose were first documented in western Unit 1C in 1962 on the Bartlett River. In 1963 moose were observed in the Chilkat Mountain range; these animals probably originated from the Chilkat Valley population near Haines. In 1965 moose were sighted for the first time along the Endicott River and St. James Bay areas. Moose probably followed the Endicott River to Adams Inlet shortly thereafter, because they were common in Adams Inlet by the 1970s. Because of thick timber stands along the Endicott and the difficulty of gathering reliable aerial survey data, our understanding of the Chilkat Range moose population is mostly limited to hunter reports and hunter harvest.

Gustavus Forelands: The first sightings of moose in the Gustavus area occurred in 1968. It is likely moose migrated to this area via the Excursion River drainage. Twenty years passed before the first moose was harvested at Gustavus in 1988, evidence that moose took a while to populate this area. Since then, the population has expanded rapidly to become the largest in the unit, accounting for the highest harvest. The number of animals in this herd has reached a level that is not sustainable, given limited winter range. Because of this concern ADF&G began a moose browse study on the forelands in 1999, and used resultant data to convince the Board of Game in 2000 to adopt a drawing permit hunt for cow moose.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

In 1998 we revised Unit 1C moose management objectives based on recent hunt and survey information. We separated the Gustavus Forelands herd from moose in the remainder of the Chilkat Range because of its discrete nature. Below is a list of the newly drafted management objectives:

1. Taku drainage: Maintain a post-hunting population of 100 moose, an annual harvest of 10, and a hunter success rate of 20%;
2. Berners Bay: Maintain a post-hunting population of 90 moose, an annual harvest of 18, and a hunter success rate of 90%;
3. Chilkat Range: Maintain a post-hunting population of 200 moose, an annual harvest of 20, and a hunter success rate of 22%;
4. Gustavus Forelands: Maintain a population of 250, an annual harvest of 40, and a hunter success rate of 33%.

METHODS

Aerial surveys were conducted throughout most of the subunit during the report period. Survey flights were accomplished both years at Berners Bay and the Gustavus Forelands, but no surveys were flown of the Taku River. One registration permit hunt (RM046) and 3 drawing permit hunts (DM041, DM042 and DM043) were used to manage moose hunting effort in Unit 1C. Berners Bay moose were managed under one bull-only hunt and a separate antlerless hunt. The remainder of Unit 1C (excluding that area south of Pt. Hobart) was managed under the RM046 registration permit hunt for bull moose, and a draw permit (DM043) for cow moose at Gustavus. Since 1995, the area south of Pt. Hobart has been included in the antler-restriction hunt conducted in Units 1B and 3 (RM038), and all moose taken there were included in the management report covering those areas. A condition of all drawing and registration hunts required successful hunters to bring in incisors from harvested moose for aging. Other data collected from the permit hunt reports included the hunt length, hunter residency, hunt location, commercial services used, and transport means (for all hunters), and date of kill (for successful hunters).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Taku: Little information is available regarding the number of moose in the Taku River drainage. A winter 2000 aerial survey enumerated 37 moose (Table 1), but the fall 2000 harvest of 23 moose was the highest since 26 moose were killed in 1985. We have never counted many moose along the Alaska portion of the Taku, suggesting that the main wintering area for these moose is in Canada. In spite of our low survey numbers, hunters have had reasonable success hunting moose on the Taku. It is likely that most moose harvested along the Taku spend a majority of the year (including winter) in Canada, and animals moving downriver from Canada during the hunting season supplement the local population. Some of the Alaska harvest undoubtedly comes from across the border, but we cannot quantify this illegal take. Aerial surveys conducted by Canadian biologists along the lower Tulsequah River in Canada during February 2000 enumerated 213 moose, with a bull to cow ratio of 98:100. If we consider these animals as part of the same population that are hunted along the Alaska portion of the Taku River, then our present harvest objectives for the Taku appear sustainable. Recently there has been no harvest on the lower Taku in Canada (Karen Diemert, personal communication). South of the Taku River on the Alaska mainland, a few moose have been harvested in the Port Houghton area over the years. These moose are an extension of the population using Thomas and Farragut bays south of the Fanshaw Peninsula, and are distinct from other Unit 1C moose populations. Most of the effort directed at Port Houghton moose comes from Petersburg.

Berners Bay: The Berners Bay moose population appears to be near the estimated carrying capacity, between 100 and 150 animals, and is being maintained with selective harvests to adjust the bull to cow ratio (Table 1). Berners Bay surveys in 2001 and 2002 enumerated 66 and 58 moose, respectively. The 2002 count was one of the lowest in the last 12 years, and the low number of calves (4) was reason for concern. This contrasts sharply with the 1999 survey of 108 animals that was the highest in recent history. This high survey count was more likely due to ideal survey conditions than to a large increase in moose numbers. Since 1993 we have issued up to 20 drawing permits annually for Berners Bay, with the number and sex of moose to be taken determined by aerial survey results.

Chilkat Range: The status of the Chilkat Range moose population is unknown, as surveys have not been conducted due to limited snow cover and dense forest canopy. We did conduct a survey of the upper Endicott River and Adams Inlet in 2000 (Table 1) and counted 125 moose, but nearly all of these animals were in Glacier Bay National Park (GBNP). Moose in the Adams Inlet area of GBNP likely cross Endicott Gap and move to the Endicott River during the spring and summer, supplementing the herd along the west side of Lynn Canal. How many of these animals are available to hunters on non-park lands is unknown. Based on harvest records and anecdotal information from hunters, the number of moose in the Chilkat Range appears to be stable.

Gustavus Forelands: Based on winter aerial surveys during 1999–2002, the Gustavus Forelands moose population appears to be steadily increasing (Table 1). Both the total number of moose and the number of calves in the herd indicate a rapidly expanding population. Although habitat conditions due to isostatic rebound on lands where glaciers have recently retreated have stimulated moose productivity, the moose population has reached a density that we believe is unsustainable given the small amount of winter habitat.

Population Composition

We only conducted thorough aerial surveys of 2 of the 4 Unit 1C moose populations during the report period and were unable to get reliable composition data in either place. The other surveys provided us with overall moose numbers and a breakdown of adults and calves, but we could not quantify bulls due to the late timing of the surveys and advanced antler drop (Table 1). This is often the case in Southeast Alaska, where adequate snow conditions for observing moose do not usually occur until midwinter. We collected lower jaws from each harvested moose from successful hunters, providing us with the age structure of the harvest (Tables 2 & 3).

Taku: We did not conduct any aerial surveys of the Taku River during this report period. This was due to lack of snow as well as mechanical problems associated with our survey aircraft. The mean age of harvested moose was 2.7 years during the report period, compared to 2.0 years for 1999 and 2000. This continuing harvest of young bulls indicates a healthy population with good recruitment. We will continue our dialogue with Canadian biologists to keep abreast of their aerial survey data from the upper Taku River in Canada.

Berners Bay: A November 1999 aerial survey allowed us to gather fairly reliable composition data. We calculated a bull to cow ratio of 17 bulls to 100 cows, and a calf to cow ratio of 16 calves to 100 cows. The ratio of bulls to cows is the lowest in the last 10 years, but may be partly due to some of the bulls having shed their antlers; 3 bulls were seen during the survey with only one antler. The percent calves in the herd was the second lowest since 1990. The surveys during this report period were both without composition data due to their timing, but we were able to quantify the number of moose and percent calves in the herd. During 2001 fifteen percent of the herd was calves but in 2002 this percent dropped to 7. This was the lowest calf percentage since 1990.

Mean age at harvest of Berners Bay moose was 3.5 years for males and 4.6 years for females during the report period. This compares to a mean age of 4.2 years for males and 2.8 years for females during the previous report period.

Chilkat Range: No aerial surveys were conducted in this area during the report period.

The mean age of harvested moose was 4.4 years, higher than the mean of 2.9 years from the previous report period.

Gustavus Forelands: We conducted aerial surveys in each of the 2 years of the report period. We were unable to gather bull composition information due to antlers being dropped, but we were able to count calves and calculate percent calves in the herd for 2001 and 2002 (22% and 26% respectively).

The mean age at harvest was 2.4 years compared to 2.2 during the previous report period. The harvest of young bulls is a further reflection of a productive moose herd.

MORTALITY

Harvest

Season and bag limits	Resident and nonresident hunters
Unit 1(C), Berners Bay drainages	15 Sep–15 Oct (General hunt only)
1 moose by drawing permit only; up to 30 permits may be issued	
Unit 1(C), that portion south of Point Hobart, including all Port Houghton drainages	15 Sep–15 Oct (General hunt only)
1 bull with spike-fork or 50-inch antlers or antlers with 3 or more brow tines on one side by registration permit only	
Unit 1(C), that portion west of Excursion Inlet and north of Icy Passage	
1 moose per regulatory year, only as follows:	
1 bull by registration permit only: or	15 Sep–15 Oct (General hunt only)

1 antlerless moose by drawing permit only; up to 10 permits may be issued	15 Nov–30 Nov (General hunt only)
Remainder of Unit 1(C)	15 Sep–15 Oct (General hunt only)
1 bull by registration permit only	

Game Board Actions and Emergency Orders. At the fall 2000 Board of Game meeting, the board adopted a department proposal to increase the number of Berners Bay drawing permits from 20 to 30. The board also adopted a proposal to allow ADF&G to implement a drawing hunt for up to 10 cow moose on the Gustavus Forelands beginning in fall of 2001. The board followed this with adoption of a proposal in 2002 to increase the allowable cow harvest at Gustavus to 35. Emergency orders (EOs) were issued to close the season early in the Gustavus area during both years of the report period. In both years the guideline harvest level of 45–50 bulls was met during the first week of October.

Hunter Harvest. The Berners Bay drawing permit hunt was managed for a harvest of 15 moose from 1993 through 1995. In 1996 the take increased to 17 as a result of a Fish and Wildlife undercover operation (Table 4). The permit allocation remained at 15 (8 bulls and 7 cows) for both years of the subsequent report period, but was increased to 18 permits in 1999 (10 bulls and 8 cows) and 20 permits (10 bulls and 10 cows) in 2000. During 2001, 20 permits were issued in the same manner as 2000, but that number was decreased to 15 (8 bulls and 7 cows) in 2002. Hunter success was 82% in 2001 and 64% in 2002. In 2001, hunters with bull permits had a higher success rate (89%) than those with cow permits (75%), and the same held true the following year with 71% success for hunters with bull permits, and only 57% success for cow hunters. The percentage of permittees who hunted was almost identical between bulls and cows with 89% and 88% hunting respectively. The balance of Unit 1C (except for the newly established cow season at Gustavus) was managed under a registration permit, with biologists keeping the kill within a guideline harvest level rather than a strict quota. The Chilkat Range harvest ranged from 6 to 28 from 1990 to 1998 (Table 5), with the 1998 harvest of 28 the highest ever recorded. The 2001 harvest was 12, and in 2002 the harvest was 15. The annual average harvest of 13.5 for this report period was slightly lower than the annual average harvest of 16.5 during the past 10 years.

The Gustavus Forelands bull moose harvest is currently being managed for a harvest of 45-50 bull moose under a registration permit, and 0–10 cow moose under a drawing permit. In both 2001 and 2002 the bull moose season was closed by EO after meeting the guideline harvest level. During the cow hunt in November, all 10 permittees were successful.

The Taku harvest ranged between 6 and 23 from 1991 to 2000. The 1997 harvest of 6 was the lowest in the past 10 years, due to few moose being seen rather than a decline in hunting effort (Table 4). The 2000 harvest of 23 moose was the highest in the past 10 years. This is the highest harvest recorded in the Taku drainage since 1985 when 26 moose were harvested. The annual average harvest of 17 for this report period was slightly higher than the annual average harvest of 15.4 during the past 10 years.

Permit Hunts. Over 1600 applications were submitted during each year of the report period for the Berners Bay drawing permit hunts. The proximity of Berners Bay to Juneau and the high hunter success rate explains the popularity of this hunt. From 1990 to 2000 hunter success exceeded 90% each year, but during this report period the success rate dropped down to 82% and 64% for 2001 and 2002 respectively. An additional 459 people applied for the 10 cow permits for Gustavus during fall 2002, the first year that hunt was held.

Since the registration permit format was implemented for Unit 1C (except Berners Bay, and more recently cow moose at Gustavus), more than 200 permits have been issued annually (Table 4). In 2001, a total of 555 permits were issued, followed by 551 in 2002. The increase in interest stems mainly from the popularity of the Gustavus hunt; roughly 49% of hunting permittees went to Gustavus during this report period. As in most hunts, not all the permittees actually participated in a hunt. In 2001 only 69% of the 555 permittees hunted, while 71% of 555 permittees hunted in 2002.

Hunter Residency and Success. Most moose harvested in Unit 1C continue to be taken by residents of the subunit (Table 6). During the report period, residents of the subunit took 136 of 158 harvested moose, other Alaska residents took 14, and nonresidents took 7. Southeast moose hunting areas are not readily accessible via highway vehicles, and residents from elsewhere in Alaska have better moose hunting opportunities closer to home. Nonresidents eager to take moose focus on areas with larger moose populations and a better chance of getting a trophy animal. Twenty-one percent of all Unit 1C hunters were successful in 2001, and in 2002 the success rate remained relatively stable at 20%. Hunters at Gustavus continued to experience higher success rates during this report period (30%) than did Taku River hunters (20%) or Chilkat Range hunters (15%).

Harvest Chronology. Similar to recent years, the 2001 and 2002 moose harvest was heavily weighted toward the early part of the season. This is partly because nearly all hunters participate on opening day, and hunt less as the season goes on. Also, the Gustavus hunt, that attracts the majority of hunters in the subunit, has been closed by EO in early October during each of the past 2 years thereby ending most moose hunters' seasons. Generally about 30% of the Gustavus Forelands harvest takes place in the first 3–4 days of the hunt.

Transport Methods. The type of transport used by successful hunters varies by hunt area, and difficulties with the logistics of access would be expected.

Taku: In the Taku hunt 97% of successful hunters used boats for access during the current report period (Table 7). Most hunters used boats equipped with jet units to access the upper reaches of the river, then base out private cabins near the Canadian border.

Berners Bay: In Berners Bay all successful hunters used boats for access (Table 7), and airboats are almost exclusively the boat of choice. Few if any hunters have their own airboats; rather they make arrangements with one of several local airboaters who then take them into Berners for their hunt.

Chilkat Range: Hunters in the Chilkat Range used both airplanes and boats for access. In 2001–2002, airplane and boat access were evenly divided (Table 7). Generally, most airplane access to this area is in the upper Endicott River, while most boat access takes place at St. James Bay.

Gustavus Forelands: Successful Gustavus Forelands hunters use a variety of access methods. During the report period an average of 41% used highway vehicles, 30% walked, 13% used boats, 2% used all-terrain vehicles, and 14% used airplanes for access. It is almost certain that the people who listed airplane as their mode of access actually flew into Gustavus on a commercial airline, then drove to a residence where they hunted with vehicle or on foot. The high percentage of hunters who list walking as their mode of access are residents of Gustavus who walk out their back door to hunt.

<u>Other Mortality</u>. Winters were mild during both report years, so known natural mortality was probably limited to a few wolf kills on the Gustavus Forelands. Other mortality included 3 moose that were caught in wolf snares and either died or had to be put down.

<u>Habitat</u>. We initiated a moose browse monitoring project in 1999 that is still ongoing. The aim of this project is to monitor willow utilization by moose on the Gustavus Forelands. Preliminary data analysis suggests that the moose population is higher than the range can support. Data generated by this study was used by the Board of Game in its decision to adopt a proposal to allow a cow moose hunt at Gustavus.

CONCLUSIONS AND RECOMMENDATIONS

Taku: All Taku River management objectives were surpassed during both years of the report period. In 2001 a total of 19 moose were harvested with a hunter success rate of 22%. The 2002 harvest was 15 moose with a hunter success rate of 18%. Based on aerial surveys we did not meet the 100-moose population objective. However, we believe that most Taku moose spend the winter in Canada, thereby making this management objective difficult to measure.

Berners Bay: We did not meet management objectives for the number of moose harvested (18) during either year of the report period; 14 moose were killed in 2001 and only 9 in 2002. The objective for 90% hunter success each year was not met either, with 82% and 64% of the hunters harvesting moose in 2001 and 2002, respectively. We met the population objective of 90 posthunt animals each year, with the 108 moose surveyed in 1999 and 79 moose in 2000 indicating that well over 90 moose were present.

Chilkat Range: We did not meet any management objectives for the Chilkat Range during the report period. Harvest objectives call for an annual kill of 20 moose and a hunter success rate of 22%. The 2001 harvest was only 12 moose with a success rate of 16%, while in 2002 the harvest was 15 moose with a success rate of 14%. Reasons for this decline in harvest and success are not known because we have no population information in this area. Although we have a population objective of 200 moose in this area, we are unable to conduct reliable surveys to quantify the population.

Gustavus Forelands: We were not able to meet the harvest management objectives in both years of the report period, although emergency orders to close the season were issued to prevent higher harvests. In 2001 the harvest was 45 bull moose, and 49 moose were taken in 2002, both surpassing the objective of 40 moose. The objective for a 33% hunter success rate was not met in 2001, when only 22% of all hunters killed a moose, or in 2002, when 27% of hunters were successful. During this report period the number of hunters targeting Gustavus continued to rise. The current trend of increased hunter effort will not allow for higher success rates unless our harvest objective increases as well. The population objective of 250 moose was met, given that we saw 207 animals on our survey and estimated 250–300 were present.

Rising effort and harvest on the Gustavus Forelands increases the importance of acquiring consistent aerial survey data for moose in that portion of the subunit. Acquiring additional browse utilization information as well as herd composition data is a priority here. Continued implementation of a cow hunt during the next report period to lower the productivity of that herd is advised.

We believe that a continuation of the permit registration system should accommodate current population objectives throughout Unit 1C, and we will continue to collect teeth from harvested moose for age analysis. Areas supporting the most critical winter browse should be analyzed, even cursorily, to estimate the status of moose populations in relation to carrying capacity. This is particularly true in the Gustavus area where habitat information complements our aerial survey information to help us anticipate management decisions.

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Table 1 Unit 1C aerial moose survey data, regulatory years 1990 through 2002

Year	Bulls	Cows	Calves	Unknown	Total moose	Count time (hrs)	Bulls per 100F	Calves per 100F	Calves % in herd	Moose per hour
					Berners Bay 1990–2002					
1990	14	53	18	0	85	2.6	26	34	21	33
1991	---	---	11	50	61	1.2	---	---	18	50
1992	14	61	8	0	83	2.8	23	13	10	29
1993	---	---	12	45	67	2.8	---	---	18	24
1994	17	45	13	0	75	2.0	38	29	17	38
1995–1996					No survey					
1997	6	11	12	31	60	2.1	---	---	20	29
1998	14	9	10	37	70	2.6	---	---	14	27
1999	14	11	13	70	108	2.4	17.3	16	12	45
2000	---	10	12	57	79	2.4	---	---	15	33
2001	---	10	10	46	66	2.0	---	---	15	34
2002	---	4	4	50	58	2.2	---	---	7	26
					Chilkat Range 1968–2002					
1968	1	2	1	0	4		50	50	25	
1975	0	3	2	0	5		0	67	40	
1986	3	10	6	0	19	1.5	30	60	32	
1987–1991					No survey					
1992	---	---	11	79	97	1.3	---	---	13	75
1993–1995					No survey					
1996	---	---	---	20	20	---	---	---	---	
1997					No survey					
1998	6	15	16	35	72	1.1	---	---	22	64
1999					No survey					
2000	---	6	6	113	125	1.7	---	---	---	75
2001					No survey					
2002					No survey					
					Taku River 1978–2002					
1978	3	30	15	---	49	3.4	10	50	31	14
1983	2	40	12	---	54	1.7	5	30	22	32
1986	2	42	1	---	45	1.8	5	2	2	25
1987					No survey					
1988	2	16	4	---	22	1.6	13	25	18	14
1989–1997					No survey					
1998	---	1	1	3	5	---	---	---	---	---
1999					No survey					

Table 1 continued

Year	Bulls	Cows	Calves	Unknown	Total moose	Count time (hrs)	Bulls per 100F	Calves per 100F	Calves % in herd	Moose per hour
					Taku River 2000–2002					
2000	---	5	7	36	37	2.1	---	---	19	18
2001					No survey					
					Gustavus Forelands 1998–2002					
1998	---	48	54	131	185	1.9	---	---	29	95
1999					No survey					
2000	---	45	45	117	207	3.7	---	---	22	57
2001	1	52	62	161	276	2.0	---	---	22	138
2002	---	75	82	155	312	2.5	---	---	26	125

Table 2 Unit 1C moose age at harvest, Berners Bay, regulatory years 1990 through 2002

Year	Age Class																Total	%	Mean
	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	kill	aged	age
Males																			
1990	0	0	3	0	1	1	0	0	0	0	0	0	0	0	0	0	5	100	3.5
1991	0	1	0	3	1	0	0	0	0	0	0	0	0	0	0	0	5	100	3.3
1992	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5	20	3.5
1993	0	1	2	1	1	1	1	0	0	0	0	0	0	0	0	0	7	100	4.3
1994	0	2	1	2	0	1	0	0	0	0	0	0	0	0	0	1	8	88	4.7
1995	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	7	100	1.7
1996	0	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	7	100	1.7
1997	0	2	1	5	0	0	0	0	0	0	0	0	0	0	0	0	8	100	2.4
1998	0	2	3	0	0	0	0	0	2	0	0	0	0	0	0	0	8	88	3.4
1999	0	3	1	3	1	0	1	0	0	1	0	0	0	0	0	0	10	100	3.8
2000	0	0	2	2	3	0	0	0	0	0	0	1	0	0	0	0	8	100	4.6
2001	0	2	2	1	0	2	1	0	0	0	0	0	0	0	0	0	8	100	3.6
2002	0	2	1	0	1	0	1	0	0	0	0	0	0	0	0	0	5	100	3.3
Females																			
1990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	---
1991	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	5	100	1.8
1992	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	4	75	1.7
1993	0	1	0	2	0	0	1	0	1	1	0	1	0	0	0	0	7	100	5.9
1994	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	1	7	71	6.6
1995	0	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	6	100	3.5
1996	0	0	1	0	2	0	0	0	1	0	1	0	0	1	0	0	7	100	6.1
1997	0	1	0	3	2	0	0	0	0	0	1	0	0	0	0	0	7	100	4.0
1998	0	2	3	1	0	0	0	0	0	0	0	0	0	1	0	0	7	100	3.4
1999	0	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	5	100	2.3
2000	0	0	1	1	3	0	1	0	0	0	1	0	0	0	0	0	7	100	3.3
2001	0	1	2	0	0	0	1	0	0	0	1	0	0	1	0	0	6	100	6.2
2002	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4	100	2.3

Table 3 Unit 1C moose age at harvest, excluding Berners Bay, regulatory years 1990 through 2002[a]

							Age	Class								Total	%	Mean
Year	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	kill	Aged	Age
								Chilkat Range											
1990	0	6	1	1	0	1	0	0	0	0	0	0	0	0	0	0	16	69	2.3
1991	0	3	0	2	0	0	0	0	1	0	0	0	0	0	0	0	6	100	3.3
1992	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	9	56	2.9
1993	0	5	0	2	3	0	1	0	0	0	1	0	0	0	0	0	17	71	3.8
1994	0	3	0	1	0	0	0	2	0	0	1	0	0	0	0	0	7	100	4.8
1995	0	3	3	2	0	0	2	1	1	1	0	0	0	0	0	0	14	93	4.4
1996	0	3	4	5	1	3	1	0	0	4	0	0	0	0	0	0	21	98	4.1
1997	0	5	0	3	1	1	0	1	0	1	0	0	0	0	0	0	13	92	3.3
1998	0	10	2	7	1	0	2	2	1	0	0	0	0	0	0	0	28	89	2.9
1999	0	5	3	0	1	1	0	0	0	0	0	0	0	0	0	0	11	91	2.5
2000	0	1	3	6	1	0	1	0	0	1	0	0	0	0	0	0	14	93	3.2
2001	0	2	2	1	1	2	0	2	0	0	0	0	0	0	0	0	12	83	4.2
2002	0	4	2	0	3	2	0	0	0	1	0	0	0	0	0	0	15	80	3.8
								Gustavus Forelands											
1990	0	1	2	2	1	0	1	0	0	0	0	0	0	0	0	0	8	88	3.5
1991	0	2	1	1	0	0	1	0	0	0	0	0	0	0	0	0	6	83	3.1
1992	0	1	2	1	1	1	0	1	0	0	0	0	0	0	0	0	11	64	3.9
1993	0	3	5	4	0	1	0	0	0	0	0	0	0	0	0	0	13	100	2.8
1994	0	7	4	1	1	3	0	0	1	0	0	0	0	0	0	0	20	85	3.1
1995	0	4	9	3	2	1	0	0	0	0	0	0	0	0	0	0	21	90	2.8
1996	0	18	5	4	1	1	0	0	0	0	0	0	0	0	0	0	30	97	2.2
1997	1	11	9	2	2	0	2	0	0	0	0	0	0	0	0	0	31	86	2.0
1998	2	24	10	5	3	0	0	0	0	0	0	0	0	0	0	0	48	92	1.4
1999	3	20	10	2	1	2	0	0	1	0	0	0	0	0	0	0	42	93	2.2
2000	0	23	8	9	4	2	0	0	0	0	0	0	0	0	0	0	47	98	2.2
2001	2	18	9	6	4	0	0	1	1	0	0	0	0	0	0	0	46[b]		2.6
2002	1	22	13	6	2	0	0	0	1	0	0	0	0	0	0	0	49	92	2.3

89

[a] Does not include 3 cow moose taken illegally in Gustavus in 2000.
[b] Includes 1 cow moose shot inadvertantly.

Table 3 continued

Year	0.5	1.5	2.5	3.5	4.5	5.5	6.5	Age 7.5	Class 8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	Total kill	% Aged	Mean Age
									Taku River										
1990	0	9	2	1	0	0	0	0	0	0	0	0	0	0	0	0	20	60	2.3
1991	0	5	4	1	0	0	0	1	0	0	0	0	0	0	0	0	14	78	3.1
1992	0	3	3	1	1	1	1	0	0	0	0	0	0	0	0	0	19	53	3.4
1993	0	3	4	1	3	1	0	0	0	0	0	0	0	0	0	0	15	73	2.9
1994	0	8	3	2	1	0	0	0	0	0	0	0	0	0	0	0	16	88	2.2
1995	0	7	4	0	1	1	1	0	0	0	0	0	0	0	0	0	14	100	2.6
1996	0	10	3	0	0	0	1	0	0	0	0	0	0	0	0	0	15	93	2.1
1997	0	1	1	2	1	0	0	0	0	0	0	0	0	0	0	0	6	83	3.1
1998	0	11	0	2	0	0	0	0	0	0	0	0	0	0	0	0	13	100	1.8
1999	1	9	4	1	0	0	0	0	0	0	0	0	0	0	0	0	17	88	1.8
2000	0	15	3	3	1	0	1	0	0	0	0	0	0	0	0	0	23	100	2.2
2001	0	6	5	5	1	0	0	0	0	0	0	0	0	0	0	1	19	95	3.3
2002	0	10	1	1	0	0	0	0	0	0	0	0	0	0	0	0	15	80	1.8

Year	0.5	1.5	2.5	3.5	4.5	5.5	6.5	Age 7.5	Class 8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	Total kill	% Aged	Mean Age
									Gustavus Forelands (Cow Harvest)										
2002	0	1	1	2	1	3	1	0	0	0	0	0	0	0	0	1	10	100	5.5

Table 4 Unit 1C moose hunter effort and success, regulatory years 1990 through 2002[1]

		Successful hunters			Unsuccessful hunters			Total hunters		
Year	Permits issued[1]	NR hunters	Total days	Avg. days	NR hunters	Total days	Avg. days	NR hunters	Total days	Avg. days
Berners Bay										
1990	5	5	14	2.8	0	0	0.0	5	14	2.8
1991	10	10	20	2.0	0	0	0.0	10	20	2.0
1992	10	9	23	2.6	0	0	0.0	9	23	2.6
1993	15	14	29	2.1	1	7	7.0	15	36	2.4
1994	15	14	38	2.7	0	0	---	14	38	2.7
1995	15	13	40	3.1	1	6	6.0	14	46	3.3
1996	17	14	35	2.5	0	0	---	14	35	2.5
1997	15	15	42	2.8	0	0	0	15	42	2.8
1998	15	15	29	1.9	0	0	0	15	29	1.9
1999	18	16	43	2.7	0	0	0	16	43	2.7
2000	20	15	42	2.8	2	13	6.5	17	55	3.2
2001	20	14	30	2.5	3	15	5.0	17	45	2.6
2002	15	9	26	2.9	5	28	5.6	14	54	3.9
Chilkat Range										
1990	331	16	57	3.6	94	267	2.8	106	350	3.3
1991	316	6	17	2.8	37	143	3.9	43	160	3.7
1992	317	9	41	4.6	62	234	3.8	71	275	3.9
1993	352	17	69	4.1	62	259	4.2	79	328	4.2
1994	346	7	15	2.1	47	173	3.7	54	188	3.5
1995	380	13	34	2.6	96	375	3.9	109	409	3.8
1996	396	17	31	1.8	65	308	4.7	82	339	4.1
1997	489	13	42	3.2	92	370	4.2	105	412	3.9
1998	441	28	85	3.0	58	190	3.3	86	275	3.2
1999	476	11	47	4.3	81	374	4.6	92	421	4.6
2000	455	14	47	3.4	82	326	4.0	96	373	3.9
2001	555	12	56	4.7	61	228	3.7	73	284	3.9
2002	551	15	50	3.3	96	410	4.3	111	460	4.1
Gustavus Forelands										
1990[2]	---	8	26	---	NA	NA	---	NA	NA	---
1991	---	6	21	3.5	29	163	5.6	35	184	5.3
1992	---	11	38	3.5	36	163	4.5	47	201	4.3
1993	---	13	59	4.5	45	229	5.1	58	288	5.0
1994	---	20	96	4.8	64	281	4.4	84	377	4.5
1995	---	21	90	4.3	69	294	4.3	90	384	4.3
1996	---	30	115	3.8	65	331	5.1	95	446	4.7
1997	---	31	125	4.0	73	279	4.1	104	404	4.1
1998	---	48	139	3.0	71	255	3.7	119	394	3.4
1999	---	42	173	4.1	103	528	5.1	145	701	4.8

[1] Total permit numbers include hunters without effort information. RY 2000 does not include 2 illegal cows and 1 duplicate permit.

Table 4 Continued

		Successful hunters			Unsuccessful hunters			Total hunters		
Year	Permits issued	NR hunters	Total days	Avg. days	NR hunters	Total days	Avg. days	NR hunters	Total days	Avg. days
					Gustavus Forelands					
2000	---	47	183	3.9	85	396	4.7	132	579	4.4
2001	---	46	194	4.2	160	748	4.7	206	942	4.6
2002	---	49	176	3.6	130	667	5.1	179	843	4.7
					Taku River					
1990	---	20	89	4.5	94	339	4.0	114	424	4.0
1991	---	14	52	3.7	88	358	4.1	102	410	4.0
1992	---	19	79	4.2	104	409	3.9	123	488	4.0
1993	---	16	40	2.7	77	318	4.4	93	358	4.1
1994	---	17	40	2.4	70	323	4.8	87	363	4.3
1995	---	14	48	3.4	71	254	3.6	85	302	3.6
1996	---	15	57	4.4	85	320	3.8	100	377	3.8
1997	---	6	25	5.0	85	365	4.5	91	390	4.5
1998	---	14	49	3.5	47	219	4.7	61	268	4.4
1999	---	16	40	2.5	48	146	3.0	64	186	2.9
2000	---	23	49	2.1	45	162	3.6	68	211	3.1
2001	---	19	61	3.2	68	230	3.4	87	291	3.3
2002	---	15	47	3.1	69	268	3.8	84	315	3.8
					Gustavus Forelands (Cow Harvest)					
2002	10	10	14	1.4	0	0	0	10	14	1.4

[1] Number of registration permits shown for the Chilkat Range is the total number of permits issued for all of Unit 1C excluding Berners Bay; only permittees who hunted may be categorized to specific hunt areas.
[2] Effort information for unsuccessful hunters at Gustavus Forelands is combined with the Chilkat Range for 1990

Table 5 Unit 1C moose historical harvests, number of hunters, and percent success, regulatory years 1990 through 2002

Year	NR males	NR females	NR unknown	Total kill	NR hunters	% success
			Berners Bay			
1990	5	0	0	5	5	100
1991	5	5	0	10	10	100
1992	5	4	0	9	9	100
1993	7	7	0	14	15	93
1994	8	6	0	14	14	100
1995	7	6	0	13	14	93
1996	7	7	0	14	14	100
1997	8	7	0	15	15	100
1998	8	7	0	15	15	100
1999	10	5	0	15	16	94
2000	8	7	0	15	15	100
2001	8	6	0	14	17	82
2002	5	4	0	9	14	64
			Chilkat Range			
1990	16	0	0	16	106[1]	23
1991	6	0	0	6	47	13
1992	11	0	0	11	42	26
1993	17	0	0	17	90	19
1994	7	0	0	8	56	14
1995	13	0	0	13	109	12
1996	17	0	0	17	82	21
1997	13	0	0	13	105	12
1998	28	0	0	28	86	33
1999	11	0	0	11	100	11
2000	14	0	0	14	105	13
2001	12	0	0	12	73	16
2002	15	0	0	15	111	14

Table 5 continued

Year	NR males	NR females	NR unknown	Total kill	NR hunters	% success
			Gustavus Forelands			
1990	8	0	0	8	n/a	n/a
1991	6	0	0	6	35	17
1992	9	0	0	9	47	19
1993	13	0	0	13	58	22
1994	19	0	0	19	84	23
1995	21	0	0	0	90	23
1996	30	0	0	29	95	31
1997	30	1[3]	0	31	104	29
1998	47	1[3]	0	48	118	40
1999	41	1[3]	0	42	146	29
2000	46	3[3]	0	49	132	37
2001	45	1[3]	0	46	206	22
2002	49	0	0	49	179	27
			Taku River			
1990	20	0	0	20	114[2]	18
1991	14	0	0	14	102	14
1992	19	0	0	19	123	15
1993	16	0	0	16	93	17
1994	17	0	0	17	87	18
1995	14	0	0	14	85	16
1996	15	0	0	15	97	15
1997	6	0	0	6	91	15
1998	14	0	0	14	61	23
1999	16	0	0	16	65	25
2000	23	0	0	23	69	33
2001	19	0	0	19	87	22
2002	15	0	0	15	84	18
			Gustavus Forelands (Cow Harvest)			
2002	0	10	0	10	10	100

[1.]Twelve of 106 hunters were assigned to the Chilkat Range (based on proportion hunting in each area) because they reported no specific area within Unit 1C.

[2] Twelve of 114 hunters were assigned to the Taku River (based on proportion hunting in each area) because they reported no specific area within Unit 1C.

[3] Illegal take.

Table 6 Unit 1C annual moose kill by community of residence, regulatory years 1990–2002

Year	Total kill	Gustavus	Juneau	Sitka	Wrangell	Petersburg	Haines	Other Alaska	Non-resident
				Berners Bay					
1990	5	0	5	0	0	0	0	0	0
1991	10	0	9	0	0	0	1	0	0
1992	9	0	9	0	0	0	0	0	0
1993	14	0	13	0	0	0	1	0	0
1994	14	0	13	0	0	0	1	0	0
1995	13	0	11	0	0	0	0	2	0
1996	14	0	14	0	0	0	0	0	0
1997	15	0	13	1	0	0	0	0	1
1998	15	0	12	1	0	1	1	0	0
1999	15	0	14	0	0	0	1	0	0
2000	15	0	14	0	0	1	0	0	0
2001	14	0	12	1	0	0	0	1	0
2002	9	0	8	0	0	0	1	0	0
				Chilkat Range					
1990	16	0	13	0	0	0	3	0	0
1991	6	0	6	0	0	0	0	0	0
1992	9	0	8	0	0	0	1	0	0
1993	17	0	11	0	0	0	5	1	0
1994	7	0	6	0	0	0	0	1	0
1995	13	2	10	0	0	0	0	1	0
1996	17	0	14	0	0	0	0	3	0
1997	13	0	12	0	0	0	0	1	0
1998	28	1	20	0	0	0	1	6	0
1999	11	0	7	0	0	0	0	2	1
2000	14	1	10	1	0	0	0	1	1
2001	12	0	10	0	0	0	1	1	0
2002	15	0	13	0	0	0	0	2	0
				Gustavus Forelands					
1990	8	7	1	0	0	0	0	0	0
1991	6	6	0	0	0	0	0	0	0
1992	11	10	0	0	0	0	0	0	1
1993	11	2	0	0	0	0	0	0	0
1994	20	15	4	0	0	0	0	0	1
1995	21	13	7	0	0	0	0	1	0
1996	30	22	7	0	0	0	0	0	1
1997	31	20	7	1	0	0	0	2	1
1998	48	27	16	1	0	0	1	2	1
1999	42	21	13	0	0	0	1	6	1
2000	49	29	15	0	0	0	1	3	1
2001	46	21	18	2	0	0	1	2	2
2002	49	23	20	2	0	0	0	2	2

Table 6 continued

Year	Total kill	Gustavus	Juneau	Sitka	Wrangell	Petersburg	Haines	Other Alaska	Non-resident
				Taku River					
1990	20	0	18	1	0	1	0	0	0
1991	14	0	13	0	0	1	0	0	0
1992	19	0	15	0	0	2	0	1	1
1993	15	0	12	0	0	2	1	0	0
1994	17	0	10	0	0	2	0	2	0
1995	14	0	12	1	0	0	0	1	0
1996	15	1	14	0	0	0	0	0	0
1997	6	0	5	1	0	0	0	0	0
1998	14	0	13	1	0	0	0	0	0
1999	17	0	16	1	0	0	0	0	0
2000	28	0	21	1	1	0	0	0	0
2001	19	0	18	0	0	0	0	0	1
2002	15	0	13	2	0	0	0	0	0
				Gustavus Forelands (Cow Harvest)					
2002	10	0	10	0	0	0	0	0	0

Table 7 Unit 1C successful moose hunters transport methods, regulatory years 1993–2002

Year	Airplane Total	Airplane (%)	Boat Total	Boat (%)	3 or 4 wheeler Total	3 or 4 wheeler (%)	Hwy vehicle Total	Hwy vehicle (%)	Foot Total	Foot (%)
Berners Bay										
1993	0	---	14	(100)	0	---	0	---	0	---
1994	0	---	14	(100)	0	---	0	---	0	---
1995	1	(8)	12	(92)	0	---	0	---	0	---
1996	1	(7)	13	(93)	0	---	0	---	0	---
1997	0	---	15	(100)	0	---	0	---	0	---
1998	0	---	15	(100)	0	---	0	---	0	---
1999	0	---	15	(100)	0	---	0	---	0	---
2000	0	---	15	(100)	0	---	0	---	0	---
2001	0	---	14	(100)	0	---	0	---	0	---
2002	0	---	9	(100)	0	---	0	---	0	---
Chilkat Range										
1993	5	(29)	12	(71)	0	---	0	---	0	---
1994	0	---	7	(100)	0	---	0	---	0	---
1995	5	(38)	8	(62)	0	---	0	---	0	---
1996	9	(53)	8	(47)	0	---	0	---	0	---
1997	6	(46)	7	(54)	0	---	0	---	0	---
1998	9	(32)	19	(68)	0	---	0	---	0	---
1999	8	(73)	3	(27)	0	---	0	---	0	---
2000	7	(50)	7	(50)	0	---	0	---	0	---
2001	5	(42)	7	(58)	0	---	0	---	0	---
2002	8	(57)	6	(43)	0	---	0	---	0	---
Gustavus Forelands										
1993	1	(8)	4	(31)	1	(8)	4	(31)	3	(23)
1994	1	(5)	3	(15)	0	---	11	(55)	5	(25)
1995	3	(14)	7	(33)	0	---	2	(10)	0	---
1996	1	(3)	7	(23)	3	(10)	4	(13)	12	(40)
1997	0	---	9	(31)	0	---	4	(14)	16	(55)
1998	0	---	10	(21)	0	---	21	(44)	17	(35)
1999	5	(12)	9	(22)	1	(2)	14	(34)	12	29
2000	5	(11)	6	(13)	1	(2)	20	(43)	14	(30)
2001	10	(22)	6	(13)	0	---	9	(19)	21	(46)
2002	3	(6)	6	(13)	2	(4)	30	(62)	7	(15)
Taku River										
1993	4	(25)	11	(69)	0	---	0	---	1	(6)
1994	3	(18)	14	(82)	0	---	0	---	0	---
1995	2	(14)	12	(86)	0	---	0	---	0	---
1996	6	(33)	12	(67)	0	---	0	---	0	---
1997	0	---	6	(100)	0	---	0	---	0	---
1998	0	---	14	(100)	0	---	0	---	0	---
1999	0	---	17	(100)	0	---	0	---	0	---
2000	2	---	21	(100)	0	---	0	---	0	---
2001	1	(5)	18	(95)	0	---	0	---	0	---
2002	0	---	14	(100)	0	---	0	---	0	---
Gustavus Forelands (Cow Harvest)										
2002	2	(20)	1	(10)	0	---	7	(70)	0	---

Table 8 Unit 1C moose hunters commercial services use, regulatory years 1991 through 2002

Year	Unit residents		Other AK residents		Non-residents		Total use		Transport	Non-guided services	Other services
	No	Yes	No	Yes	No	Yes	No	Yes			
Berners Bay											
1991	6	2	0	0	0	0	6	2	0	0	2
1992	9	1	0	0	0	0	9	1	0	0	1
1993	13	0	1	0	0	0	14	0	0	0	0
1994	11	0	1	0	0	0	12	0	0	0	0
1995	13	0	1	0	0	0	14	0	0	0	0
1996	12	1	0	0	0	0	12	1	1	0	0
1997	13	0	1	0	0	1	14	1	1	0	0
1998	12	0	2	1	0	0	14	1	0	0	1
1999	15	1	0	0	0	0	15	1	0	0	0
2000	15	0	2	0	0	0	17	0	0	0	0
2001	13	0	2	0	0	0	15	0	0	0	0
2002	13	0	1	0	0	0	14	0	0	0	0
Chilkat Range											
1992	88	6	12	4	0	1	100	11	10	1	0
1993	37	2	20	7	0	0	57	10	5	3	2
1994	26	5	19	0	0	0	45	4	0	0	0
1995	72	2	29	0	0	0	101	2	2	0	0
1996	56	5	13	0	0	0	64	5	5	0	0
1997	66	4	13	0	1	3	80	7	7	0	0
1998	70	1	11	4	0	0	81	5	5	0	0
1999	74	7	4	2	0	1	78	10	10	0	0
2000	57	5	11	1	0	2	68	8	8	0	0
2001	55	5	11	1	0	0	66	6	5	1	0
2002	72	9	12	0	5	0	89	9	9	0	0
Gustavus Forelands											
1992	8	0	0	0	0	0	8	0	0	0	0
1993	55	4	3	0	0	0	58	4	4	0	0
1994	81	1	0	0	1	0	82	2	2	0	0
1995	80	0	10	0	0	0	90	0	0	0	0
1996	78	3	12	1	0	1	95	5	5	0	0
1997	81	2	7	0	1	2	89	4	1	2	1
1998	104	2	9	0	1	0	114	2	2	0	0
1999	107	2	5	1	1	0	113	3	3	1	0
2000	100	3	4	0	3	0	107	3	3	0	0
2001	138	8	32	2	19	3	189	13	9	3	3
2002	145	6	17	0	7	0	169	6	5	0	1

Table 8 continued

Year	Unit residents		Other AK residents		Non-residents		Total use		Transport	Non-guided services	Other services
	No	Yes	No	Yes	No	Yes	No	Yes			
					Taku River						
1992	56	8	8	2	0	0	64	10	7	0	3
1993	61	7	71	7	0	0	132	14	12	2	0
1994	50	4	23	3	0	0	73	7	7	0	0
1995	70	5	9	0	0	0	79	5	3	0	2
1996	71	5	3	1	0	2	74	8	2	2	4
1997	60	6	4	0	0	0	64	6	5	0	1
1998	53	3	4	0	0	0	57	3	3	0	0
1999	53	1	6	0	1	0	56	1	1	0	0
2000	53	1	3	0	0	0	56	1	0	1	0
2001	75	3	4	0	2	0	81	3	3	0	0
2002	74	3	5	0	0	0	79	3	3	0	0
					Gustavus Forelands (Cow Harvest)						
2002	7	3	0	0	0	0	7	3	2	0	1

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 1D (2700 mi^2)

GEOGRAPHICAL DESCRIPTION: That portion of the Southeast Alaska mainland lying north of the latitude of Eldred Rock, excluding Sullivan Island and the drainages of Berners Bay.

BACKGROUND

Most Unit 1D moose inhabit the Chilkat River watershed and the Chilkat Peninsula. Within this area there is an estimated 200–250 mi^2 of summer range and 110–120 mi^2 of winter range, including 80 mi^2 of preferred winter range. Small areas of moose habitat are also located in the Chilkoot, Katzehin, and Warm Pass valleys, and along the western shore of Lynn Canal (ADF&G 1990).

Moose migrated to the Chilkat River Valley from drainages in Canada around 1930. Moose populations peaked in the Chilkat Valley in the mid 1960s, when as many as 700 animals may have been present (ADF&G 1991). By the early 1970s the moose population had sharply declined, possibly because of overuse of the range and overharvest. Survey data collected during the mid 1980s suggested that the herd had declined to 400 animals. More recent surveys suggest that the moose population is around 250 to 350 animals. Some care must be taken in interpreting the survey data because not all areas of the unit were surveyed each year, which undoubtedly accounts for some discrepancy in moose numbers between years.

During the late 1980s and early 1990s, Unit 1D residents expressed concern over the decrease in moose numbers from the highs seen in the 1960s, the subsequent decline in hunting opportunity, and the "stampede" nature of the “any-bull” registration permit hunts with low harvest quotas. To control the unpredictable nature of the hunt, regulations were introduced (a spike-fork/50-inch/3 brow tine requirement) but these were preempted when a Tier II subsistence hunt was implemented by the Board of Game (BOG) for the 1990 season. Widespread dissatisfaction with the allocation of 20 Tier II permits and concern over the status of the herd contributed to local opposition to holding a hunt in 1991, and no permits were issued that year. In 1992 the season was closed by emergency order before Tier II permits were issued. In March 1993 the BOG authorized a Tier II antler restriction hunt for Unit 1D. This hunt allowed more hunter opportunity while affording protection to bulls that did not meet antler requirements. The objective of restricted antler hunts is to spare a large proportion of the young and middle-aged bulls from harvest to strengthen the breeding age segment of the population while allowing many local hunters the opportunity to pursue a moose.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Population management objectives identified by staff for Unit 1D are as follows:

1. Maintain a post-hunt population of at least 200 moose;

2. Maintain a post-hunt bull-to-cow ratio of 25:100;

3. Reach a harvest of 20–25 moose with a hunter success rate of 12% (or approximately 10% of the surveyed moose).

METHODS

Chilkat River Valley aerial surveys were conducted in December 2001, but not in 2002 (Table 1). Areas covered included the Chilkat River Valley from Murphy Flats to Turtle Rock, and the Klehini, Takhin, Tsirku, Kelsall, and Chilkoot river valleys.

Each year, prior to the moose hunt, we held an informational meeting in Haines to discuss the identification of legal and illegal moose. We showed the video "Is This Moose Legal?" to help hunters interpret the spike-fork/50-inch/3 brow tine regulation used to manage the Unit 1D hunt.

In 2001 and 2002 we maintained a moose check station in Haines and required hunters to check in their harvested moose within 2 days of the kill. Incisors were collected from harvested moose as a condition of the Tier II permit. All permittees were required to turn in a hunt report card specifying if they hunted, hunt duration, hunt location, transport means (for all hunters), and date of kill (for successful hunters). We also collected data on antler measurements and configurations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

We conducted a winter survey in 2001, but lack of a survey aircraft prevented us from conducting a survey in 2002. During the survey, 220 moose were counted, nearly the same number as the previous year, and comparable to the surveys going back to the early 1980s (Table 1). Based on this number of observed animals, we estimate the moose population in the Chilkat Valley is between 250 and 350 animals.

Population Composition

Survey conditions during the 2001 count were excellent, and we were able to classify all animals seen as bulls, cows or calves. We classified 13.6 % of the moose seen on this survey as calves, similar to percentages seen in previous years (Table 1). The bull-to-cow ratio was determined to be 25:100 and the calf-to-cow ratio was 20:100. Mean age at harvest was 4.0 years during this report period, a decrease from the mean age of 4.7and 4.4 years during the previous 2 report periods (Table 2).

It is interesting to compare the age at harvest from the 1980s to the post-Tier II era (1993) and to the present. While the mean age was less than 4 years old for the seasons 1983–1989 (when any bull was legal), the mean age was greater than 5 years old from 1993 through 1995 (immediately after the antler restriction regulation was implemented). The mean age has been around 4 years during 1996–2000. The age distribution of animals harvested from 1993 to 1995 is skewed toward older animals, most likely a result of the spike-fork/50-inch/3 brow tine regulation implemented in 1993 and the fact that no hunts were held during 1991 and 1992. The increase in older bulls available after 2 closed seasons provided for a harvest of older animals for a time, but since then, the mean age has declined.

MORTALITY

Harvest

Season and bag limit	Resident hunters	Nonresident hunters
1 bull with spike-fork or 50-inch antlers or antlers with 3 or more brow tines on 1 side by Tier II subsistence hunting permit only; up to 200 permits may be issued.	15 Sep–30 Sep (Subsistence hunt only)	No open season.

Game Board Actions and Emergency Orders: During both years of this report period, Unit 1D moose hunting remained open for the entire 2-week season. In addition to the limiting aspects of a spike-fork/50-inch/3 brow tine hunt, we also managed for a harvest guideline of 25 bulls, although this guideline wasn't reached in either year. During the fall 2002 meeting, the Board of Game passed a regulatory change to increase the number of Tier II permits from 200 to 220, to go into effect in fall of 2003. ADF&G promulgated this change to compensate for hunters not using their permits and effectively excluding other residents wanting to participate in this Tier II hunt from doing so.

Hunter Harvest: In the 2001–02 period, the mean annual harvest was 19 moose, which is the same as the previous report period, but lower than the decade's high harvest of 27 in 1995 and 1996. This variability in harvest is likely due to weather conditions and changing hunting patterns rather than a reflection of the population size.

Permit Hunts: All moose hunting in Unit 1D is administered under a Tier II subsistence permit system. Two hundred permits were issued during each year of the report period (Table 3). The proposal increasing the number of permits available in the draw was made to give a greater number of applicants the opportunity to hunt, and it is expected that the number of applicants will increase with passage of this regulation.

Hunter Residency and Success: During the report period local residents were the primary Unit 1D moose hunters, although all Alaskans were eligible to apply for this (or any other Tier II hunt). Residents of Haines or Klukwan (Table 4) took 37 of the 39 moose harvested in 2001–2002. Hunter success was 12% during this report period, which is similar to the previous 4 years and within our management objectives (Table 3). However, this hunter success is substantially lower than the 10-year high of 17% during 1995–1996 (Table 5). Successful hunters took an average of 3.7 days per kill in 2001 and 2002 (Table 3). Total hunter days were 1031 in 2001 and 1049 in 2002 (Table 3), similar to the previous 2 report periods, but nearly double the hunter days expended from 1992 to 1994. The increase in hunter days in recent years is partly due to the guideline harvest not being reached, allowing the season to run its 2-week length. This is also reflected in an increase in number of days hunted by successful hunters.

Harvest Chronology: Since 1995 the opening date of the Tier II moose season has been 2 weeks earlier than former years, beginning on 15 September rather than 1 October. Because of this earlier start date, it can be difficult for hunters to locate and positively identify a legal bull due to the presence of leaves on trees and shrubs.

Transport Methods: Most Unit 1D moose hunters use boats or highway vehicles (Table 6). During the 2001 and 2002 hunting seasons, 82% and 55% of successful hunters used boats, respectively. Nearly all of the remaining successful hunters used highway vehicles (Table 6).

Commercial Services: Only one hunter reported the use of commercial services during the report period (Table 7). This is not surprising because virtually all hunters reside within or very near the subunit, and are well equipped for moose hunting. Also, many hunters have hunted together for a number of years, and in some instances share transportation and camps.

Other Mortality: Unit 1D residents have suggested that the local brown bear population has increased in recent years, and that bear predation on moose calves may be partly responsible for low recruitment rates observed. Data are not available to support this contention. During this report period, aerial surveys documented calf percentages similar to those seen in recent years, and predation is not indicated as a problem. In some years deep snow may contribute to calf mortality, although conditions during this report period were relatively mild. Deteriorating range conditions may also play a role in low calf production and survival (Hundertmark et al. 1983), and this is something that should be examined more closely.

The abundance of willows adjacent to the Haines Highway has led to several moose-vehicle collisions over the years. However, we have not collected information on these kills consistently over time, nor have we been able to obtain jaws, and thus ages, from these moose. We estimate that on average 2–4 moose are struck and killed by highway vehicles in the subunit each winter.

Poaching occurs, but the number of moose lost to this activity is not known. There is some degree of unreported harvest of illegal bull moose that are shot and left by hunters, although we believe that this number is relatively small.

Habitat: Nearly all moose habitat in this subunit lies within the Haines State Forest, managed under multiple-use guidelines of the 1986 Haines State Forest Management Plan. The plan's goals include an annual timber harvest of up to 8.8 million board feet (approximately 300 to 580 acres), at a rotation rate of 125 years. While some increased browse production may occur in logged areas, the extent, duration, and value of deciduous reproduction in these areas has not been determined. The long-term usefulness of cutover areas to moose will be reduced if timber harvest occurs in high-value wintering areas, and if cutover areas are managed to produce second-growth coniferous stands rather than deciduous browse species. It is also important to note that in Southeast Alaska it has not been determined how important coniferous stands are for moose during periods of deep snow, when they may provide critical escape cover from predation and better foraging opportunities.

Habitat changes within nonforested portions of the area are also of concern, although only anecdotally documented in recent years. Research in the early 1980s showed a low proportion of young willow plants in shrub stands in the Chilkat River valley, and it is suspected that postglacial land uplift (isostatic rebound) is causing permanent habitat change. Removal of decadent alder and cottonwood overstories in order to release willow, red-osier dogwood, and other browse species may counteract long-term changes, at least for awhile. Somewhat conversely, hunters in some areas (e.g., upper Chilkat River) report sufficient browse but few moose seen. There is some degree of local interest in mechanically changing vegetation in areas close to Haines, but no efforts have been made to date.

CONCLUSIONS AND RECOMMENDATIONS

The management objectives at the beginning of this report were adapted from the Strategic Plan for Management of Moose in Region I, Southeast Alaska 1990–94 (ADF&G, 1991). The old objective of maintaining a population of 350 moose, based on our aerial survey information, may be somewhat labile, depending upon areas surveyed and whether correction factors are used for moose sightability and survey conditions. We believe it is more practical to use a minimum population level of 200 moose as a management objective. The harvest objective of 20–25 bulls was met. The increased number of hunter days for successful and unsuccessful hunters may reflect a longer open season during this reporting period. We met the objective of a 12% hunter success rate.

The effect of predation upon moose calf survival in this area is unknown. An apparently healthy brown bear population (as well as a less prominent black bear population) may account for substantial summer mortality, according to anecdotal accounts, but there are no objective data for predation observations for this area. Winter wolf predation does not appear to be a serious problem, except when moose movements are restricted by extremely deep snow. However, an actively trapping populace likely maintains a check on this source of predation.

McCarthy (ADF&G 1990) called for investigation into the relationship between timber harvest and moose habitat in the Chilkat River valley. Other means of converting decadent hardwood stands to encourage growth of browse species should be pursued and tried on a pilot basis, while maintaining adequate coniferous growth to serve as escape cover.

Surveys for the last few years suggest that moose numbers in Unit 1D are no longer declining and indicate that the population has remained relatively stable over the past 15 years. The present regulatory structure supports a moose population concomitant with habitat capabilities.

Predation, deep snows, and mediocre habitat point to the need for regular surveys to better understand the status and trend of the population.

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Table 1 Unit 1D moose aerial survey data, regulatory years 1982 through 2000

Regulatory year	Total males	Total females	Total calves	Unk	Total moose	Count time (hrs)	Bulls per 100F	Calves per 100F	Calves % in herd	Moose per hour
1982	34	115	51	---	200	4.8	30	44	36	42
1983	16	148	47	---	211	5.8	11	32	22	36
1984	15	135	37	---	187	5.2	11	27	20	36
1985	23	155	29	---	207	5.5	15	19	14	38
1986	33	93	13	---	139	3.5	36	14	14	40
1987[1]	---	---	29	174	203	---	---	---	14	53
1988[2]	---	---	31	206	252	4.4	---	---	12	57
1989	18	45	10	---	73	1.5	40	22	14	48
1990[3]	18	67	6	---	91	3.5	30	9	7	26
1991	23	138	22	---	183	7.8	17	17	13	23
1992	27	98	21	---	149	2.9	28	21	14	52
1993	---	---	19	157	176	5.8	---	---	11	31
1994	41	77	27	---	149	4.3	53	35	18	35
1995					No survey					
1996	48	121	31	7	207	3.8	40	26	16	54
1997	10	37	36	115	198	4.1	---	---	18	48
1998	20	23	25	103	171	5.2	---	---	15	39
1999[4]	---	4	4	67	75	4.9	---	---	---	15
2000	28	30	35	129	222	5.5	18	22	15.7	56
2001	38	153	30	---	221	5.2	25	20	13.6	42
2002					No survey					

[1]Late winter survey, sex and age ratios unreliable. In a second late winter survey, a total of 215 moose (29 calves) were counted at a rate of 57 moose per hour.
[2]Late-winter survey, sex and age ratios unreliable.
[3]Numbers are for 12/14/1990 survey. A second survey, flown only in the Chilkat Valley on 3/22/1991, resulted in a total count of 28 moose in 2.9 hours.
[4]Marginal survey conditions, minimal composition information.

Table 2 Unit 1D age structure of harvested moose, regulatory years 1983 through 2002

	Age class																		
Year	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	Total kill	% aged	Mean age
1983	1	3	7	10	6	0	1	2	0	1	0	0	0	0	0	0	62	50	3.8
1984	2	15	12	2	2	1	0	0	0	0	0	0	0	0	0	0	36	94	2.3
1985	0	7	4	1	0	1	0	0	0	0	0	0	0	0	0	0	14	93	2.3
1986	Season closed																		
1987	0	3	6	7	3	1	0	0	0	0	0	0	0	0	0	0	22	91	3.2
1988	0	6	5	3	1	1	1	0	0	0	0	0	0	0	0	0	18	94	2.9
1989	0	10	5	2	2	0	0	0	0	0	0	0	0	0	0	0	18	100	2.3
1990																	19	0	---
1991–1992	Season closed																		
1993	0	2	3	3	4	2	3	1	4	0	1	0	1	0	0	0	24	100	5.1
1994[1]	0	0	0	1	1	8	2	2	0	0	0	0	1	0	0	0	17	94	5.7
1995	0	0	1	5	4	3	5	3	3	1	2	0	0	0	0	0	27	100	6.1
1996	0	5	2	3	2	4	2	2	1	1	0	0	0	0	0	0	27	78	4.5
1997	0	2	0	3	6	1	1	1	0	1	0	0	0	0	0	0	15	88	4.6
1998	0	4	2	0	7	2	0	1	0	1	2	0	0	0	0	0	19	100	4.8
1999	0	6	2	3	2	3	2	0	2	0	1	0	0	0	0	0	21	100	4.3
2000	0	2	4	1	2	3	3	0	2	0	0	0	0	0	0	0	18	95	4.6
2001	0	8	1	1	3	1	1	1	1	0	0	0	0	0	0	0	17	100	3.5
2002	0	3	2	4	5	1	1	2	2	0	0	0	0	0	0	0	22	91	4.5

[1]Does not include an illegally harvested bull, age 3.

Table 3 Unit 1D moose hunter effort and success, regulatory years 1983 through 2000

		Successful hunters			Unsuccessful hunters			Total hunters		
Year	Permits issued	# hunters	Total # days	Avg. # days	# hunters	Total # days	Avg. # days	# hunters	Total # days	Avg. # days
1983	---	62								
1984	---	35	149	4.3	314	1540	4.9	349	1,689	4.8
1985	---	14	43	3.1	29	109	3.8	43	152	3.5
1986				292	Season closed		354			
1987	294	22	22	1.0	208	208	1.0	230	230	1.0
1988	259	18	18	1.0	188	188	1.0	206	206	1.0
1989	272	18	18	1.0	208	208	1.0	226	226	1.0
1990	20	19	48	2.5	1	7	7.0	20	55	28
1991–1992					Season closed					
1993	176	24	45	1.9	83	182	2.3	107	227	2.2
1994	200	17	20	1.2	130	284	2.2	147	304	2.1
1995	200	27	58	2.1	130	401	3.1	157	459	3.0
1996	181	24	70	3.3	121	735	6.1	145	805	5.7
1997	200	17	50	3.8	130	891	6.9	145	941	6.6
1998	200	19	79	4.4	146	976	6.8	164	1,055	6.5
1999	200	21	87	4.1	137	972	7.1	158	1059	6.7
2000	200	18	74	4.1	138	821	5.9	156	895	5.7
2001	200	17	68	4.0	137	963	7.0	154	1031	6.7
2002	200	22	78	3.5	135	971	7.2	157	1049	6.7

Table 4 Unit 1D annual moose kill by community of residence, regulatory years 1984–2002

Regulatory year	Total kill	Haines	Skagway	Juneau	Sitka	Other Alaska	Non-resident
1984	35	23	1	7	2	1	0
1985	14	14	0	0	0	0	0
1986				Season closed			
1987	22	22	0	0	0	0	0
1988	18	18	0	0	0	0	0
1989	[1]	18	0	0	0	0	0
1990	19	19	0	0	0	0	0
1991–1992	18			Season closed			
1993	24	22	0	2	0	0	0
1994	17	17	0	0	0	0	0
1995	27[2]	26	0	1	0	0	0
1996	27[3]	23	0	0	0	1	0
1997	17	16	0	1	0	0	0
1998	19	18	0	1	0	0	0
1999	21	19	0	2	0	0	0
2000	18	16	0	1	0	1	0
2001	17[4]	16	0	0	1	0	0
2002	22	21	1	0	0	0	0

[1]Includes 3 illegally harvested bulls.
[2]Includes 1 illegally harvested bull, 1 unrecovered bull, and 2 illegally harvested cows.
[3]Data are only available for 51 of the 54 moose listed for 1995–96.
[4]Includes 1 illegally harvested bull.

Table 5 Unit 1D historical moose harvests, number of hunters, and percent success, regulatory years 1980 through 2002

Regulatory year	NR males	NR females	NR unknown	Total kill	NR hunters	Percent success
1980	48	0	0	48	342	14
1981	36	2	0	38	315	11
1982	24	1	0	25	267	9
1983	62	0	0	62	354	17
1984	35	1	0	36	349	10
1985	14	0	0	14	43	33
1986			Season closed			
1987	22	0	0	22	230	10
1988	18	0	0	18	206	9
1989	18	1	0	19	226	8
1990	19	0	0	19	20	95
1991–1992			Season closed			
1993	24	0	0	24	107	22
1994	17	0	0	17	147	12
1995	27[1]		0	27	157	17
1996	25	2	0	27	145	17
1997	17	0	0	17	145	12
1998	19	19	0	19	164	12
1999	21	0	0	21	163	13
2000	18 0	0	0	18	160	11
2001	17	0	0	17	154	11
2002	22	0	0	22	157	14

[1]Includes 2 illegal bulls, 1 unrecovered bull, and 2 cows. These show up in the total kill of 27.

Table 6 Unit 1D transport methods used by successful moose hunters, regulatory years 1987–2002

	Airplane		Boat		ORV		Highway vehicle		Other	
Year	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
1987	3	(14)	12	(12)	1	(5)	6	(27)	0	---
1988	0	---	16	(88)	1	(6)	1	(6)	0	---
1989	2	(11)	10	(55)	2	(11)	4	(22)	1	(1)
1990	0	---	10	(58)	0	---	7	(37)	2	(8)
1991–1992					Season closed					
1993	0	---	13	(54)	0	---	10	(45)	1	(4)
1994	0	---	13	(81)	0	---	3	(19)	0	---
1995	0	---	5	(22)	0	---	15	(65)	3	(13)
1996	3	(13)	10	(42)	0	---	10	(42)	1	(4)
1997	0	---	10	(71)	0	---	4	(29)	0	---
1998	1	(6)	11	(65)	2	(8)	3	---	0	---
1999	2	(10)	15	(71)	0	(0)	4	(19)	0	(0)
2000	0	(0)	12	(67)	2	(11)	4	(22)	0	(0)
2001	1	(6)	14	(82)	0	---	2	(12)	0	---
2002	2	(9)	12	(55)	2	(9)	5	(23)	0	---

Table 7 Unit 1D commercial services used by moose hunters, regulatory years 1993–2002

	Unit residents		Other AK residents		Total use		Other
Year	No	Yes	No	Yes	No	Yes	services
1993	60	1	3	1	73	2	2
1994	104	1	3	0	107	1	1
1995	97	0	3	0	100	0	0
1996	82	1	5	0	87	1	0
1997	76	2	3	0	79	2	0
1998	133	1	6	0	139	1	0
1999[1]	126	2	15	0	141	2	1
2000[2]	132	1	12	1	144	2	1
2001[3]	128	1	8	0	136	1	0
2002[4]	134	0	9	0	143	0	0

[1] Eleven percent did not report whether or not they used commercial services.
[2] Seven percent did not report whether or not they used commercial services.
[3] Twelve percent did not report whether or not they used commercial services.
[4] Ten percent did not report whether or not they used commercial services.

Table 8 Unit 1D moose harvest by Wildlife Analysis Areas (WAA), regulatory years 1990 through 2002

Year	WAA								
	4302	4303	4304	4405	4406	4407	4408	Unknown	Total
1990	7	7	2	0	0	0	0	3	19
1991–1992			No season						---
1993	7	13	0	0	0	0	0	4	24
1994	5	10	0	0	0	0	0	2	14
1995	13	6	0	0	0	0	0	8	27
1996	8	8	0	3	0	0	0	3	22
1997	6	4	1	0	0	0	0	3	14
1998	10	2	0	0	0	0	0	6	18
1999	6	5	0	0	0	0	2	8	21
2000	6	5	0	0	0	0	2	5	18
2001	8	5	0	2	0	0	2	0	17
2002	11	7	1	1	0	1	1	0	22

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 3 (3000 mi^2)

GEOGRAPHIC DESCRIPTION: Islands of the Petersburg, Kake, and Wrangell area.

BACKGROUND

Isolated populations of moose (*Alces alces*) occur on the major islands of Unit 3 and are believed to be the *andersonii* subspecies. Moose on the Unit 3 islands emigrated in the past several decades from the Stikine and possibly Thomas Bay populations on the Unit 1B mainland. Increased sightings during the 1980s and 1990s suggest that moose populations and distribution are increasing in the Unit.

HABITAT DESCRIPTION

Because Unit 3 moose appear to depend on deciduous vegetation in clearcut areas rather than the more persistent riparian or glacial forelands vegetation typical of most Southeast Alaska moose range, it is unclear whether a viable population can be sustained over the long term.

Unit 3 moose habitat consists primarily of old-growth spruce-hemlock forest and clearcut areas. Extensive clearcutting on many of the islands has resulted in early successional vegetation that may temporarily provide good moose browse. No estimate has been made of the amount or quality of moose range in the unit.

HUMAN-USE HISTORY

Regulation History

From 1960 through 1967 the Unit 3 moose season was open from 15 September through 15 October with a one-bull limit. The season was closed from 1968 until 1990 when the season reopened on Wrangell Island from 1 to 15 October, with a one-bull bag limit, a spike-fork or 50” antler restriction, and a harvest ticket requirement. In 1991 the season reopened on Mitkof Island from 1 through 15 October with a one-bull bag limit, a spike-fork or 50” antler restriction, and a harvest ticket requirement. In 1993 the remainder of Unit 3 was opened from 1 through 15 October with a one-bull bag limit, a spike-fork, 3-brow tine or 50” antler restriction, and a registration permit requirement throughout the unit. From 1995 to present the season dates have been 15 September through 15 October.

Action by the Board of Game effective 1 July 1995 put all of Units 1B and 3 and that portion of Unit 1C south of Point Hobart under a common registration permit hunt (RM038). A legal moose for this hunt is a bull with a spike/fork or 50-inch antlers or 3 brow tines on at least 1 side.

Historical harvest patterns

The average annual harvest during the 1990s was 19 bulls, although during 1990 the season was open only on Wrangell Island, and during 1991 and 1992 the season was opened only on Wrangell and Mitkof islands. Between 1993 (the year the entire unit opened to moose hunting) and 2000, the average annual harvest was 24 bulls.

Unit 3 moose harvest chronology has varied. Most bulls are killed during the first half of the season and the harvest rate declines as the season progresses (Table 2). Most hunters are in the field early in the season, then effort drops except on weekends. Inclement weather does not seem to reduce hunting effort early in the season.

Historical harvest locations

In 1990, the year the season first opened in Unit 3, moose hunting was restricted to Wrangell Island and 3 bulls were killed. In 1992 and 1993, the season was opened on both Wrangell and Mitkof islands, and a total 10 and 17 bulls were harvested, respectively. Since 1993, the year all of Unit 3 was opened to moose hunting, the majority of moose harvested in the unit have come from Mitkof and Kupreanof islands.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

During the formulation of the Region I moose plan in the late 1980s (ADF&G 1990), we were unaware that by the mid-1990s a moose population would be established in Unit 3 capable of supporting an annual harvest. Harvesting a Unit 3 moose is often opportunistic, and habitat management and road construction will undoubtedly have greater effect on moose numbers and hunting opportunity compared to other factors. We cannot estimate how long Unit 3 habitat will support a viable moose population. The issue of rebuilding Sitka black-tailed deer populations on the Unit 3 islands compounds the complexity of establishing moose management goals. Moose numbers are currently high enough to support a hunting season in Unit 3, and we intend to continue the hunt as long as it does not affect the integrity of the population. We have established the following draft goals for Unit 3 moose, which include a crude estimate of the population size, limited knowledge of habitat utilization and moose movements, and anecdotal information from people in the field.

ADF&G first set management objectives for Unit 3 moose in 1996. Prior to that year, the harvest was sporadic and we were unsure how persistent the population or harvest would be. After 5 years when the annual harvest increased from 8 moose to as many as 19 and hunter participation grew from 24 to nearly 400 hunters, we decided some preliminary management objectives were necessary. However, ADF&G has never tried to estimate the Unit 3 moose population by aerial survey because of the difficulty of seeing moose in a mostly forested landscape. Consequently, in succeeding years when harvest and hunter numbers continued to increase it became apparent that more moose inhabited the islands than was originally thought. Objectives were increased to match the apparent capacity of the herd to sustain the increased harvest and effort.

Unit 3:	Plan Objective	2001	2002
Post hunt numbers	400	N/A	N/A
Annual hunter kill	40	23	26
Number of hunters	470	459	457
Hunter-days of effort	2300	2759	2978
Hunter success	10%	5%	6%

METHODS

Hunters and harvested moose were opportunistically checked in the field. Additionally, hunters were required to bring antlers of harvested moose to ADF&G to verify compliance with antler restrictions. Hunters were also required to submit the lower jaw of harvested moose for aging purposes. Since 1997 hunters have been asked to report on their registration permit reports the total number of moose (by sex and age class), wolves, and bears they observed during the hunting season.

RESULTS AND DISCUSSION

Because so little is known about Unit 3 moose – their permanence or their ability to sustain a hunt – objectives have been set at current levels of harvest, effort, and success. ADF&G considers the Unit 3 hunt to be an opportunistic hunt on a population whose permanence is unknown because it relies on atypical habitat. Without information on the current population or habitat-carrying capacity, population objectives are only speculative. Without that information we have supported only hunts with self-limiting regulations (such as spike-fork/50"/3 brow-tine antler restrictions). We believe such hunts enable the population to thrive as permitted by the carrying capacity of the habitat while providing hunting opportunity. Long-term persistence of Unit 3 moose may depend upon a major habitat enhancement program or continued clearcut logging, which may be detrimental to deer populations. ADF&G is currently unwilling to take such a proactive approach. Our current objectives are to “passively manage” the hunt, keeping seasons open as long as moose appear to be abundant, noting harvest and hunter effort, but not actively attempting to increase them.

POPULATION STATUS AND TREND

Population Size

Data are insufficient to make a quantitative determination of the Unit 3 moose population. We believe Unit 3 moose numbers are at low-to-moderate density and appear to be increasing.

The Unit 3 moose population is the most enigmatic in Southeast Alaska. Numbers, distribution, sex and age ratios, calf-to-cow ratios, and other population characteristics are unknown. No surveys have ever been conducted in Unit 3. Dense forest cover and the lack of any winter concentration areas make aerial surveys impractical. Harvest data and anecdotal information collected by ADF&G wildlife biologists over a period of many years continue to suggest an expanding population. Densities seem to be the greatest on Mitkof and eastern Kupreanof islands. Information is insufficient, however, to accurately estimate moose numbers in the unit. Predators, including wolves and black bears, exist on most islands in the unit, and a few brown bears exist on some islands close to the mainland, but the extent of predation is unknown.

Population Composition

No aerial surveys of moose populations have been conducted in the unit. Information on the number of moose observations reported by hunters on registration hunt report cards provides the only available information on population composition. In 2001 a total of 459 hunters reported observing 1170 moose, including 381 bulls, 520 cows, and 269 calves, for a bull-to-cow ratio of 73:100 and a calf-to-cow ratio of 52:100. In 2002, 457 hunters reported observing 972 moose, including 296 bulls, 425 cows, and 251 calves, for a bull-to-cow ratio of 70:100 and a calf-to-cow ratio of 59:100.

Distribution and Movements

Moose appear to be expanding their range in Unit 3 despite the lack of deciduous riparian vegetation typical of most moose habitat in the region. Moose have been seen crossing Dry Straits between Farm Island on the Stikine River delta and Mitkof Island. At low tide this strait can be crossed easily and moose are reported to move in both directions. Moose appear to be well distributed on Mitkof, Wrangell, and Kupreanof islands. Moose have become well established, and their numbers appear to be increasing on Etolin, Zarembo, and Kuiu islands.

MORTALITY

Harvest

<u>Season and Bag Limit</u>	<u>Nonresident and resident hunters</u>
Unit 3	15 Sep–15 Oct (General hunt only except in Stikine Drainage)
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side by registration permit only	

<u>Game Board Actions and Emergency Orders.</u> No Board of Game actions were taken or emergency orders issued regarding Unit 3 moose during the report period.

<u>Hunter Harvest.</u> In 2001, 459 hunters harvested 23 moose in Unit 3 (Table 1). In 2002, 457 permittees harvested 26 moose.

<u>Hunter Residency and Success.</u> Almost all Unit 3 moose hunters are local residents from Petersburg, Kake, and Wrangell (Table 4). The overall hunter success rate was 5% in 2001 and 6% in 2002.

Harvest Chronology. In 2001 the largest percentage of the annual harvest occurred during the first and last week of the season (Table 2). In 2002 the largest percentage of the annual harvest occurred during the last week, followed by identical harvests in the first and second weeks of the season.

Harvest in particular WAA's. In both 2001 and 2002 the highest percentage of the annual harvest occurred in WAA # 2007 on Mitkof Island and in WAA # 5132 on Kupreanof Island, respectively.

Guided hunter harvest. No guided moose hunts are currently offered in the unit.

Transport Methods. Hunters in Unit 3 relied on highway vehicles and boats to reach the field (Table 3).

Other Mortality

Predation by wolves on adult and calf moose has been reported in Unit 3. Substantial predation of moose calves by black bears has been documented in other areas and probably occurs in Unit 3. One cow moose was poached and its carcass left to lay on Mitkof Island after the close of the moose hunting season in 2002.

HABITAT ASSESSMENT

Assessment

Little is known about what constitutes suitable and preferred moose habitat in Unit 3, or if that habitat can sustain a viable moose population over a long period of time. Recent increases in moose distribution and abundance in Unit 3 are likely linked to timber harvest. Early successional clearcuts likely contributed to the increase in moose distribution and abundance by providing temporary increases in browse availability. It is unclear whether moose will persist in Unit 3 as existing clearcuts advance in age and browse availability decreases.

Enhancement

No habitat enhancement projects specifically intended to benefit moose have been attempted in the unit. Although primarily intended as a silvicultural practice, precommercial thinning and pruning has been performed in some young second-growth stands in the unit. These efforts provide a secondary benefit to moose by improving and extending habitat suitability by reducing canopy cover, which permits sunlight to reach the forest floor and increase the production of understory forage plants. These benefits are relatively short-lived, approximately 20–25 years, after which time canopy closure again results in loss of understudy vegetation.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The long-term effects of clearcut logging will probably be detrimental to moose populations. Left untreated, the dense, closed canopy forests characteristic of young, naturally regenerating second-growth conifer stands will reduce moose carrying capacity. The only way to prevent further decline of moose habitat will be to institute additional habitat manipulation procedures.

For genetic or environmental reasons moose in the unit do not exhibit a strong correlation between age and antler configurations; therefore, some modification of the existing antler restrictions may be justified. Moose in the unit rarely achieve 50-inch antler spreads, and the population appears to contain more illegal bulls than are needed to ensure timely breeding of cows.

CONCLUSIONS AND RECOMMENDATIONS

The Unit 3 moose population appears to have responded favorably to the initial increase in available browse resulting from extensive clearcut logging, but the dense, closed canopy forests caused by the natural regeneration of second-growth stands will eventually decrease the amount of available browse. The loss of habitat and resulting decline in food availability is of concern to biologists and hunters.

In 2001 and 2002 the Unit 3 moose hunt exceeded the objectives for number of hunters and days afield, but the objectives for annual harvest or success rate were not met. The Unit 3 moose population appears to be expanding.

We recommend that for the time being, Units 1B and 3 remain unified under one registration permit with season dates from 15 September through 15 October, a 1-bull bag limit, and a requirement for spike/fork or 50" antlers or at least 3 brow tines on 1 antler. Because Unit 3 moose do not display antler characteristics that correlate well with age, some modification of the existing antler restrictions or lengthening of the season may be justified in the future.

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Table 1 Unit 3 moose harvest, regulatory years 1993 through 2002

Year	Hunter harvest reported							
	M	(%)	F	(%)	Unk.	Total	Illegal	Total
1993	13	(100)	0	(0)	0	13	0	13
1994	19	(100)	0	(0)	0	19	0	19
1995	13	(100)	0	(0)	0	13	0	13
1996	21	(100)	0	(0)	0	21	3	24
1997	22	(100)	0	(0)	0	20	2	22
1998	40	(100)	0	(0)	0	40	2	42
1999[c]	24	(100)	0	(0)	0	24	2	26
2000	30	(100)	0	(0)	0	30	1	31
2001[c]	22	(100)	0	(0)	0	22	1	23
2002	25	(100)	0	(0)	0	25	1	26

[a] Wrangell Island only.
[b] Wrangell and Mitkof islands.
[c] Includes one DLP.

Table 2 Unit 3 moose harvest chronology in, regulatory years 1993–2002

Year	15–21 Sep	22–28 Sep	29 Sep–5 Oct	6–15 Oct	Total
1993	0	0	7	6	13
1994	0	0	15	4	19
1995	4	1	5	3	13
1996	9	6	4	5	24
1997	4	7	5	6	22
1998	14	13	7	8	42
1999	7	5	5	9	26
2000	11	7	5	8	31
2001	11	2	3	7	23
2002	6	6	5	9	26

Table 3 Unit 3 successful moose hunter transport methods, regulatory years 1993–2002

Year	Airplane	Boat	Highway vehicle	3/4 wheeler	Horse	Unknown	Total
1993	1	0	12	0	0	0	13
1994	0	3	16	0	0	0	19
1995	1	1	11	0	0	0	13
1996	1	5	17	1	0	0	24
1997	0	8	13	1	0	0	22
1998	0	9	32	0	0	1	42
1999	3	5	17	1	0	0	26
2000	2	6	23	0	0	0	31
2001	0	5	18	0	0	0	23
2002	0	7	19	0	0	0	26

Table 4 Unit 3 moose hunter residency and success, regulatory years 1993–2002

	Successful					Unsuccessful					
Year	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Total hunters
1993	12	1	0	13	(4)	305	15	3	323	(96)	336
1994	18	1	0	19	(5)	351	23	0	374	(95)	393
1995	13	0	0	13	(4)	306	18	0	324	(96)	337
1996	23	1	0	24	(7)	319	10	1	330	(93)	354
1997	22	0	0	22	(6)	329	21	0	350	(94)	372
1998	40	2	0	42	(9)	399	24	1	424	(91)	466
1999	26	0	0	26	(5)	429	32	2	463	(95)	492
2000	27	4	0	31	(6)	435	33	5	473	(94)	504
2001	20	3	0	23	(5)	404	31	1	436	(95)	459
2002	25	1	0	26	(6)	393	0	0	431	(94)	457

[a] Residents of Kake, Petersburg, and Wrangell.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 5 (5800 mi^2)

GEOGRAPHICAL DESCRIPTION: Cape Fairweather to Icy Bay, eastern Gulf of Alaska coast

BACKGROUND

Moose were first documented along the lower Alsek River in eastern Game Management Unit 5 in the late 1920s or early 1930s. Range expansion to the west followed slowly, with animals not documented on the Malaspina Forelands west of Yakutat Bay until the 1950s. It is believed that the glaciers and waters of Icy Bay curtailed westward movement of this moose population.

The moose population in Unit 5 grew rapidly and peaked in the early 1960s, with a population estimate exceeding 2000 animals. The population began declining toward a more realistic carrying capacity (thought to be substantially lower than 2000) in the mid 1960s. Poor reproductive success and severe winters in 1970 and 1972 depressed moose numbers further and resulted in the Unit 5A moose-hunting season being closed from 1974 to 1977. After the hunting closures in the mid 1970s, the Yakutat Forelands moose population slowly increased to its present level of 600–800 animals. The population appears to be at the carrying capacity of the habitat. The Nunatak Bench area was closed to hunting after rising water levels from the Hubbard Glacier ice dam flooded much of the moose habitat there in summer 1986. Following the retreat of the Hubbard Glacier and the subsidence of the waters of Russell Fiord in fall 1986, brushy vegetation recolonized the shoreline and moose reoccupied this range. Based on 1994 surveys, the Board of Game (BOG) reopened moose hunting in this area, beginning with the 1995 season.

Since 1978 Unit 5 moose hunting has been managed under a registration permit system.

In 1991 a federal subsistence season was instituted and ran concurrently with the state season. This federal season restricted hunting on federal public lands to local resident hunters during the first week of the season. In 1996 the Federal Subsistence Board lengthened the federal season by one week, starting it a week earlier than the state season. Although the concurrent seasons had been managed under the state's registration permit system, the new "early hunt" has been administered under a separate federal registration permit issued by the U. S. Forest Service (USFS) and the National Park Service and prohibits hunting on federal public lands except by Yakutat residents from 8 October through 21 October. However, there is a block of 9 townships of nonfederal land near Yakutat where nonfederally qualified subsistence users can legally hunt during the first week of the state season that begins 15 October.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

The following objectives based on existing biological data have been identified by staff with input from the public and are contained in the Strategic Plan for Management of Moose in Region I, Southeast Alaska (ADF&G 1991). They are compared with current population estimates and use levels (these estimates include data from both state and federal hunts).

	Current report period means (2001–2002)	Plan objective
Unit 5A Yakutat Forelands		
Posthunt moose numbers (estimated)	600–800	1000
Annual hunter kill	41	70
Number of hunters (annually)	190	250
Hunter-days of effort (annually)	830	1025
Hunter success (annual)	24%	28%
Unit 5A Nunatak Bench		
Posthunt moose numbers (estimated)	54	50
Annual hunter kill	1.5	5
Number of hunters (annually)	2.5	10
Hunter-days of effort (annually)	5.5	60
Hunter success (annual)	60%	50%
Unit 5B Malaspina Forelands		
Posthunt moose numbers (estimated)	200	250
Annual hunter kill	6	25
Number of hunters	25	50
Hunter-days of effort	134	200
Hunter success	24%	50%

METHODS

Aerial surveys were conducted in portions of Unit 5A and 5B during the report period as dictated by snow cover (Table 1). All surveys were flown with a Cessna 185 or 206 aircraft because better-suited survey aircraft are not available in Yakutat.

Three registration permit hunts were used to manage moose hunting effort in Unit 5: RM061, RM062 and RM059. In addition, we oversee a federal permit for the RM061 area. A condition of all registration hunts required successful hunters to bring in incisors from harvested moose for aging. Other data collected from the permit hunt reports included the hunt length, hunter residency, hunt location, commercial services used, transport means, and date of kill.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In the Yakutat and Malaspina forelands, where the heavy coniferous forest makes it difficult to detect moose, we assume a moose sightability of about 50% (Smith and Franzman 1979). Nunatak Bench lacks coniferous stands, resulting in much higher sightability. Given the wide range of survey intensity from year to year, perhaps the best gauge of moose numbers is the number of moose observed per hour of survey time (Table 1).

Unit 5(A) Yakutat Forelands: Aerial surveys suggest that the moose population size on the Yakutat forelands has remained relatively stable over the past 20 years (Table 1). During this report period we were only able to conduct a partial moose survey during RY 2001 due to poor snow conditions. This most recent survey enumerated 274 animals, but included only 50% of the survey area. The sighting rate of 41 moose per hour is comparable to other years. Because of the inconsistent survey coverage, the number of moose seen per hour of surveying is probably a better benchmark than overall numbers of moose for interpreting moose population density. It is important to look critically at this moose-per-hour data by examining the survey areas as well as the time spent surveying. Longer survey times over the past 10 years correspond to lower sighting rates; this is probably due to a larger survey area including areas away from moose concentrations, thereby lowering sighting rates.

In March 2002 the USFS in Yakutat began a cooperative study with ADF&G to assess several parameters of the moose population on the Yakutat Forelands. These are moose sightability, productivity, fitness, and seasonal habitat use. Initially, 20 cow moose were captured and fitted with global positioning system (GPS) radio collars. Blood was drawn to determine pregnancy status, fecal pellets were collected for diet analysis, rump fat was measured via ultrasound for a condition index, and an incisor tooth was collected for age analysis. The moose were then radiotracked throughout the summer and fall, noting presence or absence of calves when possible, and downloading location data from the GPS collars. In early winter of 2002 and spring 2003 these marked animals were recaptured and again processed. In addition, more animals were radiocollared (both cows and bulls) to meet the objectives of the study.

Unit 5(A) Nunatak Bench: The moose herd at Nunatak Bench continues to hold its own despite a 65 foot rise in water level at the site during summer 2002. As happened in 1989, the Hubbard Glacier advancement created a dam that resulted in a rise in the water level in this area. However, unlike in 1989, the moose population hasn’t appeared to suffer from this event this time around, based on the most recent aerial survey count (Table 1). The extremely high count of 54 moose in 2000 was probably more due to good survey conditions than to a sudden increase in moose numbers.

Unit 5(B) Malaspina Forelands: The Unit 5B moose population appears to be relatively stable, based on the most recent aerial surveys conducted in RY2001 (Table 1). Although the number of moose seen isn’t as high as in some past surveys, the number of moose seen per hour of surveying suggests the moose density hasn’t changed much over time. We estimate the moose population in 5B to be 150–200 animals.

Population Composition

Although we recorded composition during 2001 for the Nunatak Bench and Malaspina Forelands moose herds, these figures are not wholly accurate due to survey timing (Table 1). Several of the bull moose we counted had only one antler remaining, and likely there were others that had lost both antlers. Because of this, our estimate of bulls is low and of cows is inflated, resulting in recorded bull- and calf-to-100 cow ratios that are lower than actual. However, we were able to conduct a reliable composition survey in spring 2002 on the Yakutat Forelands with the aid of a helicopter (Table 1).

Since 1984 the mean age at harvest of Unit 5A Yakutat Forelands moose has ranged from a low of 2.2 years in 1995, to a high of 4.4 years in 2002 (Table 2). Mean age at harvest increased from 3.6 during the previous report period to a mean of 4.2 years during 2001–02. This increased age at harvest is substantially higher than the previous 10-year mean of 3.2. However, the harvest of 1.5 aged bulls rebounded to 31% during the current report period from a 20-year low of 15% during 1999–2000 (Table 2).

In contrast to the relatively consistent age of moose harvested in Unit 5A, the mean age of harvested Malaspina Forelands moose has been erratic, ranging between 2.7 and 5.4 years since 1990. The limited access and resultant lower hunting pressure on the Malaspina Forelands probably allows bulls to reach an older age than those on the Yakutat Forelands (Table 2). Also, we are dealing with a smaller sample size of harvested moose in 5B that leads to this phenomenon.

The low moose harvest at Nunatak Bench has not allowed us to gather any meaningful age distribution information.

MORTALITY

Harvest

Season and bag limits	Resident and nonresident hunters
Unit 5A, except Nunatak Bench	15 Oct–15 Nov
1 bull by registration permit only; up to 60 bulls may be taken; the commissioner may close the season in that portion west of the Dangerous River when 30 bulls have been taken from that area	
Unit 5A, Nunatak Bench	15 Nov–15 Feb
1 moose by registration permit only; up to 5 moose may be taken	
Unit 5B	1 Sep–15 Dec
1 bull by registration permit only; up to 25 bulls may be taken	

Game Board Actions and Emergency Orders. No emergency orders regarding Unit 5 moose hunting were issued during the report period.

Hunter Harvest. The annual harvest of moose in Unit 5A ranged from 38 to 61 during 1984–1998, with a mean of 51. However, during the last 2 report periods, the mean harvest has declined to 41 animals (Table 3). The reasons for this decline are not clear, although hunter effort, foul weather, and some loss of moose from heavy snows during the winter of 1998–99 are likely factors. We cannot determine with any certainty if there was a decline in hunter effort due to missing federal permit information. For the 2002 season, both a state and a complete federal database were compiled, which show that hunter effort appears to be fairly consistent with effort prior to the dual registration permit system implemented in 1996.

The harvest in Unit 5B also declined precipitously during this report period. The mean annual harvest dropped to an all-time low of 6 moose, with only 3 being taken in 2002. A glance at hunter effort in Table 3 indicates a lack of effort was not the reason for the low harvest; rather, it appears to be a lack of moose. The 21 unsuccessful hunters spent an average of 5.4 days afield in search of a moose, and given that any bull is legal in this area, this suggests that few bulls were seen. Further investigation into the hunting effort during 2002 revealed 2 reasons somewhat responsible for this low harvest. First, 75% of the hunting effort took place at Esker Stream, and after 2 bulls were harvested, the remaining hunting effort did not yield any moose. Second, in 2002 the number of guided hunters was only a portion of what it had been in previous years (Table 7), and they only harvested 1 moose compared to the 3–5 animals taken by guided hunters in previous years (Table 4). An aerial survey conducted in 2001 (Table 1) indicated the moose density based on moose seen per hour of flying was comparable to previous surveys.

The harvest of 3 moose at Nunatak Bench was equivalent to the previous report period. Two animals were taken in 2001 and 1 was taken in 2002 (Table 3).

Permit Hunts. The total number of permits (both state and federal) issued for the Yakutat Forelands hunt (RM061) exceeded 300 for both 2001 and 2002, in part due to Yakutat residents obtaining both permits (Table 5). This continues to cause considerable confusion for ADF&G personnel when tabulating hunting effort. We were unable to gather federal permit information for approximately 40% of federal hunters for 2001; however, we were able to obtain complete information for 2002.

The Nunatak Bench hunt (RM059) received less than half of the hunting effort (5 hunters vs. 12) of the previous 2-year period, but the number of moose harvested was identical at 3. Difficult access to this area makes it a very challenging place to hunt and few people are willing to even attempt a hunt at Nunatak.

The Unit 5B hunt (RM062) also received more hunting pressure during this report period (50 hunters) compared to the previous 2 years (38 hunters). Despite increased effort, the harvest dropped from 18 bulls taken during 1999–2000 to only 12 bulls taken during this report period. Nonresident effort in 2002 dropped 58% from the previous year, which partially accounts for the decrease in the total harvest.

Staff from the Department of Public Safety/Division of Fish and Wildlife Protection and both ADF&G fisheries divisions continued to assist with permit issuance and monitoring of these permit hunts. Enforcement personnel from the USFS also helped monitor the Unit 5A hunt during the report period. Reminder cards and certified letters were used to increase compliance with reporting requirements for the state permit hunts. The federal permit process complicates matters because some hunters pick up both a state and a federal permit, while other hunters get one or the other. In addition, the federal hunt reporting requirements are not as stringent as ours, in that delinquent hunt reports are not pursued.

Hunter Residency and Success. Local residents hunt primarily in Unit 5A on the Yakutat Forelands (Table 4). Beginning with state regulations in 1987, local residents were able to hunt the first week of the season before it opened to nonlocal hunters. In 1991 federal subsistence regulations allowed local residents exclusive hunting rights on federal lands for the first week of the concurrent state and federal seasons. The 1996 implementation of a federal season preceding the state season by a week has further enhanced opportunity for local hunters. The first portion of the moose hunt traditionally accounts for a majority of the 5A harvest, and since most easily accessible land is under federal management, harvest by Yakutat residents predominates. Local hunters took 71% of the bulls harvested in 5A in 2001–2002. The majority of moose taken by local hunters were taken during the first 2 weeks of the season. Later in the season, use increased by nonlocal hunters in areas farther from Yakutat (especially east of the Dangerous River) and in those areas accessible only by airplane. Nonlocal Alaskans hunting in Unit 5A took 10 moose (26% of bulls taken under registration permits) in 2001 and 10 (22%) in 2002. Most nonlocal Alaska hunters are from Juneau. Nonresidents took 3 moose in Unit 5A during the 2001 season and 1 in 2002 (Table 4).

Since 1986 the overall success of Unit 5A hunters has ranged from 19 to 35 percent (Table 3). In 2001 hunter success was 25%, then 24% in 2002. Information gathered for the 2002 hunt, which includes complete federal data, suggests that hunter effort is near the level reached in 1993, when effort reached an all-time high (Table 5). Considerable time has been spent to incorporate federal data and suggests that 1996–2000 hunter effort is underrepresented. Care should be taken in interpreting these data because of the ambiguous federal hunt information.

Hunting effort at Nunatak Bench during the report period was substantially lower than the previous report period (11 hunter days for 5 hunters during 2001–2002 versus 28 days for 12 hunters during 1999–2000). Hunter success during this report period was 60% compared to 25% during the previous 2 years. Local hunters harvested all 3 moose taken at Nunatak Bench during the report period (Table 4).

The Malaspina Forelands hunt is less dominated by local use because it is less convenient to hunt, and inclement weather often deters local hunters from short excursions to this area. Local residents took 3 of 12 moose (25%) harvested during the report period, compared to 22% during the previous 2 years. Nonlocal state residents killed 4 of the moose during the report period, while nonresidents took the largest proportion, at 5 animals (41%). Nonresident harvest dropped 50% from the previous report period. All nonresident hunters were guided.

Harvest Chronology. Moose harvest from Unit 5 early in the state season is relatively low, partly because only Unit 5B is open from 1 September through 14 October (Table 4), and this area typically accounts for only a small portion of the total Unit 5 harvest. Most of the Unit 5 harvest takes place during the first weeks of the 5A season, when areas adjacent to Yakutat and easily accessible by boat or highway vehicle are first open. Most of the harvest on the Yakutat Forelands took place during the first part of the state season, but unlike the previous report period, the guideline harvest was not reached during either year, and the season remained open until the scheduled closing date of 15 November. Moose were harvested throughout the latter part of the season, but in small numbers.

Two of 3 moose taken at Nunatak Bench were harvested in November and the third was taken in January. Most moose harvested in this area are taken in January or February when they are nearer the beach and easier to access, and when days lengthen, allowing for more hunting opportunity.

The Malaspina Forelands harvest is generally concentrated during the latter part of September and early October. This was the case during this report period, largely the result of nonresident hunting coincident with the beginning of the rut.

Transport Methods. Transport methods used in the Yakutat Forelands during the current report period differed from the previous report period (Table 6). The use of aircraft dropped from 37 to 27% for successful hunters. The use of boats (40%) surpassed highway vehicles (19%) as the next most popular method. Three- and 4-wheelers accounted for 14% of the transportation used, and are probably underrepresented because some hunters reporting highway vehicles or "other" probably used off-road vehicles as well. Many unsuccessful hunters also use these machines for access. Virtually every fish camp has one or more of these machines present, and although these off-road vehicles have been used in Yakutat for many years, more hunters seem to be using them in a less incidental fashion and more as a primary method of access. These machines are commonly used to drag whole moose from a kill site to the nearest road. Rutted meadows from wheeled vehicles are now a common sight in Unit 5A.

Despite the importance of aircraft for hunter transportation, relatively few Yakutat residents use them. Most locals hunt with the aid of riverboats, ATV's, or highway vehicles, while most nonresident hunters charter aircraft for access. The use of aircraft generally increases later in the season as nonlocal hunters begin hunting in nonroaded portions of the unit.

Commercial Services. Commercial services were used by 13% of Unit 5 moose hunters during the report period (Table 7). Nonlocal hunters were more likely to use commercial services, with transport to the field being used the most. Commercial services were used by a higher percentage of Unit 5B hunters than in Unit 5A. This undoubtedly reflects the fact that the Malaspina Forelands are more difficult to access.

Other Mortality. One male, one female, and one moose of unidentified sex were harvested under federal ceremonial permits, and one male and one female were taken under state ceremonial permits during the report period. This represents a 50% decline in the federal ceremonial harvest from the previous report period, but an increase from 0 to 3 in the state ceremonial harvest.

The winter of 1998–1999 was severe, with deep snow persisting until late May on much of Unit 5. Anecdotal information from a local pilot suggests that many moose succumbed to wolf and bear predation during late winter and spring.

Habitat. ADF&G staff did not undertake any habitat assessment or enhancement procedures during the period.

CONCLUSIONS AND RECOMMENDATIONS

Complete fall sex and age composition counts of all Unit 5 moose herds need to be conducted, if possible, during the next report period. Reliable survey data will allow us to better interpret the decline in moose harvest and make necessary adjustments to our management strategies if necessary. Hopefully, the moose study that is underway will provide us with a sightability model we can use in interpreting our survey data to more accurately estimate the moose population. Age data on harvested moose should continue to be collected and carefully scrutinized. In addition, a joint state-federal permit for the RM061 hunt needs to be pursued to allow us to reliably capture hunting effort.

Most management goals for Unit 5 moose hunts were not met during this report period. The most glaring shortfalls have been in the harvest objectives. These objectives have not been met for any of the 3 moose populations in recent history and should be changed to more realistic numbers.

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Table 1 Unit 5 aerial survey data, regulatory years 1984 through 2002

Year	MM	FF	Calves	Unk	Total	Count time (hrs)	MM Per 100 FF	Calves per 100 FF	Percent calves in herd	Moose per hour
					5A Yakutat Forelands					
1984	90	229	60	---	379	12.1	39	26	16	31
1985	50	168	41	---	259	11.0	30	24	16	24
1986	34	166	60	---	260	11.3	20	36	23	23
1987	---	---	83	---	322	11.2	---	---	26	29
1988	91	339	85	---	515	10.3	27	25	17	50
1989						No survey				
1990	43	309	93	---	445	6.8	14	30	21	66
1991[1]	---	---	---	---	204	8.0	---	---	---	26
1992	---	---	37	---	196	5.9	---	---	19	33
1993[2]	---	---	---	---	219	6.3	---	---	---	35
1994[3]	51	124	51	158	397	9.3	20	32	21	41
1995	14	71	78	303	466	8.5	---	---	17	55
1996	10	68	8	---	86	1.9	15	12	9	45
1997						No survey				
1998	7	17	17	333	374	6.7	---	---	---	56
1999						No survey				
2000	1	10	11	343	365	9.1	---	---	---	40
2001[6]	26	32	33	183	274	6.7	NA	NA	12	41
2002[7]	28	146	21	0	195	NA	19	14	11	NA
					5A Nunatak Bench					
1984	10	13	4	---	27	0.5	77	31	15	54
1985						No survey				
1986	5	4	1	---	10	0.5	125	25	10	20
1987–1993						No survey				
1994	3	18	---	---	25	0.3	16	22	16	75
1995	5	6	6	16	33	0.3	---	---	18	110
1996–1998						No survey				
1999	---	---	---	33	33	0.4	---	---	---	83
2000	---	1	1	52	54	0.8	---	---	---	69
2001[8]	8	4	3	20	35	0.5	23	9	13	66
2002						No survey				
					5B Malaspina Forelands					
1981[4]	21	88	25	---	134	3.1	24	28	19	43
1982	26	103	16	---	145	8.4	25	16	11	17
1983	---	---	21	---	66	1.8	---	---	32	37
1984–1986						No surveys				
1987[5]	---	---	14	---	69	2.8	---	---	20	25
1988–1994						No surveys				
1995	4	10	11	84	109	1.75	---	---	10	62
1996–1998						No surveys				
1999	---	---	---	38	38	0.8	---	---	---	48
2000	---	2	3	108	113	2.2	---	---	---	51
2001[8]	22	8	9	52	91	2.0	24	15	10	46
2002						No survey				

[1] NPS survey using a PA-18, from 3/1 to 3/5, 1991, from the mouth of the Doame River northwest to the Dangerous River.
[2] USFS survey using a C-185 done from 2/14 to 2/17, 1994, between Yakutat and Dry Bay.
[3] Age and sex ratios reflect flights made in a PA-18 (5.5 hrs. from 12/2 to 12/3, 1994); total numbers include flights in both PA-18 and C-185 (3.62 hrs. from 12/6 to 12/7, 1994.
[4]Bancas Point to Sitkagi Bluffs only.
[5] Sex and age ratios unreliable.
[6.]Includes only that area between Yakutat Bay and the Dangerous River.
[7.]Composition survey using a helicopter. Not meant to quantify moose numbers.
[8.]Composition not wholly accurate as some antlerless moose were likely bulls.

Table 2 Unit 5 age structure of harvested moose, regulatory years 1984 through 2002

Year	0.5	1.5	2.5	3.5	4.5	5.5	6.5	Age Class 7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	Total kill	% Aged	Mean Age
									Yakutat Forelands										
1984	2	13	11	6	7	3	2	3	0	0	0	0	0	0	0	0	49	96	3.2
1985	1	15	10	10	2	1	3	1	0	1	1	1	0	0	0	0	46	100	3.4
1986	3	10	13	8	4	9	3	1	0	2	0	0	0	0	0	0	54	98	3.6
1987	1	14	7	3	7	2	1	0	1	0	0	0	0	0	0	0	38	95	3.0
1988	0	17	16	5	2	3	1	0	1	0	1	0	0	0	0	0	47	98	2.9
1989	0	10	16	7	5	4	0	1	0	0	0	0	0	0	0	0	45	96	3.1
1990	0	16	18	14	4	3	2	0	0	0	0	0	0	0	0	0	57	100	2.9
1991	0	20	18	7	4	1	0	1	1	0	0	0	0	0	0	0	52	100	2.7
1992	0	13	5	5	3	1	2	1	0	0	0	0	0	0	0	0	50	60	3.0
1993	0	12	7	14	3	2	1	2	1	0	0	0	0	0	0	0	50	84	2.8
1994	0	23	8	6	5	4	0	3	2	1	0	1	0	0	0	0	60	90	2.9
1995	0	20	12	4	2	3	1	0	1	0	0	0	0	0	0	0	45	96	2.2
1996	0	19	12	9	5	2	5	1	0	2	0	0	0	0	0	0	60	92	2.8
1997	1	22	18	8	4	3	1	0	2	0	1	0	0	1	0	0	61	97	2.7
1998	1	15	11	10	6	2	4	1	0	2	0	0	0	0	0	0	55	95	2.9
1999	0	6	15	6	7	0	2	1	0	0	0	0	0	0	0	0	41	90	3.2
2000	0	6	6	9	7	3	2	2	1	0	0	0	0	0	0	0	37	97	3.9
2001	1	11	4	5	5	2	4	1	2	0	0	0	0	1	0	0	38	95	3.9
2002	0	12	5	6	4	2	3	4	2	0	1	1	1	0	0	0	45	91	4.4
									5A Nunatak Bench										
1995										No age data									
2000	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	100	5.0
2001	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	50	3.5
2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	---
									5B Malaspina Forelands										
1990	0	5	2	3	2	1	0	1	0	0	0	0	0	0	0	0	14	100	3.2
1991	0	3	3	1	2	2	1	0	3	0	0	0	0	0	0	0	17	88	4.5
1992	0	0	5	0	0	0	0	1	0	0	0	0	0	0	0	0	7	86	3.3
1993	0	2	4	3	3	0	1	0	0	0	0	0	0	0	0	0	15	87	2.8
1994	0	0	0	1	3	1	1	0	1	0	0	0	0	0	0	0	7	100	4.9
1995	0	2	5	1	3	0	0	0	1	0	0	0	0	0	0	0	12	100	2.9
1996	0	1	2	1	2	3	1	0	0	2	1	1	0	0	0	0	16	88	5.4

Table 2 continued

Year								Age	Class								Total	%	Mean
	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	kill	Aged	Age
1997	0	1	2	3	1	0	0	1	2	0	0	0	0	0	0	0	13	77	4.1
1998	0	1	3	3	2	0	0	0	0	0	0	0	0	0	0	0	10	90	2.7
1999	0	1	1	1	2	0	1	1	0	0	0	0	0	0	0	0	7	100	4.4
2000	0	1	1	5	1	0	0	0	1	0	0	0	0	0	0	0	11	82	3.8
2001	0	4	0	2	1	1	0	0	1	0	0	0	0	0	0	0	9	100	3.5
2002	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	3	67	3.0

Table 3 Unit 5 historical harvests, hunters, and success, regulatory years 1984–2002

Year	Nr MM	Nr FF	Nr unk.	Total kill	Nr hunters	Percent success
			5A Yakutat Forelands			
1984	49	0	0	49	230	21
1985	46	0	0	46	129	36
1986	54	0	0	54	198	27
1987	38	0	0	38	199	19
1988	47	0	0	47	153	31
1989	45	0	0	45	163	28
1990	57	0	0	57	178	32
1991	52	0	0	52	175	30
1992	50	0	0	50	199	25
1993	50	1[1]	0	51	204	25
1994	60	1[1]	0	61	208	29
1995	48[2]	2	0	50	185	24
1996	60	1	0	61	190	32
1997	59	1	1	61	194	30
1998	54	1	0	55	195	27
1999	41	1	0	42	114	35
2000	37	0	0	37	146	25
2001	37	1	0	38	152	25
2002	43	1	1	45	187	24
			5A Nunatak Bench			
1984	3	3	0	6	14	43
1985	2	0	0	2	3	67
1986–1994				Season closed		
1995–1996				No moose harvested		
1997	2	0	0	2	2	100
1998	0	1	0	1	3	33
1999	0	0	0	0	5	0
2000	2	1	0	3	7	43
2001	2	0	0	2	2	100
2002	0	1	0	1	3	33
			5B Malaspina Forelands			
1984	15	0	0	15	50	30
1985	13	0	0	13	62	21
1986	9	0	0	9	34	26
1987	8	0	0	8	34	24
1988	11	0	0	11	40	28
1989	12	0	0	12	44	27
1990	14	0	0	14	49	40
1991	17	0	0	17	39	44
1992	7	0	0	7	25	28
1993	15	0	0	15	31	48
1994	7	0	0	7	26	27
1995	12	0	0	12	28	43
1996	16	0	0	16	31	52
1997	13	0	0	13	29	45
1998	10	0	0	10	24	42

Table 3 continued

Year	Nr MM	Nr FF	Nr unk.	Total kill	Nr hunters	Percent success
1999	7	0	0	7	12	58
2000	11	0	0	11	26	42
2001	9	0	0	9	26	35
2002	3	0	0	3	24	13

[1] Illegal kills not included in the calculation of hunter success.
[2] Includes 3 bulls harvested under ceremonial permits; not included in hunter success ratios.

Table 4 Unit 5 annual moose kill by community of residence, regulatory years 1984 through 2002

Year	Total kill	Yakutat	Juneau	Ketchikan	Sitka	Pelican	Hoonah	Petersburg	Haines	Wrangell	Other AK	Non-resident
						5A Yakutat Forelands						
1984	49	18	16	2	6	0	2	1	0	1	1	2
1985	44	28	13	0	3	0	0	0	0	0	0	0
1986	54	22	16	1	4	1	3	0	4	0	2	1
1987	38	27	7	0	1	0	0	0	0	0	2	1
1988	47	38	6	0	0	0	1	0	0	0	1	1
1989	45	40	2	0	1	0	0	0	0	0	2	0
1990	50	45	11	1	0	0	0	0	1	0	3	2
1991	52	28	15	0	2	0	0	0	1	0	5	2
1992	50	32	7	0	0	3	0	0	3	0	2	3
1993	50	31	11	0	3	1	0	0	0	0	2	2
1994	60 [1]	38	14	1	0	2	0	0	0	0	3	2
1995	50[2]	35	14	0	0	1	0	0	0	0	0	0
1996	60	45	7	0	1	0	0	0	0	0	3	4
1997	61	45	13	0	0	1	0	0	0	0	1	1
1998	55	38	10	0	0	0	0	0	0	0	4	3
1999	41	27	10	0	0	0	0	0	0	0	1	3
2000	37	27	7	0	0	0	0	0	0	0	1	2
2001	38	25	8	0	0	0	0	0	0	0	2	3
2002	45	34	6	0	1	0	0	0	2	0	1	1
						5A Nunatak Bench						
1984–1996							(No Data)					
1997	2	2	0	0	0	0	0	0	0	0	0	0
1998	1	1	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	3	1	0	0	0	0	0	2	0	0	0	0
2001	2	2	0	0	0	0	0	0	0	0	0	0
2002	1	1	0	0	0	0	0	0	0	0	0	0
						5B Malaspina Forelands						
1984	15	5	1	6	0	0	0	0	0	0	0	3
1985	13	8	2	1	0	0	1	0	0	0	1	0
1986	9	3	2	0	0	0	0	0	0	0	0	4
1987	8	5	1	0	0	0	0	0	0	0	0	2
1988	11	5	3	1	1	0	0	0	0	0	1	0
1989	12	7	2	1	0	0	0	0	0	0	1	1
1990	14	9	3	0	0	0	0	0	0	0	1	1
1991[3]	17	7	4	1	0	0	0	0	0	0	3	1
1992	7	4	3	0	0	0	0	0	0	0	0	0
1993	15	3	2	1	0	0	0	0	0	0	0	9
1994	7	3	2	0	0	0	0	0	0	0	1	1
1995	12	4	3	0	1	0	0	0	0	0	0	4
1996	16	6	2	0	0	0	1	0	1	0	0	6
1997	13	4	1	0	0	0	0	0	0	0	1	7

Year	Total kill	Yakutat	Juneau	Ketchikan	Sitka	Pelican	Hoonah	Petersburg	Haines	Wrangell	Other AK	Non-resident
1998	10	4	2	0	0	0	0	0	0	0	0	4
1999	7	2	0	0	0	0	0	0	0	0	0	5
2000	11	2	2	0	1	0	0	0	0	0	1	5
2001	9	1	4	0	0	0	0	0	0	0	0	4
2002	3	2	0	0	0	0	0	0	0	0	0	1

[1] Does not include 1 known illegal kill.
[2] Includes 5 moose harvested under ceremonial permits, 3 bulls and 2 cows.
[3] Includes 1 kill by hunter of unknown residency.

Table 5 Unit 5 hunter effort and success, regulatory years 1990 through 2002[1]

		Successful hunters			Unsuccessful hunters			Total hunters		
Year	Permits issued	Nr hunters	Total days	Avg. days	Nr hunters	Total days	Avg. days	Nr hunters	Total days	Avg. days
					5A Yakutat Forelands					
1984	---	49	132	2.7	181	978	5.4	230	1110	4.8
1985	---	44	117	2.7	84	457	5.4	128	574	4.6
1986	---	54	171	2.7	143	696	4.9	197	867	3.6
1987	---	38	109	2.9	161	948	5.9	199	1057	5.6
1988	206	47	95	2.0	106	281	2.7	153	376	2.4
1989	213	45	107	2.4	118	620	5.3	163	727	4.3
1990	213	57	110	1.9	122	497	4.2	178	607	3.5
1991	236	52	162	3.1	123	425	3.4	175	587	3.6
1992	238	50	130	2.6	149	771	6.0	199	901	4.5
1993	239	50	204	4.1	154	979	6.5	204	1183	5.9
1994	268	60	167	2.9	148	712	4.8	208	879	4.4
1995	245	45	99	2.3	140	471	3.4	185	570	3.1
1996	277	60	147	2.6	76	427	3.6	190	574	3.0
1997	300	59	154	2.8	110	453	4.1	194	607	3.1
1998	303	52	102	2.0	135	373	2.8	195	475	2.4
1999	157	41	101	2.5	73	282	4.2	114	383	3.6
2000	173	37	92	2.6	108	626	6.0	146	718	5.2
2001	198	38	130	3.4	126	604	4.8	164	734	4.5
2002	221	45	137	3.0	171	788	4.6	216	925	4.3
					5A Nunatak Bench					
1984	---	6	27	4.5	8	24	3.0	14	51	3.6
1985	---	2	44	22.0	1	10	10.0	3	32	10.7
1986–1994					Season Closed					
1995	19	0	0	0	3	3	1.0	3	3	1.0
1996	9	0	0	0	3	4	1.3	3	4	1.3
1997	10	2	3	1.5	0	0	0	2	3	1.5
1998	11	1	2	2.0	2	5	2.5	3	7	2.3
1999	12	0	0	0	5	14	3.5	5	14	3.5
2000	14	3	6	2.0	4	8	2.0	7	14	2.0
2001	9	2	5	2.5	0	0	0	2	5	2.5
2002	9	1	2	2.0	2	4	2.0	3	6	2.0
					5B Malaspina Forelands					
1984	---	15	40	2.7	40	191	4.8	55	231	4.2
1985	---	13	34	2.6	49	226	4.6	62	260	4.2
1986	---	9	40	4.4	27	139	5.1	36	179	5.0
1987	---	8	56	2.8	16	83	5.2	24	139	5.8
1988	58	11	39	3.5	29	120	4.1	40	159	4.0
1989	65	12	47	3.9	32	143	4.7	44	190	4.3
1990	60	14	53	3.8	35	80	2.4	49	133	2.8
1991	60	17	51	3.0	22	90	4.5	39	141	3.8
1992	52	7	22	3.1	18	61	3.4	25	83	3.3
1993	54	15	30	2.0	16	91	5.7	31	121	3.9
1994	42	7	109	15.6	19	26	1.9	26	135	6.4
1995	56	12	46	3.8	15	57	3.8	27	103	3.8
1996	55	16	71	4.4	14	75	5.4	30	146	4.9

Table 5 continued

Year	Permits issued	Successful hunters Nr hunters	Successful hunters Total days	Successful hunters Avg. days	Unsuccessful hunters Nr hunters	Unsuccessful hunters Total days	Unsuccessful hunters Avg. days	Total hunters Nr hunters	Total hunters Total days	Total hunters Avg. days
5B Malaspina Forelands										
1997	48	13	44	3.4	16	62	4.8	29	106	4.1
1998	43	10	44	4.4	14	63	4.5	24	107	4.6
1999	37	7	36	5.1	5	25	6.3	12	61	5.5
2000	46	11	54	4.9	15	71	5.1	26	125	5.0
2001	45	9	31	3.4	17	118	6.9	26	149	5.7
2002	36	3	6	2.0	21	113	5.4	24	119	5.0

[1] Includes data from both federal and state moose permits. Not all information is available for each hunter; calculations for any given field may only include a subset of hunters.

Table 6 Unit 5 transport methods used by successful hunters, regulatory years 1990 through 2002[1]

Year	Airplane		Boat		3 or 4 wheeler		ORV		Highway vehicle		Foot	
	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
5A Yakutat Forelands												
1990	29	(51)	10	(18)	7	(12)	0	---	11	(19)	0	---
1991	29	(56)	6	(12)	7	(13)	0	---	10	(19)	0	---
1992	22	(44)	8	(16)	9	(18)	0	---	11	(22)	0	---
1993	25	(50)	12	(24)	6	(12)	0	---	5	(10)	2	(4)
1994	24	(41)	15	(25)	9	(15)	0	---	9	(15)	2	(3)
1995	15	(37)	11	(27)	9	(23)	1	(3)	4	(10)	0	---
1996	13	(22)	15	(26)	10	(17)	0	---	16	(28)	4	(7)
1997	17	(44)	6	(16)	4	(11)	0	---	11	(29)	0	---
1998	16	(29)	15	(28)	8	(15)	0	---	15	(28)	0	---
1999	10	(32)	15	(48)	0	---	0	---	6	(19)	0	---
2000	12	(44)	11	(41)	0	---	0	---	4	(15)	0	---
2001	11	(32)	14	(41)	1	(3)	0	---	8	(24)	0	---
2002	10	(23)	17	(39)	9	(20)	1	(2)	7	(16)	0	---
5A Nunatak Bench												
1995	0	---	0	---	0	---	0	---	0	---	0	---
1996	0	---	0	---	0	---	0	---	0	---	0	---
1997	0	---	2	(100)	0	---	0	---	0	---	0	---
1998	0	---	1	(100)	0	---	0	---	0	---	0	---
1999	1	(25)	3	(75)	0	---	0	---	0	---	0	---
2000	0	---	7	(100)	0	---	0	---	0	---	0	---
2001	0	---	2	(100)	0	---	0	---	0	---	0	---
2002	0	---	1	(100)	0	---	0	---	0	---	0	---
5B Malaspina Forelands												
1990	9	(69)	4	(31)	0	---	0	---	0	---	0	---
1991	14	(82)	2	(12)	0	---	1	(6)	0	---	0	---
1992	5	(100	0	---	0	---	0	---	0	---	0	---
1993	12	(80)	0	---	3	(20)	0	---	0	---	0	---
1994	5	(71)	2	(29)	0	---	0	---	0	---	0	---
1995	8	(89)	0	---	0	---	1	(11)	0	---	0	---
1996	8	(58)	1	(7)	3	(21)	0	---	0	---	2	(14)
1997	3	(22)	4	(31)	4	(31)	1	(8)	0	---	1	(8)

Table 6 continued

Year	Airplane Total	(%)	Boat Total	(%)	3 or 4 wheeler Total	(%)	ORV Total	(%)	Highway vehicle Total	(%)	Foot Total	(%)
						5B Malaspina Forelands						
1998	6	(60)	1	(10)	3	(30)	0	---	0	---	0	---
1999	2	(29)	1	(14)	4	(57)	0	---	0	---	0	---
2000	9	(82)	0	---	2	(18)	0	---	0	---	0	---
2001	6	(75)	0	---	2	(25)	0	---	0	---	0	---
2002	2	(67)	0	---	0	---	1	(33)	0	---	0	---

[1] Not all information is available for each hunter; calculations for any given field may only include a subset of hunters.

Table 7 Unit 5 commercial services used by hunters, regulatory years 1991 through 2002[1]

Year	Unit residents No	Unit residents Yes	Other AK residents No	Other AK residents Yes	Nonresidents No	Nonresidents Yes	Total use No	Total use Yes	Transport	Registered guide	Other Services
					5A Yakutat Forelands						
1991	11	7	0	13	0	3	11	23	19	2	2
1992	123	8	40	17	5	1	168	26	22	0	4
1993	122	11	26	18	3	2	151	31	28	2	1
1994	131	9	26	24	0	0	157	33	32	1	0
1995	111	9	21	26	3	3	135	38	36	1	0
1996	44	1	16	18	4	2	64	21	19	1	1
1997	67	5	21	13	4	7	92	24	22	1	2
1998	101	1	18	17	7	5	126	23	18	3	1
1999[2]											
2000[2]											
2001	82	2	23	16	1	4	99	22	19	2	1
2002	130	3	33	12	2	1	165	16	15	1	0
					5A Nunatak Bench						
1995	3	0	----	----	----	----	3	0	----	----	----
1996	3	0	----	----	----	----	3	0	----	----	----
1997	2	0	----	----	----	----	3	0	----	----	----
1998	3	0	----	----	----	----	3	0	----	----	----
1999	2	0	4	0	----	----	6	0	0	0	0
2000	3	0	3	0	----	----	6	0	0	0	0
2001	2	0	0	0	0	0	2	0	0	0	0
2002	3	0	0	0	0	0	3	0	0	0	0
					5B Malaspina Forelands						
1991	1	4	0	9	0	0	1	13	9	0	4
1992	2	3	3	5	0	4	5	12	5	7	0
1993	1	5	6	7	0	7	7	19	13	6	0
1994	6	0	0	8	1	1	7	9	8	1	0
1995	6	9	1	5	3	4	10	18	15	2	1
1996	3	1	2	9	0	9	5	19	11	8	1
1997	1	3	0	1	0	5	1	9	3	5	0
1998	3	1	0	2	3	4	6	7	4	5	0
1999	3	1	0	0	0	5	3	6	1	5	0

Table 7 continued

Year	Unit residents		Other AK residents		Nonresidents		Total use		Transport	Registered guide	Other Services
	No	Yes	No	Yes	No	Yes	No	Yes			
5B Malaspina Forelands											
2000	2	3	2	3	0	14	4	20	6	14	0
2001	1	2	1	9	0	13	2	24	12	12	0
2002	6	2	4	7	0	5	10	14	9	5	0

[1] Not all information is available for each hunter, therefore the calculations for any given field may only include a subset of hunters.
[2] Data not available at time of report submittal.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: Unit 6 (10,140 mi^2)

GEOGRAPHIC DESCRIPTION: Prince William Sound and North Gulf Coast

BACKGROUND

Moose populations in most of Unit 6 originated from translocations of calves from the Kenai Peninsula, Anchorage, and Matanuska-Susitna area (Burris & McKnight 1973). During 1949–1958, Cordova residents successfully raised 24 captive moose calves and released them on the western Copper River Delta in Subunit 6C. This small population grew rapidly and expanded eastward into Subunit 6B by the early 1960s. Eastward expansion continued into Subunit 6A to the Bering River area by the late 1960s, and to Cape Yakataga by the mid 1970s. The population reached a record high of approximately 1600 in 1988 (Griese 1990), then declined to about 1227 by 1994 as part of a planned reduction (Nowlin 1998). The only moose endemic to Unit 6 are small populations in the Lowe River drainage and Kings Bay in Subunit 6D, numbering about 40 animals total.

Hunting of the introduced population in 6C began with 25 bulls harvested in 1960. Harvest began in 6B and 6A during 1965 and 1971, respectively. Moose in 6A were divided into 2 populations (east and west of Suckling Hills) during 1977 and have been managed separately since then. Hunters have harvested approximately 3800 moose during 1965–1998 in Subunits 6A, 6B and 6C. In contrast, total kill of the endemic moose population in 6D during the same period was approximately 40 moose. The harvest quota for cow moose in Subunit 6C was commandeered into federal subsistence during 2000–01, followed by 75% of the bull harvest quota during 2002–03.

Population objectives were relatively conservative in the 1970s and early 1980s because of concern about mortality during severe winters. Objectives were established at 0.9–1.2 moose/mi^2 after a severe winter in 1971–72 and remained conservative under management plans written in 1976 (Rausch 1977). Nowlin (1995) revised objectives in 1994 using new information about carrying capacity of the winter ranges (MacCracken 1992) and refined estimates of population size.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

Our goals in Subunit 6A (East) are to take large moose and to provide for optimum harvest. For the remainder of Unit 6 the goals are to provide for optimum harvest and to provide for the greatest opportunity to hunt.

POSTHUNT MANAGEMENT OBJECTIVES

Our management objective for Subunit 6A (East) is to maintain a population of 300–350 moose and a minimum bull:cow ratio of 30:100. Our objectives for Subunit 6A (West) and 6B are to maintain populations of 300–350 moose and minimum bull:cow ratios of 15:100 in each unit. In 6C our objective is to increase the population to 400 moose by the year 2006 and maintain a minimum bull:cow ratio of 15:100.

METHODS

We conducted modified (Gasaway et al. 1986) censuses to estimate moose population size and composition. We used Piper Super Cub (PA-18) and Bellanca Scout aircraft for searches of sample units. Estimates of sex and age ratio were derived only from censuses conducted before mid December. Population estimates were not corrected for sightability. Corrections calculated during previous censuses indicated we observed >89% of the moose present (Nowlin 1998).

Sample units for aerial censuses cover all moose habitat in Subunits 6A–6C. Viereck et al. (1986) described the habitat types present, and MacCracken (1992) identified types that were most important for moose. These habitat types were below 500 feet elevation in river valleys and deltas of the coastal plain and included open tall-willow (*Salix sp.*), closed tall alder-willow (*Alnus sinuata-Salix sp.*), low sweetgale-willow (*Myrica gale-Salix sp.*), woodland spruce (*Picea sitkensis*) and aquatic (wet forb-herbaceous) (Nowlin 1995).

Hunters participating in drawing or registration permit hunts were required to report. Those who failed to report were telephoned and sent no more than 2 reminder letters. Hunters participating in general moose hunts were sent a reminder letter if they failed to return their hunt report.

We summarized census and harvest data by subunit, except for 6A, which was divided into eastern and western portions. The eastern portion was all drainages into the Gulf of Alaska between Cape Suckling and the head of Icy Bay. The western portion was all drainages into the Gulf between Cape Suckling and Palm Point.

We began a cooperative study funded by the U.S. Forest Service, Cordova Ranger District to monitor moose habitat of the western Copper River Delta (CRD) in Subunit 6C. Moose habitat on the CRD is dynamic, with some areas entering into unproductive seral stages and others supporting new growth. Hence, rather than trying to measure carrying capacity based on habitat, we examined nutritional status of moose based on rump fat thickness, which had a strong linear relationship (r^2=0.96, p=0.0001) with total body fat of pen-reared moose (Stephenson et al. 1998). A total of 12 cows were captured (half with calves) and collared during November and again in March. Rump fat thickness was measured using ultrasonography.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Lack of snow, storms and high winds limit moose censuses almost annually in Unit 6. However, unusually good conditions during February 2002 allowed the completion of censuses for all 4 moose populations in Unit 6 (Table 1). Poor conditions precluded moose surveys during regulatory year (RY) 2002–03.

POPULATION SIZE

The posthunt moose population in Unit 6 during 2001–02 was approximately 1200 moose, including 280 in 6A (East), 300 in 6A (West), 200 in 6B, 340 in 6C, and 50 in 6D. Censuses indicated the moose population in 6C stabilized at about 350 during the last several years, despite the conservative harvest (Table 1). Subunit 6B decreased because of continued low productivity and heavy predation. I suspect a high, but as yet unquantified, bull:cow ratio has limited the productivity of moose populations in 6C and 6B. Moose in 6A (West) also declined from the last survey. Subunit 6A (East) moose were stable.

POPULATION COMPOSITION

Aerial surveys indicated the proportion of calves in 6A (West) and 6A (East) was 13% and 15%, respectively (Table 1). In 6B declining population and calf survival has prompted conservative bull harvests and no antlerless hunts since 1996. The proportion of calves in 6C was 20% during February 2002, following a record low during the last reporting period. Low calf survival has occurred every 4–6 years in 6C, followed by a rebound. No estimates of bull:cow ratios were obtained because bulls had shed antlers when we conducted the censuses.

MORTALITY

HARVEST

Season and Bag Limit. In Subunit 6A (East), the bag limit for all hunters was one moose. The bull moose season during this reporting period was 1 Sep–31 Oct. Nonresident hunters were restricted to bulls with 50-inch antlers or antlers with 3 or more brow tines on at least 1 side. Resident hunters were restricted to spike, fork or 50-inch antlers.

In Subunit 6A (West), the season for all hunters was 1 Sep–31 Oct, with a bag limit of one moose. Residents were allowed to take up to 20 bulls by registration permit, and nonresidents were allowed to take up to 5 bulls by drawing permit. We established an annual allowable harvest for bulls that included both hunts. When that harvest limit was reached, both hunts were closed by emergency order.

The season in Subunit 6B was 27 Aug–31 Oct, during the reporting period for resident hunters only with a bag limit of one moose. We authorized a harvest of 12 bulls by registration permit. No motorized vehicles were allowed for transportation 15–31 August, with the exception of highway vehicles on the maintained surface of the Copper River Highway. Also, moose could not be taken until after 3 a.m. following the day on which an airboat was used for transportation. All airboats were required to display an ADF&G identification number.

In Subunit 6C the season was for resident hunters only 1 Sep–31 Oct, with a bag limit of one moose by drawing permit. Up to 25 drawing permits were authorized, 20 for bulls and 5 for antlerless moose. Beginning in 2000–01 the 5 antlerless moose permits were administered as a federal subsistence hunt by the U.S. Forest Service, Cordova Ranger District, followed by 75% of the bull quota in 2002–03.

The general season in Subunit 6D for all hunters was 1–30 Sep, and the bag limit was one bull by harvest ticket.

Reported moose harvest for Unit 6 was 84 in 2001–02 and 72 in 2002–03 (Table 2). We kept harvest low in Subunit 6B because of continued poor calf survival, and in 6C to allow a population increase (Nowlin 1998).

Composition of the moose harvest in Unit 6 was 89% males during 2001–02 and 88% in 2002–03. Those numbers were in the normal range.

Board of Game Actions and Emergency Orders. We issued emergency orders to close the registration permit hunts for bull moose in 6B (8 Sep and 4 Sep, respectively), and 6A (West) (7 Oct in 2001). These were normal management actions. The Board of Game reauthorized antlerless moose hunts, and increased season length by one month (to 30 Nov) in 6A–6C during the March 2003 meeting.

Permit Hunts. During this reporting period, Subunit 6A (West) had 1 registration and 1 drawing permit hunt, 6B had 1 registration hunt, and 6C had 2 drawing hunts (Table 3).

Hunter Residency and Success. Local residents composed 69% of all moose hunters in Unit 6 during the reporting period (Table 4). Conservative and resident-only seasons discouraged nonlocal hunters from participating.

Harvest Chronology. Most of the Unit 6 harvest over the past 2 years occurred during September (Table 5). The harvest pattern has not changed over the past 5 years.

Transport Methods. Boats, primarily airboats, were the most commonly used transport method during this reporting period (Table 6). Airplanes and highway vehicles followed them in decreasing order of importance. This pattern of use has not changed over the past 5 years.

OTHER MORTALITY

Predation by brown bears and wolves was the primary cause of calf mortality. Brown bears and wolves were observed feeding on neonatal and adult moose in various parts of the unit (Carnes et al. 1996, MacCracken et al. 1997, personal observation). Brown bear populations increased in Subunits 6A, 6B, and 6C during the 1990s (Crowley 2000). Conservative estimates of moose kill rates for wolves in Unit 6 (Carnes et al. 1996) indicate at least one-quarter of the Subunit 6B population could be killed by wolves each year.

CONCLUSIONS AND RECOMMENDATIONS

Moose populations were below management objectives in all areas, primarily because of predation. We could not evaluate our objectives for bull:cow ratios because we completed no censuses before mid December when a significant number of bulls have dropped their antlers. High bull:cow ratios have become evident in Subunits 6B and 6C; therefore, more emphasis will be placed on obtaining these estimates in early winter rather than waiting for adequate census conditions during midwinter.

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Table 1 Unit 6 moose estimated population composition and size, 1992–03.

Unit	Regulatory year	Bulls: 100 cows	Calves(%)	Adults	Population size	90% C.I.	Total moose observed
6A (East)	1992–93	-	8	384	416	373–459	378
	1995–96	-	10	253	282	249–316	162
	1999–2000[a]	-	13	136	-	-	189
	2001–02	-	15	265	285	220–360	218
6A (West)	1992–93	23	12	259	295	255–334	273
	1995–96	-	14	271	316	272–361	221
	2000–01	-	13	348	412	181–643	382
	2001–02	-	13	260	297	236–358	253
6B	1992–93	19	17	271	328	268–387	203
	1994–95	22	10	266	296	244–347	182
	1996–97	-	6	289	308	249–367	167
	1998–99	-	9	266	320	243–396	286
	2000–01[a]	-	11	159	-	-	178
	2001–02	-	13	144	198	176–219	168
6C	1992–93	26	25	225	299	263–335	204
	1994–95	27	14	242	281	205–358	236
	1996–97	-	17	214	259	232–287	216
	1998–99	-	25	221	334	293–375	293
	2000-01	-	10	278	354	307–402	308
	2001–02	-	20	272	341	318–365	326

[a] Composition count

Table 2 Unit 6 moose harvest and accidental death, 1998–2003.

		Hunter harvest									
		Reported					Estimated			Accidental	
Unit		M	(%)	F	(%)	Total[a]	Unreported	Illegal	Total	death	Total
6A (East)	year 1998–99	13	(100)	0	(0)	13	1	0	1	0	14
	1999–2000	17	(100)	0	(0)	17	1	0	1	0	18
Regulatory	2000–01	19	(100)	0	(0)	19	1	0	1	0	20
	2001–02	12	(100)	0	(0)	12	1	0	1	0	13
	2002–03	13	(100)	0	(0)	13	1	0	1	0	14
6A (West)	1998–99	19	(95)	1	(5)	20	0	2	2	0	22
	1999–2000	19	(90)	2	(10)	21	1	1	2	0	23
	2000–01	28	(80)	7	(20)	35	1	1	2	0	37
	2001–02	28	(88)	4	(13)	32	1	1	2	0	34
	2002–03	14	(78)	4	(22)	18	1	1	2	0	20
6A TOTAL	1998–99	32	(97)	1	(3)	33	1	2	3	0	36
	1999–2000	36	(95)	2	(5)	38	2	1	3	0	41
	2000–01	47	(87)	7	(13)	54	2	1	3	0	57
	2001–02	40	(91)	4	(9)	44	2	1	3	0	47
	2002–03	27	(87)	4	(13)	31	2	1	3	0	34
6B	1998–99	23	(100)	0	(0)	23	0	0	0	0	23
	1999–2000	19	(90)	2	(10)	21	1	1	2	0	23
	2000–01	7	(88)	1	(13)	8	1	1	2	0	10
	2001–02	13	(100)	0	(0)	13	0	0	0	0	13
	2002–03	15	(100)	0	(0)	15	0	0	0	0	15

Table 2 Continued

Unit	year	Hunter harvest									
		Reported					Estimated			Accidental	
		M	(%)	F	(%)	Total[a]	Unreported	Illegal	Total	death	Total
6C	1998–99	19	(79)	5	(21)	24	0	0	0	0	24
	1999–2000	19	(83)	4	(17)	23	1	1	2	2	27
Regulatory	2000–01	20	(80)	5	(20)	25	1	1	2	3	30
	2001–02	20	(80)	5	(20)	25	0	0	0	0	25
	2002–03	21	(81)	5	(19)	26	0	0	0	0	26
6D	1998–99	0	(0)	0	(0)	0	0	1	1	0	1
	1999–2000	3	(100)	0	(0)	3	0	0	0	0	3
	2000–01	2	(100)	0	(0)	2	0	1	1	0	3
	2001–02	2	(100)	0	(0)	2	0	1	1	0	3
	2002–03	0	(0)	0	(0)	0	0	1	1	0	0
Unit 6	1998–99	75	(93)	6	(7)	81	1	3	4	0	85
TOTAL	1999–2000	77	(91)	8	(9)	85	4	3	7	2	94
	2000–01	76	(85)	13	(15)	89	4	4	8	3	100
	2001–02	75	(89)	9	(11)	84	2	2	4	0	88
	2002–03	63	(88)	9	(13)	72	2	2	4	0	76

[a] Totals may include moose of unknown sex and unit.

Table 3 Unit 6 moose harvest data by permit hunt, 1998–2003.

Unit/hunt no.	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6A/RM160[a]	1998–99	Bull	64	52	39	58	20	(95)	1	(5)	21
	1999–2000	Bull	75	56	45	52	17	(100)	0	(0)	17
	2000–01	Bull	95	46	53	45	23	(100)	0	(0)	23
	2001–02	Bull	84	50	43	57	24	(100)	0	(0)	24
	2002–03	Bull	68	63	48	52	13	(100)	0	(0)	13
6A/DM160[b]	1998–99	Bull	5	40	33	67	2	(100)	0	(0)	2
	1999–2000	Bull	5	20	50	50	2	(100)	0	(0)	2
	2000–01	Bull	5	0	0	100	5	(100)	0	(0)	5
	2001–02	Bull	5	0	20	80	4	(100)	0	(0)	4
	2002–03	Bull	5	40	67	33	1	(100)	0	(0)	1
6A/DM162	1998–99	No hunt									
	1999–2000	Antlerles	5	40	33	67	0	(0)	2	(100)	2
	2000–01	Antlerles	15	33	30	70	0	(0)	7	(100)	7
	2001–02	Antlerles	15	67	20	80	0	(0)	4	(100)	4
	2002–03	Antlerles	5	20	0	100	0	(0)	4	(100)	4
6B/RM164	1998–99	Bull	201	33	83	17	23	(100)	0	(0)	23
	1999–2000	Bull	206	36	83	14	19	(100)	0	(0)	19
	2000–01	Bull	171	37	89	7	7	(88)	1	(13)	8
	2001–02	Bull	160	34	87	12	13	(100)	0	(0)	13
	2002–03	Bull	138	36	81	18	16	(94)	1	(6)	17

Table 3 Continued

Unit/hunt no.	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6B/DM166	1998–99	No hunt									
	1999–2000	Antlerless	5	20	50	50	0	(0)	2	(100)	2
	2000–01	No hunt									
	2001–02	No hunt									
	2002–03	No hunt									
6C/DM167	1998–99	Bull	20	5	0	100	19	(100)	0	(0)	19
	1999–2000	Bull	20	5	0	100	19	(100)	0	(0)	19
	2000–01	Bull	20	5	0	100	19	(100)	0	(0)	19
	2001–02	Bull	20	0	0	100	19	(100)	0	(0)	19
	2002–03	Bull	5	0	0	100	5	(100)	0	(0)	5
6C/DM168	1998–99	Antlerless	5	0	0	100	0	(0)	5	(100)	5
	1999–2000	Antlerless	5	20	0	100	0	(0)	4	(100)	4
Fed. Subsist	2000–01	Antlerless	6	0	0	100	1 [b]	(17)	5	(83)	6
Fed. Subsist.	2001–02	Antlerless	5	0	0	100	1 [b]	(17)	5	(83)	6
Fed. Subsist.	2002–03	Both sexes	20	0	0	100	16	(100)	4	(0)	20

[a] RM prefix was a registration hunt, DM prefix a drawing hunt.

[b] Potlatch moose

Table 4 Unit 6 moose hunter residency and success, 1998–2003.

		Successful					Unsuccessful					
Unit	year	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)[b]	Local resident	Nonlocal resident	Nonresident	Total	(%)	Total hunter
6A (East)	1998–99	2	0	11	13	(62)	5	0	3	8	(38)	21
	1999–00	2	3	12	17	(44)	3	2	17	22	(56)	39
Regulator	2000–01	2	5	12	19	(43)	6	4	15	25	(57)	44
	2001–02	3	0	8	11	(28)	5	2	11	29	(73)	40
	2002–03	0	0	13	13	(27)	9	3	22	35	(73)	48
6A (West)	1998–99	13	5	2	20	(61)	11	1	1	13	(39)	33
	1999–00	14	5	2	21	(57)	11	5	0	16	(43)	37
	2000–01	25	5	5	35	(51)	24	9	0	33	(49)	68
	2001–02	22	6	4	32	(62)	14	5	1	20	(38)	52
	2002–03	15	2	1	18	(58)	11	0	2	13	(42)	31
6A TOTAL	1998–99	15	5	13	33	(61)	16	1	4	21	(39)	54
	1999–00	16	8	14	38	(50)	14	7	17	38	(50)	76
	2000–01	27	10	17	54	(48)	30	13	15	58	(52)	112
	2001–02	25	6	12	43	(47)	19	7	12	49	(53)	92
	2002–03	0	0	0	0	()	20	3	24	48	(100)	48
6B	1998–99	20	3	-[c]	23	(17)	106	5	-[c]	111	(83)	134
	1999–00	20	1	-[c]	21	(16)	98	13	-[c]	111	(84)	132
	2000–01	7	1	-[c]	8	(8)	92	4	-[c]	96	(92)	104
	2001–02	13	0	0	13	(12)	85	7	0	92	(88)	105
	2002–03	13	2	0	15	(17)	67	5	0	72	(83)	87

Table 4 continued

Unit	Regulatory year	Successful Local resident [a]	Nonlocal resident	Nonresident	Total	(%) [b]	Unsuccessful Local resident	Nonlocal resident	Nonresident	Total	(%) [c]	Total hunter
6C	1998–99	20	4	- [c]	24	(96)	1	0	- [c]	1	(4)	25
	1999–00	19	4	- [c]	23	(85)	2	2	- [c]	4	(15)	27
	2000–01	22	3	- [c]	25	(100)	0	0	- [c]	0	(0)	25
	2001–02	18	7	0	25	(96)	0	1	0	1	(4)	26
	2002–03	25	0	0	25	(100)	0	0	0	0	(0)	25
6D	1998–99	0	0	0	0	(0)	3	5	0	8	(100)	8
	1999–00	2	0	1	3	(20)	10	2	0	12	(80)	15
	2000–01	0	2	0	2	(12)	10	5	0	15	(88)	17
	2001–02	2	0	0	2	(11)	13	3	0	16	(89)	18
	2002–03	1	0	0	1	(4)	21	1	1	23	(96)	24
Unit 6 TOTAL	1998–99	55	12	13	80	(36)	126	11	4	141	(64)	221
	1999–00	57	13	15	85	(34)	124	25	17	166	(66)	251
	2000–01	56	16	17	89	(34)	133	23	15	171	(66)	260
	2001–02	58	13	12	83	(34)	118	18	12	159	(66)	242
	2002–03	39	2	0	41	(22)	108	9	25	143	(78)	184

[a] Resident of Unit 6.

[b] Totals may include harvest by hunters of unknown residency and may include harvest from unknown units.

[c] Nonresidents ineligible to receive permits.

Table 5 Unit 6 moose harvest percent by time period, 1998–2003.

Unit		Harvest periods 8/20-8/31	9/1-9/15	9/16-9/30	10/1-10/15	10/16-10/31	11/1-11/30	12/1-12/31	n
6A (East)	year 1998–99	0	38	38	15	8	0	0	13
	1999–2000	0	18	18	53	12	0	0	17
	2000–01	0	32	26	21	21	0	0	19
Regulatory		0	25	17	17	33	8	0	12
		0	31	8	31	31	0	0	13
6A (West)	1998–99	0	100	0	0	0	0	0	20
	1999–2000	0	81	5	10	5	0	0	21
2001–02	2000–01	0	31	57	11	0	0	0	35
2002–03		0	53	44	3	0	0	0	32
		0	44	50	0	6	0	0	18
6A TOTAL	1998–99	0	76	15	6	3	0	0	33
	1999–2000	0	53	11	29	8	0	0	38
2001–02	2000–01	0	31	46	15	7	0	0	54
2002–03		0	45	36	7	9	2	0	44
		0	39	32	13	16	0	0	31

2001–02
2002–03

Table 5 Continued

Unit	Regulatory year	Harvest periods 8/20-8/31	9/1-9/15	9/16-9/30	10/1-10/15	10/16-10/31	11/1-11/30	12/1-12/31	n
6B	1998–99	13	87	0	0	0	0	0	23
	1999–2000	11	68	21	0	0	0	0	19
	2000–01	25	75	0	0	0	0	0	8
	2001–02	14	79	0	0	0	7	0	14
	2002–03	0	100	0	0	0	0	0	15
6C	1998–99	0	58	4	29	8	0	0	24
	1999–2000	0	57	35	4	4	0	0	23
	2000–01	0	44	28	12	12	4	0	25
	2001–02	0	52	17	22	9	0	0	23
	2002–03	0	50	25	25	0	0	0	20
6D	1998–99	0	0	0	0	0	0	0	0
	1999–2000	0	67	33	0	0	0	0	3
	2000–01	0	50	50	0	0	0	0	2
	2001–02	0	100	0	0	0	0	0	2
	2002–03	0	0	0	0	0	0	0	0
Unit TOTAL	1998–99	4	74	8	11	4	0	0	80
	1999–2000	2	58	20	14	5	0	0	83
	2000–01	2	39	37	12	8	1	0	89
	2001–02	2	54	24	10	7	2	0	83
	2002–03	0	56	23	14	8	0	0	66

Table 6 Unit 6 moose harvest percent by transport method, 1998–2003.

Unit	Regulatory year	Airplane	Boat	3- or 4-wheeler	ORV	Highway Vehicle	n
6A (East)	1998–99	77	8	15	0	0	13
		76	6	12	0	6	17
		53	11	21	0	16	19
		67	0	25	0	8	12
		100	0	0	0	0	13
6B (West) 1999–2000	1998–99	25	75	0	0	0	20
2000–01		29	71	0	0	0	21
2001–02		34	63	0	0	3	35
2002–03		27	73	0	0	0	30
		28	72	0	0	0	18
6 TOTAL 1999–2000	1998–99	45	48	6	0	0	33
2000–01		50	42	5	0	3	38
2001–02		41	44	7	0	7	54
2002–03		38	52	7	0	2	42
		58	42	0	0	0	31

1999–2000
2000–01
2001–02
2002–03

Table 6 Continued

Unit	Regulatory year	Airplane	Boat	3- or 4-wheeler	ORV	Highway Vehicle	n
6B	1998–99	22	56	0	0	13	23
	1999–2000	18	53	0	0	41	19
	2000–01	0	70	0	0	30	10
	2001–02	17	58	0	8	25	13
	2002–03	20	73	0	0	7	15
6C	1998–99	0	37	4	4	54	24
	1999–2000	0	65	9	0	26	23
	2000–01	4	39	0	0	57	23
	2001–02	9	27	5	5	55	25
	2002–03	0	40	5	5	50	24
6D	1998–99	0	0	0	0	0	0
	1999–2000	0	33	0	0	67	3
	2000–01	50	0	0	0	50	2
	2001–02	0	50	0	0	50	2
	2002–03	0	0	0	0	0	0
Unit 6 TOTAL	1998–99	25	38	4	1	20	80
	1999–2000	27	49	5	0	19	85
	2000–01	27	45	4	0	24	89
	2001–02	25	46	5	3	22	83
	2002–03	32	48	2	2	17	70

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 7 (3520 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern Kenai Peninsula

BACKGROUND

The moose population in Unit 7 is at low density relative to other units on the Kenai Peninsula. The population is expected to remain at low density unless significant habitat alteration occurs. Widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s have impacted more than 500,000 hectares of spruce forests on the Kenai Peninsula (www.borough.kenai.ak.us/sprucebeetle). Since 2001 infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2003). Much of the affected forest has been or is scheduled for salvage logging. The impact of spruce mortality and salvage logging efforts will affect the quality of moose habitat over a large scale, but the nature of the effect remains uncertain. About 10% of the Kenai Peninsula's moose harvest over the past 20 years has come from Unit 7. Available moose habitat can be limiting in winter during heavy snow accumulations.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

To maintain a healthy population of moose with a minimum bull-to-cow ratio of 15:100.

METHODS

Composition surveys are flown in traditional count areas as funding allows. Harvest data come from hunter information taken from harvest tickets. All of the harvest data is now kept at ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet, so data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A unitwide survey has never been conducted in Unit 7. Composition surveys, combined with harvest reports, suggest the moose population has remained relatively stable during the past decade. The actual number of moose counted during composition counts is not comparable between years because survey intensity and conditions are inconsistent. Composition counts are performed in order to get an adequate sample of moose to calculate ratios of bulls to cows and calves to cows. Composition counts conducted in 3 count areas during the winter of 2001–02 showed 30 bulls:100 cows and 13 calves:100 cows (Table 1). No surveys were conducted in 2002–03.

MORTALITY

Harvest

Season and Bag Limit. The general season in Unit 7 has been 20 Aug–20 Sep since 1993. Since 1987 the bag limit has been 1 bull with a spike or fork on at least 1 antler, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF/50).

The 5-year average reported harvest for Unit 7 was 49 moose (Table 2).

Board of Game Action and Emergency Orders. There were no board actions for Unit 7 during the reporting period.

Permit Hunts. Information for permit hunts DM210 and DM211, which encompass both Unit 7 and Unit 14C, are provided in the Unit 14C management report. Permit hunt DM522, which encompasses area within both Units 7 and 15A, took 2 bulls in 2001 and no bulls in 2002 (Table 3).

Hunter Residency and Success. About half of the hunters were residents of Unit 7 (Table 4). Success rate averaged 14% over the past 5 seasons (Table 4).

Harvest Chronology. Moose were harvested throughout the season, but in somewhat larger proportions at the start and end of the season (Table 5). The chronology of the harvest is dependent on weather conditions and other factors unrelated to moose abundance.

Transport Methods. Highway vehicles and horses encompass the majority of transportation methods used by successful hunters in Unit 7 (Table 6).

Other Mortality

Motor vehicles killed an average of 24 moose per year during the past 5 years (Table 2) in Unit 7. The impact of predation on moose by wolves and bears is unknown. The level of mortality for moose during severe winters is probably high.

HABITAT

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Postlogging site preparation that encourages hardwood regeneration beneficial for moose habitat has been recommended to local foresters. If site preparation is done properly, resulting in a healthy regeneration of hardwoods, habitat quality for moose will probably increase greatly. However, if site preparation is not conducted or done inadequately, blue-joint grass (*Calamagrostis canadensis*) will initially crowd out hardwood and spruce seedlings, creating less desirable moose habitat and slowing forest succession.

CONCLUSIONS AND RECOMMENDATIONS

Recent bull:cow ratios have been higher than the recommended minimum objective of 15 bulls:100 cows. However, the limited count areas surveyed may not accurately reflect the ratio across the unit. Adequate bull-to-cow ratios are desired to minimize the length of the rut and ensure most cows conceive during their first estrous cycle (Schwartz et al. 1994). Given the low moose density in Unit 7, a higher ratio than 15 bulls:100 cows ratio may be desirable.

LITERATURE CITED

SCHWARTZ, C. C., K. J. HUNDERTMARK AND E. F. BECKER. 1994. Growth of moose calves conceived during the first versus second estrus. *Alces* 30:91–100.

U.S. DEPARTMENT OF AGRICULTURE, U.S. FOREST SERVICE, AND ALASKA DEPARTMENT OF NATURAL RESOURCES-DIVISION OF FORESTRY. February 2002. Forest Insect and Disease Conditions in Alaska-2002, General Technical Report R10-TP-113.

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Please cite any information taken from this section, and reference as:

McDonough, T. 2004. Unit 7 moose management report. Pages 107–112 *in* C. Brown, editor. Moose management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

Table 1 Unit 7 fall aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	moose observed	population size
1998–99	42	8	12	8	226	245	~900
1999–2000	45	8	29	16	126	151	~900
2000–01	52	8	12	7	99	107	~900
2001–02	30	4	13	9	184	203	~900
2002–03	no surveys conducted						~900

Table 2 Unit 7 general season moose harvest and accidental death, 1998–2003

Regulatory	Reported				Estimated			Accidental death			Grand
year	M	F	Unk	Total	Unreported	Illegal	Total	Road	Train	Total	Total
1998–99	46	0	1	47			20	46	7	53	119
1999–2000	39	0	1	40			20	24	3	27	87
2000–01	51	0	0	51			20	24	0	24	95
2001–02	55	0	0	55			20	12	9	21	96
2002–03	50	0	1	51			20	16	0	16	87

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Units 7 moose harvest for drawing permit hunts, 1998–1003

Hunt Area	Regulatory year	Permits issued	did not hunt	Percent unsuccessful hunters	Percent successful hunters	Males	Females	Unk.	Illegal	Total harvest
DM522 [a]	1998–99	--	--	--	--	--	--	--	--	0
	1999–2000	25	16	90	10	2	0	--	--	2
	2000–01	25	32	76	24	4	0	--	--	4
	2001–02	25	16	90	10	2	0	--	--	2
	2002–03	25	28	100	0	0	0	--	--	0

[a] New hunt in 1999 which includes areas within Units 15A and 7

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 7 moose hunter residency and success for the general season, 1998–2003

Percent

Regulatory year	Successful: Local resident [a]	Successful: Nonlocal resident	Successful: Nonresident	Successful: Total [b] (%)	Unsuccessful: Local resident [a]	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Total [b] (%)	Total Hunters
1998–99	23	21	3	47 (12)	147	182	14	345 (88)	392
1999–2000	12	16	8	40 (13)	119	120	7	261 (87)	301
2000–01	16	29	5	51 (15)	126	156	11	294 (85)	345
2001–02	23	26	5	55 (17)	111	146	16	273 (83)	328
2002–03	23	22	6	51 (15)	132	136	12	280 (85)	331

[a] Local = residents of Unit 7

[b] Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 7 harvest chronology % for general season moose harvest, 1998–2003

Regulatory year	Harvest periods 8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unknown	*n*
1998–99	28	2	11	13	28	13	4	47
1999–2000	10	10	13	23	20	20	5	40
2000–01	22	4	24	2	27	16	6	51
2001–02	22	2	7	16	25	27	2	55
2002–03	20	6	12	10	14	33	6	51

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 7 % harvest by transport method for general season moose harvest, 1998–2003

Regulatory year	Percent of harvest Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1998–99	7	20	11	4	0	4	50	4	47
1999–2000	25	13	2	0	0	2	48	10	40
2000–01	12	29	8	2	0	2	41	6	51
2001–02	16	14	14	7	0	4	42	4	55
2002–03	6	24	10	2	0	0	53	6	51

All data has been updated from the ADF&G online database: WildlifeInfoNet

Alaska Department of Fish and Game
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 9 (33,600 mi^2)

GEOGRAPHIC DESCRIPTION: Alaska Peninsula

BACKGROUND

Moose were scarce on the Alaska Peninsula before the mid 1900s, but they increased dramatically and spread southwest during the 1950s and 1960s. The scarcity of suitable habitat south of Port Moller limited expansion into Subunit 9D. Even during the 1960s when the population was growing, calf:cow ratios were relatively low, and the ratio declined as the population reached its peak. Evidence of range damage from overbrowsing was evident, and nutritional stress probably caused poor calf survival. Liberal hunting regulations were in effect from 1964 to 1973, first to slow population growth and subsequently (during the early 1970s) to reduce the population so that willow stands could recover from heavy browsing. Even though a series of hunting restrictions began after 1973, the population continued to decline, especially in Subunit 9E. By the early 1980s moose densities in Unit 9E were 60% below peak levels and calf:cow ratios were extremely low, despite evidence that range conditions had improved (ADF&G files). Brown bear predation on neonatal moose was the primary limiting factor of moose in Unit 9.

MANAGEMENT DIRECTION

POPULATION OBJECTIVES

Population objectives for moose in Unit 9 are to: 1) maintain existing densities in areas with moderate (0.5–1.5 moose/mi^2) or high (1.5–2.5 moose/mi^2) densities; 2) increase low-density populations (where habitat conditions are not limiting) to 0.5 moose/mi^2; 3) maintain sex ratios of at least 25 bulls:100 cows in medium-to-high density populations and at least 40 bulls:100 cows in low-density areas.

METHODS

We scheduled fall sex and age composition aerial surveys throughout Subunits 9B, 9C, and 9E during November through early December when adequate snow cover was available. We collected harvest data from harvest tickets, monitored harvests, and checked hunters primarily within the Naknek River drainage.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Results of fall sex and age composition surveys in Subunits 9B, 9C, and the central portion of 9E indicated that populations in most of Unit 9 have stabilized over the past 17 years. Very low moose densities and unreliable snow conditions in Subunit 9A, 9D, and the southern portion of 9E hindered surveys for monitoring trends in population size or composition.

In March 1999 the Board of Game found that moose in Subunits 9B, 9C, and 9E met the criteria to be considered “important for providing high levels of human consumptive use” under the intensive management legislation.

Population Size

A 1983 census in the central portion of Subunit 9E resulted in an estimate of 1148 moose (90% CI = $\pm$ 16%) in the 1314-mi^2 study area. Extrapolation of this census to the remainder of 9E provided a rough estimate of approximately 2500 moose. The area of Subunit 9C outside of Katmai National Park had approximately 500–600 moose. There were approximately 2000 moose in Subunit 9B. Subunits 9A and 9D probably contained about 300 and 200 moose, respectively.

Population Composition

Poor snow cover and weather conditions precluded surveys in 9B during this reporting period (Table 1) and prevented surveys in the majority of Unit 9 in 2002. Because weather conditions are a chronic problem, the Alaska Department of Fish and Game will continue seeking new moose survey techniques for Unit 9.

Two trend areas in 9C were surveyed in 2001, but weather precluded surveys in 2002. Bull:cow ratios were relatively stable in 2001 compared to prior ratios (Table 2). Moose populations in the trend areas surveyed are considered moderate densities (Branch River Trend Area mean density = 0.9 moose/mi^2 and Park Border Trend Area mean density = 0.8 moose/mi^2); therefore, the overall ratio of 30 bulls:100 cows was within management objectives (i.e. ratio > 25 bulls:100 cows). The calf:cow ratios in 9C were extremely low in 2001.

Surveys in 9E were conducted in cooperation with the U.S. Fish and Wildlife Service in 2001. Extremely poor snow cover prevented surveys in most trend areas in 2002. The overall bull:cow ratios in the areas surveyed exceeded the management objective of at least 25:100 with an overall ratio of 48 bulls:100 cows in 2001 (Table 3). The only trend area with less than 40 bulls:100 cows was the Blue Mountain Trend Area, which had 25 bulls:100 cows in 2001. The lower bull:cow ratio in this trend area is consistent with the most prior composition survey, which estimated 27 bulls:100 cows in 1999. The ratio of 20 calves:100 cows observed in 2002 is among the highest observed in 9E in the past 25 years, but the ratio only includes the Anchor-Ivan Trend Area, which historically has had a higher calf:cow ratio when compared with other trend areas in 9E. The estimated calf:cow ratio in 9E was 11 calves:100 cows in 2001, when more trend areas were included in the survey (n = 4). In 2001, 48% of all bulls seen (n = 99) had antlers with ≥50” spread. Total sample sizes and ratios from these areas indicate the population in 9E is relatively stable and harvests are not reducing bull:cow ratios.

While conducting line transect surveys for bears in May and June of 2002, 86 moose were observed in Unit 9D, of which 17 were calves. Because the data was collected during the moose calving season and the survey was not designed to assess moose populations, no useful comparisons can be derived from the number of calves observed. The observed sex composition was 87 bulls: 100 cows, indicating a population that is not heavily hunted.

MORTALITY

Harvest

Seasons and Bag Limit. As federal subsistence management becomes more entrenched, the number of regulation changes and divergence of state and federal regulations is increasing. In Subunit 9A, resident and nonresident hunters could hunt 1–15 Sep with a bag limit of 1 bull.

In Subunit 9B, nonresidents could hunt 5–15 Sep with a bag limit of 1 bull with ≥50-inch antlers or ≥4 brow tines; and resident hunters could hunt 1–15 Sep and 15 Dec–15 Jan, with a bag limit of 1 bull. Effective in 1997, meat of moose taken in Subunit 9B was required to remain on the bone until processed for human consumption. The federal subsistence season in 9B is 20 Aug–15 Sep and 1 Dec–15 Jan.

The nonresident season dates in Subunit 9C were the same as 9B; however, the nonresident bag limit was 1 bull with ≥50-inch antlers or ≥3 brow tines. The resident fall season has remained the same as 9B, but the resident winter season dates in 9C were different in the Naknek River drainage and the remainder of 9C. Within the Naknek drainage only bulls could be taken during the state hunting season 1–31 Dec. In the remainder of 9C, any moose was legal 15 Dec–15 Jan during the 2001–02 hunting season. In 2002 the legal animal for the winter season in the remainder of 9C was changed to 1 bull. Within the southern portion of the Naknek drainage, the federal subsistence season was open 20 Aug–15 Sep under a registration permit (RM233). In December federal lands were only open to local rural residents, and a subsistence registration permit (RM232) was required to take antlerless moose. In the remainder of 9C, the federal winter subsistence winter season was 1–31 Dec, and any moose was legal outside the Naknek drainage during the 2001–02 regulatory year. In 2002 the legal animal for the federal winter season outside of the Naknek Drainage was changed to 1 bull.

The nonresident season in Subunit 9E was 10–20 Sep, and the bag limit was 1 bull with an antler spread of ≥50 inches or at ≥3 brow tines. The state season for resident hunters in 9E was 10–20 Sep and 1 Dec–20 Jan. The bag limit was 1 bull; however, moose taken in September must have a spike or fork or have an antler spread of ≥50 inches or have ≥3 brow tines. In 2001 the federal subsistence seasons in 9E were changed to 20 Aug–20 Sep and 1 Dec–20 Jan with a bag limit of 1 bull.

Unit 9D was open only to residents with a state drawing permit (hunt DM312) 15 Dec–20 Jan with a bag limit of any bull in 2001. The number of permits issued annually by the state was increased from 10 to 20 in 2001. Starting in 2002 federal subsistence permits were issued to local residents for any bull with a quota of 10 bulls from both the state and federal hunts. The season dates for the federal hunt were 15 Dec–20 Jan.

The Unit 9 harvests during this reporting period were less than the average harvest over the past 20 years (mean = 217, SD = 33, range 170–300). During the 2001–02 regulatory year, hunters reported killing 175 moose, including 167 bulls and 8 cows (Table 4). In the 2002–03 regulatory year, 175 moose were harvested, including 170 bulls, 3 cows and 2 unknown.

Board of Game Actions and Emergency Orders. In 2001 the fall portion of the federal hunt in Subunit 9E was extended to 20 Aug–20 Sep. During the 2002 regulatory year, changes were enacted for both state and federal moose regulations. The legal animal for the state and federal winter hunts in the remainder of Subunit 9C was changed to allow only the harvest of bulls. The number of permits issued for moose in 9D was increased to 20, and a federal season for subsistence users was initiated in 9D from 15 Dec to 20 Jan.

Permit Hunts. Federal subsistence registration permits are required for the early fall season (RM233) and the December antlerless moose hunt (RM232) within the Becharof National Wildlife Refuge in Subunit 9C. A quota of 5 antlerless moose was set for RM232. Since 1996, a total of 25 permits have been issued for RM233, and 1 bull has been harvested. From 1996–2003 a total of 54 permits were issued for RM232, and 3 cows have been harvested.

Eighteen people applied for the 20 registration permits (DM312) available for Subunit 9D in 2001, and 23 people applied for 20 available permits in 2002. Of the people who received permits in 2001, three reported hunting, but were unsuccessful at harvesting a moose. Five people reported hunting in 2002, and a harvest of 2 bulls was reported. In 2002 federal subsistence registration permits (RM009) were also available to residents of 9D. One permit was issued, but poor weather prevented this individual from hunting.

Hunter Residency and Success. The number of moose hunters using Unit 9 increased during 1981–87 and peaked at 645. Since then the number leveled off at a mean of 531 for the period 1990–99. In 2000, 2001, and 2002, 468, 435, and 443 moose hunters reported using Unit 9, respectively (Table 5), indicating a decrease in the number of hunters using Unit 9 in recent years. While there have been fluctuations in the proportion of hunters in the 3 residency categories (local resident, nonlocal resident, and nonresident), the decline in the number of hunters was not attributed to any one group. Most subsistence hunters did not get moose harvest tickets and consequently were not represented in the local resident category. Since 1988 the success rates have been relatively stable for all 3 residency groups. Nonresidents typically had a higher success rate (mean = 52% from 1990 to 2002, range = 43–59%) than either residents of Unit 9 (mean = 35% from 1990 to 2002, range = 26–79%) or other Alaska residents (mean = 31% from 1990 to 2002, range = 19–38%) because virtually all of them flew out to hunt, and many employed guides.

Harvest Chronology. Since 1988, approximately 87% of the total moose harvest occurs in September (Table 6). Harvest levels during the winter season have remained low and ranged from 3 to 14% of the total harvest from 1998 to 2002, depending on weather and travel conditions.

Transportation Methods. No major change in transportation type has occurred during the past 5 years. Aircraft continued as the most common method of transportation in Unit 9. Boats were the second most common transport mode (Table 7).

Other Mortality

Given the continued low calf production, bear predation of neonatal moose appears to remain the primary cause of natural mortality. Bear:moose ratios in Unit 9 ranged from >1:1 to 1:10, and they were much higher than anywhere else within the indigenous range of moose.

CONCLUSIONS AND RECOMMENDATIONS

Hunting regulations have been restricted in all units to eliminate antlerless moose hunting due to low calf:cow ratios. Additionally, fall seasons have recently been shortened and moved to the first half of September in the northern 3 subunits to maintain bull:cow ratios at prescribed levels. The average harvest of 197 moose per year since 1998 appears to be within sustainable levels. Harvests have remained relatively stable for 17 years, despite major changes to moose regulations (i.e., the spike/fork-50" regulation) in other parts of Alaska. The reduced annual harvests since 2000 are not thought to reflect changes in the moose population, because fewer hunters have reported hunting in Unit 9 in recent years and hunter success rates have not decreased.

Brown bear predation on neonatal moose was the major limiting factor preventing an increase in moose densities in Unit 9. However, very high bear:moose ratios would require substantial reduction in bear densities to achieve a measurable improvement in moose calf survival. ADF&G has placed a priority on managing bears in Unit 9, and any drastic reduction in bear numbers would probably be opposed by a large segment of the public.

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Table 1 Moose composition counts in Unit 9B, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998	48	7	19	11	189	213	19
1999	57	10	4	2	132	135	26
2000	-	-	-	-	-	-	-
2001	-	-	-	-	-	-	-
2002	-	-	-	-	-	-	-

Table 2 Moose composition counts in Unit 9C, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998	-	-	-	-	-	-	-
1999	37	3	9	6	516	550	38
2000	33	2	7	5	290	306	52
2001	30	3	9	7	271	290	42
2002	-	-	-	-	-	-	-

Table 3 Moose composition counts in Unit 9E, 1998–2002

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose/hour
1998[a]	65	13	20	11	817	913	45
1999	48	6	10	6	154	164	43
2000	-	-	-	-	-	-	-
2001	48	12	11	7	305	328	34
2002[a]	74	27	20	11	87	97	47

[a] Includes some surveys by U.S. Fish and Wildlife Service.

Table 4 Annual moose harvest in Unit 9, 1998–2002

Year	Reported			Estimated			Total
	Male	Female	Total[a]	Unreported	Illegal	Total	
1998	198	2	200	100		100	300
1999	238	8	253	100		100	353
2000	176	2	180	100		100	278
2001	167	8	175	100		100	275
2002	170	3	175	100		100	275

[a] Includes unknown sex.

Table 5 Moose hunter residency and success in Unit 9, 1998–2002

Year	Successful				Unsuccessful			
	Local resident	Nonlocal resident	Nonresident	Total[a]	Local resident	Nonlocal resident	Nonresident	Total[a]
1998	33	48	115	200	95	114	118	329
1999	53	61	131	253	107	98	124	336
2000	37	29	113	180	112	70	105	288
2001	33	51	89	175	100	92	67	260
2002	35	39	100	175	73	107	84	268

[a] Includes unknown residency.

Table 6 Moose harvest chronology (%) in Unit 9, 1998–2002

Year	August 20–31	September 1–4	September 5–9	September 10–15	September 16–20	December 1–15	December 16–31	January 1–20
1998	<1	6	17	47	21	6	3	-
1999	<1	3	21	45	17	5	5	4
2000	<1	6	18	51	22	0	3	0
2001	<1	5	18	51	14	3	7	1
2002	<1	5	15	50	15	11	3	0

Table 7 Successful moose hunter transport methods (%) in Unit 9, 1998–2002

Year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unspecified
1998	66	0	24	2	5	0	1	2
1999	64	0	18	4	10	0	2	2
2000	63	0	24	6	2	1	1	3
2001	60	0	25	5	7	0	2	1
2002	68	0	25	3	0	1	2	1

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
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JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 11 (12,784 mi^2)

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

BACKGROUND

Moose abundance in Unit 11 was generally considered low from the early 1900s until the 1940s, increased during the 1950s, and reached a peak population in the early 1960s. When moose were most abundant, between 85 and 120 moose per hour were observed during fall composition counts. The moose population declined from the late 1960s until 1979, when the population was considered to have reached its lowest level. In 1979 only 12 moose per hour were observed during fall counts. Moose numbers stabilized, then started increasing during the early to mid 1980s and probably peaked in 1987 when 55 moose per hour were observed. Moose numbers declined between 1990 and 1991 following severe winters, then increased slightly during the mid 1990s.

Moose harvests in Unit 11 averaged 164 (123–242) per year from 1963 until 1974. Either-sex bag limits were in effect until 1974, and cows made up as much as 50% of the harvest. During this period, hunting seasons were long and split between a fall and winter season. The moose harvest and the total number of hunters peaked in the early 1970s. In response to declining moose numbers, the 1974 fall moose season was shortened, the winter season was closed, and the harvesting of cows was prohibited. Between 1975 and 1989, fall seasons remained 1–20 September. In 1990 the moose season was shortened in response to deep snow conditions and to align it with the Unit 13 season. The current state season and bag limit, which was established in 1993, is slightly more liberal.

Most of Unit 11 was included in Wrangell–Saint Elias National Monument in December 1978. In 1980 monument status was changed to park/preserve with passage of the Alaska National Interest Lands Conservation Act.

MANAGEMENT DIRECTION

POPULATION OBJECTIVE

- Allow the population to fluctuate as dictated by available habitat and predation rates.
- Maintain a population with a posthunt minimum of 30 bulls:100 cows with 10–15 adult bulls:100 cows.

HUMAN USE OBJECTIVE

- Allow human harvest of bulls when it does not conflict with management goals for the unit or population objectives for the herd.

METHODS

An aerial survey was conducted every year during the late fall to determine sex and age composition and population trends on a count area along the western slopes of Mount Drum. Harvests and hunting pressure were monitored through a harvest ticket reporting system. Predation and overwinter mortalities were monitored in the field whenever possible and by reports from hunters and trappers.

Large portions of Unit 11 are classified as limited fire suppression zones, where wildfire is allowed to burn. Unfavorable weather conditions for burning have occurred in recent years, and wildfires impacted little or no habitat this reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The number of moose observed during fall sex and age composition surveys in Count Area (CA) 11 (the western slopes of Mount Drum) increased during this reporting period (Table 1). Historically, the number of moose counted has fluctuated between years in this count area. Moose movements and survey conditions probably account for some of the yearly variation. The average number of moose observed and moose per hour counted over three-year periods were compared to smooth annual variation in survey results due to snow condition and sightability. From 1994 to 1996, an average of 132 moose (.46 moose/mi^2) at a rate of 29 per hour were observed. The three-year average between 1999 and 2001 was 106 moose (.37 moose/mi^2) at 24 per hour, down 20% from 1994–96. Because of an absence of snow in 2002, a count was not completed. The 2003 count of 138 moose, at a rate of 30 moose per hour, suggests moose numbers may have increased slightly during the past 2 years.

Population Size

An accurate population estimate is not available for all of Unit 11 because a complete census has never been conducted. Moose numbers observed during the 2003 fall composition counts in CA-11 (212 mi^2) resulted in a density estimate of 0.5 moose per mi^2. Density estimates from 0.1 to 0.4 moose/mi^2 were calculated in 1986 during late winter stratification surveys when 20% of the estimated 5200 mi^2 of moose habitat in the unit was surveyed. Based on these density estimates, an extrapolated population estimate of approximately 2500 moose was obtained. During the fall of 1993 National Park Service (NPS) biologists conducted a Gasaway census in portions of Unit 11. The density estimate was 0.58 moose/mi^2 and the extrapolated population estimate from this survey was 3000 moose (Bill Route, NPS, personal communication). During the late 1990s, declines in the number of moose counted in CA-11 suggest moose abundance may have fallen below the 1993 NPS estimate.

Population Composition

The bull:cow ratio in CA-11 in 2003 was 115:100 (Table 1). The bull:cow ratio has averaged 120:100 for the 5 years between 1997 and 2001. These bull:cow ratios have been among the highest ever observed in CA-11. This adult bull:cow ratio greatly exceeds the current management goal of maintaining no less than 30 total and 15 adult bulls:100 cows.

The calf:cow ratio in CA-11 was 15:100 in 2003, up 67 percent from the 2001 ratio of 9:100 (Table 1). Fall calf:cow ratios in CA-11 fluctuate considerably annually, with a 3-year average of 18 calves:100 cows. Unfortunately counts were not completed in 2002, though count data from adjacent GMU 13 indicated increased calf:cow ratios in the fall of 2002. An increase in yearling bulls in CA-11 during 2003 suggests there may have been an increase in calves during 2002. Calf:cow ratios below 20:100 in the fall suggest a low level of recruitment and an inability for the population to increase.

Distribution and Movement

Data from past fall composition and winter stratification surveys, field observations, and reports from the public indicate the highest moose numbers in the unit are along the slopes of Mt. Sanford, Mt. Drum, and Mt. Wrangell. Portions of Unit 11 south of the Chitina River have the lowest density of moose in the unit.

Fall rutting and postrutting concentrations normally occur in upland habitats to elevations as high as 4000 feet. Migrations to lower elevations are initiated by snowfall, but usually do not occur until late November–early December. By late winter moose numbers in riparian habitats along the Copper and Chitina Rivers are at their highest levels for the year. Some moose from the western slopes of Unit 11 move to lower elevations in a westerly direction across the Copper River to winter in eastern Unit 13.

MORTALITY

Harvest

Seasons and Bag Limit. The state season is 20 August–20 September with a bag limit of 1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on at least 1 side. The federal subsistence season has the same dates with a bag limit of 1 bull.

The combined state and federal harvest for moose in Unit 11 during 2001 was 42 moose (Table 2). Many hunters receive both state moose harvest tickets and federal subsistence moose permits and hunt in GMU 11. Unfortunately, there is some double reporting in which a hunter fills in both the harvest ticket and federal permit with identical data, and harvests and effort data are inflated. Known cases of double reporting are subtracted from the estimated total harvest data; however, harvest ticket and permit data do not have double reports subtracted and reflect slightly higher values than actually occur. Thirty-one moose were reported taken in 2001 under state regulations (Table 3) and 15 reported under federal regulations (Table 4). In 2002 the state harvest was 33, but harvest data were not available for the federal hunt. Moose harvests increased during this reporting period after reaching a low of 27 bulls taken in 1998. Hunting pressure increased in 2001 with 119 individuals reported hunting under the state harvest ticket (Table 3) and 124 rural residents obtaining federal subsistence moose permits (Table 4). During the late 1980s hunting effort was high with an average of 187 individuals reported hunting moose in Unit 11 compared to an average of 118 during the mid 1990s. Hunting effort is up since 2000 because of federal subsistence permits being available for any bull and because of displacement of hunters from Unit 13, where moose hunting opportunities have declined substantially.

Illegal and unreported harvests of both bulls and cows have been documented in Unit 11 and, in some years, may be as much as 20% of the reported harvest. Poaching activity is assumed to be greatest along the Nabesna and McCarthy Roads, where vehicle access allows for hunting and transporting illegally taken moose without being observed. It is also unknown how many small bull moose are taken off state land yet reported as legal under the federal registration permit. With 2 different bag limits for the same area, it is difficult to limit the harvest of small bulls because they are legal under the federal subsistence regulations on federal land.

Board of Game Actions and Emergency Orders. During the spring 1993 board meeting the Unit 11 season was changed to 20 August–20 September, and the bag limit was changed to 1 bull with spike-fork antlers or antlers with a minimum 50-inch width or 3 brow tines. This action aligned the state moose season and bag limit in most game management units on the road system in Southcentral Alaska. In 2000 the NPS initiated a registration permit hunt for federal subsistence hunting in Unit 11 by residents of designated communities in the resident zones of Units 11 and 13.

Hunter Residency and Success. Table 3 gives residency breakdowns for successful and unsuccessful moose hunters in the state hunt. Local rural residents accounted for 30% (n=10) of the total moose taken in Unit 11 during 2002 while nonresidents only took 24% (n=8). The remainder (n=13) went to non-local Alaska residents. Harvest rates by locals in the state hunt declined starting in 2000 because the federal subsistence permit hunt was established. Also, NPS regulations allow local rural residents to hunt in those portions of the unit designated as park. Because nonlocal residents and nonresidents can hunt only on preserve lands, they are excluded from much of the unit. Also, local residents can take any size bull under current subsistence regulations on federal lands, while nonlocals and nonresidents must take a spike-fork or 50-inch bull under state regulations.

The hunter success rate in 2002 was 27% for the state hunt, similar to the prior 2 years but down slightly from the 5-year average of 31%. The decline in 2000 success rate for the state hunt could be attributed to some hunters reporting under the federal permit. Success rates for federal hunters were lower at 19% and 12% in 2000 and 2001. Successful hunters spent an average of 6.1 days to kill a moose in 2002, while unsuccessful hunters averaged 7.7 days in the field. The time needed to take a moose increased slightly during this reporting period.

Harvest Chronology. Chronology data indicate more moose are taken during the later portion of the season in Unit 11 (Table 5). Bull moose are more vulnerable then because their movements increase at the onset of rut in mid September, which is also during leaf fall.

Transportation Methods. Unit 11 moose hunters use aircraft, 3-or 4-wheelers and highway vehicles for access to hunting areas (Table 6). NPS regulations limit transportation methods in Unit 11. Aircraft cannot be used in portions of the unit designated as park, and all vehicle use for sport hunting is restricted to existing trails by permit only. Subsistence hunters do not need a permit and are not limited to existing trails. These rules limit hunting opportunity in the more remote portions of the unit.

Natural Mortality

Predator-prey studies have not been conducted in Unit 11. Wolves and brown bears are abundant, but predation rates are unknown. Field observations of wolf kills during winter, coupled with reports by hunters and trappers of suspected wolf predation, indicate that wolves are important predators of moose in the unit. Brown bear predation is less apparent because it occurs during early summer, and detection is difficult. The low calf:cow ratios observed during fall counts indicate early calf mortality similar to that observed in areas with high brown bear predation on neonatal moose calves. The Unit 11 moose population will probably remain at low densities as long as predation limits recruitment. This suppression can occur over long periods when alternative prey such as sheep and caribou are available (Gasaway et al. 1983) as they are in Unit 11.

HABITAT

Assessment

Fires occurred throughout much of Unit 11 prior to the mid 1940s when the Bureau of Land Management (BLM) instituted fire suppression activities. The beneficial effects of those fires were reached in the 1960s, and moose numbers were high over much of the unit. Only one fire, the Wilson Camp Fire, has burned enough acreage in the past 30 years to produce a substantial amount of moose browse. That fire occurred in 1981 and covered 13,000 acres. Recent fires have either received initial fire suppression activities, or if not put out, have not had favorable burning conditions or fuel supplies. Currently vast areas within the unit support stands of mature spruce, many of which have been killed by spruce bark beetles and have limited value as moose habitat. Habitat types that moose currently use are climax upland and riparian willow communities.

Enhancement

Habitat manipulation to benefit moose is not currently an option because most of the unit is included in Wrangell–Saint Elias National Park and Preserve. Although NPS regulations prohibit habitat manipulation, Unit 11 is included in the Copper River Fire Management Plan with most remote areas under the limited suppression category.

CONCLUSIONS AND RECOMMENDATIONS

An increase in the number of moose counted and the moose per hour figures in CA-11 leads to the conclusion that moose numbers in the western portion of Unit 11 may have increased slightly over the past 2 years. A slight increase was observed in moose numbers during fall counts in Unit 13 as well, and this was attributed to the mild winters in 2001 and 2002, as well as a slight reduction in wolf numbers.

Unit 11 has relatively high numbers of brown bears and wolves. In areas with low calf:cow ratios and abundant bears and wolves, predation on calves has been shown to be an important limiting factor. Fall surveys have shown chronically low calf:cow ratios in Unit 11. Because of this, the moose population may remain relatively stable at the current low density for a long period.

Yearly fluctuations may occur when predation rates change because of snow conditions and winter severity.

Moose hunting patterns changed considerably in Unit 11 during this reporting period. Prior to this reporting period, hunting pressure and harvest were declining. This trend reversed in 1999, with both hunting pressure and the harvest increasing. The reasons for this change include the assumption that more hunters were displaced from Unit 13 because of the dramatic decline in both moose numbers and the change in season length and definition of a legal bull. Also, prior to 2000 all moose hunting in Unit 11 was monitored under the state harvest ticket system, including the federal subsistence harvest. In 2000, the NPS initiated a registration permit hunt for the federal subsistence hunt, and hunting pressure and harvests reached levels not seen in more than 10 years. Whether this effort will continue is unknown because moose numbers are low and access extremely limited. Much of the moose harvest comes from the same area each year, where there is reasonable access. An increased harvest in heavily hunted federal areas undoubtedly includes smaller bulls protected under the state SF/50 regulation. Once these available bulls are harvested, the overall take may decline because calf production/survival is low and bull recruitment is insufficient to support high harvests for very long. Also, hunters will not be able to move to new areas because of NPS access regulations.

I recommend a research program be established to investigate factors limiting growth of the moose population. Unit 11 has the potential to support more moose. The population objective of maintaining moose at existing densities (i.e., 0.3 and 0.5 moose/mi^2) needs to be reconsidered and perhaps increased. We also need to explore options available to managers to enhance the moose population consistent with NPS regulations. I also recommend reviewing the control and enforcement of the moose harvest in Unit 11. Dual management creates numerous enforcement and reporting problems, such as taking illegal moose on state or private land and reporting it as a federal subsistence moose.

LITERATURE CITED

GASAWAY, W. C., R. O. STEPHENSON, J. L. DAVIS, P. E. K. SHEPERD, AND O. E. BURRIS. 1983. Interrelationships of wolves, prey and man in interior Alaska. Wildlife monograph 84.

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Table 1 Unit 11 Moose composition counts in Count Area 11, 1998–2003.

Year	Males: 100 females	Yearling males: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose /hour	Density moose/mi^2
1998–99	111	9	15	7	97	104	24	0.4
1999–00	109	11	21	9	111	122	28	0.4
2000–01	157	3	24	9	95	104	23	0.4
2001–02	94	4	9	4	89	93	19	0.3
2002–03	N/A	--	--	--	--	--	--	--
2003–04	115	7	15	7	129	138	30	0.5

Table 2 Unit 11 Moose harvest[a] and accidental death, 1998–2003.

Regulatory	Reported			Estimated			
year	M	F	Total[b]	Unreported	Illegal	Total	Total
1998–99	27	0	28	5	5	10	38
1999–00	38	0	40	5	5	10	50
2000–01	45	0	45	5	5	10	55
2001–02	41	1	42	5	5	10	52
2002–03[c]	33	0	33	5	5	10	43

[a] Includes state harvest tickets and federal registration permit hunts. Double reporting occurred 8 times in 2000 and 4 times in 2001.
[b] Includes unknown sex.
[c] Federal harvests for 2002 not yet available.

Table 3 Unit 11 Moose hunter residency and success for general state harvest ticket hunt only, 1998–2003.

	Successful				Unsuccessful			
Regulatory year	Local resident	Nonlocal resident	Non Resident	Total[a]	Local resident	Nonlocal resident	Non-resident	Total[a]
1998–99	18	8	2	28	65	13	1	80
1999–00	25	9	6	40	37	41	4	83
2000–01	13	8	4	30	35	40	4	80
2001–02	8	12	8	31	49	34	3	119
2002–03	10	13	8	33	50	30	8	121

[a] Includes unspecified residency.

Table 4 Unit 11 Federal subsistence permit hunt, 2000–2003.

Hunt	Regulatory year	Permits issued	Percent Did not Hunt	Number (%) Unsuccessful Hunters	Number (%) Successful Hunters	Bulls	Cows	Unknown	Harvest
RM 714	2000–01	119	0	96 (81)	23 (19)	23	0	0	23
	2001–02	124	0	109 (88)	15 (12)	14	1	0	15
	2002–03	N/A							

Table 5 Unit 11 Moose harvest (%) chronology by seasonal weeks for general state harvest ticket hunt only, 1998–2003.

Regulatory	Season	Week of Season				
Year	Dates	1st	2nd	3rd	4th	5th
1998–99	20 Aug–20 Sep	0	4	22	41	33
1999–00	20 Aug–20 Sep	14	11	8	30	38
2000–01	20 Aug–20 Sep	7	3	10	27	53
2001–02	20 Aug–20 Sep	7	7	7	30	50
2002–03	20 Aug–20 Sep	13	0	23	29	35

Table 6 Unit 11 Successful moose hunter transport methods (%) for general state harvest ticket hunt only, 1998–2003.

Regulatory Year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown
1998–99	29	0	0	32	0	7	25	7
1999–00	33	0	3	33	0	8	23	3
2000–01	47	0	0	27	0	7	17	3
2001–02	55	0	3	26	0	6	10	0
2002–03	36	3	15	24	0	6	12	3

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 12 (10,000 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Tanana and White River drainages

BACKGROUND

Following federal wolf control, the Unit 12 moose population irrupted during the 1950s through the mid 1960s. Moose numbers declined rapidly during the early 1970s, similar to populations in adjacent road accessible areas. Several severe winters, high wolf and grizzly bear predation, and high localized cow moose harvests all contributed to the population decline. Cow moose hunts were stopped after 1974, and the Nabesna Road moose season was closed entirely from 1974 through 1981. Between 1986 and 1991, the Little Tok River drainage was closed to moose hunting because of low yearling recruitment and a declining bull:cow ratio. Between the mid 1970s and early 1980s, the Unit 12 moose density was estimated between 0.2 and 0.4 moose/mi^2 (ADF&G, unpublished data).

In response to the declining moose populations, wolf control programs were conducted in adjacent Units 20D (1980), 20E (1981–1983), and in northern Unit 12 (1981–1983). Beginning in regulatory year (RY) 1982, which begins 1 July and ends 30 June (e.g., RY82 = 1 Jul 1982–30 Jun 1983), attempts were made to reduce the grizzly bear population by liberalizing grizzly bear hunting regulations. Moose habitat enhancement programs were conducted during the late 1980s and again in 1997. Between 1982 and 1989 the moose population in Unit 12 increased, probably due to a combination of these management programs and favorable climatic conditions that prevailed during this period. However, the population remained at low density (0.4–0.6 moose/mi^2).

Unit 12 has been an important moose hunting area for local residents, hunters from Southcentral Alaska, and guided nonresidents. It is also an important wildlife viewing area for tourists driving the Alaska Highway. The Upper Tanana Valley is the first area in Alaska visited by thousands of highway travelers who come to view Alaska's wildlife. During the 1960s when the Unit 12 moose population was high, hunting seasons and bag limits were liberal and hunter participation and success were high. Moose were commonly viewed while

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

traveling the area's highways. During that period, needs of consumptive and nonconsumptive users were met. Since the unit's moose population declined to a low level, the hunting season and bag limit have become restrictive and harvest has declined by over 40%.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population in concert with other components of the ecosystem.
- Continue sustained opportunities for subsistence use of moose.
- Maximize sustained opportunities to participate in hunting moose.
- Maximize opportunities for the nonconsumptive use of moose.

MANAGEMENT OBJECTIVE

- Maintain a minimum posthunting sex ratio of 40 bulls:100 cows east of the Nabesna River and a minimum ratio of 20 bulls:100 cows in the remainder of the unit.

INTENSIVE MANAGEMENT OBJECTIVES

- Population: 4000–6000 moose.
- Harvest: 250–450 moose annually.

METHODS

POPULATION ESTIMATION AND COMPOSITION SURVEYS

We estimated the moose population size in an 1120-mi^2 portion of northwestern Unit 12 during November 1994 and October 1997. Methods followed standard Gasaway survey techniques (Gasaway et al. 1986), except the areas were stratified using historic count data collected during aerial contour counts or population estimation surveys. The area in northwestern Unit 12 was divided into 34 high density and 42 low–medium moose density strata sample units in 1994. Based on 1994 and 1996 survey results, we restratified the area into 37 high and 39 low–medium strata sample units in 1997. We flew 24 random sample units (16 high, 8 low–medium) covering approximately 32% of the study area during 1994 and 27 random units (19 high, 9 low–medium) covering 37% of the area during 1997. Standard search intensity was about 4.25 min/mi^2 in 1994 and 3.45 min/mi^2 in 1997. Portions of 12 sample units (1994; 8 highs, 4 lows) and 14 units (1997; 9 highs, 5 lows) were resampled at a search intensity of 12 min/mi^2 to determine a sightability correction factor.

During 2000–2003, in cooperation with Tetlin National Wildlife Refuge staff, we estimated moose population size and composition using the Geostatistical Population Estimator method (GSPE; Ver Hoef 2001), a modification of the standard Gasaway et al. (1986) technique, in all of Unit 12 excluding those portions of the Nabesna, Chisana, and White River drainages within Wrangell–St. Elias National Park and Preserve. All moose habitat in this area was divided into high (≥2 moose/sample unit) or low (<2 moose/sample unit) strata. During each year, between 60–65% of the sampled areas were high strata. A simple random sample of sample units was selected from each stratum using Microsoft®Excel for Windows®2000 software. Previous analyses suggest survey effort and the precision of population estimates are optimized when the survey effort includes approximately 40% low density and 60% high-density sample units. The GSPE method does not yet employ a sightability correction factor, so does not correct for moose not seen during the survey. Rather, the GSPE method employs greater search intensity of 8–10 min/mi^2 vs. 4–6 min/mi^2 (Gasaway et al. 1986), resulting in a higher level of sightability. All moose observed were classified as either large bulls (antlers >50 inches), medium bulls (antlers larger than yearlings but <50 inches), small bulls (spike, cerviform, or palmate-antlered [no brow separation] yearling bulls), cows, calves, or unidentified moose.

The National Park Service (NPS) conducted a "no-stratification" population estimation survey (Dale et al. 1994) in a 352-mi^2 area in the vicinity of Chisana in southeast Unit 12 during October 1998 (NPS, Wrangell–St Elias National Park and Preserve, unpublished data).

We conducted aerial composition surveys in October and November 1993–1999 in 4–9 traditional trend count areas. All moose observed were classified as either large bulls (antlers >50 inches), medium bulls (antlers larger than yearlings but <50 inches), small bulls (spike, cerviform, or palmate-antlered [no brow separation] yearling bulls), cows without calves, cows with 1 calf, cows with 2 calves, lone calves, or unidentified moose. These data were used to estimate population and composition trends by comparing moose observed per hour and composition ratios between years.

HARVEST

Harvest was estimated using harvest reports. To increase the reporting rate, reminder letters were sent to hunters who did not initially report. Information obtained from the reports was used to determine total harvest, hunter residency and success rates, harvest chronology, and transportation used. Harvest data were summarized by regulatory year. Estimates of moose legally harvested outside the hunting season for ceremonial potlatches were obtained by interviewing residents and public safety officers of villages where potlatches took place.

HABITAT

Enhancement

We made significant progress in developing a cooperative wildlife habitat logging plan with the Department of Natural Resources/Division of Forestry to increase deciduous browse and cover for wildlife and to provide nursery structure for planted spruce seedlings. The Robertson River Prescribed Burn Plan was completed in 2001 and may be implemented in summer 2005.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Based on data collected during annual October–November aerial composition surveys and area-specific population estimation surveys during 1989, 1990, 1994, 1997, 1998, 2000, and 2001, the moose population in Unit 12 increased slowly from 1982 to 1989 and remained relatively stable from 1989 to 1993. The Unit 12 moose population grew slightly during 1994–1997, possibly due to increased calf survival. The population remained stable during 1998–2003. During the growth phase in 1994–1997, the most apparent increase occurred in the northwest portion of the unit within the area affected by the 1990 Tok wildfire (155 mi^2). Population estimates indicate this area supported 0.19 moose/mi^2 in 1989, 0.6 moose/mi^2 by 1994, and about 1.0 moose/mi^2 in 1997.

The 1999 estimated population range was 3500–4000 moose using results from past year's population estimates and composition surveys conducted in 1999. The 2001 Unit 12 population estimate was 3450–4300 moose (±16%, 90% CI), with an estimated density of 0.6–0.7 moose/mi^2 of suitable moose habitat (6000 mi^2). The 2003 Unit 12 population estimate was 2900–5100 moose (±22%, 90% CI), with an estimated density of 0.6–0.7 moose/mi^2 of suitable moose habitat (6000 mi^2).

Localized moose harvest caused declines in moose numbers near villages and communities in Unit 12. Poaching and legal harvest for funeral and ceremonial potlatches had the greatest effect, because cow moose were often harvested. Since the 1990s, the Fish and Wildlife Protection officer in Tok has conducted intensive public awareness campaigns explaining the limiting effects of poaching on local moose numbers. In addition, we have worked with the local villages to improve potlatch moose harvest reporting and to develop a strategy to meet cultural needs but limit the harvest to more sustainable levels. These efforts have been largely unsuccessful; however, a recent effort by village councils and local community leaders to heighten awareness appears to be creating a positive change.

The Alaska Board of Game identified the moose population in Unit 12 as important for high levels of human consumptive use under the Intensive Management Law (AS 16.05.255[e]–[g]). This designation means the board must consider intensive management if regulatory action to significantly reduce harvest becomes necessary because the population is depleted or has reduced productivity. The board set the Unit 12 intensive management (IM) population objective at 4000–6000 moose and IM harvest objective at 250–350 moose. The Unit 12 moose population is at the lower end of the IM population objective, but calf survival is not high enough to allow the IM harvest objective to be met. Based on modeling of the Unit 12 trends in moose population, and hunter participation and harvest, the moose harvest must be maintained at 130 bulls and distributed throughout the unit to protect the bull segment of the population, especially in the more accessible areas of the unit. Significantly increasing the moose population and the sustainable harvest will require intensive management to reduce the effects of wolf and bear predation on moose survival.

Past research found that predation by both wolves and bears was the primary factor maintaining the area moose populations at low densities (0.2–1.0 moose/mi^2, Gasaway et al. 1992; U.S. Fish and Wildlife Service, unpublished data). Because the moose population in the northwest portion of the unit increased as a result of the 1990 Tok wildfire and intense public hunting and trapping of predators, other local moose population increases may be attainable in Unit 12 without government wolf control. These moose population increases probably would be moderate and would eventually be limited by predation. However these population increases should be enough to satisfy the minimum intensive management objectives for the next 3 years.

Population Composition

We conducted moose composition surveys in Unit 12 during fall 1988–2003 (Table 1). Composition data since 1994 are not directly comparable with previous years because sampling techniques changed. Prior to 1994, trend count areas within the Tok, Little Tok, Tetlin, Nabesna, and Chisana Rivers were surveyed annually. During 1994, 1997, and 2000–2003 we conducted population estimation surveys over a much larger area, which included the traditional count areas. During 1995, 1996, 1998, and 1999 a portion of the trend count areas were surveyed to protect against missing a catastrophic decline in the area's moose population during years population estimation surveys were not conducted. Benefits of conducting population estimation surveys included confidence limits around composition estimates and, because more area and habitats were sampled, it was less likely that weather or moose distribution anomalies would affect the count. We found calf:cow ratios were lower within the high strata compared to low strata, indicating that most calf:cow pairs select for habitats not normally surveyed during trend counts. Most trend count areas were located within high-density areas to optimize the number of moose surveyed.

During 2000, 2001 and 2003, Tetlin National Wildlife Refuge staff cooperated with us to design moose surveying areas to obtain population and composition estimates for most of Unit 12. We expect this cooperation to continue.

During 2001 and 2003, bull:cow ratios ranged from 25–42:100 in western and northern portions of Unit 12 and 64–89:100 in the eastern and southern portions. Most harvest occurred in the western and northern portions of the unit and in some areas caused the bull:cow ratio to decline. Within the Tok River drainages and along the north side of the Alaska Range the bull:cow ratio declined to the low 20s:100 from the low 30s:100 during the mid to late 1990s but has remained relatively stable since 1999. The Unit 12 bull:cow ratio remained above the population objective.

Annually approximately 50% of the total Unit 12 moose harvest occurred in the Tok River drainage and along the north side of the Alaska Range. Yearling bull recruitment ranged from 7–12:100 and was not adequate to compensate for harvest. The bull:cow ratio stabilized during RY99–RY03 because hunting success rate declined, probably because bull density became so low.

Calf survival to 5 months varied during the report period (Table 1; 15–33:100 cows). The number of calves that survived to 5 months during RY01–RY02 compared to the number of yearling bulls (7–12:100) suggests that wolves were probably the primary predator in Unit 12.

Distribution and Movements

Moose live throughout Unit 12 below an elevation of about 4500 feet. There are about 6000 mi^2 (15,540 km^2) of suitable habitat. There are both migratory and nonmigratory segments of the population. Moose that rut in the Tok River area appear to move the greatest distances. Many cows migrate as far south as the Gakona River for calving, return to the Tok River for the rut, and then move north to the area burned by the 1990 Tok wildfire or to the Tanana River to winter, a straight-line distance of 90–100 miles (144–160 km). While en route to the Tok wildfire area during winters 1999–2000 through 2002–2003, 10–30 moose were consistently observed using an area along the Tok River that was mechanically crushed in 1998.

Moose distribution in Unit 12 changed over the past 10 years. During RY99–RY03, very few resident moose existed on the Northway Flats, in the vicinity of Tanacross, or north of Tok along the Tanana River. Year-round poaching and harvest for funeral or ceremonial potlatches contributed to the decline of resident moose in these lowland areas near human settlements. Also, some of these moose may now be spending more time in the 1990 Tok River burned area. Use of the Tok River valley and Tetlin Hills by moose increased substantially since 1989. Densities increased from 0.19 moose/mi^2 (fall 1989) to about 1 moose/mi^2 (fall 1997–fall 2003). Increased use of this area occurred throughout the year and was a result of improved habitat from the 1990 Tok River fire and moderate harvests of predators.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits in Unit 12 are summarized in Table 2.

Alaska Board of Game Actions and Emergency Orders. The Alaska Board of Game split the moose season into 2 periods: 24–28 August and 8–17 September in most of the unit for RY01. This created a 5-day August season for any bull and eliminated the 14-day spike/fork-only August season. In the remainder, that portion east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian border, the season remained 1–30 September. Also in spring 2000, the board established the population objective for Unit 12 at 4000–6000 moose and harvest objective at 250–450 moose.

Hunter Harvest. Reported harvest in Unit 12 was 99 bulls and 2 unknown sex in RY01, 124 bulls in RY02, and 132 bulls, 1 cow and 1 unknown sex in RY03 (Table 3). The 5-year average reported moose harvest was 122. The number of hunters and harvest increased in RY95. Average annual harvest during RY90–RY94 was 92 compared to 123 (34% increase) during RY95–RY03.

Reported harvest represented about 2.5–3.5% of the prehunt Unit 12 population and had little impact on population dynamics. During RY01–RY03 the annual out-of-season take was estimated at between 25–50 moose. Most of this harvest comprised cow moose. During the early 1990s this harvest was probably as high as 60 moose annually because poaching was more of a problem and was additive to the potlatch take. Most out-of-season harvest occurred near communities and along the road system. Thus, the annual Unit 12 harvest was probably closer to 4–5.5% of the population. Under this harvest rate and these harvest distribution patterns, the moose population near Unit 12 communities continued at low levels.

Hunter Residency and Success. During RY01–RY03, local residents accounted for an average of 52% of moose hunters in Unit 12, nonlocal residents averaged 37% and nonresidents 10%. The number of local and nonresident hunters has remained relatively constant since RY94, but the number of nonlocal hunters has increased. Local hunters took 40–44% of the reported harvested bulls during RY01–RY03, nonlocals took 27–35%, and nonresidents 22–27% (Table 4). The harvest of moose by nonlocal Alaska residents increased during RY99–RY03 compared to RY93–RY98 due to a 33% increase in the number of nonlocal Alaska residents who hunted in Unit 12.

During RY01–RY03, 520–567 hunters reported hunting moose in Unit 12 (Table 4). The 5-year average was 540 compared to the average of 494 between RY94 and RY98, a 9% increase. Increased participation by nonlocal Alaska residents, mostly from Southcentral Alaska, accounts for a majority of the increase in hunters. This trend also occurred in adjacent Unit 20E. During RY01–RY03 the average success rate in Unit 12 was 22% compared to 25% during RY98–RY00.

Harvest Chronology. During RY91–RY00, an average of 33 bulls were harvested during 1–6 September (Table 5) representing 30% of the fall harvest (range = 27–35%). In an attempt to maintain or reduce the fall harvest in Unit 12, during RY01 the hunting season in most of the subunit was split into 2 periods: 24–28 August and 8–17 September. During RY93–RY00 an average of 27 bulls were harvested during 1–5 September. In RY01–RY03 an average of 11 bulls were harvested during 24–28 August. This represents a reduction of 41% during the first 5 days of the season. This reduction in harvest was not regained during the 10-day September season. The average harvest during RY01–RY03 was 10% lower than the RY98–RY00 average.

The number of hunters who used the 1–30 September season in southern Unit 12 and the total harvest for this season remained similar to past years. Most of these hunters were guided nonresidents or Chisana residents.

Transport Methods. During RY01–RY03, the transportation type used most by successful hunters, on average, was 4-wheelers (37%), followed by boats (20%), highway vehicles (19%), airplanes (18%), horses (13%), and other ORVs (11%) (Table 6). Compared to RY98–RY00, the percentage of harvest by hunters who used 4-wheelers increased from an average of 22% to an average of 37%, while the percentage of the harvest by hunters who used highway vehicles decreased from 23% to 19%. Use of all other transportation types by successful hunters remained relatively constant.

Other Mortality

Predation by wolves and grizzly bears has been the greatest source of mortality for moose in Unit 12 and has maintained the population at a low density (0.4–0.7 moose/mi^2) since the mid 1970s. In contrast with most other areas that contain sympatric moose, wolf, and grizzly bear populations, wolves, rather than bears, were the primary predator on moose calves on the Northway–Tetlin Flats, based on research conducted during the late 1980s (ADF&G unpublished data; U.S. Fish and Wildlife Service, unpublished data). Wolf predation also appeared to be the greatest source of adult mortality. However, in some mountainous areas of Unit 12, fall composition data indicate that predation on moose neonates was high, suggesting grizzly bear predation.

Considering the population status and trends of wolves and grizzly bears in Unit 12, I expect the moose population to remain at low density (0.2–1.0 moose/mi^2) for an extended period. However, it appears that concentrated public wolf trapping and bear harvest can cause local populations of moose to increase, especially in areas that received habitat enhancement. The likely mechanism is improved calf and yearling survival. Adult mortality probably changes little. Modeling data and survey data support this hypothesis.

HABITAT

Assessment

Only about 6000 mi^2 in Unit 12 are moose habitat. Excessive wildfire suppression for nearly 30 years allowed vast areas of potentially good moose habitat to become choked with spruce forests that lack high-quality deciduous moose browse. We have conducted browse surveys periodically since the 1970s and found that in most years use of preferred browse species is low in relation to availability. During deep snow winters, moose concentrated in areas along the Tok and Tanana Rivers and the browsing rate was much higher. In all years, disturbed sites with early successional species were used far more heavily than adjacent undisturbed areas. During RY01–RY03 habitat was not limiting the moose population in Unit 12, but medium- to large-scale creation of early seral species could cause the moose population to increase, as evidenced by the 1969 Ladue burn in eastern Unit 20E (Gardner 2000), the 1990 Tok burn, and the Teslin burn in the Yukon (Boertje et al. 1995). Boertje et al. (1995) hypothesized that seral stages reduce predation efficiency in a variety of ways.

Enhancement

During the 1980s over 1800 acres of old age, decadent willows were intentionally disturbed to stimulate crown sprouting of new leaders. Using data collected during our browse surveys, we estimated that these habitat enhancement projects produced over 2 million pounds of additional browse each year for wintering moose. In eastern Unit 12 the U.S. Fish and Wildlife Service has completed several prescribed fires to benefit moose on the Tetlin National Wildlife Refuge since the 1980s.

In 1997 we mechanically crushed 275 acres of decadent willow and aspen within the Tok River valley to stimulate crown growth. We conducted informal surveys in this area during summers 1999 and 2001 and found extensive stands of feltleaf willow (*Salix alaxensis*) and red-stem willow (*Salix planifolia),* preferred moose browse species. In summer 2001 most of the shrubs were 3–10 feet tall; <1% were above 10 feet and unavailable for moose. We documented continual use of this area during the winter by 10–30 moose and observed increased use as calving habitat.

Since 1998 we have been working in cooperation with the Department of Natural Resources/Division of Forestry to determine suitable logging sites within a proposed 1000-acre timber sale area in the Tok River valley. Potential cut areas are selected based on numbers of marketable trees, historic winter moose use, and the potential to regenerate quality moose browse species. In addition, we are assisting in designing and implementing scarification techniques that will promote willow and aspen regeneration following logging on these sites. Cut areas will be 80–200 acres in size. Logging should begin in winter 2004–2005.

From June to September 1990, a wildfire burned approximately 97,000 acres of primarily decadent black spruce muskeg in the Tetlin Hills and adjacent Tok River lowlands. Quality moose browse species recolonized much of this area and, in response, the area's moose population increased rapidly (0.19 moose/mi^2 in 1989 to 1.0 moose/mi^2 by 1997). Excellent moose winter browse supplies are expected to exist for the next 15–20 years.

Local residents observed the increase in moose in the area burned by the 1990 Tok wildfire. As a result, local residents are becoming more receptive to using fire or other habitat enhancement techniques to benefit moose, as evidenced by public support of the planned prescribed burns in the Robertson River and near Tanacross village in 2004–2005.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

If moose numbers are to increase along the road system in Unit 12, the number of cow moose taken for ceremonial and funerary potlatches must decline. The department has tried to address this problem with local villages during village council meetings and Traditional Knowledge workshops but limited corrective steps have been taken. Potlatches are culturally important and should be maintained; however, restrictions on harvest, especially in areas like Unit 12 where the moose densities are very low, should be implemented. In summer 2004 we worked with village residents, the Tanana Chiefs Conference, and ADF&G/Subsistence Division staff to design potlatch moose management that better protects the moose population and still meets the villages' needs.

CONCLUSIONS AND RECOMMENDATIONS

During RY01–RY03 moose were far less numerous in Unit 12 than in the 1960s. The population declined rapidly during the 1970s, increased during the late 1980s, stabilized or slightly declined from 1989 to 1993, increased slightly from 1994 to 1996, and remained stable from 1997 through 2003. Moose numbers, especially in the vicinity of the road system, were very low, which primarily affected subsistence hunters and nonconsumptive users. Every year hundreds of travelers on the Alaska Highway commented on the lack of wildlife in the Upper Tanana Valley. Habitat was not limiting, but predation and out-of-season take in certain areas maintained the moose population at low density. Between 1991 and 1997 the moose population increased within the area affected by the Tok wildfire. Residents of Tetlin and Tok and a growing number of nonlocal residents increased their hunting in the area and consequently legal and out-of-season harvest stabilized moose population growth.

In more accessible areas of Unit 12 the bull:cow ratio declined to 20–25:100 due to moderate harvest rates and low yearling bull recruitment. In the Little Tok River, an antler restriction regulation was adopted in an attempt to protect the bull:cow ratio but still allow maximum hunter opportunity. Harvest may need to be restricted in a similar manner in the Tok River drainage and along the north face of the Alaska Range because of high harvest rates.

During RY96–RY00 the number of hunters increased by 12% and harvest increased by 32% compared to RY91–RY95. However, in RY01–RY03 when the Unit 12 moose season was split into a 5-day August season for any bull and a 10-day mid September season for any bull, harvest declined by 4% compared to the average annual harvest during RY96–RY00. The most significant change in harvest patterns was the significant increase in the portion of the harvest by hunters using 4-wheelers in RY01–RY03 (37%) compared to RY98–RY00 (22%).

The Alaska Board of Game established population objectives for Unit 12 at 4000–6000 moose and harvest objectives at 250–450 moose. The 2003 population was at or just below the population objective, but recruitment of young moose into the population was not high enough in accessible areas to achieve the board's desired harvest objective. To meet harvest objectives, recruitment of young moose in the more accessible areas of Unit 12, along the road and trail systems, must be improved. Modeling data indicate harvest management objectives could be met in these portions of the unit if intensive habitat management is coupled with elevated public wolf and bear harvest.

The Unit 12 moose management objective to maintain a minimum posthunting sex ratio of 40 bulls:100 cows east of the Nabesna River and a minimum ratio of 20 bulls:100 cows in the remainder of the unit was met during RY01–RY03. The Board of Game's intensive management population objective of 4000–6000 moose was met, but the board's intensive management harvest objective of an annual harvest of 250–450 was not met.

Population trends were monitored. Additional habitat enhancement programs were planned and should be implemented during the next 2 years. Hunting seasons and bag limits were established that allowed maximum hunting opportunity and met subsistence needs. We are continuing to work with local villages to manage moose harvest and reduce the numbers of cows harvested for potlatch ceremonies. Moose viewing opportunities were shared with visitors and local residents, and several presentations were given to local schools and tourist groups annually.

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TABLE 1 Unit 12 aerial moose composition counts, fall 1988–2003

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Moose observed	Adults observed	Calves observed	Percent calves	Moose/hr
1988	64	18	33	1133	943	189	17	40
1989[a]	50	13	30	1317	1094	223	17	44
1990	47	12	25	1256	1071	185	15	40
1991	49	12	24	1472	1264	200	14	44
1992	45	10	26	1071	906	165	15	32
1993[b]	26	7	36	850	662	187	22	57
1994[c]	38	16	39	414	327	87	21	
1994[d]	97	13	25	421	374	47	11	44
1995[d]	82	12	26	526	461	65	12	51
1996	39	9	32	1258	1022	236	19	57
1997[c]	36	11	41	596	458	138	23	
1997[d]	87	22	31	512	439	73	14	39
1998[e]	65	14	34	277	229	48	17	
1998[f]	38	7	29	150	124	26	17	54
1999[b]	22	8	17	823	721	102	12	65
2000[g,h]	40	9	18	630	558	72	11	
2000[h,i]	84	10	34	268	229	39	15	
2001[g,h]	40	11	27	672	566	106	16	
2001[h,i]	64	18	33	466	400	66	14	
2002[g,h]	42	12	15	350	305	45	13	
2003[g,h]	25	7	32	575	464	111	19	
2003[h,i]	89	15	33	564	475	89	15	

[a] Tok and Dry Tok were not surveyed. These survey areas normally yield a sample of 400+ moose.
[b] Cheslina and the northern face of the Nutzotin Mountains were not surveyed. These survey areas normally have about 100 bulls:100 cows.
[c] Based on population estimation results from northwestern Unit 12.
[d] Cheslina, Kalukna, Nabesna, and Chisana count areas were sampled using contour survey techniques.
[e] Based on population estimation results from the Chisana area, southwest Unit 12 using the "No-stratification" technique.
[f] Only the north face of the Alaska Range sampled using the contour survey technique.
[g] Survey area includes state and private lands in western and northern Unit 12. Survey conducted by Alaska Department of Fish and Game.
[h] Ratios determined using weighted contributions from high and low sample areas. Actual counts of cows, calves and bulls were not used in estimates.
[i] Survey area includes federal and private lands in eastern and southern Unit 12. Survey conducted by Fish and Wildlife Service/Tetlin National Wildlife Refuge.

TABLE 2 Unit 12 moose hunting seasons and bag limits, regulatory years 2001–2002 through 2002–2003

Regulatory year	Area		Season	Bag limit[a]
2001–2002	Unit 12, that portion drained by the Little Tok River upstream from and including the first eastern tributary from the headwaters of Tuck Creek.	Resident:	24–28 Aug 8–17 Sep	1 bull with spike fork antlers or 50 inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	8–17 Sep	1 bull with spike fork antlers 50-inch antlers or antlers with 4 or more brow tines on at least one side.
	Unit 12, east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian Border.	Resident: Nonresident:	1–30 Sep No open season	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
	Remainder of Unit 12.	Resident:	24–28 Aug 8–17 Sep	1 bull. Or 1 bull.
		Nonresident:	8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
2002–2003	Unit 12, that portion drained by the Little Tok River upstream from and including the first eastern tributary from the headwaters of Tuck Creek.	Resident:	24–28 Aug 8–17 Sep	1 bull with spike fork antlers or 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	8–17 Sep	1 bull with spike fork antlers or 50-inch antlers or antlers with 4 or more brow tines on at least one side.
	Unit 12, east of the Nabesna River and south of the winter trail running southeast from Pickerel Lake to the Canadian Border.	Resident: Nonresident:	1–30 Sep No open season	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.

[a] 50-inch antlers defined as having a spread of at least 50 inches or at least 4 brow tines on at least 1 side.

TABLE 3 Unit 12 moose harvest and accidental death, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest by hunters										Accidental death		Total
	Reported						Estimated						
	M	(%)	F	(%)	Unk	Total	Unreported	Illegal	Total		Road	Total	
1990–1991	94	(96)	0	(0)	4	98	15–20	30–40	45–60		4–5	4–5	147–163
1991–1992	109	(99)	0	(0)	1	110	15–20	30–40	45–60		4–5	4–5	159–175
1992–1993	71	(100)	0	(0)	0	71	15–20	30–40	45–60		4–5	4–5	120–136
1993–1994	91	(100)	0	(0)	0	91	15–20	30–45	45–65		5–7	5–7	141–163
1994–1995	87	(100)	0	(0)	1	88	15–20	30–45	45–65		7	7	140–160
1995–1996	117	(100)	0	(0)	1	118	20–25	5–10	25–35		3–5	3–5	146–158
1996–1997	124	(100)	0	(0)	0	124	20–25	3–10	23–35		3–5	3–5	150–164
1997–1998	102	(100)	0	(0)	0	102	20–25	3–10	23–35		3–5	3–5	128–142
1998–1999	148	(99)	1	(1)	0	149	20–25	3–10	23–35		3–5	3–5	175–189
1999–2000	137	(99)	0	(0)	2	139	20–50	3–10	23–60		3–5	3–5	165–204
2000–2001	112	(100)	0	(0)	0	112	20–50	3–10	23–60		3–5	3–5	138–177
2001–2002	99	(98)	0	(0)	2	101	20–50	3–10	23–60		3–5	3–5	127–166
2002–2003	124	(100)	0	(0)	0	124	20–50	3–10	23–60		3–5	3–5	150–189
2003–2004	132	(99)	1	(0)	1	134	20–50	3–10	23–60		3–5	3–5	160–199

TABLE 4 Unit 12 moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1990–1991	45	26	17	10	98 (23)	186	131	15	0	332 (77)	430
1991–1992	48	49	13	0	110 (27)	160	132	9	4	305 (73)	415
1992–1993	23	35	12	1	71 (15)	222	164	13	9	408 (85)	479
1993–1994	38	33	18	2	91 (24)	186	90	12	1	289 (76)	380
1994–1995	43	28	17	0	88 (19)	240	118	15	1	374 (81)	462
1995–1996	55	34	26	3	118 (24)	249	113	16	0	378 (76)	496
1996–1997	62	41	20	1	124 (24)	251	119	14	0	384 (76)	512
1997–1998	43	29	30	0	102 (21)	245	125	14	0	384 (78)	492
1998–1999	68	46	35	0	149 (29)	232	110	19	0	361 (71)	510
1999–2000	69	41	29	0	139 (25)	240	155	23	0	418 (75)	557
2000–2001	49	41	21	1	112 (21)	241	144	23	1	409 (79)	521
2001–2002	49	27	22	3	101 (19)	242	155	20	2	419 (81)	520
2002–2003	53	43	26	2	124 (23)	212	170	25	0	407 (77)	531
2003–2004	54	44	36	0	134 (24)	230	164	35	4	433 (76)	567

[a] Residents of Units 12 and Units 20E and eastern 20D are considered local residents. Major population centers are Eagle, Chicken, Boundary, Northway, Tetlin, Tok, Tanacross, Slana, and Dot Lake.

TABLE 5 Unit 12 moose harvest chronology by month/day, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest chronology by month/day						Total[a]
	8/15–8/28	9/1–9/6	9/7–9/13	9/14–9/20	9/21–9/27	9/28–10/5	
1990–1991		18	41	28	4	3	98
1991–1992		34	45	22	4	1	110
1992–1993		25	31	6	4	4	71
1993–1994		29	40	16	4	0	91
1994–1995		25	26	25	3	4	88
1995–1996	2	33	52	17	5	6	118[b]
1996–1997	1	39	44	27	7	1	124[b]
1997–1998	1	30	38	19	10	1	102
1998–1999	2	41	65	30	5	1	149
1999–2000	11	37	54	23	3	2	139
2000–2001	4	32	48	16	6	2	112
2001–2002	9	0	41	34	6	4	101
2002–2003	13	0	64	45	0	0 (2 unk)	124
2003–2004	12	2	63	40	12	2 (3 unk)	134

[a] Difference between total and summation of harvests by week represents moose taken on unknown dates.
[b] One moose was taken during a federal hunt in November 1995.

TABLE 6 Unit 12 moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method								*n*
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	
1990–1991	17	15	21	11	0	6	23	5	98
1991–1992	10	14	10	25	0	14	25	2	110
1992–1993	18	23	10	11	0	10	28	0	71
1993–1994	8	19	15	22	0	16	18	2	91
1994–1995	10	20	19	18	0	7	23	2	88
1995–1996	10	13	28	17	0	6	22	4	118
1996–1997	13	9	22	19	0	7	28	2	124
1997–1998	15	21	16	20	0	3	24	1	102
1998–1999	16	12	17	20	0	11	22	1	149
1999–2000	12	9	16	22	0	12	27	2	139
2000–2001	14	10	19	24	0	12	20	2	112
2001–2002	15	10	20	31	0	9	16	0	101
2002–2003	18	9	15	31	0	10	16	2	124
2003–2004	12	13	16	31	0	10	16	1	134

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 13 (23,368 mi^2)

GEOGRAPHIC DESCRIPTION: Nelchina and Upper Susitna River

BACKGROUND

Moose densities in Unit 13 were low during the early 1900s, but started to increase by the 1940s. Moose were abundant throughout the 1950s, and the population peaked in the mid 1960s. For the next 10 years, moose numbers declined and reached a population low by 1975. Factors contributing to the decline were severe winters, increased predation, and large human harvests of both bulls and cows. The number of moose counted during fall surveys started to increase in 1978 and climbed at an average annual rate of 5% until 1987, when the population peaked again. Moose numbers started to decline again during the early 1990s because of a series of severe winters and increased predation.

Historically, Unit 13 has been an important area for moose hunting in Alaska. Annual harvests were large, averaging more than 1200 bulls and 200 cows during the late 1960s and early 1970s. Hunting seasons were long, with both fall and winter hunts. As moose numbers began to decline, harvests were reduced by eliminating both the cow hunt and winter season in 1972 and reducing fall bull seasons to 20 days in 1975. Harvests in the late 1970s averaged 775 bulls per year, but bull:cow ratios in the population were low. In 1980 the bag limit was changed from any bull to bulls with an antler spread of at least 36 inches or 3 brow tines on at least 1 antler. Under this management regime, the 1980 bull harvest dropped to 557, down 34% from the 1979 harvest of 848. From 1981 through 1988 the harvest increased, peaking in 1988 with a harvest of 1259 moose. Between 1990 and 1993 seasons were reduced in length in response to population declines attributed to severe winters. Moose seasons were again liberalized in 1993 with harvests again increasing and remaining high until the late 1990s.

MANAGEMENT DIRECTION

POPULATION OBJECTIVE

Increase the unit moose population to 20,000–25,000 moose with a minimum of 25–30 calves:100 cows and 10 yearling bulls:100 cows in the fall.

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[a] This unit report also includes data collected after the end of the reporting period at the discretion of the reporting biologist.

HUMAN USE OBJECTIVE

Increase the yearly moose harvest of bulls and cows to a combined total of 1200–2000 animals. Provide for a subsistence harvest of 600 moose per year.

METHODS

Aerial surveys were conducted during fall to learn sex and age composition and population trends in large count areas distributed throughout the unit. Censuses have been conducted periodically in different portions of the unit to obtain population estimates. Surveys were flown during calving season to determine percent twins at birth. Computer modeling of the moose population was completed to predict trends. Harvests were monitored by requiring permit and harvest ticket reports from all hunters and habitat conditions were checked periodically by examining browse utilization transects in different parts of the unit. Attempts at habitat improvement include updating the Copper River Fire Management Plan. In this plan large portions of the unit are included in a limited fire suppression category in which wildfires are allowed to burn. A controlled burn in the Alphabet hills was ignited in 2003 by Alaska Department of Natural Resources (DNR) and federal Bureau of Land Management (BLM) with approximately 5000 acres burned before unfavorable weather extinguished the fire. In addition, staff evaluated and responded to land-use proposals that could affect moose habitat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Long-term population trends for moose are monitored by observing changes in the number of moose counted per hour of survey time during fall sex and age trend counts in established trend count areas. This population index is thought to be a reliable indicator of long-term trends in moose numbers because it is not influenced as much by moose movements and survey conditions as the total number of moose counted. Moose per hour data for the current reporting period include 33 moose per hour in regulatory year (RY) 2002 and 49 in RY 2003 (Table 1). The regulatory year begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003). The rate of moose counted per hour in Unit 13 declined 54% from 1988 to 2002 going from 72 to 33. This decline was attributed to increased overwinter loss during a series of severe winters in the early 1990s and increased wolf predation that occurred from the mid 1990s on. The increase in moose per hour in 2003 was attributed to increased survival during 2 mild winters from 2001 to 2003 and a decline in wolf predation in 2002. One count area, CA-13, exhibited such a large increase that moose movements into the area, and not just increased survival, contributed to the high count. CA-13 has a history of this type of movement.

Moose censuses were conducted in the moose study area in 13A West during 1994 and 1998–2001. Moose density in 1994 was 2.16 moose and 1.5 cows/mi^2 (Ward Testa, ADF&G, personal communication). The results from 1998 and 1999 showed a decline, with average densities of 1.4 moose and 1.1 cows/mi^2. These data indicate a 31% decline in total moose and a 27% decline in cows between 1994 and 1999. The population in 13A West continued to decline in 2000 and 2001. There were .89 moose and .70 cows/mi^2 in the census area in 2001. The cow population has declined by 54% since 1994 in this area. Survey conditions were good in all years, and the results are thought to represent an actual decline in moose and not census variation.

We used the predator-prey model developed by Mark McNay (ADF&G, PredPrey v. 1.0) to model moose, wolf, and bear populations in the 13A study area west of Lake Louise. Modeling focused on this area because we have the most complete demographic data for moose, wolves, and bears in this study area. We modeled forward from 1994 to the present and 10 years into the future. The model results closely fit observed historic trends for both moose and wolf numbers in 13A. Future trends predicted by the model include a continued decline in the moose population and an eventual decline in wolf densities once moose numbers drop to a very low level.

Population Size

A unitwide population estimate for moose is not available. Density estimates from fall trend count areas range from a low of 0.5 moose/mi^2 in 13D to a high of 1.7 moose/mi^2 in 13C (Table 2). An average of 1.3 moose per mi^2 was observed within the trend count areas during 2003, up 30% from the 1 moose/mi^2 estimate the last 3 years. Moose densities observed during the last 5 years are down 35–50% unitwide from the 1987 and 1988 highs of 2 moose/mi^2. The average density found in count areas cannot be extrapolated unitwide to a population estimate because count areas are located in fall concentration areas; thus, densities are not representative of the whole unit.

Population Composition

Population composition data collected during fall sex and age composition counts from 1998 through 2003 are presented in Table 1. The bull:cow ratio in Unit 13 increased from 18 bulls:100 cows between 1996 and 1998 to 24 bulls:100 cows in 2003–04. An analysis of the bull:cow ratio by age class indicates that there was an increase of 5 yearling bulls:100 cows observed from 2001 to 2003 (Table 1). Recruitment of yearling bulls, however, is still down about 33% from the 12 yearling bulls:100 cows observed in 1988. Fall composition data in 2003 indicates that of the Unit 13 posthunt bull population left to breed, only 12% (94 out of 755) were large bulls. This is important because in portions of Unit 13 where bull:cow ratios are the lowest, the few remaining bulls are also the youngest.

Fall calf:cow ratios in 2002 and 2003 were 23 calves:100 cows and 18 calves:100 cows respectively (Table 1). Between 1978 and 1988 calf production and survival were high, varying from 22 to 31 calves:100 cows each fall. The 23 calves:100 cows observed in 2002 was the only time during this reporting period that the calf:cow ratio even approached ratios observed in the mid 1980s, when moose numbers were increasing in Unit 13. Calf ratios between 1998 and 2000 were the lowest ever observed in GMU 13, averaging only 13 calves:100 cows.

The number of cows counted per hour of survey time is also monitored. Trends in adult cow abundance are more sensitive to population changes because cows are not currently hunted and are more resistant to climatic factors. Between 1986 and 1988 the fall sex and age composition data showed an average cow per hour figure of 47. The 1990–97 average estimate of cows per hour was 39, down by 17%. The cow per hour rate continued to decline, bottoming out in 2002 at 22 cows per hour, about a 53% overall decrease since the population high in 1988. Cows per hour increased in 2003 to 34.

Productivity

In 13A west, radiocollared moose subjected to ultrasound pregnancy exams during November of 1994, 1995, and 1997 exhibited an average pregnancy rate of 88%, which was maintained until spring in all but one year (Testa 1997). These pregnancy rates approach those observed during the 1980s when calf recruitment to fall was higher. Fall in utero twinning rate was 27% for radiocollared cows in 13A tested by ultrasound. Twinning rate at birth for collared cows in 13A, based on calf observations, has averaged 17% (range = 9–27) between 1994 and 2003. Twinning rates are obtained in other subunits by aerial surveys in early June, just past the peak of parturition. Twinning rates show large annual and spatial fluctuations that probably reflect small sample size more than reproductive change. More extensive surveys were flown during spring 2001 and 2002 in 13 B, C and E. The twinning rate was 15% in 2001 and 31% in 2002. For Interior Alaska moose populations, twinning rates of 20% indicate average productivity.

Distribution and Movements

Data from fall composition surveys, censuses, and stratification flights indicate in recent years moose densities were highest in Units 13A, 13B, and 13C (Table 2). Moose were most abundant along the southern slopes of the Alaska Range in 13B and 13C and the eastern Talkeetna Mountains in 13A. Unit 13D and the Lake Louise Flats in 13A have the lowest observed densities. Historically, moose numbers in 13A west, 13B, and 13C have fluctuated more than in 13A (flats) and 13D.

Fall rutting and postrutting concentrations are in subalpine habitats. The distribution of wintering moose depends on snow depth. Moose move down to wintering areas at lower elevations as snow depth increases. Known winter concentration areas include the upper Susitna River, the eastern foothills of the Talkeetna Mountains, the Tolsona Creek burn, and the Copper River floodplain.

Mortality

Harvest

<u>Season and Bag Limit.</u> Season dates were 1–20 September for the general state moose hunt. The bag limit was 1 bull with a spike/fork antler on 1 side, or 4 brow tines on 1 side, or a spread of 50 inches or more. A Tier II subsistence permit hunt was established in 1995 with 150 Tier II permits issued. Permits are limited to one per household. The Tier II hunting season during this report period was 15–31 August. A federal subsistence hunt has been in place since 1990 for residents of Units 13, 12 and 20 with a bag limit of any bull and season dates of 1 August–20 September in federal subsistence areas only.

The 2001 Unit 13 total reported harvest of 468 moose from all hunts is the lowest take in GMU 13 in 40 years (Table 3). The GMU 13 moose harvest declined 63% between 1993, when 1278 moose were taken, and 2001. Total harvest figures for 2002 are not available, but the projected harvest estimate is 562, a 20% increase from 2001. Total hunting pressure in GMU 13 declined by 43% going from 6110 hunters in 1996 to 3472 in 2002.

Board of Game Actions and Emergency Orders. In 1993 the Board of Game standardized moose seasons and bag limits along the road system in Southcentral Alaska with a bag limit of a spike/fork on 1 side or 50-inch minimum, or 3 brow tines on 1 side, and a 30-day season 20 August–20 September. In 1999 the board reduced the general moose season in GMU 13 by 10 days (1–20 September) and changed the Tier II season dates from 1–19 August to 15–31 August. The 2000–01 moose season was reduced by emergency order in May 2000 for units 13A, B, and E, with season dates of 1–15 September, while 13C and D remained unchanged. During the spring 2001 meeting, the board changed the bag limit from a minimum of 3 brow tines to 4 for the 2001 season and eliminated nonresident moose hunting starting in 2002. During the fall 2003 meeting, the board passed a wolf control program for portions of subunits 13A, B and E.

General Hunt. Harvest ticket returns from 2002 showed 463 bulls and 3 moose of unidentified sex taken by 2705 hunters during the general state hunt (Table 4). Harvests in all units except 13D and 13E increased in 2002.

Permit Hunts. The current federal subsistence hunt replaced a previous state registration subsistence hunt in 1990. The BLM assumed management of subsistence moose hunting on federal land in 1990. Registration permits are issued to residents of Unit 13 (RM 313), as well as residents of those communities in adjacent units (RM 314) that have customary and traditional use determinations in Unit 13. Only small tracts of federal land in 13B and 13D are open to this hunt. Harvests under this permit hunt are presented in Table 5. This is a very popular hunt for Unit 13 residents, shown by the high number of households getting permits. Harvests are low and have been relatively stable the last 5 years with no trend evident. Because the amount of federal land open for this hunt is extremely limited, accounting for 1–2% of the moose habitat in GMU 13, the fact that the federal harvest accounts for up to 9% of the unitwide moose harvests leads to the speculation that a number of moose claimed under the federal hunt are actually taken on state lands.

A state subsistence moose hunt (TM300) with 150 permits issued for any bull was initiated in 1995, with permits allocated under the Tier II permitting system. The harvest in 2002 was 54 bulls (Table 5). Since its inception, the harvest has doubled and the hunter success rate increased from 22% to 42%. This hunt is becoming more important to permit holders as moose numbers decline. Of the total unit moose harvest, this subsistence harvest has gone from 3% in 1995 to 10% in 2002. Given the any bull regulation, antler composition data from this harvest show a smaller average size of harvested bulls than those taken under the general hunt. Due to the variation in size and limited number of moose harvested in this hunt, this harvest has little influence on age composition of bulls remaining after the subsistence hunting season. The general hunt begins the day after the subsistence hunt closes.

Illegal Harvests. Unreported and illegal harvest estimates are presented in Table 3. The estimate for the illegal take is high, (and I believe could exceed 10% of the reported harvest) because of the spike-fork/50-inch regulation. A number of yearlings taken and reported as forks may actually be illegal because of the difficulty distinguishing small paddles and palms from forks. Also, I believe numerous sub-50-inch bulls are harvested because few hunters can reliably tell a 50-inch bull from a 45-inch bull in the field. This assumption is based on 9 years of field experience monitoring this hunt, as well as Alaska Bureau of Wildlife

Enforcement case reports. Many of the illegal bulls taken are initially misidentified as legal by the hunter. Once an illegal bull is taken, I believe most are subsequently reported as legal. This increased illegal harvest is important because it often comes from heavily hunted areas where very few legal bulls remain. Fall sex composition data support the assumption that the illegal take is high because current bull:cow ratios in some areas, such as CA-6 (Clearwater Creek in 13B), are lower than expected given the number of bulls that should be protected under a spike-fork/50-inch regulation.

Hunter Residency and Success. Local residents of Unit 13 accounted for 10–12% of the moose harvested under the general season, according to harvest ticket returns (Table 4). Before the season closed to nonresident moose hunters, they averaged 10% of the unitwide moose harvest.

The success rate for moose hunters in the Unit 13 general hunt was 13% in 2001, down from the 16–17% observed between 1996 and 1999 (Table 4). Hunter success for the 10-year period before 1993 averaged 24%. The hunter success rate in 2002 for the Tier II subsistence permit hunt was 42%, and 7% for the federal subsistence hunt in 2001 (Table 5). Successful moose hunters in the general hunt reported spending an average of 7.7 days hunting in 2003 for all of the reporting period. In 1989 harvest ticket returns show that 3556 hunters reported an average of 5.9 days hunting for a total of 21,240 days hunting moose in Unit 13. Hunting effort peaked in 1995 when 5483 hunters spent an average of 10.2 days hunting, for a total of 55,938 days afield. By 2003 hunting effort had declined to approximately 21,169 days afield.

Harvest Chronology. Chronology data for the general hunt are presented in Table 6. The last 2 weeks of the season have accounted for more than half the harvest in every year since 1994. This harvest pattern is predictable because moose are more vulnerable later in September. Leaf fall starts occurring at this time and onset of the rut initiates calling and increased bull movements.

Transport Methods. During the last 5 years, 4-wheelers have been the most important method of transportation (Table 7). It is obvious that Unit 13 is an important 4-wheeler and off-road vehicle (ORV) area for moose hunters. In the last 2 years, those using either 4-wheelers or ORVs are the largest group of hunters and have averaged approximately 60% of the total moose harvest. As a group, aircraft and ORV users (other than 4-wheelers) have the highest rate of success, while those using 4-wheelers have a lower success rate.

Other Mortality

Brown bears are abundant in Unit 13 and are important predators of neonatal moose calves, taking up to 50% of the calves born within the first 6 weeks of life (Ballard et al. 1981). Although brown bears kill adult moose, the rate is much lower than calves. Because bears kill so many calves, a reduction in bear predation can result in increased calf survival that is carried over as spring recruitment (Ballard et al. 1987). Wolf numbers in Unit 13 started increasing in 1990. The fall 1998 and 1999 unitwide estimates exceeded 500 wolves (11.7 wolves/1000km^2), the highest in more than 25 years. In the 13A west study area, the fall 1999 moose-to-wolf ratio was 32:1. This ratio is so low that wolf predation alone could result in a decline in the moose population, especially because in Unit 13 wolves continue to take moose even when caribou are present (Ballard et al. 1987). Wolf numbers declined slightly in 2002 following 2 years of heavy wolf harvests, with a preliminary fall estimate of 420 wolves.

The winter severity index between 1998 and 2003 shows the last 2 winters were very mild. The unitwide winter severity index is based on snow depths from 17 snow courses throughout the unit. The winter of 1999–2000 was severe and is the second worst winter recorded. Spring 2000 surveys suggest increased mortality resulted from deep snow conditions, especially in 13A and E, which had record snow depths. The winter of 2000–01 was considered an average winter. Observations of winter mortality in Unit 13 over the years have led to the conclusion that moose mortality due to deep snow conditions has not been density dependent. Instead, there appears to be a threshold effect triggering increased calf mortality once snowfall reaches about 30 inches in depth. As the snow pack increases, yearlings, then adult bulls, and finally adult cows die, regardless of moose densities. In addition to killing moose, deep snows often make it easier for wolves to take moose, which increases predation mortality. Overwinter survival during the mild winter of 2002–03 was thought to be quite good because of the increase in yearling bulls observed during the fall 2003 moose counts.

HABITAT

Assessment

Unit 13 has numerous areas where habitat improvement could produce more favorable browse conditions for moose. Because of the size and remoteness of much of the unit, wildfire is considered the only feasible tool for extensive habitat improvement. Wildfires occurred throughout much of Unit 13 before 1950, when fire suppression activities were initiated. Since then, negligible acreage has burned. Current fire suppression policies in the Copper River Fire Management Plan set aside large portions of the unit as let-burn areas where wildfires will not be suppressed. However, this plan has often been ignored and some wildfires have been suppressed, even if they occurred in an area designated as limited suppression. The current level of fire suppression has resulted in fewer fires and reduced seral habitat available as moose browse. The effect has been to lower the moose carrying capacity over extensive portions of Unit 13. Because of the lack of fire-created seral plant communities, climax upland and riparian willow communities are the most important habitat types for moose in the unit.

Evaluation of browse in important moose areas from 1983 to 1986 indicates browse species were able to withstand the level of use occurring at that time. Research continues on evaluating available browse and use by moose in 13A as part of an ongoing moose research project. Preliminary indications are that current browse use rates are sustainable (Collins 1997).

The use of prescribed fires to replace wildfires as a method of improving moose habitat has had very little success in Unit 13. The climate in Unit 13 typically limits the use of prescribed fire in the driest years, when the danger of an escaped fire increases. Also, scattered cabins and private land ownership in Unit 13 have increased over the years and increase the liability associated with the use of prescribed fire. In spite of problems associated with controlled burns, work with BLM and DNR is ongoing, and a prescribed fire was attempted in 2003. The Alphabet Hills controlled burn was ignited, but the weather changed suddenly and only 5000 acres were burned. The area burned was around Kelly Lake on the south slopes of the Alphabet Hills in Unit 13B. This area was also lit in 1984, but the fire did not carry because it was too late in the season and ground moisture was too high. Plans call for additional ignition attempts, should the fire prescription again be met.

Habitat improvement by mechanical methods such as crushing is an alternative to burning. To be effective, mechanical treatment must be done on riparian habitats where moose concentrate during critical winter months. However, mechanical treatment is expensive, and the cost limits mechanical treatment to small but important concentration areas near the road system where access for heavy equipment is available. One such small site was crushed in 1993, and initial regeneration of willows was good. Additional sites for mechanical treatment have been identified along the Copper River in Unit 13C where moose winter during deep snow years. Work continues toward gaining permission from landowners to crush this area.

Low densities of moose and an annual twinning rate of up to 30% indicated habitat is adequate for population growth if predation pressure could be decreased.

CONCLUSIONS AND RECOMMENDATIONS

Changes in moose-per-hour rates during fall moose counts indicate that unitwide moose abundance declined between 1994 and 2001. Census data from 1994, and 1998–2001 indicate a 50% decline has occurred in Unit 13A. Declines occurred in all sex and age classes.

Moose count data for fall 2002 are incomplete because of a lack of snow. Some count areas were not surveyed and conditions were only fair in those surveyed. As a result of the late counts and only fair survey conditions, moose-per-hour figures are not as useful in determining population trends for 2002. Changes in moose-per-hour rates during fall moose counts indicate a unitwide moose abundance decline between 1994 and 2001. This trend is supported by a 50% decline in the 13A moose population based on census data collected between 1994 and 2001. The moose-per-hour estimate for 2003 suggests an increase in moose population between 2001 and 2003.

The calf:cow ratios observed during fall sex and age composition counts between 1998 and 2001 are the lowest ever observed in GMU 13. These ratios are 25–30% below levels observed between 1978 and 1988, when moose were increasing. The calf:cow ratio increased in 2002 and was the highest in 6 years. Although count conditions in 2002 were poor, the sample size was large enough and evident across multiple count areas, so the increase in calf:cow ratio could be accepted as a real event. Calf:cow ratios declined in 2003. Low calf:cow ratios are attributed to poor calf survival, as calf production has changed little over 26 years, based on pregnancy and birth rates for radiocollared cows that approach those observed in GMU 13 during periods of population growth. Twinning rates for moose in GMU 13 fluctuate between years and subunits, probably due mostly to small sample size, and are typical of an Interior Alaska moose population on mature range. Population modeling suggests that the GMU 13 moose population will decline in years when fall calf:cow ratios approach only 15 calves:100 cows.

The bull:cow ratio has increased over this reporting period. The 2003 bull:cow ratio was the highest in 10 years. The 2002 bull:cow ratio was higher but was considered incomplete because 2 of the heaviest hunted count areas, which generally have the lowest bull:cow ratios, were not surveyed. A breakdown of the bull:cow ratio for 2003 shows 8 yearling bulls:100 cows and 16 large bulls:100 cows, compared to 3 yearling bulls:100 cows and 18 large bulls:100 cows in 2001. The data suggests overwinter survival in 2002–03 was high for calves, and much of the higher calf crop in 2002 was recruited into the population. It also suggests that current harvests of large bulls meet or exceed recruitment into the large bull segment of the population, and current harvests are as high as can be supported by the average yearly recruitment.

The Unit 13 moose population increased slightly during the last 2 years of this reporting period. Two important factors contribute to this change: increased calf survival and overwinter moose survival. The winters of 2001–02 and 2002–03 were very mild, both in snowfall and temperature. During mild winters, there is little natural mortality, and predation rates decline as wolves have a more difficult time killing moose. The wolf population also declined by as much as 20% following record-high wolf harvests. The poorest fall calf:cow ratios occurred in years with the highest wolf estimates. Also, high wolf numbers in years with deep snow conditions resulted in higher overwinter loss to wolves.

Modeling suggests the moose population will again start to decline despite one year of lower wolf numbers and increased recruitment seen in 2002. Based on fall 2003 moose surveys and wolf estimates, wolf numbers appear to be increasing and calf survival has declined. Even if the winter of 2003–04 is mild to moderate, calf numbers going into the winter may not be high enough to allow unitwide population growth in the face of higher wolf predation.

Harvest and hunting effort figures indicate a large decline in both the number of moose harvested and the number of individuals reporting hunting. Unit 13 once was one of the most important moose hunting units in the state, and in the late 1980s the harvest was one of the highest in the state.

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Table 1 Unit 13 fall aerial moose composition counts and estimated population size, 1998–2003.

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves %	Adults	Total moose observed	Moose /hour	Density moose mi^2 (range)
1998–99	18	4	14	11	4904	5496	46	1.3 (0.5–4.9)
1999–00	21	4	14	11	4234	4738	46	1.1 (0.2–1.8)
2000–01	20	3	12	9	4000	4382	38	1.0 (0.8–4.4)
2001–02	21	3	15	11	3948	4444	35	1.0 (0.5–4.5)
2002–03	27	7	23	16	2098	2485	33	1.0 (0.5–1.9)
2003–04	24	8	18	12	3902	4457	49	1.3 (0.5–5.0)

Table 2 Unit 13 fall aerial moose composition counts, 2003.

Unit	Bulls: 100 Cows	Yearling Bulls:100 Cows	Calves: 100 Cows	Calves %	Total Moose Observed	Moose /hour	Density moose mi^2 (range)
13A	22	10	19	13	1337	60	1.4
13B	22	6	17	12	1943	44	1.3
13C	21	8	24	17	393	50	1.7
13D	71	4	14	8	180	22	0.5
13E	27	12	11	8	377	49	0.9

Table 3 Unit 13 moose harvest[a] and accidental death, 1998–2003.

Regulatory year	Reported				Estimated			Accidental			Grand Total
	M	F	U	Total[b]	Unreported	Illegal	Total	Road	Train[c]	Total	
1998–99	913	5	20	938	25	25	50	50	14	64	1052
1999–00	814	1	9	824	25	25	50	50	76	126	1000
2000–01	550	3	9	562	25	25	50	50	20	70	682
2001–02	463	0	5	468	25	25	50	50	3	53	571
2002–03	571	0	3	574	25	25	50	50	1	51	675

[a] Includes permit hunt harvest, harvest tickets and federal subsistence hunts.
[b] Includes unknown sex.
[c] 13E – the Alaska Railroad.

Table 4 Unit 13 moose hunter residency and success for general harvest ticket hunt only, 1998–2003.

Regulatory Year	Successful				Unsuccessful				Total Hunters
	Local[a] Resident	Nonlocal Resident	Non-resident	Total[b]	Local[a] Resident	Nonlocal Resident	Non-resident	Total[b]	
1998–99	66	697	91	860	410	3523	124	4083	4943
1999–00	77	551	86	722	418	3123	151	3722	4444
2000–01	39	386	47	477	362	2527	116	3036	3513
2001–02	44	312	37	395	349	2072	78	2543	2938
2002–03	54	407	2	466	315	1898	11	2239	2705

[a] Residents of Unit 13
[b] Includes unspecified residency

Table 5 Unit 13 moose harvest data for permit hunts, 1998–2003.

Hunt Number	Regulatory year	Permits issued	Percent Did not Hunt	Percent Unsuccessful Hunters	Percent Successful Hunters	Bulls	Cows	Unknown	Harvest
State Tier II	1998–99	150	17	71	29	37	0	1	38
TM300	1999–00	150	17	70	30	35	0	--	35
	2000–01	150	9	68	32	40	0	--	40
	2001–02	150	11	72	28	35	0	--	35
	2002–03	150	8	58	42	54	0	--	54
Federal Subsistence									
BLM									
RM313/314	1998–99	557	29	89	11	41	0	0	41
	1999–00	828	29	86	14	67	0	0	67
	2000–01	800	32	91	9	45	0	0	45
	2001–02	935	34	93	7	38	0	0	38
	2002–03	N/A							

Table 6 Unit 13 moose harvest chronology percent by week for general harvest ticket hunt, 1998–2003.

Regulatory Year	Season dates	Week of Season 1st	2nd	3rd	4th	5th	*n*
1998–99	20 Aug–20 Sep	13	11	21	30	24	834
1999–00	1 Sep–20 Sep	7	33	33	28		695
2000–01	1 Sep–20 Sep	7	37	39	17		445
2001–02	1 Sep–20 Sep	10	23	34	33		369
2002–03	1 Sep–20 Sep	8	26	34	32		449

Table 7 Unit 13 moose harvest percent by transport method for general harvest ticket hunt, 1998–2003.

Regulatory Year	Percent of Harvest: Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway Vehicle	Airboat	Unknown	*n*
1998–99	10	4	7	40	0	20	17	1	1	860
1999–00	11	3	9	41	0	20	14	1	2	722
2000–01	11	4	6	42	0	19	16	1	1	477
2001–02	10	4	8	39	0	21	15	1	2	395
2002–03	9	1	10	46	0	20	12	0	2	466

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 14A (2561 mi^2)

GEOGRAPHIC DESCRIPTION: Matanuska Valley

BACKGROUND

Moose were scarce in the Matanuska Valley as "colonists" arrived and settled during the 1930s, but probably grew to numbers approaching 7000 during the 1960s (Griese 1996). Numbers fluctuated with deep snow winters, but stabilized between 5000 and 6000 animals in the 1990s. Habitat enhancement through agricultural activities and a 37,000-acre fire in the southwestern part of the unit allowed the population to increase to more than 6000 animals in the late 1990s.

Annual harvest levels in the first 12 years after statehood (1960–1971) ranged from 200–1300 (Griese 2000). The harvest was predominantly bulls, averaging 350 annually, but the harvest of antlerless moose was as high as 1131 in 1962–1963 (Griese 2000). Following severe winters antlerless moose seasons were discontinued from 1972 to 1977 and the mean annual harvest of bulls declined to 251 (range:167–346). Antlerless seasons began again in 1978, and from 1978 to 1998, the annual cow harvest ranged from 0 (1990) to 284 (1996). Harvest during the "any bull" period of 1979–1992 averaged 367 (range:201–530) (Griese 2000).

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as "spike/fork-50-inch" (SF50) (Schwartz et al 1992). Since 1993, the period with antler restrictions, the harvest averaged 342 (range:233–554).

The human population in the Matanuska/Susitna area continues to be one of the fastest growing in the state. Land clearing associated with settlements and road construction has been responsible for the growth of preferred moose browse. As the area continues to grow, much of the early seral moose habitat will be replaced with homes, roads, and associated industry. During the 1990s, motorists killed an average of 180 moose annually in the Matanuska/Susitna area. Since 2000 the average road kill has increased to 207.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Habitat enhancement efforts during the 1990s were aided by wildfires. In 1993 a successful cooperative effort between state agencies resulted in a 900-acre controlled burn to enhance wintering moose habitat near Willow (Collins 1996). In June 1996, a 37,000-acre fire burned in the Big Lake area (Griese and Masteller 1998). Even though the habitat enhancement from the Big Lake burn will greatly aid moose in the future, it politically restricted future prescribed burns. The Ruffed Grouse Society and the Department of Fish and Game have begun a 5–10 year habitat enhancement project in the Matanuska Valley Moose Range. Over 3 years, 275 acres of aspen forest were clearcut to produce early successional growth to benefit grouse and other species.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.
- Provide opportunities for nonconsumptive uses.

MANAGEMENT OBJECTIVES

- To maintain a posthunt population of 6000–6500 moose with a sex ratio of 20–25 bulls:100 cows.
- To achieve an annual hunter harvest of 360–750 moose.

METHODS

We conducted Becker surveys on 1–4 December 2000 and 23–27 October 2001 (Becker and Reed 1990). We generated a population estimate and age/sex statistics using MOOSEPOP (Becker and Reed 1990). During both surveys we attempted to categorize bulls' antler size and brow-tine configuration.

We surveyed a portion of the primary wintering habitat in Subunit 14A during early March 2000 and 2001 to quantify the percent of short yearlings in the population as an assessment of recruitment.

The harvest was monitored with harvest reports. Harvest data was reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property. Age categories (calf, yearling, adult) and sex of moose from road and railroad mortalities were provided by charities receiving the meat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The population increased between the fall survey in 2000 (5552 ± 571: 80% C.I.) and the fall survey in 2001 (6679 ± 453: 80% C.I.) and stabilized into 2003 (6564 ± 748) (Table 1).

Population Composition

We observed 19 bulls:100 cows in the fall of 2001 (Table 1). No surveys were flown in 2002; however, we observed 21 bulls:100 cows in 2003. We were at, or near, our objective levels (20–25 bulls:100 cows). Calves continued to display high overwinter survival during the report period (Table 2).

MORTALITY

Harvest

Season and Bag Limit. The fall season was 10–17 August for archery-only hunters with a 20 August–30 September general season for resident and nonresident hunters for both years. During this period the bag limit was one spike/fork-50 bull.

The department issued 50 drawing permits for antlerless moose for the 20 August–30 September season in 2001 and 400 permits in 2002.

During the past 10 years the moose harvest has fluctuated from 319 to 851 moose, depending on population status and the number of permit hunts. The bull moose harvest for the past 5 years has remained relatively consistent, averaging 336 moose (range of 313–376).

Any-bull permits were discontinued in 2000. The department issued 50 antlerless moose drawing permits for the northern Matanuska River area in 2001 resulting in a harvest of 30 cows (Table 4). The department increased the number of cow permits to 400 (harvest of 212) in order to keep moose population within objectives.

Board of Game Actions and Emergency Orders. During the spring 2001 Board of Game meeting the winter ‘spike-fork-only’ hunt was eliminated and the department informed the board of our intent to issue 50 antlerless moose drawing permits because the population exceeded the upper end of the pervious population objective of 5500. The board increased the population objective to 6000–6500 and expanded the harvest objective from 600–700 to 360–750. This action came at the request of local advisory committees. The department also adjusted the potential allotment of antlerless permits from 600 down to 400.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the spike-fork/50 system, but no changes were approved.

Hunter Residency and Success. An average of 2950 people hunted in Unit 14A during the previous 5 years. Local residents of Unit 14 consistently make up the majority of the hunter composition, harvesting 92–97 percent of all moose taken in Unit 14A. Hunter success ranged 11–13 percent during the past 5 years (Table 5). Residency composition of hunters changed little from previous years.

Harvest Chronology. More moose are taken during the first week of the general season than any other period (Table 6). Generally, the next highest period of harvest was the last week of the general season, regardless of when that part of the season occurred.

Transport Methods. The elimination of the winter hunt in 2001–2002 eliminated the use of snowmachines as a transportation method (Table 7). Four-wheelers and highway vehicles have accounted for a majority of the transportation types used by successful hunters in the past 10 seasons (Table 7). In 1998 the department began tracking harvest by hunters from airboats. Since that time, 1 percent or less of the hunters have reported using airboats in GMU 14A. (Table 7).

Accidental and Illegal Mortality

Accidental human-caused moose mortality during the 5-year period 1998–2002 averaged 166 (range 130–252) moose killed by highway vehicles and 15 (range 2–34) by train (Table 3). Highway collisions appear to be increasing as a result of higher moose numbers and many more vehicles on valley roads. Winter weather only exacerbates the problem.

HABITAT

Enhancement

During the winter of 2001–02, the Ruffed Grouse Society and ADF&G conducted the first year of a multi-year project enhancing habitat in the Matanuska Valley Moose Range. To date, 275 acres of predominantly aspen forest have been cut.

CONCLUSIONS AND RECOMMENDATIONS

The new harvest objective was met in 2001 and 2002 (Table 3). The antlerless permits issued for both years helped achieve this objective. Harvest of antlerless moose is needed to maintain the population size at objective levels.

We believe effective intensive management in this subunit requires investigation into the distribution and movement of moose. Specifically, studies investigating the winter movement of moose into the Point MacKenzie agricultural project and the 1996 Big Lake burn area will reveal the proportion of the moose that are migratory and where the migratory individuals spend the nonwinter months. The Point MacKenzie winter population exceeds 10 moose/mi^2, one of the highest densities in the state. These areas are critical to moose in the unit and may be used by moose summering within adjacent units where moose populations have declined 30–40% in the past few years.

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Table 1 Unit 14A fall aerial moose composition surveys and censuses, 1991–2003

Regulatory Year	Bulls: 100 Cows	Yearling Bulls: 100 Cows	Calves: 100 Cows	Calves(%)	Adults Observed	Moose Observed	Moose /mi^2	Estimated Population Size
1991–92 [a]	14	5	39	26	1110	1472	3.7	5885±706 [b]
1992–93 [c]	9	6	40	27	697	934	n/a	5200–6200
1993–94 [d]	16	11	37	24	942	1232	3.6	5672±798 [b]
1994–95 [c]	21	8	35	22	1098	1398	n/a	5500–6500
1995–96 [e]	--	--	--	--	--	--	--	5000–5500
1996–97 [f]	23	6	42	25	1696	2290	n/a	5500–6500
1997–98 [g]	14	5	30	21	611	774	n/a	5000–6000
1998–99 [h]	17	7	33	22	1191	1509	3.0	4729±530 [b]
1999–00 [h]	19	10	37	24	1021	1317	3.4	5348±721 [b]
2000–01 [h]	18	7	37	19	1300	1693	3.5	5552±571 [b]
2001–02 [h]	19	8	34	22	1781	2301	4.2	6679±453 [b]
2002–03 [e]								
2003–04 [i]	21	9	29	19	1869			6564+748 [b]

[a] Gasaway et al (1986) survey
[b] 80% confidence interval
[c] Sampling of 1991 surveyed units (Griese and Masteller,1996)
[d] Becker survey
[e] No surveys
[f] Combined results of Matanuska River drainage east of Moose Creek and composition surveys in CAs 1–7 & Pt. MacKenzie
[g] Incomplete Becker survey due to antler drop
[h] Modified Becker survey (nonrandom sampling but duplication of 1991 sampling units)
[i] Ver Hoef Spatial Estimator Survey method

Table 2 Unit 14A late winter aerial moose composition surveys, 1990–2003

Regulatory year	Date	Count areas	moose	Calves[a]	Percent calves
1990–91	03/04–11	5,6 & 8	1348	167	12
1991–92	02/25	7	121	26	21
	04/10	3-6 & 8	546	76	14
1992–93	03/24	4-8	693	131	19
1993–94	03/05–09	4-8	981	175	18
1994–95	04/03–04	4-8 & Pt. McKenzie	518	75	14
1995–96	03/28	6 & Pt. McKenzie	471	85	18
1996–97	04/08–09	5,6, 8 & Pt. MacKenzie	226	53	23
1997–98	no surveys				
1998–99	03/12–15	4-8 & Pt. MacKenzie	1178	201	17
1999–00	03/08–10	1,2,4-8 & Pt. MacKenzie	1291	222	17
2000–01	03/26–04/02	1-8 & Pt. MacKenzie	633	120	19
2001–02	03/28–29	1,3,5-8 & Pt. MacKenzie	899	148	16
2002–03	no surveys				
2003–04	04/14	6,8	80	25	31

[a] Calves = short yearlings

Total

Table 3 Unit 14A moose harvest[a] and accidental death, 1990–2003

Regulatory	Reported				Estimated			Accidental deaths[e]			Grand
year	M	F	Unk	Total[b]	Unreported[c]	Illegal[d]	Total	Road	Train	Total	total
1990–91	258	0	1	259	13	35	48	140	22	162	469
1991–92	490	41	5	536	25	25	50	166	15	181	767
1992–93	530	155	7	692	27	30	57	132	7	139	888
1993–94	233	204	1	438	12	40	52	166	18	184	674
1994–95	281	241	9	531	14	60	74	260	39	299	904
1995–96	335	127	8	470	23	50	73	85	11	96	639
1996–97	555	288	8	851	39	50	89	185	17	202	1142
1997–98	489	251	5	745	34	55	89	168	16	184	1018
1998–99	376	208	6	590	26	55	81	134	15	149	820
1999–00	323	0	9	332	23	60	83	181	34	215	630
2000–01	313	1	5	319	22	60	82	133	7	140	541
2001–02	345	31	7	383	24	60	84	252	15	267	734
2002–03	325	215	1	541	23	60	83	130	2	132	756

[a] Includes permit hunt harvest
[b] Includes moose of unknown sex
[c] Derived by taking 7% of the reported harvest of bulls, 5% prior to 1995.
[d] Includes moose taken in defense of life or property, enforcement cases and an estimate of out-of-season take
[e] Road and train kills are minimum numbers

Table 4 Moose harvest data by permit hunts in Unit 14A, 1990–2003

Hunt	Regulatory year	Applicants	Permits issued	Percent[a] did not hunt	Percent[a] unsuccessful hunters	Percent[a] successful hunters	Bulls	Cows	Total
DM411 (Any bull–early fall)									
	1995–96	1521	70	16	54	29	20	0	20
	1996–97	1978	100	10	53	37	37	0	37
	1997–98	1414	50	6	70	24	12	0	12
	1998–99	1463	50	16	52	28	14	0	14
	1999–00[b]	--	0	--	--	--	--	--	--
DM412 (Any bull – late fall)									
	1995–96	1078	20	5	35	60	12	0	12
	1996–97	1235	30	4	11	80	24	0	24
	1997–98	1162	20	20	25	55	11	0	11
	1998–99	1200	20	10	45	45	9	0	9
	1999–00[b]	--	0	--	--	--	--	--	--
DM418 (Antlerless - late fall)									
	1993–94	3760	70	13	40	47	3	30	33
	1994–95	5464	100	10	13	76	5	71	76
	1995–96	4781	70	14	31	54	2	36	38
	1996–97	3866	70	14	0	86	2	58	60
	1997–98	3252	70	4	20	76	0	53	53
	1998–99	3740	70	11	49	40	2	26	28
	1999–00[b]	---	0	---	---	---	---	---	---

Table 4 Continued

Hunt	Regulatory year	Applicants	Permits issued	Percent[a] did not hunt	Percent[a] unsuccessful hunters	Percent[a] successful hunters	Bulls	Cows	Unk	Total
DM419 & 420 (Antlerless–early fall)										
	1990–91	0	0	---	---	---	---	---	0	---
	1991–92	7057	100	13	48	39	0	39	0	39
	1992–93	11,000	400	12	49	39	3	152	0	155
	1993–94	10,390	400	10	44	45	4	174	0	179
	1994–95	11,185	400	10	46	44	4	169	1	174
	1995–96	10,075	200	7	48	46	1	90	0	91
	1996–97	10,447	500	8	44	46	4	225	3	232
	1997–98	8675	450	8	48	44	1	195	1	197
	1998–99	9230	400	8	46	46	1	181	0	182
	1999–00[b]	---	0	---	---	---	---	---	--	---
DM409 (Antlerless-N. Matanuska River Area)										
	2001–02	4803	50	8	32	60	0	30	0	30
DM400—DM410 Antlerless early fall										
	2002–03	16,594	400	9	36	55	9	212	0	221
	2003–04	14,852	320	8	34	55	2	174	0	176

[a] Percent of permits issued
[b] Discontinued hunt
[c] DM409 initiated in 2001
[d] DM400—DM410 initiated in 2002

Table 5 Unit 14A moose hunter residency and success [a], 1990–2003[b]

	Successful					Unsuccessful					
Regulatory year	Local[c] resident	Nonlocal resident	Nonres.	Unk.	Total (%)	Local[c] resident	Nonlocal resident	Nonres.	Unk.	Total (%)	Total hunters
1990–91	242	3	8	6	259 (14)	1466	22	14	26	1528 (86)	1787
1991–92	471	11	9	6	497 (17)	2293	39	12	25	2369 (83)	2866
1992–93	499	11	12	15	537 (16)	2631	48	24	102	2805 (84)	3342
1993–94	217	4	1	4	226 (9)	2306	59	11	55	2431 (91)	2657
1994–95	273	6	1	1	281 (11)	2212	43	14	17	2286 (89)	2567
1995–96	292	11	2	3	310 (9)	3009	84	22	13	3128 (91)	3438
1996–97	475	11	11	1	498 (13)	3349	76	40	14	3479 (87)	3977
1997–98	441	21	5	5	472 (13)	3174	67	43	17	3301 (87)	3773
1998–99	329	13	11	3	356 (11)	2848	79	30	27	2984 (89)	3340
1999–00	314	8	5	4	332 (12)	2440	62	21	28	2551 (88)	2883
2000–01	295	14	7	3	319 (11)	2424	51	38	16	2529 (89)	2848
2001–02	327	13	11	2	353 (13)	2328	46	30	11	2415 (87)	2768
2002–03	297	11	12	0	320 (11)	2489	51	46	4	2590 (89)	2910

[a] Does not include drawing permit hunters
[b] All information in this table has been updated since last management report.
[c] Unit 14 residents

Table 6 Unit 14A moose harvest chronology[a] 1990–2003[b]

Regulatory	August			September					November	December			
year	10–17	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15	Unknown[c]	Total
1990–91[c]	--	--	--	211	36	--	--	--	--	--	--	12	259
1991–92[d]	--	--	--	253	109	107	--	--	--	--	--	28	497
1992–93[d]	--	--	--	255	118	143	--	--	--	--	--	21	537
1993–94[e]	--	73	16	23	37	67	--	--	--	--	--	10	226
1994–95[e]	--	61	30	47	41	84	--	--	--	--	--	18	281
1995–96[f]	3	67	20	45	31	45	--	--	41	8	26	22	308
1996–97[f]	8	85	20	41	50	67	--	--	132	30	39	26	498
1997–98[f]	3	86	22	35	42	61	--	--	111	41	51	20	472
1998–99[f]	2	68	23	41	39	56	--	--	45	21	45	16	356
1999–00[g]	6	57	14	32	25	44	53	--	--	36	52	13	332
2000–01[g]	4	67	20	38	30	43	24	--	--	27	55	11	319
2001–02[h]	10	61	28	36	43	48	46	68	--	--	--	13	353
2002–03[h]	6	70	19	32	35	51	44	53	--	--	--	10	320

[a] Does not include drawing permit hunts
[b] All information in this table has been updated since last management report.
[c] Includes all harvest reported outside season dates.
[c] Open season = Sep 1–10
[d] Open season = Sep 1–20
[e] Open season = Aug 20–Sep 20 (SF/50 –“spike-fork/50-inch”)
[f] Open season = Aug 10–17 (Archery only), Aug 20–Sep 20 (Gen.SF/50), Nov 20–Dec 15 (SF)
[g] Open season = Aug 10–17 (Archery only), Aug 20–Sep 25 (Gen.SF/50), Dec 5–Dec 15 (SF)
[h] Open season = Aug 10–17 (Archery-only), Aug 20–Sep 30 (Gen.SF/50)

Table 7 Unit 14A percent transport methods of successful moose hunters[a], 1990–2003

Regulatory year	Airplane		Horse		Boat	3- or 4-wheeler			Snowmachine		ORV	Highway vehicle		Unk.	Airboat		Sample size
1990–91			7						0			35					
1991–92			4						0			38					
1992–93			5						0		7	43					
1993–94	7		5	12		22			0	10	8	42	7			259	
1994–95	4		3	12		24			0	12	7	39	6			497	
1995–96	4		3	13		22			1		6	41	5			537	
1996–97	4		3	12	7	23					7	40	6			226	
1997–98	5		3	13	6	26					4	35	6			281	
1998–99	2		4	10	7	29			6		5	33	7		1	308	356
1999–00	2		2			22		16	7		6	36	4		1	498	332
2000–01	3	3	2		9	28	34	18	8		4	36	3	3	1	472	319
2001–02	4	5	1		10	35	37		0		7	36	5	3	1		353
2002–03	3	6	3	12	13	29	36		0		5	32	3	5	1		320

[a] Does not include drawing permit hunts
[b] All information in this table has been updated since last management report.

WILDLIFE
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 14B (2152 mi^2)

GEOGRAPHIC DESCRIPTION: Western Talkeetna Mountains

BACKGROUND

The first comprehensive moose survey in Subunit 14B in the fall of 1987 estimated moose numbers at 2814 ± 248 (80% CI) (Masteller 1995). The population declined about 35% following the deep snow winter of 1989–90 (Masteller 1995). By the fall of 1994 the population recovered to an estimated 2336 ± 527 (80% CI), but another severe winter in 1994–95 caused high mortality levels (Masteller 1998). The last survey, conducted in the fall of 1999, estimated the population at 1687 ± 244, (80% CI) indicating the population had not yet recovered.

The moose harvest has decreased since the 1970s and 1980s. Hunter harvests averaged 96 and 259 moose during the 1970s and 1980s, respectively. Liberal cow seasons allowed peak harvests to reach 372 moose in 1971, 534 in 1984, and 347 moose in 1987 (Griese 1993). With the decline in moose populations, the annual harvest average during the 1990s dipped to 58 moose. Slightly higher harvests have been reported since. Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike-fork/50-inch” (SF50) (Schwartz et al 1992).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.

MANAGEMENT OBJECTIVES

- Attain a population of 2500–2800 moose, with a sex ratio ≥ 20 bulls:100 cows during the rut.
- Achieve an annual harvest of 100–200 moose.

METHODS

We generated a population estimate in the fall of 1999 using the Gasaway et al. (1986) stratified random census technique. Surveys have not been conducted since.

The harvest was monitored with harvest reports. All harvest data was reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size

The fall 1999 survey conditions were excellent. The resulting population estimate was 1687 ± 244 (80% CI) (Table 1). However, the winter of 1999–2000 had deep snow conditions that contributed to the highest number of road/railroad kills (100) since 1990 (Table 2). The moose population had decreased about 28% since the Becker survey of 1994 and was comparable to levels found in 1990 and 1992. The 2002 survey was canceled because of poor survey conditions. In 2003 management priority focused on Game Management Unit 16B, and the 14B survey was again postponed.

Population Composition

In our November 1998 survey, we observed 38 bulls and 11 calves:100 cows with 8% of the sampled population being calves (Table 1). The fall 1999 survey estimated 40 bulls and 21 calves:100 cows with 13% of the sampled population as calves (Table 1). The yearling bull:cow ratio was 10:100 in 1998 and 12:100 in 1999. We suspect the bull:cow ratios are probably lower due to the season extension, but well above the minimum objective of 20 per 100 cows.

MORTALITY

Harvest

<u>Season and Bag Limit</u>. The fall season opened 10–17 August for archery only with a general season 20 August–30 September for resident and nonresident hunters for both years. During this period the bag limit was 1 bull with a spike or fork antler on at least 1 side or with an antler spread at least 50 inches or 3 or more brow tines on at least 1 side (SF/50).

Reported harvest has decreased since 92 bulls were taken during 1996–97 (Table 2). Hunters harvested 67 moose in each of the past 2 years (Table 2). This is higher than the previous 10-year average of 58, but still substantially lower than the historic highs reported in the 1980s.

<u>Board of Game Actions and Emergency Orders</u>. In response to declining moose numbers and the public desire to eliminate permit hunts, the board eliminated the 5–15 December winter hunt in 14B, and eliminated the any-bull permits (DM416). To replace some of the lost hunting opportunities, the general open season was extended 5 days to close 30 September.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the SF/50 system, but approved no changes.

<u>Hunter Residency and Success</u>. Residents of Unit 14 consistently make up the majority of the hunters (Table 3). The number of hunters has been relatively consistent in the past 5 years,

ranging between 426 and 546 hunters (Table 3). Hunting success rates during the past decade range between 9 and 16%.

Harvest Chronology. The extended season accounted for 23 animals taken in 2001–02 and 14 in 2002–03 (Table 4). The highest proportion of moose was taken during the last 10 days in each of the last 10 years. Only 1 animal was harvested during the archery-only season in the past 3 years.

Transport Methods. The elimination of the winter hunt in 2001–02 eliminated the use of snowmachines as a transportation method (Table 5). Four-wheelers and highway vehicles have accounted for a majority of the transportation types used by successful hunters in the past 10 seasons (Table 5). In 1998 the department began tracking harvest by hunters from airboats. Since that time, 2% or fewer of the hunters have reported using airboats in Subunit 14B.

Other Mortality

Moose killed by auto/train collisions numbered 41 in 2001–02 and 13 in 2002–03 (Table 2). These numbers are at, or below, the 10-year average of 39 auto/train collisions with moose in Subunit 14B.

CONCLUSIONS AND RECOMMENDATIONS

Even before the severe winter of 1999–2000, the moose population was below the objective level of 2500–2800. It is unlikely the 2004 survey will find the population near the objective level. The average annual harvest by hunters for the last 5 years was 68, below the objective of 100–200. Hunter harvest is unlikely to reach 100 moose unless access opportunities substantially increase, or the moose population increases.

The SF/50 regulation was adopted for Subunit 14B because it shared common boundaries with Units 16, 13 and 14A. Annual movements often carry moose across borders of Units 13E, 16A, 14A, and 14B (Modafferi 1999). Therefore, management decisions for Unit 14B should be made in conjunction with neighboring units. Concern for enforcement of the antler restriction along the boundary and the concern for false reporting were also reasons for inclusion in the program. SF/50 ensures that some bulls remain in the breeding population in heavily accessed areas (i.e. along highways and near communities).

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Table 1 Unit 14B fall aerial moose composition surveys, 1992–2003

Regulatory year	Bulls: 100 cows		Yearling 100 cows		100 cows		Calves (%)		Adults observed		observed		moose/mi^2		Population estimate (±80% CI)
1992–93 [a]	27.2														1582 ± 178
		bulls:		Calves:						Moose		Observable			
1993–94 [b]	--		--		--		--								
1994–95 [c]	31.1														2336 ± 527
		4.4		21.7		14.5		580		659		1.5			
1995–96 [b]	--		--		--		--								
								--		--		--		--	
1996–97 [b]	--		--		--		--								
		8.2		17.3		12.0		862		969		2.2			
1997–98 [b]	--		--		--		--								
								--		--		--		--	
1998–99 [d]	37.5														
								--		--		--		--	
1999–00 [e]	40.2														± 244
								--		--		--		--	
2000–01 [b]	--		--		--		--								
		9.5		11.1		7.5		407		440		--		--	
2001–02 [b]	--		--		--		--								
		12.3		21.3		13.2		616		699		1.6		1687	
2002–03 [b]	--		--		--		--								
								--		--		--		--	
								--		--		--		--	

[a] Data from "Becker Surveys" conducted in November. SCF estimated at 1.40, 1.35 and 1.25 for low, medium, and high density strata, respectively.

[b] No surveys conducted.

[c] Data from "Becker Surveys" conducted in late October–early November. SCF estimated at 1.00, 1.41 and 1.00 for low, medium and high density strata, respectively.

[d] High-grade sex and age composition survey conducted 20 November 1998.

[e] Data from "Gasaway Surveys" conducted in late October–early November. SCF estimated at 1.20, 1.33, 1.15, and 1.03 for low, medium, high, and s-high density strata, respectively.

Table 2 Unit 14B annual moose harvest (general open season plus permit hunts) and accidental death tally, 1992–2003[a]

Regulatory	Reported				Estimated			Accidental[d]			Grand
year	M	F	Unk	Total	Unreported[b]	Illegal[c]	Total	Road	Train	Total	Total
1992–93	34	0	0	34	2	5	7	10	24	34	75
1993–94	30	0	1	31	3	15	18	15	13	24	73
1994–95	36	0	0	36	4	15	19	34	57	91	146
1995–96	55	0	0	55	5	20	25	6	21	27	107
1996–97	92	0	0	92	9	20	29	10	7	17	138
1997–98	72	2	0	74	7	20	27	13	14	27	128
1998–99	78	3	0	81	8	20	28	16	18	34	143
1999–00	65	0	2	67	7	20	27	21	80	101	195
2000–01	56	0	0	56	6	20	26	14	7	21	103
2001–02	66	0	1	67	7	20	27	31	10	41	135
2002–03	67	0	0	67	7	20	27	13	0	13	107

[a] All information in this table has been updated since last management report.
[b] Derived by taking 5% of the total reported kill prior to SF50 (1993) and 10% after 1993.
[c] Includes moose taken in defense of life or property.
[d] Road and train are minimum numbers. Road kills do not include unsalvageable animals.

Table 3 Unit 14B moose hunter residency and success for the general open season, 1992–2003[a]

	Successful					Unsuccessful						
Regulatory year	Local[b] resident	Nonlocal resident	Nonres.	Unk.	Total (%)	Local[b] resident	Nonlocal resident	Nonres.	Unk.	Total		Total hunters
1992–93	31	0	3	0	34 (11)	259	10	5	6	280		314
1993–94	28	1	2	0	31 (9)	285	3	2	7	297		
1994–95	35	0	1	0	36 (11)	290	8	3	4	305		
1995–96	36	1	2	3	42 (9)	413	12	5	11	441	328	483
1996–97	56	2	3	0	61 (11)	475	12	9	2	498	341	559
1997–98	43	1	5	0	49 (10)	393	18	9	2	422		471
1998–99	55	2	4	0	61 (13)	397	12	12	4	425		486
1999–00	44	2	4	1	51 (9)	459	12	13	11	495		546
2000–01	40	3	4	1	48 (10)	420	20	14	3	457		505
2001–02	61	3	3	0	67 (16)	330	13	13	3	359		426
2002–03	57	4	6	0	67 (14)	368	8	23	2	401		

[a] All information in this table has been updated since last management report. 468

[b] Unit 14 residents.

Table 4 Unit 14B moose harvest chronology for the general open season, 1992–2003[a]

Regulatory	August			September					November	December			
year	10–17	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15	Unknown	Total
1992–93 [b]	--	--	--	24	6	--	--		--	--	--	4	34
1993–94 [c]	--	5	2	5	6	12	--	--	--	--	--	1	31
1994–95 [c]	--	8	1	1	5	19	----	--	--	--	--	2	36
1995–96 [d]	2	3	0	4	9	13	--	--	2	2	7	0	42
1996–97 [d]	0	15	2	3	9	12	--	--	8	1	8	3	61
1997–98 [d]	1	7	1	6	11	9	--	--	3	3	5	3	49
1998–99 [d]	2	6	5	6	6	16	--	--	4	4	7	5	61
1999–00 [e]	0	6	2	3	5	14	9	--	--	3	7	2	51
2000–01 [e]	0	3	0	5	2	15	9	--	--	2	10	2	48
2001–02 [f]	0	10	0	4	6	6	15	23	--	--	--	3	67
2002–03 [e]	1	7	5	5	7	8	19	14	--		--	1	67

[a] All information in this table has been updated since last management report.
[b] Open season = Sep 1–10.
[c] Open season = Aug 20–Sep 20 (SF/50 –"spike-fork/ 50-inch").
[d] Open season = Aug 10–17 (Archery-only), Aug 20–Sep 20 (Gen.SF/50), Nov 20–Dec 15 (SF-only).
[e] Open season = Aug 10–17 (Archery-only), Aug 20–Sep 25 (Gen.SF/50), Dec 5–15 (SF-only).
[f] Open season = Aug 10–17 (Archery-only), Aug 20–Sep 30 (Gen.SF/50).

Table 5 Unit 14B transport methods used by successful moose hunters during the general season, 1992–2003[a]

Regulatory year	Percent of successful moose hunters: Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unk	Airboat	No. moose harvested
1992–93	26	0	0	41	0	15	15	3		34
1993–94	23	0	6	32	0	10	23	6		31
1994–95	8	6	6	36	0	14	25	6		36
1995–96	12	0	7	36	5	12	26	2		42
1996–97	12	0	5	32	20	6	22	5		61
1997–98	16	2	10	27	12	12	18	2		49
1998–99	8	2	3	36	15	10	20	5	2	61
1999–00	18	2	0	29	16	10	24	2	0	51
2000–01	8	0	2	27	17	19	23	2	2	48
2001–02	15	1	4	42	0	15	22	0	0	67
2002–03	7	0	7	46	0	9	27	3	0	67

[a] All information in this table has been updated since last management report.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 14C (1912 mi^2) and Portage and Placer River drainages in Unit 7
Geographic Description: Anchorage area

BACKGROUND

Moose were uncommon in the Anchorage area before the 1940s. They increased in the late 1940s as brushy regrowth replaced mature forests cut or burned during the development of Anchorage and the Fort Richardson Military Reservation. Numbers increased considerably during the early 1950s, and by the late 1950s and early 1960s moose were abundant. The moose population has remained high during the past 4 decades.

Prime browse occurs in open-canopied, second-growth willow, birch, and aspen stands on burned-over military lands and on several hundred acres of military lands that have been rehabilitated during the last 2 decades. Parks, greenbelts, and residential areas in the Anchorage Bowl also contain browse. Quality riparian habitat abounds along area streams and rivers. Extensive stands of subalpine willow are on south-facing slopes in most drainages in the area. However, during the last 2 decades, overabundant moose have reduced the distribution and density of browse species.

Annual harvests have fluctuated dramatically in recent decades. A record harvest of nearly 500 moose (50% females) occurred in 1965, but hunters harvested only 18 moose in 1978. Diverse harvests were often due to changes in seasons and bag limits as much as changes in the moose population. Annual harvests increased steadily during the late 1980s and early 1990s but began to decline in 1992. The 5-year mean harvest during this reporting period was 87 moose (28% cows).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

Maintain a population of 2000 moose
Maintain a posthunting sex ratio of no fewer than 25 bulls:100 cows.

METHODS

We conducted aerial surveys annually, except in 2000 and 2002, in most hunt areas to estimate sex and age composition during fall and early winter (Table 1). Fall surveys were not flown in 2000 and 2002 because there was inadequate snow cover until late December or early January, after most bulls had shed antlers. Hunters were required to report their success on either harvest or permit reports, depending on whether they participated in the general season or a special permit hunt. The reports require information on days hunted, hired services, harvest date and location, sex of the animal taken, method of transportation, and antler configuration.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The moose population was reasonably stable during the 1980s. Stability was partially due to a series of mild winters beginning in 1979–80.

Moose are adversely affected by snow depths of 70–90 cm (28–36 inches), which impede movement, and depths greater than 90 cm restrict movement to the extent that adequate food intake may be unattainable (Coady 1974). Mean snow depths in Anchorage area lowlands are not normally challenging to wintering moose. Since 1988, however, the Anchorage area has experienced a series of severe winters. Continued severe winters will exacerbate overbrowsing, which may result in substantial losses of moose in subsequent years.

Deep snows during the winter of 1994–95 caused a substantial decline in the unit's moose population. Vehicle collisions and starvation caused most of the known moose mortality. The number of moose killed in collisions with vehicles and trains continued to increase (Table 2). Fall 1996 surveys found the moose population 25–30% below the fall 1994 estimate. With milder winters and a reduction in harvest, the unit's moose population recovered by fall 1998 to near or above the management objective of 2000. Another severe winter in 1998–99 reduced the population to an estimated 1650 by fall 1999. The population rebounded to an estimated 1965 in fall 2001. This pattern of population declines following severe winters and slow increases following milder winters is consistent with a population at or above carrying capacity.

Population Size

We estimated a fall 2001 population of 1965 moose in Unit 14C, including the Placer and Portage River drainages (Table 1). The fall 2002 population probably exceeded 2000 moose following the mild winter of 2001–02.

Population Composition

The bull:cow ratio ranged from 36:100 to 53:100. It has increased unitwide, with substantial increases in the Fort Richardson/Elmendorf/Off-base Ship Creek, Peters Creek, and Eklutna/Thunderbird drainages (Table 1). There is no clear trend in bull:cow ratios in other count areas. The calf:cow ratio ranged from 26:100 to 30:100, and the percentage of calves in the population ranged from 16 to 18%. The unit had 9–17 yearling bulls per 100 cows.

Distribution and Movements

Moose are year-round residents, ranging from sea level to an elevation of 3500 feet. During winters with substantial snow accumulation, most moose are at elevations below 1500 feet. Movements of several miles or more by both sexes occur during the breeding season in late September through October and again before green-up in late March and early April.

MORTALITY

Harvest

Season and Bag Limit. The open seasons for resident and nonresident hunters in the Fort Richardson Management Area were 4 September–15 November and 15 December–15 January in 2001–02, and 3 September–15 November and 15 December–15 January in 2002–03. The bag limit was one moose by drawing permit; however, some hunts specified bull or antlerless only. Hunting was limited to archery only, except in the fall season when muzzleloading rifles were permitted north of Eagle River. We issued 95 archery permits and 25 muzzleloader permits for bulls and antlerless moose. We issued an additional 15 drawing permits for both sexes for Elmendorf Air Force Base in 2001 and 2002. The bag limit was one moose; however, bull or antlerless moose were specified on permits, and the season was 4–30 September in 2001 and 3–30 September in 2002. There was no open season in the Anchorage Management Area. The open season in the Birchwood Management Area was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was one moose by drawing permit; however, bull or antlerless moose were specified on permits. Fifteen permits were issued in 2001 and 2002. The open season in the Eklutna Lake Management Area was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was one bull by archery only. The hunt was administered by registration permit with a quota of 4 bulls. The general season in the remainder of Unit 14C was 4–30 September in 2001 and 3–30 September in 2002. The bag limit was 1 bull moose with spike-fork/50-inch antlers; however, hunters could take antlerless moose by drawing permit in specified drainages (40 permits were issued in 2001 and 2002). The open season for the Twentymile River area was 20 August–30 September in 2001 and 2002. The bag limit was 1 bull by drawing permit with 10 permits issued each year.

Board of Game Actions and Emergency Orders. In 1995 and 1996 the Board of Game considered several proposals for a moose hunt in the Anchorage Management Area, but delayed a final decision until the March 1997 meeting in Anchorage. In March 1997 the board considered several proposals for hunting with shotguns and muzzleloaders in Chugach State Park and bow hunts in several municipal parks. None was approved. However, the Board of Game finally authorized a moose hunt for antlerless moose and spike-fork bulls in the upper Campbell, Rabbit and Potter Creek drainages (DM666) in March 1999. No permits have been issued because the Division of Parks and Outdoor Recreation continued to prohibit discharge of firearms in these drainages. Beginning in 1998, only Alaska residents could obtain an antlerless moose permit in the remainder of Unit 14C. In March 1999 the Board of Game extended the season for the Eklutna Management Area to 20 October to allow bowhunting during the rut and extended the general season moose hunt from 20 September to 25 September. The general season moose hunt was extended from 25 September to 30 September beginning in fall 2001. All antlerless moose hunts were reauthorized annually, except DM666 beginning in 2001. The DM666 spike-fork bull bag limit remains in effect.

Following the post-9/11 base closure and in recognition of unprecedented national events, the Board of Game authorized the department to extend the moose hunting season on Elmendorf Air Force Base from 15 December 2001 to 15 January 2002 to allow a winter hunt for 2001 permittees (EO 02-16-01; effective 14 December 2001). Based on positive feedback from hunters and the base's natural resources staff, in March 2003, the Board of Game authorized extending the hunting season on Elmendorf from 30 September to 15 December and increased the number of permits from 15 to 25 to allow a late-season hunt similar to that on Fort Richardson. Elmendorf natural resources staff preferred a late-season hunt 15 October–15 November. The hunt was initiated in 2003. Because Fort Richardson already had a winter moose hunt, 2001 permittees could not be accommodated in the winter of 2001–02. Instead, the Board of Game extended the permit period to allow permittees who were not successful in taking a moose on Fort Richardson in fall 2001 to be reissued permits to hunt on Fort Richardson in fall 2002 (EO 02-16-01; effective 20 Nov 2001). Some 2001 permittees were unable to participate in 2002, and those permits were issued to new applicants. The total number of Fort Richardson permits was not increased, so only 4 of 20 permits from DM422 and 4 of 40 permits from DM424 were issued to new applicants in 2002.

An emergency order closed the moose-hunting season in the Eklutna Management Area (RM445) effective 3 October 2000, when the quota of 4 moose was achieved. An emergency order closed the moose-hunting season in the Eklutna Management Area effective 21 September 2001, when the quota of 2 moose was achieved. The 2001 quota had been reduced because 5 moose were harvested and 1 mortally wounded during the 2000 season. An emergency order closed the moose-hunting season in the Eklutna Management Area effective 27 September 2002 after the third of the 4-bull quota was reported on 25 September, and it was likely that the quota would be exceeded over the weekend of 28–29 September.

The Board of Game revised 5 AAC 92.230 (Feeding of game). Effective 1 July 2002, it is illegal to negligently leave human food, pet food, or garbage in a manner that attracts moose. The previous wording was “intentionally” rather than “negligently.” Initially the fine was $50, but it was increased to $100 in September 2002. In the 2000s a few moose were increasingly reported getting into dumpsters and other garbage containers; however, no citations were issued during this report period for feeding moose.

Hunter Harvest. During the 2001–02 and 2002–03 seasons, 86 and 94 moose were harvested, respectively, with a 2-year mean of 60 bulls and 31 cows (Table 2). Approximately 36% of the bulls were taken during the general season. The remaining moose were taken in permit hunts. Harvests were affected by the emergency closures on Elmendorf Air Force Base and Fort Richardson in fall 2001. The 2 military reservations were closed to public access on 11 September, after the hunting season was open 7 days. Only 3 of 70 hunters were successful, and most had not started to hunt.

Permit Hunts. During the 2001–02 season, we issued 302 permits to hunt moose in Unit 14C. Of these, 54 hunters (32%) were successful. The success rate was much higher than normal, presumably because a higher proportion of permittees than usual did not hunt (44%). Many of these permittees did not hunt due to the loss of public access to the military reservations. Winter moose hunts tend to be more successful than fall hunts in the Anchorage area because permittees are allowed to take either sex, and moose are more numerous and easier to see and track. In 2002–03, 314 permits were issued and 71 hunters (30%) were successful (Table 4).

Drawing permit hunts are very popular. In 2001, 8437 hunters applied for 199 drawing permits (1792 applications were for the 10 bull permits for the Placer/Twentymile hunts). In 2002, 3846 hunters applied for 140 drawing permits (1091 of the applications were for the 10 permits for the Placer/Twentymile hunts). The number of applicants has declined in recent years in part because of the reissuance of many permits in 2002 due to post-9/11 closures and a newly established access fee of $125 required to hunt on Fort Richardson and Elmendorf AFB. In addition to those receiving drawing permits, 102 bowhunters in 2001 and 114 bowhunters in 2002 registered for a permit for the Eklutna Valley archery hunt. The number of registered bowhunters increased in 1999 due to a hunting extension of one month, which facilitated moose calling during the peak of the rut. However, the number registering to hunt has declined in the last decade, and many of those who register have not hunted, which has increased success rates slightly (Table 4). The high number of unsuccessful bowhunters in this hunt reduces the total success rate for permit hunts (Table 4).

Fort Richardson and Elmendorf AFB proposed to charge a fee for recreational access permits beginning in 2001. The fee was nominal for most recreational activities ($5 or $10), including sport angling; however, the user fee was $125 for moose hunting. I conducted a telephone survey of hunters who had applied for and other hunters who had been issued moose drawing permits on Fort Richardson for the 2000–01 season (Sinnott 2001). All 266 applicants and permittees contacted completed the survey for a response rate of 100%. Fifty-two percent of the permittees were “very satisfied” with their 2000–01 moose hunt. Only 21% were “unsatisfied” or “very unsatisfied.” The “best thing about the hunt” was its convenience, according to 58% of the permittees. Many hunters expressed frustration with the way the hunt was managed by the military. The top 4 complaints (62%) included too few open areas (26%), problems with military police in the field (16%), onerous check-in/checkout procedures (10%), and problems with the orientation class (10%). Nevertheless, most of the applicants (98%) and permittees (93%) intended to apply for a Fort Richardson permit again, and most of the applicants (64%) and permittees (66%) said they would pay a $100 access fee to hunt on the military reservation. Applicants and permittees gave similar reasons why they would pay a $100 user fee. The most frequently mentioned reasons were the hunt 1) was close to town and therefore more convenient and less expensive than moose hunts in other parts of the state, 2) has a high success rate, and 3) was generally “worth it.” Many respondents expressed resignation over additional fees; however, they were more likely to accept the fee if it was used for wildlife management and if all user groups paid equitable fees.

<u>Hunter Residency and Success</u>. Residents of Unit 14 accounted for 90% and 87% of the moose harvested in Subunit 14C in 2001–02 and 2002–03, respectively (Table 3). Nonresidents accounted for 4% and 3% of the total harvest in Subunit 14C in 2001–02 and 2002–03, respectively.

<u>Harvest Chronology</u>. It is difficult to compare annual harvests for the first week in September (Table 5) because season opening dates are variable (i.e., the day after Labor Day). After the general season was shortened by 10 days (from 30 September to 20 September) in 1990, harvests shifted primarily to the second week in September, rather than being compressed into the third week, as might be expected (Table 5). The second week in September is essentially the opening week of moose hunting for much of the unit when the day after Labor Day is later than usual (e.g., 8 September in 1998). On the other hand, when the general season was extended from 20 September to 25 September (e.g., 1999 and 2000), about one-fourth to one-third of hunters harvested a bull in the last few days of the season. When the general season hunt was extended from 25 September to 30 September in 2001 and 2002, a relatively large proportion of successful

hunters (9% in 2001 and 13% in 2002) took a bull the last 2 days of the hunting season, and the majority of the harvest shifted from the second to the third week of the hunting season (Table 5). The permit archery hunt is held on military land from mid December through mid January, after many moose summering in the Fort Richardson-Elmendorf-Ship Creek area became accessible in lowland areas of Fort Richardson.

Transport Methods. Approximately two-thirds of all successful moose hunters reached their kill sites by highway vehicle (Table 6). The high proportion of walk-in hunters is due to proximity of many moose to roads and trails and prohibition of motorized off-road vehicles and airplanes in most of Chugach State Park.

Other Mortality

Moose killed by vehicles and trains accounted for 62–73% of known, human-caused mortality during the reporting period. Vehicles killed at least 239 moose and trains killed 22 moose in 1994–95, a record high because of near-record snow depths that forced many moose into town. During this report period, a mean of at least 175 moose were killed in vehicle and train collisions annually (Table 2). These are conservative figures because not all collisions are reported and some moose, never found, die from injuries. An additional 10–20 moose have died from unknown, but not natural, causes each year (e.g., 13 in 2002 and 14 in 2003) and have been salvaged by trappers for use as bait in other units.

Natural mortality was low in the Anchorage area from the mid 1950s to the late 1980s because of moderate annual snowpack and relatively low numbers of predators. More moose have starved in recent winters due to 1) greater than average snowpacks in some years that cover potential browse and require greater expenditure of energy and 2) overbrowsing in previous winters. In recent years, 4–5 packs of wolves have occupied Subunit 14C.

HABITAT

Assessment

Large tracts of subalpine and riparian habitat are protected throughout the 500,000-acre Chugach State Park and Chugach National Forest land between Girdwood and Portage. Several thousand acres of lowland habitat are on military lands between lower Ship Creek and Eagle River. Extensive urbanization has reduced winter range on portions of the military reservation and on private lands throughout the unit. Increased traffic on existing roads continues to boost Anchorage road kills. Several new roads, either in the design stage or proposed (e.g., Abbott Loop extension and Dowling extension), will bisect natural areas and may result in many moose-vehicle collisions. Low-speed roads and trails associated with development, however, also provide movement corridors, which reduce energy expenditures for moose during years of heavy snowfall.

Enhancement

Extensive habitat enhancement on military, state, and municipal lands is not economically feasible because burning, the most cost-effective method, is difficult to do safely in a densely populated area. Habitat enhancement is not a desirable alternative in Chugach State Park. The Chugach National Forest enhanced moose habitat in a limited area near Portage, primarily to enhance viewing opportunity. Winter habitat will inevitably decrease over time in the Anchorage area, as will the number of moose that depend on winter habitat.

CONCLUSIONS AND RECOMMENDATIONS

The population objectives were met. The bull:cow ratio exceeded 25:100. Although the fall 2001 population was estimated at 1965 moose, slightly below the management objective of 2000 moose, the fall 2002 population probably exceeded 2000 moose.

Existing management programs were developed in cooperation with staffs from Fort Richardson, Elmendorf Air Force Base, and Chugach State Park. Through restrictions on harvest methods and compromises on open and closed areas, management regimes have been developed and are acceptable to all parties.

Current regulations adequately address management concerns by providing for substantial hunting opportunities and harvests from a productive moose population in an area where several land management agencies have limited access modes.

Nuisance moose in residential areas remain a significant problem. The Alaska Department of Transportation and Public Facilities (DOT&PF) estimated rural moose-vehicle collisions cost an average of $15,150 for vehicle repairs; emergency, medical, and legal services; and lost wages (DOT&PF 1995). Moose-vehicle collisions may cost Anchorage residents $2.4 million/year, based on the number of moose-vehicle collisions reported during this 5-year report period. Moose also cause considerable damage to ornamental plants, vegetable gardens, and fruit trees in winter and spring. Some residents continue to feed local moose, despite the regulation prohibiting feeding, and when a handout is not immediately forthcoming, these moose can be unusually aggressive toward people. Area staff spends considerable time listening and responding to complaints about property damage, public safety, and injured moose. On the other hand, residents tolerate much damage, and most residents and visitors consider moose a desirable species. Public education regarding moose behavior and biology may improve public tolerance and reduce conflicts (Whittaker et al. 2001).

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Table 1 Subunit 14C fall aerial moose composition counts and estimated population size, 1998–2003

Area	Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size[a]
Twentymile River	1998–99	24	4	30	19	181	48	240
Portage River	1999–2000	18	4	23	16	116	35	135
Placer River	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	180
	2002–03[b]	--	--	--	--	--	--	
Hillside	1998–99	29	13	36	22	213	70	280
	1999–2000	35	7	35	21	145	51	170
	2000–01[b]	--	--	--	--	--	--	
	2001–02	46	26	33	19	161	49	185
	2002–03[b]	--	--	--	--	--	--	
Anchorage Bowl	1998–99	--	--	--	--	--	--	300[c]
(except Hillside)	1999–2000	--	--	--	--	--	--	250[c]
	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	300[c]
	2002–03[b]	--	--	--	--	--	--	
Fort Richardson	1998–99	42	13	32	18	386	32	503
Elmendorf AFB	1999–2000	57	24	31	16	408	31	474
Off-base Ship Cr.	2000–01[b]	--	--	--	--	--	--	
	2001–02	63	20	33	17	482	29	555
	2002–03[b]	--	--	--	--	--	--	

Table 1 Continued

Area	Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size[a]
Eagle River	1998–99	36	6	22	14	101	--	130
	1999–2000	--	--	--	--	--	--	110
	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	120
	2002–03[b]	--	--	--	--	--	--	
Peters Creek	1998–99	73	16	16	9	69	24	90
	1999–2000	95	11	26	12	42	19	50
	2000–01[b]	--	--	--	--	--	--	
	2001–02	112	23	31	13	63	20	70
	2002–03[b]	--	--	--	--	--	--	
Eklutna River Thunderbird Cr.	1998–99	18	0	24	17	48	13	60
	1999–2000	28	6	22	15	48	12	55
	2000–01[b]	--	--	--	--	--	--	
	2001–02	42	8	11	7	55	12	65
	2002–03[b]	--	--	--	--	--	--	
Bird Creek Indian River[d]	1998–99	--	--	--	--	--	--	150
	1999–2000	--	--	--	--	--	--	120
	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	140
	2002–03[b]	--	--	--	--	--	--	

Table 1 Continued

Area	Regulatory Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Total moose observed	Moose /hour	Estimated population size[a]
Hunter Creek Knik River	1998–99	36	0	27	16	104	52	140
	1999–2000	23	4	12	9	123	37	145
	2000–01[b]	--	--	--	--	--	--	
	2001–02	23	4	21	15	163	44	185
	2002–03[b]	--	--	--	--	--	--	
Lake George[e]	1998–99	--	--	--	--	--	--	165
	1999–2000	--	--	--	--	--	--	140
	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	165
	2002–03[b]	--	--	--	--	--	--	
Unit 14C Total	1998–99	36	9	30	18	1102	35	2100
	1999–2000	41	13	26	16	882	31	1650
	2000–01[b]	--	--	--	--	--	--	
	2001–02	53	17	29	16	924	29	1965
	2002–03[b]	--	--	--	--	--	--	

[a] Estimates based on sightability indices of 0.77 (1998), 0.86 (1999) and 0.87 (2001), calculated with MOOSPOP for the Fort Richardson survey. Estimates in unsurveyed drainages are extrapolated based on trends in adjacent count areas.
[b] Fall surveys not conducted due to lack of snow.
[c] No aerial surveys; estimate is best guess.
[d] Last surveyed in 1988.
[e] Last surveyed in 1997.

Table 2 Subunit 14C moose harvest and accidental death, 1998–2003

Regulatory year	Hunter harvest: Reported M (%)	F (%)	Total[a]	Estimated: Unreported	Illegal	Total	Accidental death[b]: Road	Train	Total	Total
1998–99	72 (74)	25 (26)	97	10	10	20	152	6	158	275
1999–2000	61 (84)	12 (16)	73	10	10	20	150	11	161	254
2000–01	63 (72)	24 (28)	87	10	10	20	160	5	165	272
2001–02	57 (66)	29 (34)	86	10	10	20	229	9	238	344
2002–03	62 (66)	32 (34)	94	10	10	20	143	11	154	268

[a] Includes those with unreported sex.
[b] Reported deaths only.

Table 3 Subunit 14C moose hunter residency and success, 1998–2003

	Successful				Unsuccessful				
Regulatory year	Local resident[a]	Nonlocal resident	Nonresident	Total (%)[b]	Local resident[a]	Nonlocal resident	Nonresident	Total (%)[b]	Total hunters
1998–99	94	1	2	97 (19)	418	7	3	428 (81)	525
1999–2000	64	5	4	73 (14)	437	19	4	461 (86)	534
2000–01	80	5	2	87 (20)	320	17	6	347 (80)	434
2001–02	77	6	3	86 (27)	217	10	5	232 (73)	318
2002–03	82	9	3	94 (21)	316	20	9	345 (79)	439

[a] Residents of Unit 14 (majority from Subunit 14C).
[b] Includes hunters with unspecified residency.

Table 4 Subunit 14C moose harvest data by permit hunt, 1998–2003

Hunt no. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest[a]
DM210, 211 Twentymile Portage Placer	1998–99	50	16	57	43	100	0	18
	1999–2000	35	54	100	0	0	0	0
	2000–01	10	40	83	17	100	0	1
	2001–02	10	30	43	57	100	0	4
	2002–03	10	40	67	33	100	0	2
DM424,425,427 Fort Richardson (archery only)	1998–99	95	14	61	39	75	25	32
	1999–2000	95	14	65	35	72	28	29
	2000–01	95	16	50	50	73	27	40
	2001–02	95	38	47	53	39	61	31
	2002–03	95	14	61	39	41	59	32
DM422,423 Fort Richardson (muzzleloader)	1998–99	25	20	72	28	67	33	6
	1999–2000	25	8	61	39	89	11	9
	2000–01	25	16	67	33	57	43	7
	2001–02	25	76	67	33	100	0	2
	2002–03	25	8	57	43	80	20	10
RM445[b] Eklutna (archery only)	1998–99	161	35	97	3	100	0	3
	1999–2000	311	22[c]	98	2	100	0	3
	2000–01	229	54[d]	95	5	100	0	5
	2001–02	102	59[e]	93	7	100	0	3
	2002–03	114	43[f]	94	6	100	0	4

Table 4 Continued

Hunt no. /Area	Regulatory Year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest[a]
DM441 Hunter Knik	1998–99	20	15	59	41	17	83	7
	1999–2000	20	5	95	5	0	100	1
	2000–01	10	0	70	30	0	100	3
	2001–02	10	20	75	25	0	100	2
	2002–03	10	10	67	33	0	100	3
DM428, 429 Elmendorf AFB (archery only)	1998–99	15	7	43	57	50	50	8
	1999–2000	15	7	50	50	86	14	7
	2000–01	15	7	50	50	57	43	7
	2001–02	15	7	43	57	50	50	8
	2002–03	15	13	31	69	56	44	9
DM442 Ship	1998–99	10	50	80	20	0	100	1
	1999–2000	20	30	93	7	0	100	1
	2000–01	20	20	81	19	0	100	3
	2001–02	20	35	92	8	0	100	1
	2002–03	20	15	65	35	0	100	6
DM443 Peters and Little Peters	1998–99	10	10	78	22	0	100	2
	1999–2000	10	20	100	0	0	0	0
	2000–01	10	30	86	14	0	100	1
	2001–02	10	10	89	11	0	100	1
	2002–03	10	20	62	38	0	100	3

Table 4 Continued

Hunt no. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest[a]
DM448, 449 Birchwood[c] (archery only)	1998–99	15	7	79	21	33	67	3
	1999–2000	15	20	92	8	100	0	1
	2000–01	15	27	73	27	100	0	3
	2001–02	15	27	91	9	0	100	1
	2002–03	15	27	82	18	50	50	2
Totals for all permit hunts	1998–99	401	23	74	26	69	31	80
	1999–2000	546	31	86	14	77	23	51
	2000–01	429	35	74	26	66	37	70
	2001–02	302	44	68	32	46	54	54
	2002–03	314	25	70	30	55	45	71

[a] Includes moose with unspecified sex.
[b] Registration hunt.
[c] Includes 58 permittees who did not report.
[d] Includes 39 permittees who did not report.
[e] Includes 21 permittees who did not report.
[f] Includes 22 permittees who did not report.

Table 5 Subunit 14C moose harvest[a] chronology, 1998–2003

Regulatory year	Percent of harvest 9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	n
1998–99[b]	--	56	44	--	--	16
1999–2000[c]	5	32	27	36	--	22
2000–01[d]	20	33	20	27	--	15
2001–02[e]	6	19	34	31	9	32
2002–03[f]	4	17	43	22	13	23

[a] Excludes permit hunt harvests.
[b] Season 9/8–9/20
[c] Season 9/7–9/25
[d] Season 9/5–9/25
[e] Season 9/4–9/30
[f] Season 9/3–9/30

Table 6 Unit 14C moose harvest percent by transport method, 1998–2003

Regulatory year	Percent of harvest Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unknown/ Other	n
1998–99	2	5	10	2	0	6	71	3	87
1999–2000	4	4	1	1	0	1	86	3	73
2000–01	2	1	6	0	0	2	84	5	87
2001–02	5	6	4	3	0	1	60	7	86
2002–03	6	7	4	0	0	0	68	9	94

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15A (1314 mi^2)

GEOGRAPHIC DESCRIPTION: Northern Kenai Peninsula

BACKGROUND

Historical records and reports from residents indicate moose were abundant throughout the 1900s in Subunit 15A. The most recent population peak occurred in 1971. The near absence of wolves from 1913 to 1968 and increased moose survival following a 500-square-mile forest fire in 1947 were 2 factors that increased moose numbers throughout the 1950s and 1960s. Although seasons were long and either-sex harvest was allowed, the moose population increased beyond its carrying capacity and extensive overbrowsing occurred by the late 1960s. A wildfire in 1969 burned approximately 135 mi^2 (11 percent of 15A), initially reducing moose habitat in 15A, then harsh winters from 1971 to 1974 reduced the moose population over the entire Kenai Peninsula. Estimates for Subunits 15A and 15B indicate the combined population estimate declined from 7900 in 1971 to 3375 by 1975. Subunit 15A represents 75% of these estimates, a decline from 5900 to 2500 moose. By 1982, following more favorable winters, the moose population estimate for 15A increased to 3000.

In 1987 and 1990 estimation methods described by Gasaway (1986) were used in the unit for the first time. They indicated a stable population trend in the range of 3014–3850 moose. In February 2001, we completed a moose census using methods developed by Jay VerHoef (ADF&G Fairbanks biometrician). Using VerHoef's modified Gasaway census technique we estimated the moose population in Subunit 15A at 2097 (95% confidence intervals 1704–2431). The winters of 1998–99 and 1999–2000 were classified as severe for 15A with snow accumulation up to 40 inches.

No large wildfires have occurred since 1969 on the Kenai Peninsula. Consequently, less browse associated with successional forest stages was available to moose and a gradual decline in moose population size is anticipated during normal winters. Small wildfires and intentional habitat improvement efforts have temporarily reversed this general trend in local areas.

Increased human presence and impact of the Alaska National Interest Lands Conservation Act on the Kenai Peninsula have increased the necessity for cooperative interagency management of renewable resources. To this end, the department works closely with a variety of agencies and landholders while retaining management authority for wildlife on nonfederal lands and nonsubsistence wildlife species on federal lands. The Kenai National Wildlife Refuge is the largest landholder in Subunit 15A and actively participates in a variety of cooperative moose management programs. These include support of the ADF&G Moose Research Center near Sterling, cooperative management of Skilak Loop as a wildlife viewing area, and recent attempts to provide increased access for hunters in wheelchairs. Close coordination and cooperation should continue.

A selective harvest strategy with a spike/fork-50-inch bag limit was initiated on the Kenai Peninsula in 1987. The proportion of males in the population has subsequently increased, and hunters seem generally satisfied with the selective harvest strategy. We completed a 5-year evaluation of selective harvest on the Kenai in 1992, and a 10-year evaluation in 1999.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain a healthy population of moose with a posthunting bull-to-cow ratio of at least 15:100 in Unit 15A, excepting the Skilak Loop Wildlife Management Area (SLWMA).

Primary moose management objectives in the SLWMA are to:

- View moose in a natural setting throughout the year.
- Provide opportunities to view all components of the moose community, including their behavior and habitat.
- Provide opportunities to harvest moose when a reduction in numbers is desirable to achieve other objectives.
- Achieve and maintain the resident population at 130 animals or a density of 1.8 to 2.0 moose per mi^2. Resident moose in excess of 130 will be available for harvest.
- Increase the bull-to-cow ratio to at least 40 bulls:100 cows.

In addition to the resident population, moose from surrounding areas commonly winter in SLWMA. Winter populations reach 300 animals. Habitat will be managed to provide for 130 resident and up to 170 additional wintering moose.

METHODS

During years with adequate snowfall, we conducted aerial surveys in November and December in selected trend count areas to ascertain sex and age composition. In 2001 and 2002 weather conditions were not suitable to conduct these surveys.

A population estimate for Subunit 15A was developed from data collected in February 2001. Ver Hoef developed the techniques used for S-Plus Spatial Statistics.

All of the harvest data is now kept at the ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables; therefore, data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The February 2001 estimate for moose wintering in the unit was 2097 ± 15.9% (1704–2431) at the 95% CI. The February 1990 estimate for moose wintering in the unit was 3432 ± 12.18% (3014–3850) at the 90% CI. These data indicate a decline of approximately 39 percent of the mean; however, it is believed that most of this decline occurred during the severe winters of 1998–99 and 1999–2000. The winters of 2000–01 through 2002–03 were relatively mild and should have been favorable for moose survival and production.

Population Composition

Poor weather and lack of complete snow cover prevented us from completing a fall sex and age composition survey in 1999–2000, 2000–01 or 2002–03. In 1998 we observed 1528 moose in fall composition surveys, compared to 1467 in 1996 (Table 1). Calves composed 17% of the 1998 sample and occurred in the proportion of 27:100 cows. Calf composition data declined compared to data from 1992 to 1996; however, calf survival was high the previous year.

MORTALITY

Harvest

Season and Bag Limit. The general open season in Subunit 15A was 20 August–20 September. In spring of 1995 the Alaska Board of Game approved an archery season for 10–17 August. Archery hunters were restricted to the same bag limit used during the general season. The bag limit was 1 bull with spike/fork or 50-inch antlers or at least 3 brow tines on at least 1 antler (SF/50). Forty permits were issued in a drawing permit hunt in the SLWMA for antlerless moose in 1999–2000 and 20 permits for spike/fork bulls. The antlerless season was 15–30 September and the spike/fork bull season 21–30 September. The bag limit for the antlerless season prohibited harvesting of calves and females with calves. These permit hunts were not held during the fall 2000–2003 seasons.

During the last 5 years the annual moose harvest ranged from 91–271 (Table 2), while the number of hunters ranged from 1161–1428 (Table 4). Variations in harvest generally reflect the number of yearling bulls available (which is related to winter severity) and weather conditions during the hunting season. Results of a 10–17 August archery season are included in the total harvest figures.

Federal subsistence harvest statistics were not available for the past 2 years when this report was written. However, no moose harvests were reported during the 18–19 August federal subsistence season during the previous 4 years.

Board of Game Actions and Emergency Orders. No Board of Game action was taken during this reporting period.

Permit Hunts. No permits were issued for the SLWMA during this report period. Due to a lack of adequate snow cover, we were not able to conduct surveys in this area. By agreement with the

Kenai National Wildlife Refuge, a survey of the area must be completed, and a minimum count of 130 moose must be obtained before permits for this can be issued.

Hunter Residency and Success. During the last 5 years hunter success ranged from 8 to 19% (Table 4). During all years, local residents (people living in Unit 15) accounted for the vast majority (79–86%) of moose hunters using this subunit.

Transport Methods. Most moose hunters use highway vehicles as their primary method of transportation to access hunting areas in Subunit 15A. The percentage of hunters using highway vehicles ranged from 55 to 74% during the last 5 years (Table 5).

Harvest Chronology. Twenty-one percent of the 2001 and 24% of the 2002 harvest occurred during the 10–17 August archery season (Table 6). Twenty-one percent of the 2001 and 23% of the 2002 harvest occurred during the first 5 days of the general hunt season. The highest percentage of harvest occurred during these 2 time periods during this report period.

Other Mortality

Crippling loss by hunters and loss to predation was unknown. In 2001, 100 moose were reported killed in 15A by vehicle/wildlife accidents, compared to 73 in 2002 (Table 2). About 50% of moose killed by vehicles each year are calves. Between 1998 and 2002, on average 90 moose were killed in wildlife/vehicle accidents in Unit 15A. A public awareness program begun in 1990 to reduce the number of vehicle/wildlife collisions (Del Frate and Spraker 1991) has failed to demonstrate a significant reduction in accidents.

HABITAT

Assessment

The 1969 burn (85,000 acres) is still providing browse for most of the moose wintering in Subunit 15A. However, this area and small areas of improved habitat north of Skilak Lake compose only 10–15% of moose habitat in the unit. The remaining moose habitat is unproductive due to forest succession and browse heights not optimal for moose.

Enhancement

In May 1991 approximately 8320 acres burned in the southeastern portion of 15A near Pothole Lake. This burn is expected to increase available moose habitat; however, this may only benefit animals in the immediate area of the burn due to its small size. Substantial statewide publicity regarding beneficial effects of wildfire for forest succession wildlife stemmed from the Pothole Lake fire.

A 10,369-acre area in the Mystery Creek Road vicinity was to be burned by U.S. Fish and Wildlife Service in the fall of 1991. Unfavorable weather conditions and other factors prevented this prescribed burn project until July 1999 when a small portion of the area was burned. Approximately 40% of this area was to be left untreated as scattered islands for wildlife cover and as a seed source for revegetation.

CONCLUSIONS AND RECOMMENDATIONS

Kris Hundertmark (ADFG) completed a 10-year review of the selective harvest strategy in 1999. The bull-to cow-ratio increased from a 5-year (1982–86) average of 13:100 to 22:100 in 1991, but declined to 16:100 in 1992 following the severe winter of 1991–92. In 1994–95 the ratio rebounded to 24:100 and remained relatively stable at 26:100 in the 1996 and 1997 fall composition surveys. In 1998 the ratio increased to 31:100.

With the increase in the number of bulls, the opportunity for viewing and photography has increased. Public perception of improved population health and the need for public support for continuation of the SF/50 program has also widened.

Composition surveys were conducted during November 2003. We counted a total of 510 cows, 118 bulls, and 132 calves (23 bulls:100 cows and 26 calves:100 cows). A more complete analysis of these data will be provided in the next management report because these counts occurred after this report period. Over the past 5 years, hunter effort has averaged 1242 hunters per season, ranging from 1161 to 1428. The interest in archery hunting has also remained high, with the archers taking 21% and 24% of the harvest in the past 2 years, respectively.

During the past 10 years, 5 severe winters have affected moose numbers in Subunit 15A. The number of available bulls following these winters declined, as did the harvest.

Unlike other game management units in Alaska, no emergency reduction in the 2001–02 or 2002–03 moose seasons or bag limit was necessary due to effects of the previous winters. The conservative nature of the SF/50 bag limit on the Kenai Peninsula allowed the department to continue to offer the same recreational opportunity as in previous years. No changes in management objectives or bag limits are recommended at this time. Currently, the largest impacts on the Kenai Peninsula moose population are declining habitat quality and deaths caused by collisions with motor vehicles.

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Table 1 Unit 15A aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Total moose observed	Estimated population size
1998–1999 [a]	29	9	27	17	1248	1508	3000–3800
1999–2000		No Surveys					
2000–2001 [b]				20	1617		1704–2431
2001–2002 [a]	21	6	31	20	620	778	1500–2500
2002–2003		No Surveys					1500–2500

[a] Summary of composition counts

[b] Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15A general season moose harvest and accidental death, 1998–2003

	Hunter Harvest										
Regulatory	Reported				Estimated			Accidental death			
year	M	F	Unk	Total	Unreported	Illegal	Total	Road	Train	Total	Grand total
1998–1999	267	0	4	271			40	138	0	138	449
1999–2000	87	0	4	91			40	81	0	81	212
2000–2001	130	0	1	131			40	59	0	59	230
2001–2002	227	0	1	228			40	100	0	100	368
2002–2003	139	1	1	141			40	73	0	73	254

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Unit 15A harvest data for drawing permit hunts, 1998–2003

Hunt No. /Area	Regulatory year	Permits issued	did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
DM524	1998–1999	40	10	69	31	0	11	0	11
Skilak	1999–2000	40	15	71	29	0	8	0	8
Loop	2000–2001	No	Season						
Antlerless	2001–2002		Season						
	2002–2003	No No	Season						
Skilak	1998–1999	No	Season						
Loop	1999–2000	20	16	100	0	0	0	0	0
Spike/	2000–2001	No	Season						
Fork	2001–2002	No	Season						
		No	Season						

Percent

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15A moose hunter residency and success for the general season, 1998–2003

2002–2003	Successful				Unsuccessful				
Regulatory year	Local resident[a]	Nonlocal resident	Nonresident	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Total	Total hunters
1998–1999	238	30	3	271(19)	997	143	17	1157	1428
1999–2000	78	9	4	91 (8)	935	150	18	1103	1194
2000–2001	103	23	5	131(11)	814	199	19	1032	1163
2001–2002	196	28	4	228(18)	848	163	25	1036	1264
2002–2003	119	19	3	141(12)	835	156	29	1020	1161

[a] Local = residents of Unit 15

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15A moose general season transport methods (% of harvest), 1998–2003

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1998–1999	3	0	7	9	0	3	72	6	271
1999–2000	8	1	16	12	0	5	55	2	91
2000–2001	4	2	11	12	0	3	66	2	131
2001–2002	3	1	7	11	0	3	72	3	228
2002–2003	4	1	6	9	0	1	74	5	141

All data has been updated from the ADF&G online database: WildlifeInfoNet.

Table 6 Unit 15A moose general season harvest chronology (% of harvest), 1998–2003

Regulatory year	Harvest periods[a]								
	8/10–8/17	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unk	*n*
1998–1999	17	23	8	8	8	15	14	6	271
1999–2000	16	16	5	10	11	15	20	5	91
2000–2001	11	24	7	8	8	13	28	2	131
2001–2002	21	21	8	4	10	17	16	4	228
2002–2003	24	23	9	4	4	14	18	4	141

[a] Archery season 10–17 Aug, general open season 20 Aug–20 Sep
All data has been updated from the ADF&G online database: WildlifeInfoNet.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15B (1121 mi^2)

GEOGRAPHIC DESCRIPTION: Kenai Peninsula

BACKGROUND

The moose population in Subunit 15B has been relatively stable for the past decade. Censuses conducted in 1990 and 2001 estimated the population at around 1000. Forests within 15B have succumbed to widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s. More than 500,000 hectares of spruce forests have been affected (www.borough.kenai.ak.us/sprucebeetle). Since 2001, infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2002). Salvage logging efforts are limited because most of the area in 15B is within the Kenai National Wildlife Refuge and has a "wilderness" designation, which limits all commercial activities.

About 10% of the Kenai Peninsula's moose harvest over the past 20 years has come from 15B. Most of the hunting within 15B is by drawing permit only (15B East) and is designated as a "trophy" area.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Central Kenai Peninsula

- Maintain a population of moose with a bull-to-cow ratio of 15:100
- Allow for maximum opportunity to participate in hunting in 15B West

In 15B East

- Maintain a population of moose with a bull-to-cow ratio of 40:100
- Provide for the opportunity to harvest a large-antlered bull under aesthetically pleasing conditions

METHODS

Composition surveys are flown in traditional count areas as funding allows. Harvest data is provided by hunter information taken from harvest tickets. All the harvest data is now kept at

ADF&G's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet; therefore, data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A February 2001 census of the 650.4 square miles of suitable moose habitat in Subunit 15B estimated the population at 958 moose (95% CI: 777–1139). This produced a density of about 1.5 moose/mi^2. Because the census was conducted during February after most bulls had shed their antlers, composition by sex was not determined. Calves composed 21% of the population, compared to 10% found in the February 1990 census (Table 1). No survey flights have been conducted since this 2001 census.

MORTALITY

Harvest

Season and Bag Limit.	Resident Open Season	Nonresident Open Season
Unit 15B that portion bounded by a line running from the mouth of Shantatalik Creek on Tustumena Lake, northward to the west fork of Funny River to the Kenai National Wildlife Refuge; then east along the refuge boundary to its junction with the Kenai River and Skilak Lake; then south along the western side of Skilak River, Skilak Glacier and Harding Icefield; then west along the Unit 15B boundary to the mouth of Shantatalik Creek. One bull with 50-inch antlers by drawing permit only; up to 100 permits will be issued.	1 Sep–20 Sep 26 Sep–15 Oct	1 Sep–Sep 20 26 Sep–15 Oct
Remainder of Unit 15B One bull with spike-fork or 50-inch antlers or antlers with 3 brow tines on at least 1 side, by bow and arrow only or 1 bull with spike-fork or 50-inch antlers or 3 brow tines or more on at least 1 side	10 Aug–17 Aug 20 Aug–20 Sep	

The 5-year average reported harvest for the general season in 15B was 48 moose (Table 2).

Board of Game Actions and Emergency Orders. There were no board actions for 15B moose during the reporting period

Permit Hunts. Subunit 15B East is managed as an area where hunters are able to view and harvest large-antlered bulls through a drawing permit system. A total of 2039 and 1839 applications were received during 2001 and 2002, respectively for all drawing hunts in 15B. Permittees reported harvesting 16 bulls in 2001 and 12 in 2002 (Table 3).

Hunter Residency and Success. Most 15B hunters during the general season were residents of Unit 15 (Table 4). The success rate averaged 16% over the past 5 seasons (Table 4).

Transport Methods. Highway vehicles encompass the majority of transportation methods used by successful hunters in 15B during the general season (Table 5).

Harvest Chronology. Moose were harvested throughout the season (Table 6). The chronology of the harvest is dependent on weather conditions and other factors unrelated to moose abundance.

Other Mortality

An average of 45 moose per year have been killed by motor vehicles in Unit 15B during the past 5 years (Table 2). The impact of predation on moose by wolves and bears is unknown. The level of mortality for moose during severe winters is likely high.

HABITAT

Assessment and Enhancement

No significant burns have occurred since 1890 when a wildfire burned most of the unit. The U.S. Fish and Wildlife Service enhanced approximately 3700 acres of predominantly winter habitat using a variety of mechanical tree removal techniques in 1968. Since 1968, five wildfires and one controlled burn have occurred, resulting in 11,500 acres burned, or 3% of the acreage below timberline. The advancement of blue-joint grass (*Calamagrostis canadensis*) after beetle infestations typically reduces the regeneration of hardwoods and spruce saplings. This process could slow forest succession and may negatively impact moose browse in the area.

CONCLUSIONS AND RECOMMENDATIONS

The permit hunts in 15B East continue to provide excellent opportunities to hunt and view large bulls and continue to be popular among residents. The only practical means of access into this area is by horse, and the cost of contracting with a local outfitter has increased beyond what most hunters are willing to pay.

Harvest levels are well within acceptable guidelines to maintain a minimum bull:cow ratio of 40:100. Summer and winter moose range on the Kenai National Wildlife Refuge in 15B continues to deteriorate due to wilderness lands management policies that favor advanced forest succession. ADF&G and the U.S. Fish and Wildlife Service should cooperate on selected habitat enhancement projects (mechanical manipulation and prescribed burns) to improve moose habitat in the unit.

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Table 1 Unit 15B aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Moose observed	Estimated population size
1998–1999	No Surveys						
1999–2000	No Surveys						
2000–2001[a]				21	766		777–1139
2001–2002	No Surveys						
2002–2003	No Surveys						

[a] Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15B general season moose harvest and accidental death, 1998–2003

	Hunter Harvest										
Regulatory	Reported				Estimated			Accidental death			
year	M	F	Unk	Total	Unreported	Illegal	Total	Road	Other	Total	Total
1998–1999	56	0	1	57		20		74	--	74	131
1999–2000	42	0	1	43		20		47	--	47	110
2000–2001	47	0	0	47		20		30	--	30	97
2001–2002	49	0	1	50		20		42	--	42	112
2002–2003	40	1	0	41		20		33	--	33	94

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 3 Unit 15B East harvest data for drawing permit hunts, 1998–03

Hunt Nr/ Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk.	Total harvest
Totals for	1998–1999	100	37	70	30	19(100)	0	0	19
all permit	1999–2000	100	35	74	26	17(100)	0	0	17
hunts	2000–2001	100	38	73	27	17(100)	0	0	17
DM530–539	2001–2002	100	35	75	25	16(100)	0	0	16
	2002–2003	100	40	80	20	12(100)	0	0	12

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15B West moose hunter residency and success for the general season, 1998–03

Regulatory year	Successful					Unsuccessful				
	Local resident[a]	Nonlocal resident	Nonresident	Total[b]	(%)	Local resident[a]	Nonlocal resident	Nonresident	Total[b]	Total hunters
1998–1999	55	2	0	57	(17)	236	35	2	273	330
1999–2000	42	1	0	43	(15)	197	32	6	235	278
2000–2001	41	4	1	47	(17)	198	28	2	229	276
2001–2002	49	1	0	50	(17)	223	26	3	252	302
2002–2003	38	1	2	41	(14)	221	19	5	245	286

[a] Local = residents of Unit 15

[b] Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15B West moose general season transport methods (% of harvest), 1998–03

Regulatory year	Percent of harvest								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1998–1999	0	5	5	9	0	5	65	11	57
1999–2000	0	9	5	7	0	7	67	5	43
2000–2001	2	6	9	4	0	0	74	4	47
2001–2002	0	4	2	18	0	2	66	8	50
2002–2003	0	15	0	7	0	2	66	10	41

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 15B moose general season harvest chronology (% of harvest), 1998–03

Regulatory	Harvest periods [a]								
Year	8/10–17	8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unknown	*n*
1998–1999		42	9	4	11	12	16	7	57
1999–2000	26	28	7	0	2	16	16	5	43
2000–2001	17	15	4	0	13	19	28	4	47
2001–2002	16	20	8	0	10	8	24	14	50
2002–2003	24	15	10	15	7	7	12	10	41

[a] Archery season 10–17 Aug (established in 1999), general open season 20 Aug–20 Sep
All data has been updated from the ADF&G online database: WildlifeInfoNet

Alaska Department of Fish and Game
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 15C (2441 mi^2)

GEOGRAPHIC DESCRIPTION: Southern Kenai Peninsula

BACKGROUND

The moose population in Subunit 15C has contributed on average more than 40% of the Kenai Peninsula's moose harvest during the past 20 years. Available habitat on the lower peninsula can be limiting in winters with heavy snow accumulations. Important winter habitat includes the Ninilchik River, Stariski Creek, Anchor River, Fritz Creek, lower reaches of Fox River and Sheep Creek, and the Homer Bench. Despite several winters of deep snow in the late 1990s, the estimated moose population size increased about 30% between surveys in 1993 and 2002. Community development continues to grow, increasing the interactions of human residents and moose.

Widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations commencing in the 1990s have impacted more than 500,000 hectares of spruce forests on the Kenai Peninsula (www.borough.kenai.ak.us/sprucebeetle). Since 2001, infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S.D.A. et al. 2002). Much of the affected forests has been, or is, scheduled for salvage logging. Spruce mortality and salvage logging efforts will affect the quality of moose habitat on a large scale, but the nature of the effect remains uncertain.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Maintain a healthy and productive population
- Maintain a minimum sex ratio range of 15-20 bulls:100 cows

METHODS

Composition surveys are flown in traditional count areas as funding allows. Censuses were done in 1993 and 2002. Harvest data come from hunter information taken from harvest tickets. All harvest data is now kept at the Department's Web-based database called WinfoNet. This report reflects updated data in all tables using data from WinfoNet; therefore data may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A random-stratified census (Gasaway 1986) was conducted in lowland portions of Subunit 15C (1190 mi^2) during the winter of 1992–93. The population was estimated at 2079 moose (95% CI: 1425–2734). During the winter of 2001–02, a geostatistical census (Ver Hoef 2001) conducted over the same area produced an estimate of 2981 moose (95% CI: 2508–3454). A comparison between surveys showed a population increase of about 30% (Table 1). Both censuses were conducted in late winter, precluding composition counts. There were likely additional moose in the mountainous portion of Subunit 15C, outside the census area, during both censuses.

Population Composition

The actual number of moose seen during composition counts is not comparable from year to year because survey intensity and conditions are inconsistent. Composition counts are performed in order to get an adequate sample of moose to calculate ratios of bulls to cows and calves to cows. Composition counts conducted in 2001 in 2 traditional count areas, one around the Caribou Hills and the other south of the Anchor River, showed healthy bull:cow and calf:cow ratios (Table 1).

MORTALITY

Harvest

Season and Bag Limit. The general season in Subunit 15C has been 20 August–20 September since 1993. Since 1987 the bag limit has been 1 bull with a spike or fork on at least 1 antler, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF/50).

The 5-year average reported harvest for 15C was 247 moose (Table 2).

Board of Game Action and Emergency Orders. The board has reauthorized the antlerless moose permits for the Homer area (DM549) each year since 1995. There were no other board actions for Subunit 15C during the reporting period.

Permit Hunts. Since 1987 there has been a Tier II subsistence hunt for one bull in a portion of Subunit 15C southwest of a line from Point Pogibshi to the point of land between Rocky and Windy Bay. No bulls have been taken during this season in the last 4 years (Table 3).

The antlerless hunt for moose near Homer was initiated in 1995 (DM549). No permits were issued in 2000 or 2001. In 2002, 50 permits issued resulted in a harvest of 24 cow moose (Table 3).

Hunter Residency and Success. The vast majority of hunters were residents of Unit 15 (Table 4). Success rate averaged 20% over the past 5 seasons (Table 4).

Harvest Chronology. The highest proportion of moose harvested throughout the season occurred during the first 6 days of the season (Table 5).

Transport Methods. Highway vehicles and 4-wheelers combined encompass the vast majority of transportation methods used by successful hunters (Table 6).

Other Mortality

Moose killed in Subunit 15C by motor vehicles averaged 72 annually over the last 5 years (Table 2). The high number of moose wintering within the Homer Bench continues to be habitat-limited during deep snow winters. The level of mortality for these moose during severe winters is probably high.

HABITAT

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Post-logging site preparation that encourages hardwood regeneration beneficial for moose habitat has been recommended to local foresters and has been conducted on some sites with apparent success. If site preparation is done properly, resulting in a healthy regeneration of hardwoods, habitat quality for moose will likely increase greatly. However, if site preparation is not conducted or done inadequately, blue-joint grass (*Calamagrostis canadensis*) will initially crowd out hardwood and spruce seedlings, creating less desirable moose habitat and slowing forest succession.

Enhancement

Mitigation funds stemming from the construction of the Bradley Lake Hydroelectric Project allowed for the creation of Kachemak Moose Habitat Inc., a group focused on improving and protecting moose habitat. Trustees for the group purchased 593 acres of land in the Fritz Creek drainage near Homer and continue to orchestrate land purchases and conservation easements to benefit moose habitat on the lower Kenai Peninsula.

CONCLUSIONS AND RECOMMENDATIONS

The bull:cow ratio was within the objective range of 15–20 bulls:100 cows. However, these ratios vary dramatically across count areas because of clustered distributions of postrut aggregations. Adequate bull:cow ratios are desired to minimize the length of the rut and ensure most cows conceive during their first estrous cycle (Schwartz et al. 1994). There are biological uncertainties regarding the movement of moose throughout the subunit. Movements to the Homer Bench appear to be dictated by snow depth, but it is not known what proportion of moose display this migratory behavior or the source locations for the migrants. Investigations into how movements on the lower peninsula contribute to the fitness of the migrants versus nonmigratory moose, a determination of animal locations across seasons, and other answers could contribute greatly to our knowledge of population dynamics of this population. These answers could help management actions for subpopulations of moose that are affected by severe winters and also clarify the bull:cow ratios in specific areas during the rut.

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Please cite any information taken from this section, and reference as:

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Table 1 Unit 15C fall aerial moose composition counts and estimated population size, 1998–2003

Regulatory year	Bulls: 100 Cows	Yearling bulls: 100 Cows	Calves: 100 Cows	Calves (%)	Adults	Total Moose observed	Estimated Population size
1998–1999 [a]				20	380	474	2300–3000
1999–2000 [b]	27	7	18	12	506	578	2500–3000
2000–2001 [a]				22	256	329	2500–3000
2001–2002 [c]	19	8	31	21	958	1207	2508–3454
2002–2003		No Surveys					2500–3500

[a] Summary of late winter composition counts; sex of adults could not be distinguished
[b] Summary of composition counts
[c] Estimates from geostatistical census method, estimated population size shown = 95% CI

Table 2 Unit 15C moose general season harvest and accidental death, 1998–2003

Regulatory	Hunter Harvest										
	Reported				Estimated			Accidental death			
year	M	F	Unk.	Total	Unreported	Illegal	Total	Road	Train	Total	Total
1998–1999	279	0	1	280				76	--	76	386
1999–2000	167	0	4	171				59	--	59	260
2000–2001	204	0	4	208				58	--	58	296
2001–2002	309	1	3	313				87	--	87	430
2002–2003	257	3	2	262				78	--	78	370

All data has been updated from the ADF&G online database: WildlifeInfoNet

30
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30

Table 3 Unit 15C moose harvest data by permit hunt, 1998–2003

Hunt Nr. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters	Bulls	Cows	Unk	Total harvest
TM549 [a]	1998–1999	4	0	50	2	0	0	2
Point	1999–2000	4	25	0	0	0	0	0
Pogibshi	2000–2001	4	0	0	0	0	0	0
		4	25	0	0	0	0	0
		4	25	0	0	0	0	0
DM549	1998–1999 [b]	20	24	21	0	11	0	11
		35	26	27	0	7	0	7
	2000–2001	0						0
2001–2002	2001–2002	0						0
2002–2003	2002–2003	50	18	58	0	24	0	24

[a] Tier II moose hunt for any bull

1999–2000 [b] Includes DM550-late season permits

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 4 Unit 15C moose hunter residency and success for the general season, 1998–2003

	Successful				Unsuccessful				
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total[b] (%)	Local[a] resident	Nonlocal resident	Nonresident	Total[b]	Total hunters
1998–1999	253	23	2	280 (21)	903	110	16	1032	1312
1999–2000	145	14	10	171 (15)	875	109	8	995	1166
2000–2001	178	25	5	208 (18)	836	107	24	976	1184
2001–2002	258	39	13	313 (25)	785	132	36	960	1273
2002–2003	226	28	7	262 (20)	873	127	39	1040	1302

[a] Local = residents of Unit 15

[b] Includes unspecified residency

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 5 Unit 15C moose general season harvest chronology (% of harvest), 1998–2003

Regulatory year	Harvest periods 8/20–25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unknown	*n*
1998–1999	32	10	12	13	11	17	5	280
1999–2000	28	11	11	18	12	16	5	171
2000–2001	28	13	18	12	10	16	4	208
2001–2002	27	12	13	16	12	15	5	313
2002–2003	38	10	8	9	12	16	6	262

All data has been updated from the ADF&G online database: WildlifeInfoNet

Table 6 Unit 15C moose general season transport methods (% of harvest), 1998–2003

Regulatory year	Percent of harvest Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	*n*
1998–1999	1	6	2	35	0	6	45	5	280
1999–2000	1	8	2	39	0	7	40	4	171
2000–2001	<1	13	4	45	0	7	26	4	208
2001–2002	2	9	3	43	0	5	33	4	313
2002–2003	0	6	4	42	0	6	39	3	262

All data has been updated from the ADF&G online database: WildlifeInfoNet

Alaska Department of Fish and Game
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 16A (1850 mi^2)

GEOGRAPHIC DESCRIPTION: West side of Susitna River (Kahiltna River to Chulitna River)

BACKGROUND

The moose population in Subunit 16A has been known to fluctuate greatly due to severe winters. Griese (1996) described significant winter die-offs of moose occurring at least once each decade beginning with the 1950s. The winter of 1989–90 caused 30–40% mortality from malnutrition, highway accidents, and predation facilitated by deep snows. Recovery from the resulting low density was slowed by subsequent deep-snow winters of 1990–91, 1992–93 and 1994–95 and by increasing predator populations.

Subunit 16A shares land within Denali National Park and Denali State Park. Access is limited to a few points from the Parks Highway, Petersville Road or Oilwell Road. Boats or 4-wheelers are then used to access more remote portions of the unit. Since Subunit 16A was separated from Subunit 16B in 1973, historical annual hunter harvest fluctuated as a result of variable moose densities, availability of cow moose hunts and improved hunter access (Griese 1996). Harvest numbers ranged from a high of 308 (1984) to a low of 37 (1990). The annual harvest has averaged 157 bulls in the past 5 seasons (1998–2002).

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as "spike-fork/50-inch" (SF50) (Schwartz et al. 1992).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.
- Provide maximum opportunity to participate in hunting moose.
- Enhance wildlife viewing opportunities within state and national parks.

MANAGEMENT OBJECTIVES

- Attain a population of 3500–4000 moose, with a sex ratio of 20–25 bulls:100 cows during the rut.
- Achieve an annual harvest of 190–360 moose.

METHODS

On 17–25 November 2000, we conducted a stratified-random-sample survey in Unit 16A (Becker and Reed 1990). We generated a population estimate and calculated age/sex statistics using MOOSEPOP (Becker and Reed 1990). We attempted to categorize antler size of bulls and identify brow-tine counts on bulls with 30-inch or larger antlers. The previous survey in this subunit was conducted in the fall of 1997.

The harvest was monitored with harvest reports. All harvest data were reviewed for accuracy and updated if necessary. Some figures may not match those previously reported. The Alaska Railroad Corporation provided numbers of moose killed by trains, and the Department of Public Safety provided numbers of moose killed by highway vehicles or in defense of life or property.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The population decreased about 33% between the fall surveys in 1997 (3636 ± 614: 80% CI) and 2000 (2420 ± 528: 80% CI) (Table 1). No surveys were attempted in 2002 because of poor weather and lack of snow. In 2003 management priority focused on GMU 16B, and a 16A survey was not attempted.

Population Composition

The composition assessed in 2000 included 28 bulls and 22 calves:100 cows, which is down from 33 bulls and 35 calves:100 cows found in 1997 (Table 1). We suspect the bull:cow ratios are probably lower due to the season extension but above the minimum objective of 20 per 100 cows.

MORTALITY

Harvest

<u>Season and Bag Limit</u>. The fall season was 10–17 August archery-only, 20 August–30 September general season for resident and nonresident hunters for both years. The bag limit was 1 bull with a spike or fork antler on at least 1 side, an antler spread at least 50 inches, or 3 or more brow tines on at least 1 side (SF/50).

The annual harvest has been relatively stable for the past 5 years, averaging 157 moose, below the harvest objective minimum (190–360) (Table 2). The lower harvest is likely due to lower moose densities and the elimination of the permit hunts (Table 3).

<u>Board of Game Actions and Emergency Orders</u>. In response to declining moose numbers and the public desire to eliminate permit hunts, the board eliminated the winter hunt (5–15 December) in

16A, and eliminated the any-bull permits (DM556). To replace some of the lost hunting opportunities, the general open season was extended 5 days to close 30 September. In addition, the 10–17 August archery-only hunt was created.

At the spring 2003 meeting, the board considered several proposals to change moose hunting and the SF/50 system; however, no changes were approved.

Hunter Residency and Success. The number of moose hunters in Subunit 16A averaged 900 during 2001–2003 (Table 3). The majority were not residents of Unit 16 (Table 3). Hunter success was 18% during 2001 and 16% during 2002. Both years were slightly higher than the 10-year average of 15%.

Harvest Chronology. No moose were taken in the archery-only season in either 2001 or 2002. Hunters generally waited until the end of the season to hunt in Subunit 16A, harvesting more than 50% of the general season moose during the last 10 days (Table 4).

Transport Methods. The elimination of the winter hunt in 2001–02 eliminated the use of snowmachines as a transportation method (Table 6). Four-wheelers and boats have accounted for a majority of the transportation type used by successful hunters in the past 10 seasons. In 1998 the department began tracking harvest by hunters from airboats. Since that time, up to 5 percent of the successful hunters have reported using airboats in 14B.

HABITAT

Enhancement

An 18,000-acre area east of the lower end of Kroto Creek (Deshka River) was prepared for a controlled burn in 1994 (W. Collins personal communication). The prescribed burn continues to be delayed because of concern for public criticism in the wake of the 1995 Miller's Reach/Big Lake wildfire and a lack of fire crew presence. It is unlikely this prescribed burn will take place.

Timber harvest has varied from year to year. Recently word of a new wood fiber market has stimulated interest from many in the industry. If this market should continue to develop, the potential for moose habitat improvement may increase.

The National Park Service has renewed interest in building a new access road and visitor center on the south side of Denali National Park. Construction of a visitor center and access road may have an impact on moose habitat and movement. More important, the associated infrastructure and industry development associated with this project may affect moose hunting and other consumptive uses in the area.

CONCLUSIONS AND RECOMMENDATIONS

The approximate 33% decline in the moose population between the 1997 and 2000 surveys is probably due to the winter conditions in 1999–2000 and an increase in wolf numbers (Masteller 2000). The harvest increased slightly in 2001 due to an extension of the general season, elimination of the any-bull permits, and/or a slight recovery in the moose population (Table 4). Hunter effort will probably continue to increase due to improved access within the unit. It is unlikely the moose population will reach the objective levels until the predator population decreases, habitat quality improves, and we have mild winters with moderate snow depths.

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Table 1 Unit 16A fall aerial moose composition counts and estimated subpopulation sizes, 1990–2003

Regulatory year	Bull: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults observed	Total moose observed	Moose /mi^2	Population estimate
1990–91 [a]	27	7	31	29	1105	1366	1.8	3123±289 [b]
1991–92 [c]	--	--	--	--	--	--	--	--
1992–93 [d]	36	11	32	19	779	963	1.7	2900 ± 564 [b]
1993–94 [d]	24	10	24	16	698	828	1.9	3284 ± 903 [b]
1994–95 [e]	36	11	33	19	804	981	--	3000–3,600
1995–96 [c]	--	--	--	--	--	--	--	--
1996–97 [c]	--	--	--	--	--	--	--	--
1997–98 [d]	33	12	35	21	974	1234	2.1	3636 ± 614 [b]
1998–99 [c]	--	--	--	--	--	--	--	--
1999–2000	--	--	--	--	--	--	--	--
2000–01 [d]	28	6	22	15	661	787	1.4	2420 ± 528
2001–02 [c]	--	--	--	--	--	--	--	--
2002–03 [c]	--	--	--	--	--	--	--	--
2003–04 [c]	--	--	--	--	--	--	--	--

[a] Gasaway et. al. (1986) survey methodology
[b] 80% C.I.
[c] No surveys conducted
[d] Becker and Reed (1990) survey methodology
[e] Sex and age composition surveys

Table 2 Unit 16A annual moose harvest and accidental death, 1990–2003[a]

Regulatory year	Reported				Estimated			Accidental[d]			Grand Total
	M	F	Unk	Total[a]	Unreported[b]	Illegal[c]	Total	Road	Other	Total	
1990–91	37	0	0	37	2	10	12	6	0	6	55
1991–92	135	0	3	138	7	15	22	15	0	15	175
1992–93	136	0	2	138	7	15	22	9	0	9	169
1993–94	96	0	2	98	10	20	30	9	0	9	137
1994–95	113	0	0	113	10	20	30	4	0	4	152
1995–96	133	0	0	133	8	25	33	15	0	15	181
1996–97	200	1	1	202	14	25	39	4	0	4	245
1997–98	197	0	1	198	14	25	39	14	0	14	251
1998–99	168	0	0	168	12	25	37	12	0	10	215
1999–2000	168	0	3	171	12	25	37	14	0	16	224
2000–01	139	0	1	140	10	25	35	20	0	20	195
2001–02	153	0	0	153	11	25	36	15	0	15	204
2002–03	153	0	1	154	11	25	36	12	0	12	202

[a] All information in this table has been updated since last management report.

[b] Derived by taking 5–10% of the reported kill 7% from 1996 to present

[c] Includes moose taken in defense of life or property

[d] Roadkill is minimum number and does not reflect moose hit and lost or unsalvageable.

Table 3 Unit 16A moose hunter residency and success, 1990–2003[a]

Regulatory year	Successful Local resident[b]	Successful Nonlocal resident	Successful Nonresident	Successful Unk	Successful Total	(%)	Unsuccessful Local resident[b]	Unsuccessful Nonlocal resident	Unsuccessful Nonresident	Unsuccessful Unk	Unsuccessful Total	Total hunters
1990–91	4	32	1	0	37	(7)	23	430	9	12	474	511
1991–92	9	123	4	2	138	(16)	29	673	12	8	722	860
1992–93	7	126	4	1	138	(16)	34	631	24	21	710	848
1993–94	5	62	1	2	70	(11)	39	497	6	10	552	622
1994–95	6	55	2	1	64	(11)	32	458	8	4	502	566
1995–96	6	65	6	1	78	(11)	61	521	16	5	603	681
1996–97	14	120	4	1	139	(19)	54	514	13	6	587	726
1997–98	16	114	11	0	141	(18)	54	545	25	3	627	768
1998–99	6	110	2	2	120	(15)	55	573	19	7	654	774
1999–2000	14	115	9	4	142	(17)	42	645	18	10	715	857
2000–01	3	107	6	3	119	(12)	55	773	22	5	855	974
2001–02	12	131	10	0	153	(18)	40	649	19	5	713	866
2002–03	7	133	14	0	154	(16)	42	728	29	1	800	954

[a] All information in this table has been updated since last management report.

[b] Unit 16 residents

Table 4 Unit 16A moose harvest chronology[a] by months of season, 1990–2003[b]

	August		September					November	December			
Year	20–26	27–31	1–7	8–14	15–20	21–25	26-30	20–30	1–7	8–15	Unknown	Total
1990–91 [c]	--	--	21	11	--	--	--	--	--	--	5	37
1991–92 [d]	--	--	72	53	7	--	--	--	--	--	6	138
1992–93 [d]	--	--	75	51	6	--	--	--	--	--	6	138
1993–94 [e]	13	4	8	19	24	--	--	--	--	--	2	70
1994–95 [e]	6	4	11	13	29	--	--	--	--	--	1	64
1995–96 [f]	8	1	11	12	34	--	--	5	1	4	2	78
1996–97 [f]	5	4	19	26	41	--	--	18	6	10	10	139
1997–98 [f]	20	7	11	29	36	--	--	17	4	8	9	141
1998–99 [f]	9	5	13	21	40	--	--	11	4	13	4	120
1999–00 [g]	11	7	15	21	38	32	--	--	2	16	4	142
2000–01 [g]	6	3	5	16	37	29	--	--	7	11	4	119
2001–02 [h]	8	3	7	10	34	37	52	--	--	--	2	153
2002–03 [h]	17	2	9	11	33	34	44				4	154

[a] Does not include harvest from drawing permit hunts
[b] All information in this table has been updated since last management report.
[c] Open season = 1–10 Sep
[d] Open season = 1–15 Sep
[e] Open season = 20 Aug–20 Sep (SF-50)
[f] Open season = 20 Aug–20 Sep 20 (SF-50), 20 Nov–15 Dec (SF-only)
[g] Open season = 20 Aug–25 Sep (SF-50), 1–15 Dec (SF-only)
[h] Open season = 10–17 Aug (Archery-only), 20 Aug–30 Sep (SF-50). No moose harvested in 2001 or 2002

Table 5 Transport method used by successful moose hunters[a] in Unit 16A, 1990–2003[b]

Regulatory year	Percent of successful moose hunters									No. moose harvested
	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unk	Airboat	
1990–91	22	3	24	14	0	24	14	0		37
1991–92	15	0	25	30	0	11	17	1		138
1992–93	16	0	21	28	0	14	18	3		138
1993–94	13	0	23	34	0	11	19	0		70
1994–95	22	0	17	34	0	8	17	2		64
1995–96	12	0	19	19	3	15	31	1		78
1996–97	9	0	19	30	17	6	15	3		139
1997–98	9	0	15	34	16	6	15	4		141
1998–99	10	1	19	22	16	7	23	2	2	120
1999–00	7	1	25	39	6	3	17	2	1	142
2000–01	10	0	15	40	5	13	12	0	5	119
2001–02	10	0	25	38	0	8	16	1	3	153
2002–03	10	0	23	33	0	11	16	2	5	154

[a] Does not include harvest from drawing permit hunts.

[b] All information in this table has been updated since last management report.

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MOOSE MANAGEMENT REPORT

From: 1 July 1991
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 16B (10,405 mi^2)

GEOGRAPHIC DESCRIPTION: West Side of Cook Inlet and Kalgin Island

BACKGROUND

Moose numbers probably exceeded 10,000 in Subunit 16B during the early 1980s (Griese 1996). Harkness (1993) speculated the population before the severe winter of 1989–90 was probably 8500–9500 moose. Following a 15–20% decline after the winter of 1989–90, moose numbers in the unit continued to decline in response to continued deep snow winters and growing predator influence (Griese 2000). Faro (1989) implied that predation on neonatal moose calves by bears influenced recruitment and caused the current declining trend. ADF&G biologist Thomas McDonough (unpublished data) estimated 150–200 wolves in the unit during the winter of 2001–02, up from the 120–140 wolves estimated in the fall 1998 (Masteller 2000).

Since 1972, when 16B was separated from 16A, hunter harvest of moose has declined from a high of 842 in 1973 to a low of 99 moose during a short 1990 season. Harvest in the 1990s averaged 249 moose per year. From 1962 to 1974, hunting seasons in 16B were liberal (20 Aug–30 Sep and 1–30 Nov season for either-sex moose). Through 1989, except 1975, an antlerless moose hunt was held during September. Increasing numbers of hunters and lower moose recruitment caused late season hunts to be converted to permit hunts beginning in 1983. Tier II permits were issued starting in 1990 to assure local residents an opportunity to meet subsistence needs.

Starting in 1993, the bull harvest during the general season was restricted to moose with antlers having a spike or fork on at least 1 side or a minimum of 3 brow tines on at least 1 side or a minimum width of 50 inches. This selective harvest strategy is referred to as “spike-fork-50-inch” (SF/50) (Schwartz et al 1992).

The Kalgin Island moose population resulted from translocation of calves during 1957–59. Numbers grew to a density of 7 moose/mi^2 during 1981 (Taylor 1983), but was reduced to approximately 1 moose/mi^2 by 1985. High moose densities severely degraded habitat, and the department adopted restrictive population objectives to maintain moose densities at less than 1 moose/mi^2 while vegetation recovered (Faro 1990). In 1999 the Board of Game adopted an any-

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

moose registration hunt 20 August–30 September. The board later shortened the season to 20 September to relieve conflicts between hunters and other occupants of the island.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain and enhance the moose population to provide for high levels of human consumptive use.

MANAGEMENT OBJECTIVES

Unit 16B (*excluding Kalgin Island*)

- Maintain a moose population of 6500–7500 moose and 20–25 bulls:100 cows.
- Achieve a harvest of 310–600 moose

Kalgin Island

- Maintain a posthunt population of 20–40 moose with at least 15 bulls:100 cows

METHODS

Because of its size, we divide 16B into 3 zones (north, middle, and south) for survey purposes. The northern area is described as 16B north of the Skwentna River. The middle area is that area north of the Beluga River and Beluga Lake and south of Skwentna River. The southern portion is all of 16B south of Beluga River and Beluga Lake except Kalgin Island. We have conducted various surveys (Gassaway et. al. 1986, Becker and Reed 1990) of each of these units as funding and priority allows (Table 1).

For this reporting period, surveys were conducted on Kalgin Island in October 2001 and most of the mainland, but canceled in 2002 because of poor survey conditions.

We collected harvest and hunter effort data from registration (Kalgin), general harvest and Tier II permit reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size

We last estimated the 16B North population at 1187 ± 182 (80% C.I.) in fall 2001 (Table 1). The 16B Middle population was 1836 ± 267 (80% C.I.) in fall 2001 (Table 1). A recent census of Unit 16B South has not been completed; however, an estimate was attempted in 2001 when most of the area was surveyed. That estimate was 718 moose. The Unit 16B fall population in 2001 was likely 3700–4000 moose. The latest survey on Kalgin Island conducted after the hunt in 2003 showed at least 125 moose.

Population Composition

The 16B North composition assessed in 2001 was 40 bulls and 14 calves:100 cows (Table 1). The 16B Middle composition assessed in 2001 included 32 bulls and 10 calves:100 cows (Table

1). The 16B South composition was 31 bulls and 13 calves:100 cows in 2001 (Table 1). Kalgin Island in 2001 had 60 bulls and 80 calves:100 cows.

MORTALITY

Harvest

Season and Bag Limit.
The general season was closed in both 2001 and 2002. Four hundred Tier II permits were issued for 20 August–30 September (SF/50) and 15 November–28 February (any bull) periods. These Tier II hunts are divided into 3 units (TM565, TM567, TM569). The registration hunt for any moose on Kalgin Island shortened to 20 August–20 September in 2001 and 2002.

The harvest decreased dramatically in 2001 due to the closure of the general season (Table 2). The Tier II harvest increased due to the greater allotment of permits issued in 2001 and 2002 (Table 3). The harvest on Kalgin Island decreased when the season was shortened in 2001 (Table 3).

Board of Game Actions and Emergency Orders. At the March 2001 meeting, the board eliminated the general season in 16B because of the continuing decline in moose numbers unitwide. Responding to local advisory committee recommendations, the board increased the population objective to 6500–7500 from 5500–6500. The board also shortened the hunt on Kalgin Island by 10 days to relieve conflicts between hunters and other occupants of the island. The board revisited the moose season in March of 2003. At that meeting it returned to a 20-day Tier I (resident-only) season after ruling that enough moose were available for harvest in the unit.

Hunter Residency and Success. The general season was closed during this reporting period (Table 4).

Harvest Chronology. The general season was closed during this reporting period (Table 5).

Transport Methods. The lack of road accessibility to the unit is reflected by the dominance of aircraft and boat transportation used by successful hunters. The general season was closed during this reporting period (Table 6).

Other Mortality

The severe winter of 1999–2000 negatively impacted the moose population. In midwinter we observed moose floundering in snow depths exceeding 5 feet (Griese 2000). As the winter progressed, rain fell giving the surface an ice crust that facilitated easy wolf travel and complicated moose movement. Recent survey results reflect a continued population decline. The effects of predation by wolves and bears are suspected on mainland 16B as assessed from low calf recruitment in the fall. A wolf survey conducted in January and February 2002 estimated the minimum number of wolves in Unit 16B at 150–200, up dramatically from the 120–140 wolves estimated in the fall 1998 (Masteller 2000).

Due to the continued decline in moose numbers throughout 16B, ADF&G staff drafted a proposal to close the federal subsistence hunt for cow moose. The Federal Subsistence Board approved this proposal in May of 2004.

CONCLUSIONS AND RECOMMENDATIONS

The moose population in Unit 16B was below objective levels for this reporting period. Our estimate of 3700–4000 moose is below the minimum objective of 6500 and below what we believe the habitat could support. Current season and bag limit structure will allow bull:cow ratios to remain above minimum objective levels. If the moose density remains low, we should be cautious to maintain bull:cow ratios at or above the upper end of our objective of 25 bulls:100 cows.

Additional information is needed to better manage moose in 16B. Future efforts should be directed at gaining accurate and precise estimates of wolf and bear populations. A long-term monitoring program of the unit's moose browse will provide needed empirical data to further clarify whether predators or habitat is more limiting in this declining moose population. Prescribed burns should be considered for habitat enhancement, since much of the unit contains mature stands of birch, aspen and spruce forest.

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Table 1 Unit 16B fall aerial moose composition counts and estimated subpopulation sizes, 1990–2003

Reg. year	Area	Date	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults	Total moose observed	Moose observed: mi^2	Population estimate
1990–91	Northern[a]	11/21–27	32	9	23	15	650	745	1.4	2650±412 [b]
	[a]	12/08–21	34	5	25	16	673	789	1.4	3824±314 [b]
1991–92 [c]			--	--	--	--	--	--	--	--
1992–93	Southern[d]	12/15	36	5	12	12	109	124	--	--
1993–94 Middle	Northern [e]	11/15–20	50	10	16	10	374	416	1.1	2006±432 [b]
	[e]	11/28–12/3	21	9	25	17	391	463	1.4	3653±1965 [b]
1994–95	Northern [f]	11/13–18	42	10	12	7	405	431	1.0	--
	[f]		26	4	24	16	314	374	--	--
	[g]	11/29–12/2	25	5	25	17	220	261	1.0	810–1210
Middle	Kalgin Is.[h]	11/18–25 11/18	35	15	65	33	27	40	1.7	55–75
1995–96 Middle	Northern [d]	2/27–28	--	--	--	7	298	321	--	--
Southern	Middle [d]		--	--	--	12	855	969	--	--
	[d]	2/29–3/3 2/27–28	--	--	--	6	505	537	0.8	1081±145 [b]
	Kalgin Is. [f]	2/09	--	--	--	28	26	36	1.5	60–90
1996–97	Northern[a]	11/1–2	38	7	23	14	422	484	1.2	1912±325
	Southern[d]		32	7	14	10	305	338	--	--
Southern	Kalgin Is.[f]	11/8–9 11/8	67	27	60	26	25	35	1.5	80–110
1997–98	Southern[d]	11/25, 12/3	37	8	13	9	544	591	--	--
	Kalgin Is.[f]		--	--	--	23	17	22	0.9	100–130
1998–99	Southern [d]	2/27 11/22	35	7	8	6	337	357	--	--
	Kalgin Is.[h]		27	9	36	29	82	116	5.0	130–150
1999–00	Middle [a]	12/7 11/22–27	28	2	9	7	587	631	1.3	3314±489 [b]
	[d]	11/15–22	38	4	8	6	432	458	--	--
	Kalgin Is.[h]	01/5	--	--	--	24	38	50	2.2	60–80

Southern

Table 1 Continued

Reg. year	Area	Date	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Percent calves	Adults	Total moose observed	Moose observed /mi^2	Population estimate
2000–01	Northern [e]	11/20–22	39	5	7	5	253	268	0.6	909±184
	Southern [d]		--	--	--	--	85	98	--	--
	Kalgin Is.[h]	12/16	--	--	--	30	35	50	2.2	80–100
2001–02	Northern [e]	12/12 11/5–7	40	7	14	9	393	438	0.8	1187±182
	Middle [e]		32	4	10	7	494	537	0.7	1836±267
	Southern [d]	10/30–11/4	31	3	13	9	539	594	--	700–850
	Kalgin Is.[h]	11/8–11	--	--	--	33	64	96	4.2	110–140
2002–03[c]		10/22								
2003–04	Northern [e]	11/24-12/6	35	7	17	9		326		898±163
	Middle [c]									
	Southern [d]		46	17	23	14		154		
	Kalgin Is.[h]	12/1	38	--	89	39	76	125	5.7	125+

[a] Gasaway et. al. (1986) random stratified survey
[b] 80% confidence intervals
[c] No survey this year
[d] Trend area composition survey (2–4 min./mi^2)
[e] Becker survey (Becker and Reed 1990)
[f] Sex and age composition survey (4–6 min./mi^2)
[g] J. VerHoef's regression sampling method for 1/3 of area (612 ± 151 (80% CI)) plus 350–550 estimated for remainder of area
[h] Sex and age composition survey (6–8 min./mi^2)

Table 2 Unit 16B annual moose harvest and accidental death, 1990–2003[a]

Regulatory	Reported[b]				Estimated			Accidental			Grand
year	M	F	Unk	Total	Unreported	Illegal[c]	Total	Road	Other	Total	Total
1990–91	93	5	1	99	10	25	35	2	0	2	136
1991–92	256	0	0	256	15	25	40	1	0	1	303
1992–93	233	2	3	238	15	25	40	0	0	0	278
1993–94	154	21	0	175	10	35	45	0	0	0	221
1994–95	230	0	0	230	15	35	50	2	3	5	285
1995–96	186	10	3	199	10	25	35	0	0	0	235
1996–97	293	9	3	305	20	25	45	1	0	1	351
1997–98	315	15	1	331	20	25	45	1	0	1	374
1998–99	289	7	1	297	20	30	50	0	0	0	346
1999–00	297	50	4	351	20	25	45	0	0	0	396
2000–01	264	42	0	306	20	25	45	0	0	0	351
2001–02	131	22	1	154	20	25	45	0	0	0	199
2002–03	88	16	1	105	20	25	45	0	0	0	150

[a] All information in this table has been updated since last management report.
[b] Includes all reported harvest including federal subsistence.
[a] Includes moose taken in defense of life or property

Table 3 Unit 16B moose harvest data by permit hunt, 1993–2003

Hunt Number [a]	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unk	Total
TM565	1993–94	30	13	10	73	7	15	0	22
	1994–95	138	32	23	40	55	0	0	55
	1995–96	140	40	46	10	14	0	0	14
	1996–97	141	26	38	35	49	0	0	49
	1997–98	139	30	32	37	50	1	0	51
	1998–99	140	21	39	37	52	0	0	52
	1999–00	140	22	31	41	57	0	0	57
	2000–01	140	16	54	31	43	0	0	43
	2001–02	140	29	41	30	42	0	0	42
		141	24	52	24	33	0	0	33
TM567	1993–94	15	33	0	67	4	6	0	10
	1994–95	59	19	14	66	39	0	0	39
	1995–96	60	30	58	7	4	0	0	4
	1996–97	60	18	30	49	30	0	0	30
2002–03	1997–98	59	12	38	48	29	0	0	29
	1998–99	60	17	37	42	25	0	0	25
	1999–00	60	13	18	58	34	0	0	34
	2000–01	60	25	37	38	23	0	0	23
	2001–02	160	31	41	28	45	0	1	46
	2002–03	160	36	56	8	13	0	0	13

Table 3 Continued

Hunt Number [a]	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unk	Total
TM569	1993–94	60	45	35	20	12	0	0	12
	1994–95	58	43	29	17	10	0	0	10
	1995–96	60	32	47	18	8	1	2	11
	1996–97	60	45	25	28	16	0	1	17
	1997–98	59	53	24	17	9	1	0	10
	1998–99	60	30	42	25	15	0	0	15
	1999–00	60	35	37	20	12	0	0	12
	2000–01	60	50	42	8	5	0	0	5
	2001–02	100	42	27	31	32	0	0	32
		100	24	54	22	21	0	0	21
DM571/	1995–96	50			20	0	9	1	10
RM572	1996–97	60			20	2	8	0	10
	1997–98	60			20	1	11	0	12
2002–03	1998–99	40			18	0	7	0	7
	1999–00	437	37	42	18	30	50		
	2000–01	355	32	50	18	22	42		
	2001–02	142	30	48	22	10	21		
	2002–03								

[a]TM = Tier II permit, RM = registration permit, DM= drawing permit

80
64
31

Table 4 Unit 16B moose hunter[a] residency and success 1990–2003[b]

Regulator year	Successful: Local[c] resident	Nonloca resident	Nonres.	Unk	Total	(%)	Unsuccessful: Local[c] resident	Nonloca resident	Nonres.	Unk	Total	(%)[b]	Total hunters
1990–91	3	64	2	0	69	(16)	24	327	1	0	352	(840	419
1991–92	13	153	35	3	204	(26)	24	514	41	7	586	(74)	780
1992–93	14	135	38	5	192	(25)	26	480	54	11	571	(75)	763
1993–94	15	79	36	1	131	(23)	28	362	40	9	439	(77)	570
1994–95	5	83	38	1	126	(23)	23	353	35	2	413	(77)	539
1995–96	5	114	38	3	160	(25)	33	407	44	5	489	(75)	649
1996–97	12	145	39	3	199	(30)	24	412	31	0	467	(70)	666
1997–98	14	163	48	4	229	(32)	25	416	36	2	479	(68)	708
1998–99	7	153	37	1	198	(25)	25	497	53	4	579	(75)	777
1999–00	7	115	40	6	168	(22)	27	489	62	18	596	(78)	764
2000–01	10	129	30	2	171	(22)	20	534	60	4	618	(78)	789
2001–02[d]	--	--	--		--	--	--	--	--	--	--	--	--
2002–03[d]	--	--	--		--	--	--	--	--	--	--	--	--

[a] Does not include individuals participating in permit hunts

[b] All information in this table has been updated since last management report.

[c] Unit 16 residents

[d] No general open season

Table 5 Unit 16B moose harvest chronology[a] by months of season, 1990–2003[b]

Year	August		September					January	Unknown	Total
	20–26	27–31	1–7	8–14	15–20	21–25	26–30	10–23		
1990–91 [c]	--	--	47	10	--	--	--	--	12	69
1991–92 [d]	--	--	62	57	77	--	--	--	8	204
1992–93 [d]	--	--	52	71	60	--	--	--	9	192
1993–94 [e]	11	5	12	30	57	--	--	9	7	131
1994–95 [f]	16	11	17	41	37	--	--	--	4	126
1995–96 [g]	15	5	15	28	38	23	33	--	3	160
1996–97 [g]	9	16	18	30	45	28	48	--	5	199
1997–98 [g]	11	12	22	27	63	35	49	--	9	229
1998–99 [g]	14	8	18	30	33	38	50	--	7	198
1999–00 [h]	5	1	10	28	35	37	45	--	7	168
2000–01 [h]	3	5	14	19	55	34	37	--	4	171
2001–02 [i]	--	--	--	--	--	--	--	--	--	--
2002–03 [i]	--	--	--	--	--	--	--	--	--	--

[a] Does not include harvest from permit hunts
[b] All information in this table has been updated since last management report.
[c] Open season = 1–10 Sep
[d] Open season = 1–20 Sep
[e] Open season = 20 Aug–20 Sep (SF/50), 10–23 Jan (SF/50 – Res. only)
[f] Open season = 20 Aug–20 Sep (SF/50)
[g] Open season = 20 Aug–30 Sep (SF/50); Kalgin Island = 20 Aug–20 Sep (Any bull)
[h] Open season = 20 Aug–30 Sep (SF/50)
[i] No general open season

Table 6 Transport method used by successful moose hunters[a] in Unit 16B, 1990–2003[b]

Regulatory year	Percent of successful moose hunters									No. moose harvested
	Airplane	Horse	Boat	3-or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Airboat	Unk	
1990–91	65	0	19	1	3	3	4		4	69
1991–92	68	1	22	4	0	1	2		2	204
1992–93	64	3	19	4	0	3	2		5	192
1993–94	56	11	21	1	6	1	0		4	131
1994–95	60	11	17	3	1	1	1		6	126
1995–96	67	9	19	3	0	1	0		1	160
1996–97	61	9	18	6	1	3	1		3	199
1997–98	62	6	19	4	0	2	3		3	229
1998–99	56	7	23	8	0	2	1	2	2	198
1999–00	60	5	19	10	0	2	2	0	2	168
2000–01	65	3	20	7	0	1	2	1	2	171
2001–02 [c]	--	--	--	--	--	--	--	--	--	--
2002–03 [c]	--	--	--	--	--	--	--	--	--	--

[a] Does not include harvest from permit hunts

[b] All information in this table has been updated since last management report.

[c] No general open season

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 17 (18,800 mi^2)

GEOGRAPHIC DESCRIPTION: Northern Bristol Bay

BACKGROUND

Moose are relatively new inhabitants in the Bristol Bay area, possibly migrating into the area from middle Kuskokwim River drainages during the last century. Until recently, populations were low, and moose primarily inhabited the Nushagak/Mulchatna River system. Local residents harvested moose opportunistically; however, caribou, reindeer, bears, and beaver were historically the main sources of game meat. The department began collecting data on the Unit 17 moose population in 1971. At that time, Faro (1973) reported that moose were not abundant in the unit and that animals close to the villages were subject to heavy hunting pressure.

Hunting seasons have varied over the years, but the bag limit has always been restricted to bulls. In the past, a general disregard for seasons and bag limits by unit residents was suspected to be the principal factor contributing to low densities of moose in the unit (Taylor 1990).

In the last 2 decades moose populations throughout Unit 17 have increased substantially in number and range. Reasons for this increase include moderate snowfalls in several successive winters and decreased human harvest of female moose. The reduction in the female harvest was caused in part by a positive response by unit residents to department education efforts and an abundance of an alternative big game resource as the Mulchatna caribou herd grew and extended its range (Van Daele 1995).

Moose are now common along the Nushagak/Mulchatna Rivers and all of their major tributaries. They are also throughout the Wood/Tikchik Lakes area. Moose have successfully extended their range westward into the Togiak and Kulukak River drainages of Subunit 17A, where a viable population has become established.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

SUBUNIT 17A

Manage for a minimum population of 300 moose and a target population of 1100–1750 moose.

SUBUNIT 17B

Manage for a population of 4900–6000 moose with a human use objective of 200–400 moose. Achieve and maintain a density of 1 moose/mi^2 on habitat considered good moose range.

SUBUNIT 17C

Manage for a population of 2800–3500 moose with a human use objective of 165–350 moose. Maintain a minimum density of 0.5 moose/mi^2

METHODS

Moose populations in Subunit 17A were monitored in cooperation with personnel from the Togiak National Wildlife Refuge (TNWR). Movements along the border of Subunits 17A and 17C were monitored during a radiotelemetry study from 1989 to 1994. In March 1998, 36 moose were radiocollared in 17A to study movements and population parameters (Aderman, et. al. 1999). Additional moose have been radiocollared in 17A each year since. Late-winter aerial surveys of 17A were conducted during this reporting period.

Aerial surveys of trend count areas in Subunits 17B and 17C have been used in the past to sample sex and age composition and to collect data on population trends in representative portions of the unit. Optimal survey periods were 1 Nov–15 Dec when moose were established on their winter ranges and bulls still had their antlers. In most years, however, suitable weather, snow cover, and survey aircraft were not available during the optimal period. Late-fall composition surveys in the upper Nushagak and Mulchatna River drainages were initiated in 1992–93 to investigate population trends, but have not been conducted since 1998.

Moose population estimation surveys have been attempted 6 times in portions of Subunits 17B and 17C. A portion of 17C was surveyed in 1983. In 1987 a portion of the upper Mulchatna River area in 17B was surveyed, and in 1995 western 17C, along with most of 17A, were surveyed. In March 1999 a population estimation survey for 17C was completed using a spatial statistics stratification model. In March 2001 a population estimation survey for the western portion of 17B (upper Nushagak River drainage) was completed using a spatial statistics stratification model. In March 2002 a population estimation survey for the eastern porting of Unit 17B (Mulchatna drainage) was completed using a spatial statistics stratification model.

We collected harvest data by means of harvest ticket reports and registration permit reports. Nonreporting hunters were contacted by telephone and were sent reminder letters. We monitored harvest and cooperated with enforcement efforts of Alaska Bureau of Wildlife Enforcement during the hunting season.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

POPULATION SIZE

Aderman et. al. (1995) estimated there were approximately 100 moose in Subunit 17A and the portion of 17C surveyed in 1995. In March 2000 and 2001, department staff and TNWR staff surveyed 17A, east of and including the Matogak River drainage and north of the Nushagak Peninsula, counting 422 moose in 2000 and 471 in 2001. A survey conducted in February 2002 indicated a minimum population of 652 moose in 17A (Aderman and Woolington 2003). The present population size in 17A probably exceeds 700 moose. We have seen a continued increase in the number of moose in the unit since the early surveys.

The moose population in Subunit 17B was estimated to be 2500–3000 moose in 1987 (Taylor 1990). That estimate was based on extrapolations from a survey in the upper Mulchatna River area. Assuming that 50% of the unit is good moose habitat, we established the management goal for the unit at 4900 moose. Survey data for this unit were inconsistent and difficult to interpret. Taylor (1988) noted that trend count data were of limited use in estimating moose density in Unit 17, and periodic population estimation surveys were the only objective method of assessing trends. Lacking such information, we conducted late winter surveys of major drainages to investigate population trends between 1992 and 1997. From the available data, it appeared the moose population size in the unit was stable to increasing. In March 2001, I conducted a moose population estimation survey in the western portion of 17B, including the upper Nushagak River drainage and drainages of Lake Kulik and Lake Beverley. Ninety-five of 441 sample units were surveyed, yielding an extrapolated estimate of 1202 (± 141 at 90% CI) moose, including 61 (± 9 at 90% CI) calves (5.1% of moose). In March 2002, I conducted a moose population estimation survey in the eastern portion of 17B (Mulchatna River drainage). One hundred of 646 sample units were surveyed, yielding an extrapolated estimate of 1953 (± 254 at 90% CI), including 76 (± 12 at 90% CI) calves (3.9% of total moose). These estimates indicate the 17B moose population is less than the population management objective.

The moose population in 17C was estimated to be 1400–1700 moose in 1987 (Taylor 1990). That estimate was based on extrapolations from the moose survey conducted in 1983. The management objective for the unit is a minimum of 2800 moose. In March 1999, I conducted a moose population estimation survey for 17C north of the Igushik River. One hundred and three (103) of 774 sample units were surveyed, yielding an extrapolated estimate of 2955 (± 488 at 90% CI) moose, including 435 (± 76 at 90% CI) calves (14.7% of moose). This estimate indicates the 17C moose population was within the population management objective range.

POPULATION COMPOSITION

Bull:cow ratios in all areas of Unit 17 have historically been high, but no composition data were collected during this reporting period. Calf production and survival have fluctuated between areas and years. In 1997–98, late winter survey data indicated minimum calf percentages of 19.4% in the Mulchatna drainages and 24.9% in the upper Nushagak drainages. The 1999 survey indicated a minimum calf percentage of 14.7% in Unit 17C. The 2001 survey indicated a minimum calf percentage of 5.1% in western Unit 17B, and the 2002 survey indicated a minimum calf percentage of 3.9% in eastern Unit 17B.

DISTRIBUTION AND MOVEMENTS

Much of Unit 17 is wet or alpine tundra, and moose are located predominantly along the riparian areas. We know little about specific movement patterns, except that they are influenced primarily by the rutting season in late September and by snow conditions throughout the winter.

Data from a joint ADF&G–TNWR radiotelemetry study indicated most moose radiocollared in western 17C stayed in that area, but there was some movement into 17A. One radiocollared moose and her calf moved from Weary River to Kulukak River (Jemison 1994). During the February 1995 population estimation survey, 29 moose moved into 17A from the upper Sunshine Valley in 17C (Aderman et al. 1995). Aderman et al. (2000) found that in 17A, some radiocollared moose remained in the same range during winter and summer, while others used different ranges during those seasons. Since then, moose radiocollared in 17A have moved into western 17A and the southern part of Unit 18. These moose seem to be part of a continued westward expansion of moose into previously unpopulated moose habitat.

MORTALITY

HARVEST

Season and Bag Limit. Subunit 17A was open to resident/subsistence hunters only by registration permit 25 Aug–20 Sep (RM573). Registration permit holders could take one bull.

The general moose hunt in Subunits 17B and 17C was open for resident hunters 1–15 September. The bag limit for residents was 1 bull with spike/fork or 50” antlers or with 3 or more brow tines on at least 1 side. The general moose hunt in 17B for nonresident hunters was open 5–15 September. The bag limit for nonresident hunters was 1 bull with 50" or greater antler spread or with 4 or more brow tines on at least 1 side. Nonresidents were prohibited from hunting in 17C.

The fall resident-only registration hunt in 17B and 17C (RM583) was open 20 August–15 September. Registration permit holders could take one bull.

The winter resident-only registration hunt in 17B and 17C (RM585) was open 1–31 December. Registration permit holders could take one bull. Areas that remained closed during this winter hunt were the Mulchatna River drainage upstream and including the Chilchitna River (in 17B), and the Iowithla River drainage, Sunshine Valley, and all portions of the unit west of the Wood River and south of Aleknagik Lake (in 17C).

Registration hunt RM 573 permits were valid only in 17A, and were available to any Alaska resident who applied in person at Togiak (5 Aug–25 Sep). Registration hunt RM583 and RM585 permits were valid for both 17B and 17C. Permits were available to any Alaska resident who applied in person at Dillingham (RM583: 15 Jul–31 Aug, RM585: 25 Oct–31 Dec).

Board of Game Actions and Emergency Orders. Responding to an agenda change request and proposal submitted by the Bristol Bay Native Association, in October 2002 the Board of Game established a 2-week registration moose hunt for residents only in 17A, which may be announced between 1 December and 31 January. This season was not announced for winter 2002–2003 because of insufficient snow cover to allow travel.

Hunter Harvest. Because of an almost 4-fold increase in hunters afield since 1983 (1983/84–293; 2001/02–1175), reported moose harvests in Unit 17 have more than tripled (1983/84–127; 1999/2000–425). The reported harvest in the past 5 years in 17B has ranged from 168 to 226, with an annual average harvest of 185 moose. In Unit 17C the 5-year mean annual harvest was 188, with a range of 136 to 226 moose (Table 1).

Hunters continued to harvest moose with large antlers throughout this reporting period. During each of the last 7 seasons, more than 46% of the reported harvest has consisted of moose with antler spreads of 50" or greater. The largest antlers reported for each of these seasons have exceeded 69" (Table 2).

General Hunt. The general moose hunt in 17B and 17C is of shorter duration and with more restrictive bag limits than the registration hunts. Greater numbers of nonlocal Alaska residents and nonresidents hunt moose during this hunt than local (Unit 17) Alaska residents (Table 3). Subunit 17A has not had an open general moose hunting season since 1980–81. The reported harvest in the past 5 years for the general moose season in 17B has ranged from 96 to 165, with a mean annual harvest of 133 moose (Table 4). In 17C, the 5-year mean annual harvest for the general hunt has been 23 moose, with a range of 19 to 28 (Table 5).

Permit Hunts. Longer seasons and more liberal bag limits have enticed many resident hunters to participate in the registration hunts (RM573, RM583, and RM585). In fall 2001, 870 permits were issued for Unit 17 registration moose hunts, and 707 hunters reported they hunted, killing 250 moose. In fall 2002, 834 permits were issued for Unit 17 registration moose hunts, and 676 hunters reported hunting, killing 284 moose. Each year approximately 20% of those receiving registration moose hunting permits for Unit 17 reported that they did not hunt (Tables 6, 7, 8, 9).

During the 2001 hunting season in 17A, 47 hunters reported killing 7 moose; the following season, 2002, 36 hunters reported killing 8 moose (Table 6). In 2001, 814 registration hunt permits were issued for Subunits 17B&C, with 655 hunters reporting that they hunted and 243 moose killed. In 2002, 794 registration hunt permits were issued for 17B&C, with 640 hunters reporting that they hunted and 276 moose killed (Tables 7 and 8).

Hunter Residency and Success. The mean number of moose hunters participating in the general moose hunting season in Unit 17 during the past 5 years was 503, an increase from the previous reporting period (Woolington 2002). Participation by resident hunters in the general hunt has declined because of increased interest in the registration hunt. Nonresident participation has generally increased despite more restrictive regulations. Unitwide success during the general hunt ranged from 25 to 36% during the past 5 years, with a mean annual success rate of 31%. In regulatory years 1998–99 though 2002–03, nonresidents accounted for 66% of reporting hunters, residents of Unit 17 accounted for 6%, and other residents of Alaska made up 26% of the total number of hunters in the general hunt (Table 3).

The mean number of moose hunters participating in registration moose hunts in Unit 17 during the past 5 years was 618, a 16% increase from the previous reporting period (Woolington 2002). Success during the registration hunts in Unit 17 ranged from 33 to 46% during the past 5 years, with a mean annual hunter success rate of 40%. Residents of Unit 17 composed 80%, and other residents of Alaska made up 20% of hunters in the registration hunts from regulatory years 1998–99 through 2002–03 (Table 9).

Harvest Chronology. Because of changes in seasons and weather, chronology data did not indicate consistent patterns (Table 10 and 11). Unit residents were the main participants in the August and December seasons. These seasons were originally established to provide local residents an opportunity to harvest moose that were not rutting and discourage the illegal killing of female moose during closed seasons.

Transport Methods. Aircraft were the primary means of access for moose hunters in the general hunt in Unit 17 (5-yr mean = 66%, Table 12). Most participants in the registration hunt used boats for access (5-yr mean = 78%, Table 13). In 1990–91, use of off-road vehicles during the fall, including 3- and 4-wheelers, became prohibited modes of transportation for big game hunters in Unit 17B.

OTHER MORTALITY

Observations of predation by wolves and bears occurred regularly throughout this reporting period. Reports from local resident and nonlocal hunters suggest wolf numbers appeared to be increasing unitwide, and brown bears are common. Snow depths throughout the unit were moderate during the winters of this reporting period, and there were no reports of excessive winter mortality. Moose were apparently able to find abundant forage on winter ranges in riparian areas.

Two moose were killed by a motor vehicles on the Aleknagik Lake Road near Dillingham during this reporting period. The meat was salvaged for human consumption.

Illegal harvest of moose in Unit 17 was probably more of a problem in the past than during recent years. Unit residents used to actively pursue moose with snowmachines during the winter and spring when both male and female moose were taken. Considerable efforts by both state and federal management agencies to work with local communities to see the benefits of reducing illegal moose kills have resulted in changing attitudes. It appears that illegal harvests have decreased dramatically in the past 10 years. There has also been a significant decline in the number of female moose taken. It is now common to see moose near local villages throughout the winters.

HABITAT

ASSESSMENT

Aderman (1999) established 7 intensive mapping areas in Subunit 17A, based on computer-aided analysis of Landsat photos. He visited 104 sites for ground-truthing in July 1998. Information collected included dominant vegetation species, slope, aspect, and drainage. Aderman (1999) estimated a minimum of 560 mi^2 of optimal moose winter habitat and another 520 mi^2 of secondary moose winter habitat in 17A.

No formal habitat-monitoring programs were conducted in the remainder of Unit 17. Moose winter ranges along the Nushagak and Mulchatna Rivers, and along the lower reaches of the major tributaries to those rivers, are probably in good condition. Although there is evidence of heavy browsing in some areas, willow stands on gravel bars are abundant and include a good mix of brush heights. Winter range conditions in the middle and upper reaches of the tributaries have not been assessed, but are probably not as productive.

ENHANCEMENT

No habitat enhancement activities have been documented in Unit 17. Because of the relative inaccessibility of most of the unit and the occurrence of natural habitat change, human-caused habitat enhancement activity is not practical or necessary.

Lightning-caused wildfires are not uncommon in the unit, particularly in Subunit 17B. During this reporting period, there were no large wildfires.

In most years the most important natural force responsible for enhancing moose habitat was the scouring of gravel bars and low-lying riparian areas by ice and water during spring thaw. This was especially true for the Nushagak and Mulchatna Rivers and the lower reaches of the major tributaries to those rivers.

NON-REGULATORY MANAGEMENT PROBLEMS

Dramatic increases in the number of caribou in the Mulchatna herd through the mid 1990s impacted the moose population in this unit, though there was little direct competition between these ungulates. Short-term impacts of large caribou populations include decreased illegal moose harvest by local residents and increased hunting pressure by other residents and nonresidents interested in combination hunts for moose and caribou. The most significant long-term impact on moose may be the response of predator populations to abundant prey resources. Wolf numbers appeared to increase in the unit during this reporting period. There were few instances of wolves following the caribou herd, so when the herd moved out of a pack's territory, moose became the primary source of meat for wolves. The same prey shift can be expected should the caribou herd crash.

CONCLUSIONS AND RECOMMENDATIONS

Predation by wolves, bears, and reported harvests of moose continued to increase in recent years. Good browse conditions and a continuing series of average winters resulted in stable-to-increasing moose populations in Subunits 17A and 17C during this reporting period. The moose population exceeded the minimum goal in 17A and continued to increase. The first reliable population estimate for all of 17B was achieved during this reporting period. Moose numbers in 17B are probably in decline as evidenced by the poor calf recruitment. Although objective habitat evaluations were lacking for most of the unit, it appeared that browse quality and quantity were sufficient to support the population on most of the winter ranges.

Fall trend counts were notoriously unreliable in providing consistent data on moose populations in Unit 17. Suitable survey conditions, including complete snow coverage, light winds, and moose movements onto winter range, rarely occur before antler drop. Regular population estimation surveys of portions of the unit during late winter provide the best moose population information. Unfortunately, they do not provide reliable information on sex or age composition.

Moose hunting activity and harvest have increased in Unit 17 during the past decade. The increased number of caribou in the area has contributed to more nonlocal hunters in the Nushagak River and Wood River drainages. Hunting methods and harvest chronology have remained consistent in recent years, so the increased harvest is indicative of increased effort.

The moose population in 17A has increased dramatically in recent years. We worked with local residents and staff from TNWR and continued work on a draft moose management guideline that established an objective of 1100–1750 moose in the unit. We also continued work on a cooperative moose research project with TNWR to 1) document population trends, 2) evaluate the moose habitat in the unit and estimate carrying capacity, and 3) develop appropriate management goals and regulatory proposals. It is critical that these cooperative efforts be coupled with continued efforts to inform the local public of the continued advantages of reducing illegal harvest of moose in the unit.

The Board of Game had considered impacts of liberalized caribou seasons on the Unit 17 moose population and adjusted the moose season for 1993–94. The board adjusted it again in 1997. The board and the department will need to continue managing these 2 ungulate populations and attempt to monitor predator populations.

Recommended management actions for the next few years include the following:

- Conduct a population estimation survey each winter on a rotating basis of subunits;

- Finalize the moose management plan for Subunit 17A in cooperation with Togiak National Wildlife Refuge, local advisory committees, and local citizen groups;

- Continue to manage Unit 17 moose populations conservatively as long as large numbers of hunters are attracted to the area in pursuit of Mulchatna caribou;

- Continue to seek cost-effective and accurate methods to obtain bull:cow ratios within the unit.

LITERATURE CITED

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Table 1 Reported moose harvest data for all hunts in Unit 17, 1964/65–2002/03

Regulatory Year	Reported Harvest	Hunters afield	Success rate	Unit[a]			
				17A	17B	17C	Unk
1964–65	32	---	---	---	---	---	---
1965–66	42	---	---	---	---	---	---
1966–67	26	90	29%	---	---	---	---
1967–68	38	77	49%	---	---	---	---
1968–69	46	66	70%	---	---	---	---
1969–70	15	31	48%	---	---	---	---
1970–71	25	35	71%	---	---	---	---
1971–72	37	63	59%	---	---	---	---
1972–73	38	74	51%	---	---	---	---
1973–74	42	93	45%	---	---	---	---
1974–75	69	119	58%	---	---	---	---
1975–76	115	207	56%	---	---	---	---
1976–77	49	168	29%	---	---	---	---
1977–78	54	113	48%	---	---	---	---
1978–79	65	160	41%	---	---	---	---
1979–80	33	68	49%	---	---	---	---
1980–81	89	212	42%	---	---	---	---
1981–82	76	209	36%	---	---	---	---
1982–83	49	149	33%	---	---	---	---
1983–84	127	293	43%	0	72	48	0
1984–85	158	344	46%	0	86	70	0
1985–86	148	401	37%	0	94	52	0
1986–87	202	486	42%	0	122	73	0
1987–88	207	499	42%	0	152	42	0
1988–89	187	457	41%	0	157	28	0
1989–90	175	438	40%	0	122	48	0
1990–91	225	489	46%	0	178	44	0
1991–92	268	590	45%	0	172	85	0
1992–93	263	705	47%	0	160	90	13
1993–94	249	705	35%	1	150	78	20
1994–95	296	800	37%	0	167	94	69
1995–96	336	881	38%	0	192	109	35
1996–97	373	913	41%	0	207	113	53
1997–98	347	956[b]	36%	15	168	126	38
1998–99	389	1048[b]	37%	10	168	171	40
1999–2000	425	1116[b]	38%	10	170	192	53
2000–01	373	1112[b]	34%	10	226	136	1
2001–02	419	1175[b]	37%	7	182	226	4
2002–03	404	1147[b]	35%	8	179	214	3

[a] Harvest data not broken down by unit before 1983–84.
[b] Included hunters who registered for both fall and winter registration hunts.

Table 2 Unit 17 moose antler sizes (percent) in the reported harvest, 1992/93–2002/03

Regulatory Year	Antler size			Largest antlers
	<30"	30–50"	>50"	
1992–93	6	36	57	80”
1993–94	3	30	68	73”
1994–95	9	29	62	73”
1995–96	7	35	57	78”
1996–97	9	26	65	75”
1997–98	6	36	57	73"
1998–99	9	35	56	74”
1999–2000	7	37	56	71”
2000–01	8	27	65	80”
2001–02	19	28	53	72”
2002–03	20	35	46	69”

Table 3 Unit 17 moose hunter[a] residency and success, 1992/93–2002/03

Regulatory Year	Successful				Unsuccessful				Total hunters
	Local Resident	Nonlocal resident	Nonresident	Total (%)	Local resident	Nonlocal Resident	Nonresident	Total(%)	
1992–93	61	79	64	212 (41)[b]	65	114	124[b]	310 (59)[b]	522
1993–94	21	28	93	144 (33)[c]	27	117	142[c]	292 (67)[c]	436
1994–95	22	41	91	161 (33)[d]	24	117	180[d]	329 (67)[d]	490
1995–96	23	30	115	171 (35)[e]	28	103	177[e]	314 (65)[e]	485
1996–97	16	35	144	196 (40)[f]	33	82	174[f]	291 (60)[f]	487
1997–98	13	33	100	150 (35)[g]	29	79	161	277 (65)[g]	427
1998–99	15	34	120	169 (32)	27	111	220	359 (68)[h]	528
1999–2000	16	26	99	146 (29)[i]	20	91	235	358 (71)[i]	504
2000–01	4	41	139	184 (34)	18	98	236	353 (66)[j]	537
2001–02	11	27	125	169 (36)[k]	14	97	191	302 (64)[k]	473
2002–03	12	25	77	120 (25)[l]	19	115	217	351 (75)	741

[a] Excludes hunters in permit hunts.
[b] Includes 8 successful and 7 unsuccessful hunters of unknown residency.
[c] Includes 2 successful and 6 unsuccessful hunters of unknown residency.
[d] Includes 7 successful and 8 unsuccessful hunters of unknown residency.
[e] Includes 3 successful and 6 unsuccessful hunters of unknown residency.
[f] Includes 1 successful and 2 unsuccessful hunters of unknown residency.
[g] Includes 4 successful and 8 unsuccessful hunters of unknown residency.
[h] Includes 1 unsuccessful hunter of unknown residency.
[i] Includes 5 successful and 12 unsuccessful hunters of unknown residency.
[j] Includes 1 unsuccessful hunter of unknown residency.
[k] Includes 6 successful and 2 unsuccessful hunters of unknown residency.
[l] Includes 6 successful hunters of unknown residency.

Table 4 Unit 17B reported moose harvest[a] and accidental death, 1992/93–2002/03

Regulatory Year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated[b] Unreported	Illegal	Total	Accidental death	Grand total
1992–93	152 (100)	0	0	152	0	0	0	0	152
1993–94	125 (100)	0	1	126	0	0	0	0	126
1994–95	132 (100)	0	0	132	0	0	0	0	132
1995–96	148 (100)	0	0	148	0	0	0	0	148
1996–97	171 (100)	0	0	171	0	0	0	0	171
1997–98	127 (100)	0	0	127	0	0	0	0	127
1998–99	139 (100)	0	0	139	0	0	0	0	139
1999–2000	122 (100)	0	0	122	0	0	0	0	122
2000–01	165 (100)	0	0	165	0	0	0	0	165
2001–02	141 (100)	0	0	141	0	0	0	0	141
2002–03	96 (100)	0	0	96	0	0	0	0	96

[a] Excludes permit hunt harvest.
[b] No estimates of unreported/illegal harvests have been made for this unit.

Table 5 Unit 17C reported moose harvest[a] and accidental death, 1992/93–2002/03

Regulatory Year	Hunter Harvest: Reported M (%)	F (%)	Unk.	Total	Estimated[b] Unreported	Illegal	Total	Accidental death	Grand total
1992–93	56 (100)	0	0	56[c]	0	0	0	0	56
1993–94	18 (100)	0	0	18	0	0	0	0	18
1994–95	28 (100)	0	0	28[d]		0	0	1[e]	29
1995–96	32 (100)	0	0	[f]		0	0	0	22
1996–97	23 (100)	0	0	22 23[g]	0	0	0	2[h]	25
1997–98	21 (100)	0	0	21[i]	0	0	0	0	21
1998–99	27 (100)	0	0	27[j] 0	0	0	0	1	28
1999–2000	23 (100)	0	0	23[k] 0	0	0	0	0	23
2000–01	18 (100)	0	0	18[l]	0	0	0	1	19
2001–02	26 (100)	0	0	26[m]	0	0	0	2	28
2002–03	21 (100)	0	0	21[n]	0	0	0	0	21

[a] Excludes permit hunt harvest.
[b] No estimates of unreported/illegal harvests have been made for this unit.
[c] Does not include 3 bulls from an unspecified portion of Unit 17.
[d] Does not include 1 bull from an unspecified portion of Unit 17.
[e] Includes 1 bull killed in defense of life or property.
[f] Does not include 3 bulls from an unspecified portion of Unit 17.
[g] Does not include 11 bulls from an unspecified portion of Unit 17.
[h] Does not include 1 cow and 1 bull killed in motor vehicle accidents near Dillingham.
[i] Does not include 2 bulls from an unspecified portion of Unit 17.
[j] Does not include 3 bulls from an unspecified portion of Unit 17.
[k] Does not include 1 bull from an unspecified portion of Unit 17.
[l] Does not include 1 bull from an unspecified portion of Unit 17.
[m] Does not include 2 bulls from an unspecified portion of Unit 17.
[n] Does not include 3 bulls from an unspecified portion of Unit 17.

Table 6 Unit 17A reported moose harvest data by permit hunt, 1997/98–2002/03

Hunt No /Area	Regulatory Year	Permits issued[a]	Percent did not hunt	Percent Unsuccessful hunters[b]	Percent Successful hunters[b]	Bulls (%)	Cows (%)	Unk.	Total harvest
573	1997–98	44	11	62	38	15 (100)	0	0	15
	1998–99	48	10	77	23	10 (100)	0	0	10
	1999–2000	57	28	76	24	10 (100)	0	0	10
	2000–01	56	13	80	20	10 (100)	0	0	10
	2001–02	56	16	87	13	7 (100)	0	0	7
	2002–03	40	10	78	22	8 (100)	0	0	8

[a] Registration permits were valid for only Unit 17A.
[b] Includes only those permittees reporting that they hunted.

Table 7 Unit 17B reported moose harvest data by permit hunt, 1992/93–2002/03

Hunt No /Area	Regulatory Year	Permits issued[a]	Percent did not hunt	Percent unsuccessful hunters[b]	Percent Successful hunters[b]	Bulls (%)	Cows (%)	Unk.	Total harvest
983	1992–93	277	30	63	27	8(100)	0	0	8
583	1993–94	433	19	61	39	23 (100)	0	1	24
	1994–95	438	18	56	44	35 (100)	0	0	35
	1995–96	521	21	56	44	44 (100)	0	0	44
	1996–97	546	20	63	37	36 (100)	0	0	36
583/585	1997–98[c]	629	25	63	37	41 (100)	0	0	41
	1998–99[c]	634	25	69	31	29 (100)	0	0	29
	1999–2000	749	24	53	47	48 (100)	0	0	48
	2000–01	685	23	61	39	61 (100)	0	0	61
	2001–02	814	20	72	28	41 (100)	0	0	41
	2002–03	794	19	66	34	83 (100)	0	0	83

[a] Registration permit valid for both Units 17B and 17C. Permit data are for both areas combined; harvest data are specific to Unit 17B.
[b] Of those permittees that reported hunting in Unit 17B.
[c] Includes permits issued and harvest for both fall (20 Aug–15 Sep) and winter (1–31 Dec) permit hunts.

Table 8 Unit 17C reported moose harvest data by permit hunt, 1992/93–2002/03

Hunt No /Area	Regulatory Year	Permits issued[a]	Percent did not hunt	Percent unsuccessful hunters[b]	Percent successful hunters[b]	Bulls (%)	Cows (%)	Unk.	Total harvest
983	1992–93	277[b]	30	63	27	31[d] (100)	0	3	34
583	1993–94	433	19	61	39	59[e] (100)	1	0	60
	1994–95	438	18	56	44	65[f] (100)	0	1	66
	1995–96	521	21	59	41	87[g] (100)	0	0	87
	1996–97	546	20	54	46	89[h] (99)	0	1	90
583/585	1997–98[c]	629	25	60	40	105[i] (100)	0	0	105
	1998–99[c]	634	25	48	52	144[j] (100)	0	0	144
	1999–2000	749	24	49	51	169[k] (100)	0	0	169
	2000–01	685	23	68	32	118[l] (100)	0	0	118
	2001–02	814	20	60	40	200[m](100)	0	0	200
	2002–03	794	19	51	49	193 (100)	0	0	193

[a] Registration permits valid for both Units 17B and 17C. Permit data are for both areas combined, harvest data are specific to Unit 17C.

[b] Of those permittees who reported hunting in Unit 17C.

[c] Includes permits issued and harvest for both fall (20 Aug–15 Sep) and winter (1–31 Dec) permit hunts.

[d] Not included are 8 bulls from an unspecified portion of Unit 17.

[e] Not included are 20 bulls from an unspecified portion of Unit 17 and 1 bull from Unit 17A.

[f] Not included are 34 bulls from an unspecified portion of Unit 17.

[g] Not included are 33 bulls from an unspecified portion of Unit 17 and 1 unreported sex.

[h] Not included are 51 bulls from an unspecified portion of Unit 17.

[i] Not included are 36 bulls from an unspecified portion of Unit 17.

[j] Not included are 37 bulls from an unspecified portion of Unit 17.

[k] Not included are 52 bulls from an unspecified portion of Unit 17.

[l] Not included are 51 bulls from an unspecified portion of Unit 17.

[m] Not included are 2 bulls from an unspecified portion of Unit 17.

Table 9 Unit 17 moose hunter residency and success[a] by permit hunt, 1992/93–2002/03

Regulatory Year	Successful Local Resident	Nonlocal resident	Nonresident	Total (%)	Unsuccessful Local resident	Nonlocal resident	Nonresident	Total(%)	Total hunters
1992–93	43	7	0	50 (27)	122	11	0	133 (73)	183
1993–94	84	21	0	105 (39)	130	33	0	164 (61)	269[c]
1994–95	106	29	0	135 (44)	128	45	0	175 (56)	310[d]
1995–96	117	48	0	165 (42)	131	100	0	231 (58)	396
1996–97	117	60	0	177 (42)	157	92	0	249 (58)	426
1997–98	164	33	0	197 (37)	272	60	0	332 (63)	529
1998–99	183	37	0	220 (42)	251	54	0	305 (58)	525
1999–2000	221	58	0	279 (46)	262	71	0	333 (54)	612
2000–01	144	45	0	189 (33)	304	82	0	386 (67)	575
2001–02	193	57	0	250 (36)	370	82	0	452 (64)	702
2002–03	228	56	0	284 (42)	323	69	0	392 (58)	676

[a] Includes only permittees who reported hunting.
[b] Unit 17 residents.
[c] Includes 0 successful and 1 unsuccessful hunter of unknown residency.
[d] Includes 0 successful and 2 unsuccessful hunters of unknown residency.

Table 10 Unit 17 reported moose harvest[a] chronology percent by month, 1992/93–2002/03

Regulatory Year	Harvest periods									
	Aug 10–20	Aug 21–31	Sep 1–10	Sep 11–20	Sep 21–30	Dec 1–10	Dec 11–20	Dec 21–31	Unk.	n[b]
1992–93[c]	0	3	44	41	0	2	2	4	3	212
1993–94[d]	1	2	54	35	0	0	1	1	6	144
1994–95[d]	1	3	47	37	3	1	2	3	5	161
1995–96[d]	1	2	55	32	0	0	1	1	9	171
1996–97[d]	1	2	63	27	0	1	0	2	6	196
1997–98[d]	0	1	55	36	0	1	1	1	5	150
1998–99[d]	0	2	60	35	0	0	0	0	2	169
1999–2000	0	3	51	42	0	2	0	1	1	146
2000–01	0	0	55	10	0	0	0	0	4	184
2001–02	0	3	57	38	0	1	1	0	1	169
2002–03	0	2	55	38	0	0	1	0	3	120

[a] Excludes permit hunt harvest.
[b] Reported harvest
[c] General season dates: Unit 17B (upstream) – 1–20 Sep
Unit 17B (remainder) - Residents: 1–20 Sep, 1–31 Dec
Nonresidents: 5–15 Sep
Unit 17C (Iowithla, etc.) - Residents: 1–15 Sep
Unit 17C (remainder) - Residents: 1–15 Sep, 1–31 Dec
[d] General season dates Unit 17B – 1–15 Sep
Unit 17C - Residents: 1–15 Sep

Table 11 Unit 17 reported moose harvest chronology for permit hunts, percent by month, 1992/93–2002/03

Regulatory Year	Harvest periods Aug 10–20	Aug 21–31	Sep 1–10	Sep 11–20	Sep 21–30	Dec 1–10	Dec 11–20	Dec 21–31	Unk.	n^a
1992–93[b]	20	72	2	0	0	0	0	0	6	50
1993–94[c]	9	40	19	10	2	3	6	5	8	105
1994–95[c]	7	30	29	10	1	2	7	8	6	135
1995–96[c]	15	33	26	14	1	2	1	4	6	165
1996–97[c]	7	33	23	20	1	2	5	3	5	177
1997–98[d]	6	35	16	21	0	2	4	11	5	197
1998–99[d]	10	44	22	14	0	1	1	6	2	220
1999–2000	13	44	16	13	0	1	4	4	6	279
2000–01	17	32	24	19	0	2	1	1	5	189
2001–02	11	46	21	10	0	2	2	7	1	250
2002–03	12	41	20	15	0	6	1	1	3	284

[a] Reported harvest
[b] Registration permits valid for 20–31 Aug.
[c] Registration permits valid for any bull, 20 Aug–15 Sep and 1–31 Dec.
[d] Registration permits valid for any bull; Unit 17A, 25 Aug–20 Sep, Unit 17B and 17C, 20 Aug–15 Sep and 1–31 Dec.

Table 12 Unit 17 reported moose harvest[a] percent by transport method, 1992/93–2002/03

Regulatory Year	Percent of harvest								Total moose
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1992–93	64	0	29	0	2	0	1	3	212
1993–94	71	0	26	0	9	0	0	1	144
1994–95	71	0	22	0	2	0	1	3	161
1995–96	64	0	33	1	1	0	1	1	171
1996–97	68	0	29	0	2	0	1	1	196
1997–98	65	0	30	1	3	0	1	0	150
1998–99	67	0	32	0	1	1	0	1	169
1999–2000	61	0	36	0	3	0	0	0	146
2000–01	75	0	23	0	0	0	0	2	184
2001–02	64	0	34	1	0	0	0	1	169
2002–03	61	0	38	1	0	0	0	1	120

[a] Excludes permit hunt harvest.

Table 13 Unit 17 reported moose harvest by permit hunt, percent by transport method, 1992/93–2002/2003

Regulatory Year	Percent of harvest								Total moose
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	
1992–93	9	0	83	1	0	1	1	5	50
1993–94	15	0	73	0	6	0	4	3	105
1994–95	18	0	59	0	12	0	3	8	135
1995–96	25	0	68	0	4	0	1	2	165
1996–97	26	0	63	0	6	0	2	3	177
1997–98	8	1	73	0	16	0	1	2	197
1998–99	5	0	81	3	6	0	0	5	220
1999–2000	11	0	74	1	9	0	2	2	279
2000–01	13	0	78	1	3	0	1	4	189
2001–02	10	0	74	1	10	0	1	4	250
2002–03	12	0	82	1	1	1	2	2	284

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 18 (42,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Moose are thought to have begun migrating to the Yukon-Kuskokwim Delta during the mid to late 1940s. Local elders from the Yukon River have confirmed this timing. The Yukon population occupies most of the available riparian habitat and the population is growing. The Kuskokwim population is small and is still in the process of colonizing the available riparian habitat. Most of the Yukon-Kuskokwim Delta is lowland treeless tundra, which is not suitable as winter habitat for moose.

Moose densities are moderate and growing in the Yukon River drainage, but very low throughout the entire lower Kuskokwim River drainage. Although moose are now more common than in the past, overall densities in Unit 18 are low relative to habitat availability.

Heavy hunting pressure from communities along the Kuskokwim River has effectively limited moose population growth along that riparian corridor. While moose population growth along the Yukon River had been slowed for similar reasons, compliance with hunting regulations has improved and moose populations there have responded. Extensive habitat is available for moose colonization and range expansion along most of the lower Kuskokwim River and its larger tributaries. Moose densities in adjacent Units 17, 19 and 21E remain higher than moose densities in Unit 18.

The boundaries of Unit 18 and those of the Yukon Delta National Wildlife Refuge (YDNWR) nearly coincide. The southern tip of Unit 18 is within the Togiak National Wildlife Refuge (TNWR). ADF&G shares common interests with the refuges and we regularly cooperate during surveys, field projects, and public meetings.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Allow the Unit 18 moose populations to increase to the levels the habitat can support.
- Maintain healthy age and sex structures for moose populations within the Yukon and Kuskokwim River drainages.

- Determine population size, trend, and composition of Unit 18 moose populations.
- Achieve a continual harvest of bulls without hindering population growth.
- Improve harvest reporting and compliance with hunting regulations.
- Minimize conflicts among user groups interested in moose within and adjacent to Unit 18.

MANAGEMENT OBJECTIVES

- Allow the lower Yukon River moose population to increase above its estimated size of 2500–3500 moose. Allow the lower Kuskokwim River moose population to increase above its estimated size of 75–250 moose to at least 2000 moose.
- Maintain the current age and sex structure for both populations, with a minimum of 30 bulls: 100 cows.
- Conduct seasonal sex and age composition surveys as weather allows.
- Conduct winter censuses and recruitment surveys in the established survey areas on a rotating basis.
- Conduct fall and/or winter trend counts to determine population trends.
- Conduct hunts consistent with population goals.
- Improve knowledge of, and compliance with, harvest reporting requirements and hunting regulations through education and incentives.
- Address user conflicts through education and hunter contacts.

METHODS

We monitor moose harvests and hunting activity in Unit 18 using harvest tickets/reports and by contacting hunters in the field. In September 2001 we operated a hunter check station at Paimiut Slough along the Yukon River near the border of Units 18 and 21E. In 2002 we contacted Unit 18 hunters within the Kuskokwim River drainage by boat. Whenever possible, we collect incisors and take antler measurements. Hunter participation is voluntary.

We've conducted an incentive program to encourage hunters to turn in their harvest reports annually since 1998. The department purchased prizes that were randomly distributed to hunters selected from a list of those who returned harvest reports. In recent years, hooded sweatshirts emblazoned with a logo depicting the potential reproduction from one cow moose were awarded as prizes. We held the drawing in August just prior to the upcoming hunting season.

In March 2002 we conducted moose censuses using spatial census (geostatistical) methods developed by Ver Hoef (2001). The survey area boundaries are shown in Figure 1 and are delineated within Unit 18 as follows:

- Paimiut Area: The Yukon River from old Paimiut Village downstream to Pilot Village.

- Andreafsky Area: The Yukon River from Pilot Village downstream to Mountain Village.

- Lowest Yukon Area: The Yukon River downstream from Mountain Village.

- Lower Kuskokwim Area: The Kuskokwim River riparian corridor between Kalskag and Kwethluk.

- Nyac Area: The uplands of the eastern tributaries of the lower Kuskokwim River and the riparian corridor along the Kisaralik River. This census area has been delineated, but has not yet been surveyed.

We altered the size of our survey areas to achieve cost savings, safety, and other efficiencies and to allow us to conduct a census in more than one area per year. Table 1 lists the size of the areas surveyed during each census and Figure 1 depicts the larger survey areas. We plan to census all of the Yukon River drainage survey areas in one year and alternate with the Kuskokwim River drainage survey areas the following year.

We conducted composition counts within the Yukon River survey areas in spring 2003 and in winter 2003. These surveys provided a measure of productivity and survival and provided an opportunity to observe body condition.

During August and September 2002, we conducted browse surveys along the mainstem of the Yukon and Kuskokwim Rivers using a boat and following methods developed by Seaton (2002).

We continued a cooperative strategy to establish a moose population along the Lower Kuskokwim River with the Lower Kuskokwim Fish and Game Advisory Committee (LKAC), the Association of Village Council Presidents (AVCP), interested individuals, and the U.S. Fish and Wildlife Service (FWS). As part of this effort, we conducted trend counts with observers from the Kuskokwim River villages to compare the Yukon River moose population to the number of moose on the Kuskokwim River.

We provided public information and education through public service announcements made available to the media, regular newspaper articles, and informal hunter contacts. We distributed coffee cups emblazoned with an educational logo depicting the potential production of one cow moose to hunters, advisory committee members, village leaders, Board of Game members, and others influential with hunters. This "moose circle coffee cup" has become a valuable focus for our educational efforts.

We provided enforcement information to the Department of Public Safety, Division of Fish and Wildlife Protection (now the Bureau of Wildlife Enforcement (ABWE) in Bethel and Aniak.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In March 2002, we conducted moose population censuses in the Lowest Yukon, Andreafsky, Paimiut, and Lower Kuskokwim survey areas (Table 1). In general, the Yukon River moose population has continued to grow but a population along the Lower Kuskokwim has not yet become established.

Unless otherwise noted, the following results are reported at the 95% CI.

The moose population in the Lowest Yukon Area grew from a minimum count of 65 moose in 1994 to an estimated 674 ± 21.9% in 2002. Prior to 2002, this area was censused over a much larger area using a minimum count method because the extremely low moose numbers made Gasaway style (Gasaway et al. 1986) census methods impractical.

The moose population in the Andreafsky Area was estimated at 524 ± 29.8% moose in 1999 and at 418 ± 22.4% moose in 2002. However, the size of this count area was reduced in 2002 and the midpoint of the density estimate increased between these 2 surveys from 0.23 to 0.36 moose/mi^2; however, this difference was not significant. By eliminating the northern half of this survey area, we removed the most difficult and dangerous terrain and saved time and money, making it possible to complete surveys of all the Yukon River survey areas in one season.

The moose population in the Paimiut Area was estimated at 2024 ± 12.9% moose in 1999 using Gasaway style census methods. In 2002 this population was estimated at 2382 ± 16.1% moose using spatial methods. The midpoint of the density estimate increased from 1.30 to 1.52 moose/mi^2, but the difference was not significant.

In 2000 and 2002 we estimated the number of moose at 86 ± 26.4% and 117 ± 18.3% respectively in the Lower Kuskokwim Area using spatial techniques. The midpoint of the density estimate increased from 0.09 to 0.13 moose/mi^2 but the difference was not significant.

The moose density within the Lower Kuskokwim Area was 0.13 moose/mi^2 in 2002 but the moose habitat in this area is comparable to that in the Paimiut Area where the moose density in 2002 was 1.52 moose/mi^2. Clearly, the moose habitat in the Lower Kuskokwim Area is underutilized.

We planned to conduct population censuses in the Yukon River survey areas in 2001 and 2003, but they were canceled due to low snow accumulations and inadequate survey conditions. This is why our schedule of surveying each major river system every other year was not followed.

During January 2000, March 2001, and April 2002, we conducted moose trend counts to compare moose densities within the Kuskokwim River drainage to those along the Yukon River within the Paimiut Area (Table 2). We flew 4 passenger aircraft and flew at 80 mph, 700 feet indicated altitude or 500 feet above ground level and counted moose in the best moose habitat near the rivers. The observers included a pilot, a biologist, and 1 or 2 observers from Kuskokwim River villages per flight. An additional goal of these trend counts was to educate the village observers by giving them a perspective of the potential for larger moose populations within the Kuskokwim River drainage.

Population Composition

During the winter moose censuses in March 2002, we classified adults and calves in each of the survey areas (Table 3). No sex composition information is available from these surveys because they were conducted during the winter after antlers were shed. Moose calf survival was high, probably due to mild winter conditions during the current and previous winters, low to moderate predation, and good habitat.

We conducted composition counts during calving within the Lowest Yukon Area on 7 June 2001; 6 June 2002; and 9 June 2003 (Table 4). Although sample sizes are small, these data suggest high twinning rates, good survival, low predation rates, and a young age structure in this recently colonized area.

The Paimiut Area typically experiences green up a week to 10 days earlier than other parts of the unit and although we attempted a composition count within the Paimiut Area in spring 2003, we were unable to obtain useful data due to early leaf emergence.

In March 2003, we conducted a winter composition count in the Paimiut and Lowest Yukon survey areas and found 28 calves:100 adults in the Paimiut Area and 81 calves:100 adults in the Lowest Yukon Area. These data are consistent with the 2002 observations of a stable to growing population in the Paimiut Area and of a rapidly growing population in the Lowest Yukon Area.

Distribution and Movements

Moose are distributed throughout the Yukon River riparian corridor with highest concentrations occurring during the winter. Within this riparian corridor, the densities are greatest in the Paimiut Area followed by the Lowest Yukon and Andreafsky areas. Moose are usually found at low density near the villages but along the Yukon River that tendency is less pronounced now compared to previous reporting periods. Some moose are also found along the tributaries and distributaries of the Yukon and in the highlands north of the Yukon River.

The number of moose wintering in the Paimiut Area was judged to be lower in 2003 than during previous years. We attribute this change in winter density to low snow rather than a genuine decline in the moose population. Scattered reports of moose near Hooper Bay, Ingakslugwat Mountains, and in other areas not considered to contain winter range supports our contention that moose were not confined to their normal winter areas in 2003.

Moose can be found throughout the year along the riparian corridor of the Kuskokwim River from Lower Kalskag to Bethel. They exist at extremely low densities given the available habitat. Moose are seen in the downriver third of this corridor only sporadically.

The area drained by the tributaries of the Kuskokwim River and those rivers draining into Kuskokwim Bay supports small numbers of moose as colonizing animals from adjacent areas arrive. However, these moose have not survived to establish localized populations except perhaps in the Kwethluk River drainage where we received reports of moose wintering in 2001, 2002, and 2003. The latest report included 18 moose.

We have some radiotelemetry data, which show that moose are entering Unit 18 from adjacent Unit 17. During this reporting period, 5 of 35 moose radiocollared in adjacent Unit 17A were located at least once in Unit 18. These moose appear to be colonizing the southern drainages of Unit 18 including the Goodnews and Kanektok River drainages where Togiak NWR staff observed 5 moose in March 2002. We also have reports from local residents of increasing numbers of moose in this area. (Aderman and Woolington, 2001, and Aderman, personal communication).

During the summer, moose are found in low numbers throughout the unit. Moose have been reported along the Manokinak and Izaviknek rivers, near Chevak, and even swimming in the ocean beyond the mouth of the Yukon River. While these reports are unusual, they make the point that moose move about broadly throughout the Yukon-Kuskokwim Delta.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits for this reporting period can be found in Table 5. The bag limit throughout Unit 18 is one bull.

On federal public lands within Unit 18, federal regulations limit moose hunting to Alaska residents of Unit 18 and residents of Upper Kalskag. Within the Kuskokwim River drainage upriver from and including the Tuluksak River drainage, federal regulations also permit residents of Aniak and Chuathbaluk to hunt on federal public lands.

Federal seasons in Unit 18 were the same as the State of Alaska seasons with 2 exceptions. The federal season within the Kuskokwim River drainage was from 25 August to 25 September. Also, there is no federal season in Unit 18 south of and including the Kanektok River drainages.

2001–2002 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, that portion north and west of a line from Cape Romanzof to Kusilvak Mountain, and then to Mountain Village, and excluding all Yukon River drainages upriver from Mountain Village		
1 bull	5 Sep – 25 Sep	5 Sep – 25 Sep
Remainder of Unit 18		
1 bull per regulatory year; during the period 1 Dec–28 Feb, a 10-day season may be announced by emergency order (this EO did not include the Kuskokwim River drainage or the portion of Unit 18 south and east of the Kuskokwim River drainage)	1 Sep–30 Sep 27 Dec–5 Jan	1 Sep – 30 Sep

2002–2003 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, all Yukon River drainages north of the south banks of Kwikluak Pass and the Yukon River, including sloughs, downstream of Mountain Village		
1 bull	1 Sep–25 Sep	5 Sep–25 Sep
Unit 18, south of the south banks of Kwikluak Pass and		

2002–2003 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
the Yukon River, and north and west of a line from Cape Romanzof to Kuzilvak Mt., and then to Mountain Village		
1 bull	1 Sep – 25 Sep	No open season
Unit 18, all Yukon River drainages north of the south bank of the Yukon River, including sloughs, upstream from Mountain Village		
1 bull per regulatory year; during the period 1 Dec–28 Feb, a 10-day season may be announced by emergency order	1 Sep – 30 Sep 17 Jan – 26 Jan	1 Sep – 30 Sep
Remainder of Unit 18		
1 bull per regulatory year; during the period 1 Dec–28 Feb, a 10-day season may be announced by emergency order (this EO did not include the Kuskokwim River drainage or the portion of Unit 18 south and east of the Kuskokwim River drainage)	1 Sep–30 Sep 17 Jan – 26 Jan	No open season

<u>Board of Game Actions and Emergency Orders.</u> A 10-day winter resident season during the period from 1 December–28 February upriver from Mountain Village may be announced by emergency order when weather and travel conditions are safe. The season dates are selected after polling the affected villages. This season was opened from 27 December–5 January in 1996–1997, 1997–1998, 1998–1999, 1999–2000, and 2001–2002. Most villages prefer to have this season just after Christmas to allow time for travel conditions to improve and to avoid interference with the holiday. They also prefer to hunt prior to Slavic since feasting is an important part of the Russian Orthodox celebration. This explains the static nature of these emergency order openings.

During 2002–2003 the winter season was opened along the Yukon River upriver from Mountain Village from 17 to 16 January. It was not opened earlier due to poor travel conditions.

The winter moose season was not opened within, and south and east of the Kuskokwim River drainage. For the third year in 2002–2003 the winter season remained closed in this portion of Unit 18, following a request by the LKAC to leave it closed for at least 5 years. However, the LKAC has recently prepared a proposal to close the moose season entirely for 5 years within the Kuskokwim River portion of Unit 18 as part of an overall strategy to improve moose numbers. If the proposal passes, the time period to leave this winter season closed will be superseded.

The Board of Game closed nonresident moose hunting south of the Yukon River during the fall 2001 meeting in response to concerns that arose with the initiation of a nonresident caribou hunt south of the Yukon River. The board determined that nonresident caribou hunters in the Kilbuck Mountains would put an undesirable amount of pressure on the low moose population if nonresident hunts for both species were permitted. This change divided Unit 18 into 4 areas with different moose seasons beginning in 2002–2003.

As in 2000–2001, the fall 2002–2003 resident moose season in the hunt area downriver from Mountain Village was opened on 1 September rather than 5 September by emergency regulation to provide additional opportunity to harvest moose in response to poor salmon returns. This was the third time in 5 years that this season was extended.

Human-Induced Harvest. During the 2001–2002 open season, 427 hunters reported a harvest of 162 moose**.** For the 2002–2003 season, 589 hunters reported a harvest of 223 moose. This continues the general trend of increasing reported moose harvest in Unit 18 that began in the early 1990s (Table 6).

Local demand for moose is high in Unit 18. The annual combined reported and unreported harvest is estimated at 7–12% of the population on the Yukon River. Harvest exceeds annual recruitment on the Kuskokwim River and moose only survive there due to continual migration from adjacent areas. Estimated unreported harvest probably exceeds the reported harvest in the Kuskokwim drainage. We estimate the unitwide unreported harvest is approximately 100–200 moose annually.

The reported harvest of moose in Unit 18 does not reflect the actual harvest, but only shows the harvest by people who operate within the regulatory system. In recent years we have seen an increase, but the percentage of local residents hunting during established seasons with valid hunting licenses and harvest tickets is increasing, particularly during the fall. On the Yukon River, we believe that harvest reporting has improved largely because of the presence of the Paimiut hunter check station, the acceptance of harvest tickets/reports, the willingness of most hunters to harvest only bulls, our harvest reporting incentive program, and the successful cooperative effort that resulted in a huntable moose population below Mountain Village and greater public confidence in the regulatory system. However, there are hunters who do not report, so moose harvest data from Unit 18 should be regarded as minimum estimates.

The majority of the reported Unit 18 moose harvest comes from the Yukon River drainage (Table 7) accounting for approximately 78% (127 moose) of the reported harvest in 2001–2002 and 83% (185 moose) in 2002–2003.

A moose hunting moratorium downriver from Mountain Village ended when a season was reopened in 1994–1995. Since then, 232 bull moose have been reported harvested in that hunt area. This includes 34 bulls harvested in 2001–2002 and 69 bulls harvested in 2002–2003. This is particularly interesting since as recently as 1988, no moose were observed during an intensive survey of this area.

During September 2001 we operated the Paimiut moose hunter check station for the 16th consecutive year at the junction of Twelve-Mile Slough and Paimiut Slough on the Yukon River approximately 4 miles east of Unit 18. Only 97 hunters stopped at the check station and we examined 18 moose. This is lower than during previous years when more than 200 hunters visited the check station and upwards of 60 moose were examined. The decreasing trend is likely to continue as the Yukon River moose population in Unit 18 continues to grow, making long, expensive moose hunting trips upriver unnecessary; as income from commercial fishing remains unstable; and as a greater understanding of land ownership and access restrictions by upriver regional and village corporations makes hunting trips into Unit 21E less appealing. Because of these, we decided that 2001 would be the final year we would operate the check station at Paimiut.

We operated a floating check station within the Unit 18 portion of the Kuskokwim River drainage during the 2002–2003 hunting season and contacted approximately 50 hunters, mostly during the last week of the season as Unit 18 hunters took advantage of the longer Unit 18 moose season compared to Unit 19 where they began their hunts. We provided information regarding the importance and benefits of not killing cow moose and distributed coffee mugs emblazoned with the moose circle logo. We did not encounter any successful Unit 18 moose hunters within the Kuskokwim drainage.

In Unit 18, there is growing use of state regulation 5 AAC 92.019, which allows moose to be taken outside established seasons for customary and traditional Alaska Native funerary or mortuary religious ceremonies. Typically, Unit 18 hunters contact the department prior to hunting under this statute, and we provide them with a letter outlining the regulation, informing them which animals are legal, and describing how to accomplish harvest reporting. We also provide the hunters with a copy of the administrative code (regulation) and contact the Alaska Bureau of Wildlife Enforcement to inform them of the arrangement.

This regulation requires the department to publicize a list of big game populations and areas, if any, for which the taking of a big game animal would be inconsistent with sustained yield principles. A big game animal from a population on this list would not be available for harvest for funerary or mortuary purposes under this statute. The list for Unit 18 includes all cow moose and all moose within and south and east of the Kuskokwim River drainage.

During 2001–2002, one hunter contacted the department regarding mortuary moose and reported an unsuccessful hunt. During 2002–2003, 4 hunters contacted the department and 2 moose were taken, 1 hunter reported that he was unsuccessful, and 1 hunter did not report (unsuccessful hunters are not required to report). All of these hunts took place along the Yukon River in Unit 18.

Permit Hunts. There were no permit hunts for moose in Unit 18 during the reporting period.

Hunter Residency and Success. As reported in past years, Alaska residents accounted for most of the moose hunting activity in Unit 18 with the vast majority being Unit 18 residents. Of 428 hunters who reported hunting during the 2001–2002 season, 7 were nonresidents. Of 589 hunters who reported hunting during the 2000–2001 season, 2 were nonresidents. Low moose densities within the Kuskokwim drainage, high cost, and federal restrictions generally make Unit 18 an unattractive destination for nonresident moose hunters.

The moose hunter success rates based on harvest reports were 38% for both the 2001–2002 and 2002–2003 seasons. Successful hunters spent an average of 7.8 days hunting in 2001–2002 and 7.0 days in 2002–2003. Unsuccessful hunters spent an average of 9.3 days hunting in 2001–2002 and 9.8 days in 2002–2003.

Many Unit 18 hunters are aware that hunting opportunities are better in adjacent Units 19 and 21E. On the Kuskokwim River many of the residents hunting moose between Kalskag and McGrath (in Unit 19) are from Unit 18. Similarly, on the Yukon River Unit 18 residents regularly hunt in Unit 21E, and even though the number of hunters making these upriver trips is declining, about 100 hunters from Unit 18 still visited the check station at Paimiut in 2001–2002. As a consequence, harvest allocation has been controversial among residents of Unit 18 and residents of Units 19 and 21E.

Harvest Chronology. The majority of reported moose harvest occurs during September when the general season is open. Only small numbers of moose have been reported harvested in the winter season (Table 6).

As the Yukon River moose population grows and becomes more accessible to Yukon River villagers, extended camping trips to hunt moose are being replaced by day trips from home. Harvest chronology is being driven by these day hunts and is influenced more by weather and the work week than by moose movements. Furthermore, hunters prefer to take moose early in the season citing better meat quality. As a consequence, only about 5% of the fall harvest takes place during the last 5 days of September.

Transport Methods. During the reporting period, boats were by far the most frequently used mode of transportation by moose hunters in Unit 18. Other minor reported modes of transportation were snowmachines and aircraft. There has been virtually no change in the method of access reported by moose hunters in Unit 18 since moose harvest reporting began.

Other Mortality

Black and grizzly bears occur along the major river corridors and large tributaries in Unit 18. We regularly see black and grizzly bears during moose calving surveys, and local residents have complained of heavy predation on calves by bears. However, little direct information is available regarding this type of predation in Unit 18. Certainly, some predation occurs, but the effect bears have on moose numbers, particularly through predation on calves, is unknown.

Reports indicate that wolf numbers have increased considerably during this and the previous 3 reporting periods. This is expected because caribou have become more available, moose numbers have increased, and trapping pressure has declined. We estimate that 250–300 wolves in 25–30 packs live in Unit 18. Throughout most of Unit 18 the distribution and density of wolves reflects the distribution and density of moose, especially in the Yukon River drainage. In the lower Kuskokwim River drainage, caribou are the main prey for wolves and wolf distribution is not as closely linked to moose.

HABITAT

Assessment

We estimate a minimum of 8000 mi^2 of moose habitat exists in Unit 18. Approximately 4500 mi^2 of this habitat occurs along the riparian zone of the Yukon River and the remaining 3500 mi^2 is found along the Kuskokwim River and its tributaries. The islands and adjacent sloughs along the Yukon River corridor from Paimiut to Mountain Village represent the most productive moose habitat in Unit 18. The Yukon Delta has many distributaries fringed by willows and cottonwoods and even though the moose population has grown in this area, it still has fewer moose than could be supported by the available forage.

The riparian corridor along the Kuskokwim River in Unit 18 downstream of Kalskag is excellent moose habitat. Between Lower Kalskag and Akiachak, the forest and brush along the Kuskokwim provide some escape cover for moose. Downstream of Akiachak toward the mouth of the Kuskokwim, the riparian corridor narrows and escape cover is lacking. Along the Kanektok, Goodnews, and Arolik Rivers, moose are rarely found in the riparian corridor because cover and browse are very sparse.

Tributaries of the Kuskokwim bordered by spruce and cottonwood, interspersed with willow and alder, extend onto the tundra along the Gweek and Johnson Rivers to the west, and along the Tuluksak, Fog, Kisaralik, Kasigluk, Akulikutak, Eek, and Kwethluk Rivers, and smaller unnamed rivers to the east. In each of these drainages, the habitat could support more moose. Lack of escape cover from illegal hunters is the limiting factor affecting moose numbers in these low-density areas.

During late August and early September 2001, we conducted an assessment of moose browse along the Yukon and Kuskokwim rivers following methods developed by Seaton (2002). Our goal was to categorize the effect of recent moose browsing on the predominant shrubs used by moose in winter, with an objective of categorizing shrub architecture to estimate what proportion of shrubs in each moose survey area exhibit a "broomed" growth form caused by repeated heavy browsing.

We selected sample sites within each of the moose survey areas based on boat accessibility, moose distribution during winter, and safe boating access during inclement weather. Within these sites feltleaf willow (*Salix alaxensis*) was the predominant species generated by primary succession following floods or ice scouring along sloughs. A few sites were in meadows off the mainstem of the river where diamondleaf willow (*S. pulchra*) was often the most prevalent species. A single linear transect was conducted at each site and these were defined by a start location using a GPS system and a compass bearing. Shrub architecture was characterized for the nearest stem to the boot toe on every fifth step and about 30 characterizations were made per transect.

We assigned shrub or sapling architecture between 0.5 and 3.0 m to one of 3 categories based on the visible browsing history over the life of the plant. *Unbrowsed* plants had no evidence of moose or snowshoe hare browsing, past or present. *Browsed* plants had fewer than half of current annual growth (CAG) twigs arising from lateral stems that were a product of browsing. *Broomed* plants could have sapling forms (main apical stem broken by moose) or bushy forms (more than half of the CAG leaders arising from lateral stems that were produced as a result of browsing). Broomed plants are essentially those in which moose or hares have significantly affected the growth form but not necessarily browse production or availability. A high proportion of broomed plants in a stand suggests that most of the plants used by herbivores have been intensely browsed in the past. We also noted if plants were *mature*, whereby >50% of CAG is >3.0 m.

Data and observations were summarized for each of the survey areas. The survey areas differ in moose density, vegetation, possibly predator abundance, patterns of snow accumulation, and spring phenology (up to 10 days later downriver on the Yukon).

LOWEST YUKON

We made 7 stops along Tunurokpak and Patsys Sloughs downriver from Mountain Village. Hare browsing was observed to 2 m, which provides a rough idea of snow drifting height by late winter. Hares had begun declining in abundance from their peak 2 winters ago and seemed to be influencing the growth form of shrubs more than moose (Table 8). Moose use of browse in this survey area was the lowest among the 4 we sampled, even though mean density of wintering moose was substantially higher on the Lowest Yukon survey area than on the Lower Kuskokwim. This area also had the highest proportion of mature shrubs, an indication that neither browsing nor ice scouring has kept willows from achieving free-to-grow status in the active floodplain.

ANDREAFSKY

We made 5 stops between St. Mary's and the site named Pilot Village on the U.S. Geological Survey topographical maps and observed a moderate amount of browsing and brooming (more by hares than moose), although sample sizes were small (Table 8).

PAIMIUT

We visited 15 sites between Pilot Station and the hunter check station on Paimiut Slough. The highest proportion of browsing and brooming by moose occurred in this survey area (Table 8), which corresponds to the highest moose density among the 4 survey areas (Table 1). The brooming index for Paimiut (28.2) was similar to that observed on the Yukon Flats in an area noted for its low moose density. Moose had more of an effect on shrub architecture than hares (Table 8).

LOWER KUSKOKWIM

We collected data at 8 sites between Lower Kalskag and Church Slough, just upriver from Bethel. The highest proportion of unbrowsed shrubs occurred in this count area, with neither moose nor hares having much effect on shrub growth form (Table 8).

The information in Table 8 conveys our visual impression that a substantial amount of available browse in the active floodplain is not used by moose, particularly in the downriver areas. Many shrubs categorized as “browsed” had only 1 or 2 stems eaten and often needed close inspection to detect use. Diamondleaf willow occurred mostly in the meadows adjacent to the floodplain and had the highest proportion of broomed architecture caused by moose. Diamondleaf was often much older with relatively little CAG biomass compared to feltleaf willow in the floodplain. Redstem willow (*S. arbusculoides*), which grows both in floodplain and meadow sites, was also heavily broomed (Table 9).

We observed lateral growth of CAG leaders from the trunks of feltleaf shrubs up to 20 cm diameter at breast height and >10 m tall on terraces 1–2 m above the active floodplain. When the older shrubs assume a mature tree form (>50% CAG >3.0 m), these low lateral leaders can provide substantial forage to moose despite the decadent appearance of older stands. In the areas we sampled, browsing on *mature* feltleaf willows composed 1.5% of foraging events for moose. This tree-like growth form and similar forage use in feltleaf willow has also been observed along Three Day Slough on the Koyukuk River which supports one of the highest winter densities of moose in Interior Alaska.

We did a rough count of 60 stems/m^2 in a 3-year-old feltleaf willow cohort roughly 1.5 m tall on primary succession at the lower mouth of Tucker Slough (upstream from Russian Mission). This density extrapolates to 600,000/ha (242,817/ac), which is 1–2 orders of magnitude higher than in meadows or higher terraces with older, taller willows spaced more widely. Although self-thinning mortality from competition will be severe over the next few years, feltleaf biomass per hectare in the younger cohorts is high. Widespread feltleaf cohorts of the same age are evidence of major flood events on sections of both rivers 5–6 years ago, indicating ample fluvial disturbance in much of Unit 18 in recent years.

Enhancement

There were no habitat enhancement activities in Unit 18 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The most important management need is to improve moose numbers within the Kuskokwim River drainage. We have continued discussions with the LKAC, the YDNWR, village and tribal leaders, and other interested parties to develop a strategy to increase moose numbers that is acceptable to local residents and managers alike and we have agreed upon a strategy centered around a 5-year moose hunting moratorium (Appendix 1). The LKAC voted unanimously to submit a proposal to the Board of Game to initiate the moratorium beginning in the fall of 2004. Local support is not universal but it is widespread as exemplified by the signed resolutions and other expressions of support we received from 11 of the 13 affected villages. We believe this support is essential for this strategy to succeed.

An issue that had greater importance during previous reporting periods is the allocation of hunting effort and harvest by local residents of Units 18, 19 and 21E. This is a “downriver resident” versus “upriver resident” issue along the Yukon and Kuskokwim Rivers. This issue has not been resolved but has lessened along the Yukon River as more moose have become available within Unit 18, and as understanding of upriver land ownership has grown. We hope to address this issue along the Kuskokwim through the Kuskokwim River moose strategy described above.

CONCLUSIONS AND RECOMMENDATIONS

Within living memory, moose have colonized the Yukon-Kuskokwim Delta in moderate densities along the Yukon River from Paimiut to the mouths of the Yukon, but remain at low to very low densities throughout the remainder of the unit. Although much of Unit 18 is lowland tundra unsuitable as moose winter habitat, moose could be present in higher numbers because areas of riparian habitat remain unoccupied and in all areas where moose are present, their numbers are lower than the habitat could support. Calf production and yearling recruitment are high, but hunting pressure from the relatively dense human population in the unit has slowed moose population growth and prevented a Kuskokwim River moose population from becoming established.

The illegal harvest, particularly of cows and particularly within the Kuskokwim River drainage, remains the most serious moose management problem in Unit 18. Although compliance is improving, a poorly developed cash economy, declining commercial fishing opportunities, and a high and growing density of people along the major rivers complicate moose management considerably. More than 20,000 rural residents live in 42 communities throughout Unit 18 and we need continued effort to curb illegal harvest of moose.

Differing state and federal seasons and bag limits for moose had previously hampered our ability to effectively manage moose and enforce hunting regulations. Recently however, there has been very good cooperation among federal and state wildlife managers to work toward common solutions for moose management. In general, throughout Unit 18 state and federal seasons now coincide.

Recent actions by user groups to shoulder some responsibility for the growth of local moose populations are welcome signs of increasing participation with existing management systems. Continued efforts to work with local user groups are vital for effective management and we are encouraged by the efforts of the LKAC to adopt a strategy to improve moose numbers within the Kuskokwim drainage.

We recommend that monitoring and taking inventory of the moose population remain a priority in Unit 18, especially the continuation of the population censuses along the Yukon and Kuskokwim Rivers. We should also continue to conduct composition counts and trend counts. The census results, in conjunction with composition surveys, will provide the department with baseline demographic and recruitment information to properly manage the moose population.

The poor harvest reporting rates in Unit 18 are being addressed through an incentive that uses harvest reports as entry forms for a prize drawing. This raffle was initiated during the 1998–1999 hunting season and it has been well received by area hunters. Table 10 shows a trend of increasing use of harvest tickets/reports that began prior to the initiation of this program and has continued. The credit this program deserves for this continued increase is unknown; however, there are educational components associated with this program that provide additional value. We recommend that this program be continued.

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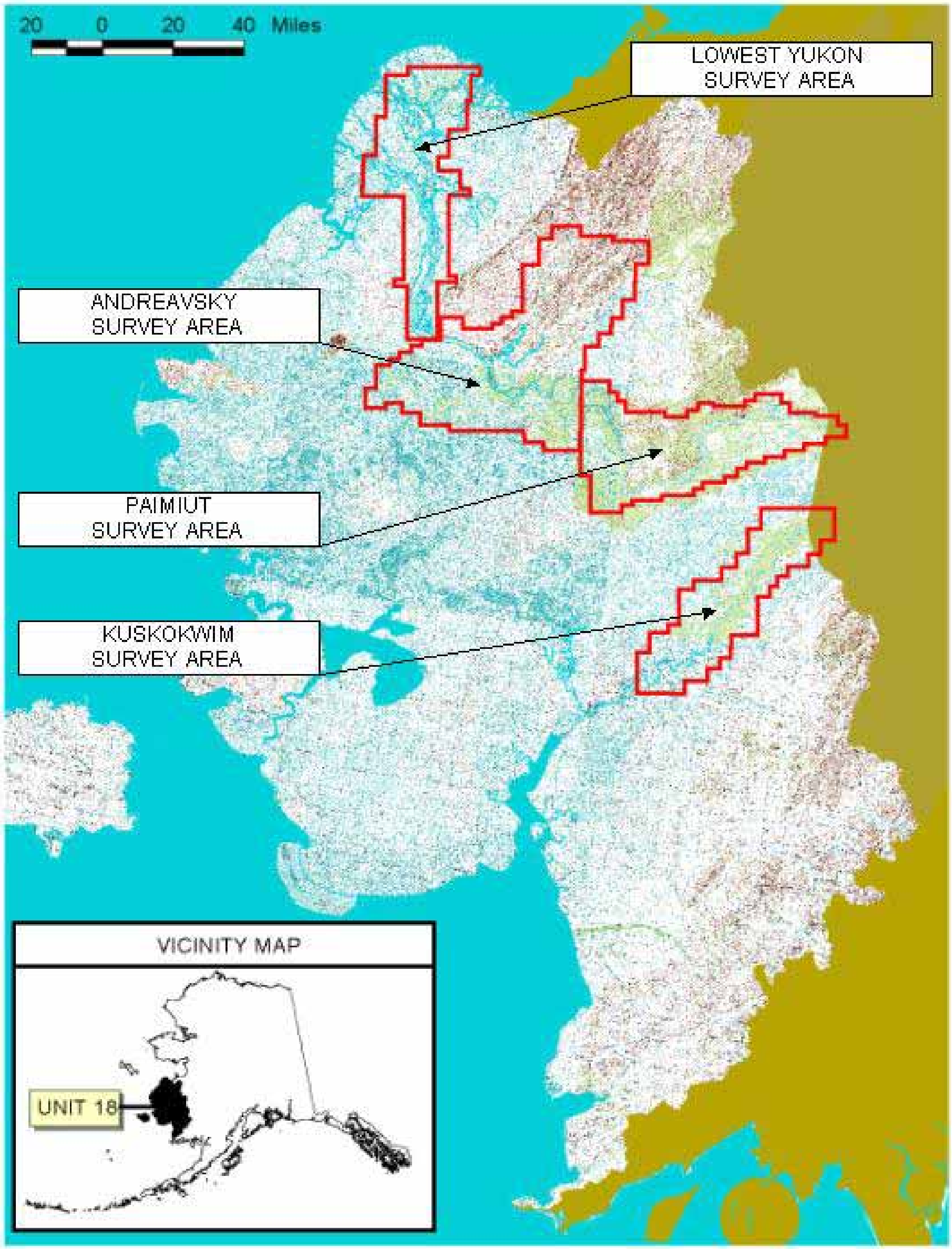

Figure 1 Unit 18 showing geostatistical population survey areas (Ver Hoef style survey areas). The larger area is shown for survey areas where boundaries were adjusted.

Table 1 Unit 18 moose population census history

Survey Area	Year	Area (mi^2)	Estimate at 95%CI	Density ($moose/mi^2$)	Census Technique
Lowest Yukon	1988	1703	0	NA	Minimum count
	1992	1703	28	0.02	Minimum count
	1994	1703	65	0.04	Minimum count
	2002	1151	674 ± 21.9%	0.59	Spatial method
Andreafsky	1995	1393	52 ± 74.0%	0.04	Gasaway method
	1999	2279	524 ± 29.8%	0.23	Spatial method
	2002	1150	418 ± 22.4%	0.36	Spatial method
Paimiut	1992	1558	994 ± 19.7%	0.64	Gasaway method
	1998	1558	2024 ± 12.9%	1.30	Gasaway method
	2002	1571	2382 ± 16.1%	1.52	Spatial method
Lower Kuskokwim	1993	648	216 ± 44.6%	0.33	Gasaway method
	2000	907	86 ± 26.4%	0.09	Spatial method
	2002	907	117 ± 18.3%	0.13	Spatial method
Lower Kuskokwim Unit 18 only	2002	869	94 ± 23.0%	0.11	Spatial method

Table 2 Comparison of moose seen per hour on the Kuskokwim in Unit 18 vs. similar habitat in the Paimiut survey area.

Location	Date	time searching	moose observed	moose per hour
Kuskokwim	Jan 2000	4:45	47	10
Kuskokwim	March 2001	1:25	8	6
Kuskokwim	April 2002	1:00	2	2
Yukon River	Jan 2000	1:56	445	229
Yukon River	March 2001	1:10	311	266
Yukon River	April 2002	0:59	90	90

Table 3 March 2002 estimate of calves:100 adults within Unit 18 survey areas

Survey Area	Calves:100 Adults
Paimiut	50.6
Andreafsky	21.8
Lowest Yukon	29.5
Lower Kuskokwim	40.3

Table 4 Spring composition counts in the Lowest Yukon Area

Year	Total	Bulls	Cows > 2	Cows = 2	Yearlings	Calves	Twins
2001	55	12	5	11	19		8
2002	25	5	7	2	3	4	4
2003	88	12	13	15	24	2	22

Table 5 Summary of moose hunting regulations and harvest in Unit 18, 2001–2003

Regulatory year	Resident or Nonresident hunt	Season dates	Bag limit and area affected
2001–2002	Residents and Nonresidents	5 Sep–25 Sep	1 bull; Yukon River Delta[a]
	Residents and Nonresidents	1 Sep–30 Sep	1 bull; remainder of Unit 18
	Residents	27 Dec–5 Jan[b]	1 bull; remainder of Unit 18 excluding the Kuskokwim River drainage[c]
2002–2003	Residents	1 Sep–25 Sep[d]	1 bull; Yukon River Delta north[e]
	Nonresidents	5 Sep – 25 Sep	1 bull; Yukon River Delta north[e]
	Residents	1 Sep–25 Sep[d]	1 bull; Yukon River Delta south[f]
	Nonresidents	no open season	Yukon River Delta south[f]
	Residents and Nonresidents	1 Sep–30 Sep	1 bull; Above Mountain Village north[g]
	Residents	1 Sep–30 Sep	1 bull; Above Mountain Village south[h]
	Nonresidents	no open season	Above Mountain Village south[h]
	Residents	17 Jan–26 Jan[b]	1 bull; excluding Yukon River Delta[a] and the Kuskokwim River drainage[c]

[a] That portion of Unit 18 north & west of a line from Cape Romanzof to Kusilvak Mountain, to Mountain Village, and excluding all Yukon River drainages upriver from Mountain Village.

[b] A 10-day winter season is announced by emergency order between 1 Dec and 28 Feb.

[c] The Kuskokwim River drainage includes the Kuskokwim River drainage proper and that poriton of Unit 18 south and east of the Kuskokwim River drainage.

[d] This resident season was changed by emergency regulation to address an economic emergency caused by poor salmon returns.

[e] That portion of Unit 18 including all Yukon River drainages north of the south bank of Kwikluak Pass and the Yukon River, including sloughs, downstream of Mountain Village.

[f] That portion of Unit 18 south of the south banks of Kwikluak Pass and the Yukon River, including sloughs, downstream of Mountain Village and north and west of a line from Cape Romanzof to Kusilvak Mountain, to Mountain Village.

[g] That portion of Unit 18 including all Yukon River drainages north of the south bank of the Yukon River, including sloughs, upstream of Mountain Village.

[h] That portion of Unit 18 south and east of a line from Cape Romanzof to Kusilvak Mountain, to Mountain Village and south of the south bank of the Yukon River, including sloughs, upstream of Mountain Village (or remainder of Unit 18).

Table 6 Fall and winter moose harvests for Unit 18, 1978–2003

Regulatory	Fall harvest		Winter harvest		Unknown harvest		Total
Year	(N)	(%)	(N)	(%)	(N)	(%)	Harvest (N)
1978–1979	42	88	6	12	0	0	48
1979–1980	11	92	1	8	0	0	12
1980–1981	45	94	3	6	0	0	48
1981–1982	72	90	8	10	0	0	80
1982–1983	54	93	4	7	0	0	58
1983–1984	61	97	2	3	0	0	63
1984–1985	63	87	7	10	2	3	72
1985–1986	43	83	8	15	1	2	52
1986–1987	54	90	6	10	0	0	60
1987–1988	40	83	8	17	0	0	48
1988–1989	67	98	0	2	0	0	68
1989–1990	31	94	1	3	1	3	33
1990–1991	55	90	6	10	0	0	61
1991–1992	63	94	4	6	0	0	67
1992–1993	64	83	13	17	0	0	77
1993–1994	93	97	3	3	0	0	96
1994–1995	76	87	11	13	0	0	87
1995–1996	71	96	3	4	0	0	74
1996–1997	97	100	0	0	0	0	97
1997–1998	95	100	0	0	0	0	95
1998–1999	124	99	1	1	0	0	125
1999–2000	136	95	7	5	0	0	143
2000–2001	166	95	5	3	4	2	175
2001–2002	140	86	9	6	13	8	162
2002–2003	202	91	10	4	11	5	223

Table 7 Reported moose harvest in the Yukon River, Kuskokwim River and Johnson River drainages, Unit 18, 1981–2003

	Moose harvest (%)		
Regulatory year	Yukon River	Kuskokwim River	Johnson River
1981–1982	57	32	11
1982–1983	58	36	6
1983–1984	63	33	4
1984–1985	62	32	6
1985–1986	67	17	16
1986–1987	66	34	0
1987–1988	52	42	6
1988–1989	81	19	0
1989–1990	55	39	6
1990–1991	80	15	5
1991–1992	75	24	1
1992–1993	64	33	3
1993–1994	77	24	2
1994–1995	86	14	0
1995–1996	85	15	0
1996–1997	72	28	0
1997–1998	75	24	1
1998–1999	78	12	6
1999–2000	80	18	2
2000–2001	82	14	3
2001–2002	127	29	2
2002–2003	185	32	4
Average	79	26	4

Table 8 Categorization of browse architecture on winter range of moose in GMU 18, western Alaska, August–September 2002. Feltleaf willow (*Salix alaxensis*) composed 77% of 1,134 shrubs sampled, followed by balsam poplar (*Populus balsamifera*, 7%), redstem willow (*S. arbusculoides*, 5%), diamondleaf willow (*S. pulchra*, 4%), and other shrub species.

						Moose		Snowshoe hares	
Count area (transects)	n[a]	% unbrowsed	% mature	% browsed	Brm index[b]	% browsed	Brm index[b]	% browsed	Brm index[b]
Lowest Yukon (7)	262	46.9	14.5	36.3	5.9	6.9	0 (18)	29.4	7.2 (83)
Andreafsky (5)	171	45.0	1.2	45.0	16.3	17.0	9.4 (32)	28.1	20.0 (60)
Paimiut (14)	460	37.0	1.7	41.5	28.2	37.4	29.2 (243)	4.1	17.4 (23)
Lower Kuskokwim (8)	240	77.5	6.3	16.3	0	10.0	0 (24)	6.3	0 (15)

[a] Number of shrubs categorized along linear transect, across all transects in survey area.

[b] Index is proportion of shrubs receiving any browsing that were broomed ((broomed / [browsed + broomed])* 100), by respective herbivore. Sample size for index ratio (in parentheses for moose and hares individually) is number broomed + number browsed. In 16 instances where both hares and moose had browsed an individual shrub, the event was recorded for both herbivores (1.4% of all observations).

Table 9 Categorization of browse architecture on winter range of moose in GMU 18, western Alaska, August–September 2002.

							Moose		Snowshoe hares	
Species[a]	Trans[b]	n[c]	% unbrowsed	% mature	% browsed	Brm index [d]	% browsed	Brm index [d]	% browsed	Brm index [d]
S. alaxensis	35	877	50.1	6.7	35.0	16.1	22.6	29.7 (244)	12.4	10.7 (122)
P. balsamifera	15	76	60.5	0	32.9	10.7	26.3	16.7 (24)	6.6	16.7 (6)
S. arbusculoides	14	51	35.3	2.0	37.3	34.5	5.9	76.9 (13)	31.4	0 (16)
S. pulchra	7	46	47.8	4.3	21.7	54.5	4.3	85.7 (14)	17.4	0 (8)
S. lasiandra	7	30	30.0	0	46.7	33.3	23.3	0 (7)	23.3	50.0 (14)
S. spp.[e]	8	25	20.0	0	76.0	5.0	20.0	0 (5)	56.0	6.7 (15)
C. stolonifera	1	15	46.7	0	40.0	25.0	40.0	25.0 (8)	0	0 (0)
A. spp.	3	13	76.9	7.9	15.4	0	15.4	0 (2)	0	0 (0)
R. hudsonianum	1	1	0	0	0	0	100	0 (1)	0	0 (0)

[a] *Salix alaxensis* (feltleaf willow), *Populus balsamifera* (balsam poplar), *S. arbusculoides* (redstem willow), *S. pulchra* (diamondleaf willow), *Cornus stolonifera* (red osier dogwood), *Alnus* spp. (alder), *Ribes hudsonianum* (northern black currant).

[b] Number of transects where represented (35 total among the 4 moose count areas).

[c] Number of shrubs categorized along linear transect, across all transects and moose count areas.

[d] Index is proportion of shrubs receiving any browsing that were broomed ((broomed / [browsed + broomed])* 100), by respective herbivore. Sample size for index ratio (in parentheses for moose and hares individually) is number broomed + number browsed. In 16 instances where both hares and moose had browsed an individual shrub, the event was recorded for both herbivores (1.4% of all observations).

[e] Positive identification not obtained; believed to be primarily *S. richardsonii* (Richardson willow) and *S. bebbiana* (Bebb willow).

Table 10 Number of hunters and reported harvest since the 1993–1994 regulatory year. A harvest reporting incentive program was initiated in 1998–1999.

Regulatory year	Number of hunters	Reported Harvest
1993–1994	249	96
1994–1995	247	87
1995–1996	301	74
1996–1997	350	97
1997–1998	363	95
1998–1999	383	125
1999–2000	436	143
2000–2001	421	175
2001–2002	428	162
2002–2003	589	223

APPENDIX 1.

Lower Kuskokwim Moose Strategy

1) The people of the Lower Kuskokwim River communities desire a larger moose population so a greater harvest can be sustained. This document is an agreement among the signatories on our strategy to achieve our goal.

2) This strategy applies to the Unit 18 portion of the Kuskokwim River drainage, including the Eek River drainage.

3) The moose season in this area will remain closed for 5 years beginning in the year 2004.

4) The fall season will be reopened for bulls only after 5 years of no hunting or there is a minimum moose population in the Lower Kuskokwim moose count area of 1000.

5) We recognize the importance of cow moose to future moose populations. We understand that there will be no cow hunts unless habitat degradation occurs from excessive moose browsing. We understand that most moose in a population are cows and that 20–30 bulls per 100 cows is normal in hunted populations.

6) We anticipate that the moose population will grow to at least 2000 moose in the Lower Kuskokwim count area after adherence to a 5-year moratorium on hunting and continued adherence to a harvest of bulls only.

7) We understand that a larger moose population will better, but not completely, serve the subsistence needs of the residents of this area. We fully expect, however, that the number of moose harvested locally will greatly increase.

8) Enforcement has a role in this strategy that needs to be developed in a cooperative fashion.

9) The reward this strategy promises is substantial, and we are committed to achieving our goal of at least 2000 moose in the Lower Kuskokwim moose count area.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 19 (36,486 mi^2); 21A and 21E (23,270 mi^2)

GEOGRAPHIC DESCRIPTION: All of the drainages into the Kuskokwim River upstream from Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers.

BACKGROUND

Moose are a relatively recent faunal addition to western Interior Alaska. According to oral history, their initial discovery was apparently sometime after the turn of the 20th century. As recent as the 1970s, populations were probably at record highs. Currently, moose are found throughout this area, with the exception of the rugged peaks of the Alaska Range. The major factors influencing moose abundance in the area include predation, weather, and hunting. Hunting pressure is thought to be moderate except in a few easily accessible areas. Failure to report harvests, particularly by local residents, is a chronic problem.

Unit 19, as well as Units 21A and 21E, can be conveniently divided into 2 regions that have distinct differences in moose habitat, user access, and hunting practices. Units 19A, 19D, and 21E are generally lower elevation areas accessible by boat. Hunters generally have been local residents living and hunting for food in Unit 19, Unit 21, or adjacent Unit 18. Units 19B, 19C, and 21A are generally higher elevation areas where access is largely restricted to aircraft. Few people live in these areas, and those traveling there to hunt have been mainly seeking large bulls for their trophy quality, although acquisition of meat has been an important consideration as well.

Aerial composition surveys have been the primary means of assessing population status and trend in this large area. There is a history of surveys dating back several decades. Unfortunately, these data are of limited value because of inconsistencies in survey areas and methods. The surveys are also subject to annual variations in weather conditions that affect moose movements and the timing and quality of surveys.

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Historical moose survey information is limited. A combination of changes in moose survey techniques and the logistical challenges of moose surveys in remote areas has resulted in a discontinuous and often not comparable moose count database. Since the general standardization of survey techniques in the 1980s, we have attempted to establish trend count areas and survey areas to balance the information needs of management with fiscal limitations.

Regulations, including controlled use areas (CUA) and other requirements to manage moose hunting and reduce conflicts between user groups, have existed in the area for many years. The Holitna-Hoholitna CUA consists of the middle to lower portions of the Holitna and Hoholitna Rivers and Titnuk Creek. It is closed to the use of any boat equipped with inboard or outboard motor(s) with an aggregate power in excess of 40 horsepower for the taking of big game, including transportation of big game hunters, their hunting gear, and/or parts of big game, during 1 August through 1 November.

The Upper Holitna–Hoholitna Management Area consists of Unit 19B within the Aniak, Kipchuk, Salmon, Holitna, and Hoholitna River drainages. Hunters in this CUA must stop at a check station. Moose and caribou taken in the area by a hunter who accesses the area by aircraft must be transported out of the area by aircraft. Meat from moose harvested prior to 1 October within the Unit 19A portion of the Holitna-Hoholitna CUA and in all of Unit 19B must remain on the bones of the front quarters and hindquarters until removed from the field or processed for human consumption. Nonresident hunters in Unit 19B must attend an Alaska Department of Fish and Game (ADF&G) approved hunter orientation course. This course involves watching department videos about care of big game meat and judging size and trophy quality of moose antlers.

In Unit 19D the Upper Kuskokwim CUA closes the area to the use of aircraft for moose hunting. This CUA consists of much of Unit 19D upstream from the Selatna River.

In Units 21A and 21E, the Paradise CUA closes the area to the use of aircraft for moose hunting. This CUA includes the area between the Innoko River and the lower Bonasila River near Anvik.

MANAGEMENT DIRECTION

Unit boundaries within the area were designed to provide for 2 major uses of moose. The lowland areas along the Kuskokwim River (Units 19A and 19D) and along the Yukon and lower Innoko Rivers (Unit 21E) have been managed to attempt to provide a sustained, relatively high harvest of moose. The higher elevation portions (Units 19B, 19C, and 21A) have been managed largely for trophy quality animals. Because topography directly affects access, management of the area should continue to be based on these premises.

MANAGEMENT OBJECTIVES

- Annually assess population status, trend, and bull:cow ratios in portions of the area where harvest levels make significant impacts on moose populations.

- Maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C, and 21A.

- Assess accuracy of harvest reporting in selected portions of the area.

- Encourage landowners to reduce fire suppression efforts on wildfires that do not threaten human life, property, or valuable resources, so that fire can fulfill its natural role in maintaining young, highly productive, and diverse habitats.

METHODS

We conducted population composition and trend surveys in selected portions of the area using standard aerial survey techniques (Gasaway et al. 1986). We conducted these surveys in 50–100 mi^2 sampling areas with fixed boundaries. We used fixed-wing aircraft to conduct the surveys in the fall after sufficient snowfall occurred, but prior to antler shedding by bulls. Search intensity was usually 3–5 minutes/mi^2, depending on the habitat type and the associated visibility.

We estimated population size in a portion of Unit 21E during February 2000 and in a broad area around the Aniak River in Unit 19A during March 2001 using the Geostatistical Population Estimator technique (GSPE; Ver Hoef 2001). We also used the GSPE to estimate populations in a portion of Unit 19D East in November 2000, October 2001, and November 2003. The survey area included the portion of Unit 19D in the Kuskokwim River drainage upstream from the Selatna River, not including the Takotna River drainage upstream from its confluence with the Nixon Fork. Radiocollared moose observed within a 528-mi^2 area of the larger survey area were recorded during 2001 and 2003 for sightability correction factor (SCF) calculations. A limited late winter survey to estimate calf survival was conducted in the Holitna-Hoholitna drainage of Unit 19A during 8–9 April 2003. Using a Cessna 206 with a pilot and 1 observer, the riparian zones within ½ mile of the Holitna River (from the mouth to Ituliluk Creek) and lower Hoholitna River (from the Holitna River confluence to Big Diamond) were surveyed. Moose were classified as adult or yearling cohorts; classification to gender was not possible due to the absence of antlers on adult males.

We fitted 38 moose (29 adult females, 9 adult males) with radio collars in October 2003. Moose were captured using standard helicopter darting procedures, including the use of an immobilization drug mixture of carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado, USA) and xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Iowa, USA). Capturing these moose in the fall presented challenges, partly because of differences in seasonal distribution of moose, open water, lack of snow to help locate moose, and warmer temperatures. Overall the capture project was a success; however, early spring captures are easier to accomplish. Radio collars were distributed on moose in Unit 19A in the lower Holitna River (10 collars), the lower Aniak River drainage (10 collars) and in Unit 19B in the upper Holitna and Hoholitna drainages (18 collars). Flights to track the locations of these radiocollared moose were conducted on a regular basis since they were put in place.

We conducted calf twinning surveys during May and June. They were conducted much like the fall composition and trend surveys, except they were flown beginning in mid May when moose calving starts and continued through early June when leaf out limits sightability. Calf twinning surveys were completed in fixed geographical areas; however, search effort was greatest in meadows and low shrub areas with high sightability.

We monitored harvest by requiring hunters to acquire moose harvest tickets and to report residency, effort, location of hunt, transportation method, commercial services used, success, sex of kill, and antler width. In a portion of Unit 19D, we established a registration hunt in the fall 2001 season to better gather hunter data and to collect teeth from harvested moose to assess the age structure of the harvest. Population and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

We conducted trend area counts in Units 19A, 19C, and 19D during RY01–RY02. We completed population estimates in Unit 21E in February 2000, the Aniak area in Unit 19A during March 2001, and in Unit 19D in November 2000, October 2001 and November 2003.

Unit 19A. The Unit 19A moose population was declining, based on trend data from the Holitna–Hoholitna trend count area and a density estimate using the GSPE in 1731 mi^2 of the Aniak River drainage in March 2001. Trend area information from the Holitna–Hoholitna drainages indicated observable moose numbers increased from the late 1980s until RY94, when peak numbers of total moose and moose per hour were observed (Table 1a). Trend counts during RY96 and RY97 indicated a decrease in total numbers of moose observed. Trend surveys were not conducted during RY98–RY00 or RY02–RY03 because of poor survey conditions and manpower challenges. The November 2001 trend count indicated very low numbers, including very low bull:cow ratio (6:100), low calf:cow ratios (8:100), and the lowest number of moose per hour ever recorded (59) in the trend area. Some of the decline could have been due to atypical moose distribution caused by shallow snow and relatively temperate late fall weather. The March 2001 GSPE density estimate in the Aniak River drainage was 0.70 moose/mi^2 (±21%, 90% CI), indicating a moderate late winter moose density for large areas (>2000 km^2) of western Interior Alaska. These data indicated poor calf survival to fall and poor overwinter adult survival. Based on local hunter and trapper information, predation by wolves and an increasing grizzly bear population could be primary factors influencing the moose population.

Unit 19B. No trend count data or population estimates are available for Unit 19B. Moose trend count areas were established sporadically, but were abandoned because early winter snowfall conditions varied greatly, influencing moose distribution and causing extreme variations in the data. However, the moose population in Unit 19B appeared to be stable to declining, based on harvest data and information from local hunters and guides.

Unit 19C. The moose population in Unit 19C was stable to declining based on trend counts (Table 1b). Trend data through fall 1996 showed a population increase. Composition ratios were very similar during RY97 and RY99; however, the total number of observed moose declined during this report period. The RY01 fall survey indicated a continued slow decline in the bull:cow ratio and a stable calf:cow ratio. For the first time, the yearling bull:cow ratio showed a decrease, possibly indicating low calf survival. The total number of moose observed was similar to other years, and the average number of moose observed per hour was similar to RY99. The decline in the bull:cow ratio was due to declining overall numbers. Based on hunter and trapper information, poor calf survival was primarily due to predation by bears and wolves. No survey was conducted in RY02 due to poor survey conditions. The RY03 trend survey indicated a stable bull:cow ratio and improved calf:cow ratio and yearling bull:cow ratio. In addition, the number of moose observed per hour during RY03 was higher than the RY99 and RY01 surveys, indicating the population may be stable.

Unit 19D. The moose population in Unit 19D remained at low densities during this reporting period (RY01–RY02). Low densities are indicative of the low-density equilibrium described by Gasaway et al. (1992) for wolf–bear–moose systems in Alaska and Yukon, Canada. The GSPE completed in November 2000 in Unit 19D East (5204 mi^2) indicated overall moose density was 0.16 $moose/mi^2$ (±33%, 95% CI). The October 2001 GSPE, completed in the same area as the 2000 survey, was 0.32 to 0.67 $moose/mi^2$ (90% CI, 84% SCF). The higher 2001 count was attributed to several possible factors including 1) higher survey intensity, 2) better sightability conditions, and 3) randomly drawing more productive sample units.

The November 2003 GSPE survey indicated overall moose density was 0.23 to 0.42 $moose/mi^2$ (90% CI, 75% SCF). The 2003 survey data should be interpreted with caution because the survey was terminated due to poor weather. Only 50% of sample units in the 528-mi^2 core area and 7% of sample units in the remaining 4676 mi^2 of the survey area were flown. Unit 19D also contains the well-established Candle–Wilson composition/trend count areas where observed numbers of moose fluctuated between 51 and 82 total moose during RY98–RY03 (Table 1c).

Unit 21A. No department trend count data or population estimates are available for Unit 21A. However, based on harvest data, winter observations by trappers, and survey data from the Innoko National Wildlife Refuge, we estimate the moose population in Unit 21A to be stable to declining. Trend data was not collected on a regular basis in the unit. However, anecdotal winter observations by trappers indicated a decline in the overwintering population. Also, staff from the Innoko National Wildlife Refuge estimated a density of 0.64 $moose/mi^2$ (±29.6%, 90% CI) in the refuge portion of Unit 21A and Unit 21E. Results of this estimate are not directly comparable to our GSPE density measures due to differences in technique.

Unit 21E. The moose population in Unit 21E is believed to have been stable during RY01–RY02. No surveys were conducted in the Holy Cross trend area during RY99–RY03 due to poor survey conditions (Table 1d). Our February 2000 GSPE survey in a 5070-mi^2 portion of Unit 21E indicated a moderate to high density of 1.0 $moose/mi^2$ and provided a baseline for further population monitoring.

Population Composition

In Unit 19A, bull:cow ratios from 12 fall surveys between RY76 and RY97 in the Holitna River drainage showed some deterioration of the bull:cow ratio, and the RY01 survey indicated further decline (Table 1a). Intense hunting pressure in that area, along with predation from bears and wolves, probably caused some of the declining ratios. Fall calf:cow ratios fell precipitously in this area, indicating low calf survival. This substantiated data gathered during the February 2000 survey along the Hoholitna River. That survey indicated 9-month-old calf survival was <5% (7:152), which was very low. The total number of moose observed was also low during the survey, indicating a declining population in that area.

Unit 19B composition data is largely unknown. However, harvest data indicated a decline in the number of bulls during RY99–RY02 (Table 2a). Anecdotal information collected from several guides indicated a reduction in the number of bulls available over the past few seasons.

The Farewell trend count area represented Unit 19C population composition. In 12 surveys conducted in the Farewell area from RY87 to RY03, notable increases in the moose population were seen through RY96. Data indicated a general decline in the bull:cow ratio from RY97 through RY01. Yearling bull:cow ratios remained relatively steady from RY90–RY99; however, RY01 survey data indicated a decline in the yearling bull:cow ratio. Calf:cow ratios appeared to remain stable. The RY03 survey data indicated stable bull:cow ratios and improved yearling bull:cow and calf:cow ratios (Table 1b).

In Unit 19D the moose population continued at low densities. Bull:cow ratios in the Candle-Wilson count area were low and declined from 13:100 in RY98 to 5:100 in RY03 (no surveys occurred in RY99 and RY02). Yearling bull:cow ratios were very low (2–4:100) and calf:cow ratios varied from 22 to 52:100 cows (Table 1c). Fluctuations could have been due to a combination of decreasing sample size and declining calf survival. The 2001 GSPE survey indicated bull:cow ratios of 19–66:100 and 13–37:100, yearling bull:cow ratios of 3–13:100 and calf:cow ratios of 14–42:100 (90% CI, 84% SCF). The 2003 GSPE survey indicated bull:cow ratios of 13–37:100, yearling bull:cow ratios of 0–13:100 and calf:cow ratios of 30–84:100 (90% CI, 75% SCF). Both the 2003 GSPE and the 2003 Candle-Wilson trend count data indicate that the calf:cow ratios have increased, although the bull:cow ratios remain low. Twinning rates for moose in Unit 19D East were 39% (18 of 46) in 2002, 36% (14 of 39) in 2003, and 39% (12 of 31) in 2004 (Keech and Boudreau 2004).

Units 21A and 21E sex and age composition data were not gathered from the Holy Cross trend count area during RY99–RY03 due to poor survey conditions in the fall. A February 2000 GSPE survey estimated 16% calves in Unit 21E, indicating good production and survival to February. A twinning survey on the lower Innoko in Unit 21A on 4 June 2003 indicated a twinning rate of 30%.

MORTALITY

Harvest

Seasons and Bag Limits.

Bag limits and season dates for RY01 were:

Regulatory Year 2001–2002 **Unit and Bag Limits**		**Open Season**
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit only; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the Kolmakof River drainage and south of the Kuskokwim River upstream from, but not including, the Holokuk River drainage		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
Or, 1 moose.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
Or, 1 bull by registration permit RM655.		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–25 Sep

Regulatory Year 2001–2002 Unit and Bag Limits		Open Season
Unit 19D, that portion of the Kuskokwim River drainage upstream from and including the Selatna River drainage, except for that portion of the Upper Kuskokwim Controlled Use Area south and east of the Kuskokwim and North Fork Kuskokwim River		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River Controlled Use Area south and east of the Kuskokwim River and North Fork Kuskokwim River		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainage, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep 20
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
	Or,	1 Dec–31 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
Or; 1 moose; moose may not be taken within one-half mile of the mainstem of the Yukon or Innoko Rivers.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Bag limits and season dates for RY02 were:

Regulatory Year 2002–2003 Unit and Bag Limits		**Open Season**
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof River and the Holokuk River within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof River and the Holokuk River outside the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19A, that portion of the Kuskokwim River downstream from, and including, the drainages of the Kolmakof River and the Holokuk River within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		5 Sep–20 Sep
Unit 19B within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep

Regulatory Year 2002–2003 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
Or, 1 bull by registration permit RM655.		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage downstream from the Big River drainage and upstream from the Selatna River, but excluding the Selatna River drainage and the Black River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River upstream from and including the Big River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A, within the Nowitna River drainage		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov

Regulatory Year 2002–2003 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Remainder of Unit 21A		
RESIDENT HUNTERS: 1 bull		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
Or, 1 moose; moose may not be taken within one-half mile of the mainstem of the Yukon or Innoko Rivers.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep

Few changes were made to the hunting seasons in RY03. Seasons and bag limits during RY03 were:

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit only; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof and Holokuk Rivers within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof and Holokuk Rivers outside the Nonresident Closed Area		

Regulatory Year 2003–2004 **Unit and Bag Limits**		**Open Season**
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19A, that portion of the Kuskokwim River downstream from, and including, the drainages of the Kolmakof and Holokuk Rivers, within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19B within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
Or; 1 bull by registration permit RM655		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage downstream from the Big River drainage and upstream from the Selatna River, but excluding the Selatna River drainage and the Black River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River drainage upstream from and including the Big River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A, that portion within the Nowitna River drainage		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Remainder of Unit 21A		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep

Further changes to the regulations were enacted for the RY04 and RY05 seasons. Most of these changes were in response to the Central Kuskokwim Moose Management Plan (CKMMP) (ADF&G 2004). Changes are described in the next section, and bag limits and season dates for RY04–RY05 are:

Regulatory Year 2004–2005 Unit and Bag Limits	Open Seasons
Unit 19A, that portion within the Lime Village Management Area	
RESIDENT HUNTERS: 2 antlered bulls; up to 28 antlered bulls may be taken by Tier II subsistence permit; up to 14 permits may be issued.	10 Aug–25 Sep Or, 20 Nov–31 Mar
NONRESIDENT HUNTERS:	No open season
Remainder of Unit 19A	
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season in RY04
1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep beginning RY05
Unit 19B within the Nonresident Closed Area	
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.	1 Sep–20 Sep
Or, 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season
Remainder of Unit 19B	
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.	1 Sep–20 Sep
Or, 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side. Hunter orientation required.	5 Sep–20 Sep
Unit 19C	
RESIDENT HUNTERS: 1 bull with spike-fork or 50-inch antlers, or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
Or, 1 bull by registration permit RM655.	1 Feb–28 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage upstream from the Selatna and Black River drainages but excluding the Takotna River drainage upstream of Takotna village	

Regulatory Year 2004–2005 Unit and Bag Limits	Open Seasons
RESIDENT HUNTERS: 1 antlered bull by registration permit RM650.	1 Sep–25 Sep
NONRESIDENT HUNTERS:	No open season
Unit 19D, that portion of the Takotna River drainage upstream of Takotna village	
RESIDENT HUNTERS: 1 antlered bull by registration permit RM650.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season
Unit19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River	
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
Remainder of Unit 19D	
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season
Unit 21A, that portion within the Nowitna River drainage	
RESIDENT HUNTERS: 1 antlered bull.	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–20 Sep
Remainder of Unit 21A	
RESIDENT HUNTERS: 1 antlered bull	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–25 Sep
Unit 21E	
RESIDENT HUNTERS: 1 antlered bull.	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. Unit 19D season dates for RY00 were changed during the spring 2000 Alaska Board of Game meeting. We proposed reducing the season to 15 days in September and eliminating the December season, except in the remainder of the unit downstream of the Selatna River. The goal was to slow the decline in bull:cow ratios. The board passed a 5-day season reduction during the fall season throughout the unit and shortened the December season upstream of the Selatna River to 1–15 December.

Included with these changes was a complete elimination of the nonresident season below the Selatna River drainage.

During a special May 2001 meeting in Fairbanks, the board made several changes to the moose season for RY01 in Unit 19D East. The board expanded the size of the Upper Kuskokwim Controlled Use Area for moose hunting to include all the Takotna River drainage and the Kuskokwim drainage south of the Big River to the Selatna River and Black River drainages. The board created a moose registration hunt in Unit 19D East to allow the department to collect more precise information on hunter effort and harvest. The board also passed a proposal to open a small area for nonresidents to hunt moose in the Cheeneetnuk and Gagaryah River drainages, excluding a corridor extending 2 miles north of the Swift River. The board had closed that area during the spring 2000 meeting.

In RY01 the 1–15 December season for any bull in the part of Unit 19D upstream from the Selatna and Black River drainages was closed by emergency order. We also closed the 1–10 February seasons in Unit 19A by emergency order.

During the spring 2002 board meeting in Fairbanks, several changes were made for RY02. A nonresident closed area was created in Units 19A and 19B. This area became closed to the taking of caribou and moose by nonresidents in areas extending 2 miles on either side of, and including, the Holitna River from the mouth of the Chukowan River to the Kuskokwim River; the Titnuk River from Fuller Mountain to the Holitna River; the Hoholitna River from Old Woman Rock to the Holitna River; the Aniak, Salmon, and Kipchuk Rivers from the mouth of Bell Creek of the Salmon River to the Kuskokwim River, including the main channel of the Aniak River downstream from Atsaksovlak Creek, and the Kipchuk River from its confluence with the Aniak River to a point 25 river miles upstream; the Owhat River; the Kolmakof River from its confluence with the Kuskokwim River to a point 5 river miles upstream; the Holokuk River from its confluence with the Kuskokwim River upstream to its confluence with Chineekluk Creek; Veahna Creek; the Oskawalik River from its confluence with the Kuskokwim River upstream to a point 2 miles north of Henderson Mountain; Crooked Creek from its confluence with the Kuskokwim River upstream to Crevice Creek; the George River from its confluence with the Kuskokwim River upstream to the South Fork; the Buckstock River, from its confluence with the Aniak River to a point 5 river miles upstream; the Doestock River from its confluence with the Aniak River to a point 5 river miles upstream; Aniak Slough; and the Kuskokwim River from the mouth of the Holitna River downstream to the boundary of Unit 18.

In Unit 21A in the Nowitna River drainage, the nonresident season was shortened to 5–20 September to align with the lower Nowitna River nonresident season. In Unit 19A the board prohibited hunting for moose and caribou by nonresidents within 2 miles of either side of all rivers in Unit 19A from Kalskag to the Holitna River. This was a compromise between the area guides and local subsistence hunters who had proposed closing the unit entirely to nonresident hunters.

The department supported shortening the RY02 fall season in Units 19A and 19B, but the board decided to maintain the existing seasons. It passed a proposal to reduce the February season in Unit 19A upstream of the Holokuk and Kolmakof drainages from 1–10 February to

1–5 February and changed the bag limit from any moose to bulls only. The board maintained the 1–10 February season in Unit 19A downstream from, and including, the Holokuk and Kolmakof drainages. The board also extended the Holitna-Hoholitna River Management Area to include the Aniak River drainage, requiring hunters who fly into Unit 19B and take big game to also fly out of Unit 19B. This restriction was implemented to address concerns that meat was spoiling during the long raft trip into Unit 19A. These hunters can no longer float downriver from Unit 19B into Unit 19A. The board passed a proposal for the August portion of the Unit 19D moose season changing the border from the riverbank to the drainage, allowing hunters on the North Fork Kuskokwim River to hunt both banks. The board eliminated the December season in Unit 19D East and reduced it to 1–15 December in the remainder of the unit. The board passed a department-amended version of a public proposal to reduce the season in Unit 19C to 1–20 September. The original proposal was to restrict resident hunters to bulls with 50-inch antlers and increase the antler restrictions for nonresidents to 55 or 60 inches.

For RY03 the board shortened the nonresident season in Unit 19C by moving the ending date from 25 September to 20 September and eliminated the February resident season in Unit 21E.

At the spring 2004 meeting, the board changed many area season dates and bag limits for the RY04 season. In Unit 19A the board changed the bag limit in the Lime Village Management Area from 2 moose to 2 antlered bulls, eliminated the hunting season for nonresidents in the entire unit for RY04, and established season dates of 1–20 September for RY05.

In Unit 19B the board shortened all resident and nonresident seasons to 1–20 September. The board also changed the bag limit in the nonresident closed area from 1 bull to 1 antlered bull for resident hunters who choose to hunt with registration permit RM640, or 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side for resident hunters who choose to hunt with a general season harvest ticket.

In Unit 19C the board changed the bag limit for resident hunters during the September season from 1 bull to 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Registration hunt RM655 for resident hunters was shortened from 15 January–28 February to 1–28 February. The board changed the nonresident season in Unit 19C to 1–20 September, adding 5 days to the beginning of the season.

In Unit 19D the area for registration hunt RM650 by resident hunters was changed to include the Kuskokwim River drainage upstream from the Selatna and Black River drainages, including the Takotna River drainage, and the bag limit was changed from 1 bull to 1 antlered bull. The season date for RM650 in the Kuskokwim River drainage upstream from the Selatna and Black River drainages but excluding the Takotna River drainage upstream of Takotna village was lengthened to 1–25 September by adding 5 days at the end of the season. The season date for RM650 in the Takotna River drainage upstream from Takotna was shortened to 1–20 September by deleting the August portion of the season. The board made no changes to the nonresident season in Unit 19D between and including the Cheeneetnuk and Gagaryah River drainages, excluding the portion within 2 miles of the Swift River. However, the board eliminated the December season for resident hunters in this area and in the remainder of Unit 19D.

In Units 21A and 21E the board changed the bag limit for resident hunters from 1 bull to 1 antlered bull. The board also eliminated the resident hunters' November season in Unit 21A.

Hunter Harvest. Hunter harvest is reported in Tables 2a–2h. Reported annual moose harvest in Unit 19A continued to decline during RY01–RY02 (average = 81). The average reported annual harvest during RY98–RY02 was 106 (Table 2b). The majority of moose reported taken during RY98–RY02 were bulls (98%), with light cow harvest in February. Because the reporting rate by local hunters was low, actual harvest rates were a minimum of 33% greater.

Annual reported harvests in Units 19B and 19C were probably much closer to actual harvest than in Unit 19A. They averaged 122 and 120 moose, respectively, during RY98–RY02 (Tables 2a and 2d). Harvest in these units declined from RY99–RY00 to RY01–RY02.

In Unit 19D, compliance with reporting requirements had been poor. The 5-year reported kill averaged 95 during RY98–RY02 (Table 2e). We implemented registration hunt RM650 in most of the unit beginning in RY01. This may have increased reporting compliance for the portion of Unit 19D that remained a general season hunt during RY01–RY02. Reported harvest averaged 106 during RY01–RY02, compared to 90 during RY99–RY00 before the registration hunt was implemented.

In Unit 21A, reported moose harvest decreased during the report period, with 85 animals taken on average, compared with an average of 113 during RY99–RY00 (Table 2g). The 5-year average harvest during RY98–RY02 was 103 moose. In Unit 21E reported harvest declined during RY98–RY02, with an average harvest of 181 moose. During RY01–RY02, harvest averaged 168 moose in Unit 21E. The reported harvest of 210 moose in RY97 was the highest on record (Table 2h).

Permit Hunts. Beginning in RY90 a Tier II drawing permit hunt was established for moose hunting in the Lime Village Management Area in Unit 19A. During RY90, 10 permits were issued with a harvest quota of 25 moose of either sex. In RY93 the bag limit was changed to 28 moose with a limit of 2 per permit. Reported harvests were light. For example, the RY98 hunt included 7 moose killed, 1 unsuccessful hunter, and 7 permittees who did not attempt to hunt (Table 3). There was also a federal permit hunt in the same area, with a harvest quota of 40 moose.

In Unit 19C, registration hunt RM655 was established in RY97. The season was 15 January–15 February and excluded the use of aircraft. Hunter participation had been low; however, interest by Nikolai residents has increased. The average reported harvest during RY98–RY02 was 4 moose (range 0–7), with an average of 8 hunters (range 3–18). During the report period (RY01–RY02), 27 permits were issued and 13 moose were harvested.

In RY01 registration hunt RM650 was put into place in Unit 19D East. This was a result of the Unit 19D East planning team meetings. The goal was to more accurately assess hunter effort and success in Unit 19D East. Moose teeth collected from successful hunters in this hunt will be processed and aged to examine the age structure of the population. The number of permits issued decreased from 210 in RY01 to 225 in RY02, and harvest increased from 73 to 98 moose (Table 3).

Antler Size. In RY98–RY02 the average antler size for harvested bulls was 54 inches in Unit 19B, 51 inches in Unit 19C, and 52 inches in Unit 21A. These units had a high proportion of nonresident hunters who were required to take bulls with a minimum antler size of 50 inches. The average antler size was 44 inches in each of Units 19A, 19D and 21E for RY98–RY02. These units had a high proportion of local resident hunters who were not required to take bulls with a minimum antler size. Average antler size during this 5-year period increased slightly in Units 19A, 19B, and 21E; decreased slightly in Units 19C and 19D, and were generally stable in Unit 21A during RY98–RY02.

Hunter Residency and Success. During RY98–RY02 the majority of hunters in Units 19A, 19C, 19D, and 21E were Alaska residents (Tables 4a–4h). Local residents made up the majority of those hunters in Unit 19D. The majority of hunters in Unit 19B and 21A were nonresident hunters. Access, residency restrictions and availability of boat access were likely the primary factors that determined hunter residency.

Hunter residency remained relatively stable during RY98–RY02. Of those who reported hunting in Unit 19A, hunters who lived in Unit 19 accounted for 29% of the total, Alaska residents from outside Unit 19 accounted for 50%, and nonresidents accounted for 21% (Table 4b). Unit 19B hunters consisted of nonlocal Alaskans (37%) and nonresidents (63%) (Table 4c). Hunters in Unit 19C were nonlocal Alaskans (63%) and nonresidents (37%). Very few people live in Units 19B and 19C. Unit 19D hunters were largely local residents (55%), while nonlocal Alaska residents made up 34%, and nonresidents accounted for 11% of the hunters who reported (Table 4e). Residency restrictions in much of the area likely decreased the number of nonresident hunters.

During RY98–RY02, hunter residency varied little from the previous 5-year period. Unit 21A hunters consisted largely of nonresidents (53%) and nonlocal Alaskans (47%). Locals did not report hunting in Unit 21A (Table 4g), and few people live there. This is a shift from predominantly nonresident hunters in Unit 21A during RY96–RY00 to an increase in percentage of nonlocal residents during RY98–RY02. Hunters who reported hunting in Unit 21E during RY98–RY02 were mostly nonlocal residents, primarily from Unit 18 (61%), while 20% were from the 4 villages in the unit and nonresidents averaged 19% (Table 4h).

During RY98–RY02, success rates were stable or declining in the different units (Tables 4a–4h). In Unit 19A the average success rate was 37% and declined from 50% in RY98 to 26% in RY02 (Table 4b). In Unit 19B, success averaged 34% and was relatively stable ranging 31% to 37% (Table 4c). In Unit 19C, success averaged 48% and declined from 52% in RY98 to 42% in RY02 (Table 4d). In Unit 19D success averaged 46% and ranged 35% to 60% during RY98–RY02 (Table 4e). In Unit 21A average success was 49% and ranged from 58% in RY98 to 45% in RY01 (Table 4g). In Unit 21E average success was 74% and declined from 80% in RY98 to 67% in RY02 (Table 4h).

Transport Methods. Transportation methods used by successful moose hunters are reported in Tables 5a–5h. As in previous years, boats were the most commonly used method during the report period (RY01–RY02) in Units 19A, 19D, and 21E, averaging 71%, 84%, and 68%. Aircraft were the second most common method in those units, averaging 21%, 12%, and 17% (Tables 5b, 5e and 5h). In Units 19B, 19C, and 21A, aircraft transportation dominated during

RY01–RY02, averaging 85%, 65%, and 74% (Tables 5c, 5d and 5g). Boats were the second most common method of transport in Units 19B and 21A, averaging 13% and 20%. In Unit 19C, however, the second most common transportation method was 3- or 4-wheelers, averaging 24% during RY01–RY02 (Table 5d). Most of these hunters transported ATVs to the Farewell Station airstrip. Differences in transportation methods in different areas were used to define the original unit boundaries to spatially separate user groups and hunting patterns. Therefore, local hunters have been largely separated from nonlocal hunters since the unit boundaries were last adjusted in the early 1980s.

Other Mortality

Illegal harvests, defense of life or property kills, wounding loss, and funeral potlatch (Table 6) harvests probably account for an additional 150–200 moose deaths annually in Unit 19 and probably 100–150 additional kills in Units 21A and 21E. Of much greater importance to the dynamics of the moose population, however, is predation mortality. Based on trapper questionnaires, pilot reports, and data collected during moose surveys, predation on calves, yearlings, and adults by wolves has been substantial in recent years, as has calf predation by black bears.

HABITAT

Assessment

In forested regions of Interior Alaska, abundant moose browse is generally associated with recent disturbance, such as flooding of riparian habitats and post-fire seral stages on upland sites. In Unit 19D East, over 2300 linear miles of riparian habitat is maintained by shifting rivers in a wide band along the Kuskokwim River and its major tributaries. Additional riparian habitat exists along smaller creeks and around hundreds of boreal lakes and ponds. Limited suppression of naturally occurring wildfires has created a mosaic of vegetation successional stages. During most summers, hundreds of square miles of boreal forest burn throughout the area, creating increased potential for rejuvenation of moose winter forage. In addition, climax stands of subalpine willow persist in bands near treeline in the hills along the north side of the Kuskokwim drainages.

Habitat assessment began prior to predator management experiments to assess potential for a numerical response by moose. In February 2000 we revisited 12 browse transects established during 1989–1994 along the Kuskokwim River near McGrath and found that riparian willows were beginning to outgrow the reach of moose because flooding disturbance had been absent for several years (ADF&G memo, Fairbanks, 25 Feb 2000). The 1999–2000 snowfall in the same area was greater than normal, forcing more moose onto the riparian willow bars. Substantial browsing was documented in these areas. We subsequently used plot-based methods to sample major cover types for estimating forage biomass availability and browsing removal over Unit 19D East (Mar 2001, n = 36 sites) and within the Experimental Micro Management Area (EMMA) near McGrath (Mar 2003, n = 18). The proportion of current annual growth removed over Unit 19D East was 16.0% (95% CI = ±1.2%) and within the EMMA was 15.5% (95% CI = ±1.9%; C.T. Seaton, ADF&G, Fairbanks, unpublished data).

Direct measure of carrying capacity is difficult to estimate for free-ranging wildlife populations because of variability in habitat composition at the landscape scale and annual weather conditions that influence forage production of both summer and winter range and winter energy expenditure. However, the proportional forage removal (above) and twinning rates (30% during 2001) for this area indicate favorable nutritional status compared to other regions of higher moose density in Interior Alaska (C.T. Seaton, ADF&G, unpublished data). Therefore, it is unlikely that the moose population is currently limited by the available habitat near McGrath.

Enhancement

We are exploring habitat enhancement as part of the applied research program to increase the harvestable surplus of moose near McGrath. We continued cooperation with fire management personnel at the Alaska Department of Natural Resources/Division of Forestry to ensure that natural fires are allowed to burn wherever possible. We also completed a prescribed fire plan for portions of Unit 19C in the Farewell area. The potential for mechanical treatment (dozer crushing) of riparian willows was discussed, with cost and logistics being formidable challenges in this remote area. Fortunately, spring flooding conditions along the Kuskokwim River in 2002 produced substantial ice-scouring that helped rejuvenate willow stands growing out of reach of moose. In addition, wildland fires occurred over approximately 325,000 acres of diverse vegetation types in Units 19D, 21A and 19A in summer 2002.

MANAGEMENT PLANNING

In RY99 the Unit 19D East moose population situation gained political attention and the governor appointed a group referred to as the Unit 19D East Adaptive Management Team to develop recommendations for the department to address the moose population declines. The results of the adaptive management team included a 5-year plan to assess the limiting factors of the moose population in Unit 19D East. The major parts of this study were to obtain a more precise estimate of moose density, determine the cause and rate of adult and calf mortality, determine the density of wolves in the area, assess the habitat condition for moose and further develop the research project to be adaptive and build on information as it was gathered. For specific results of that study see the Unit 19D East research performance report (Keech and Boudreau 2004).

ADF&G launched an effort with the Aniak Regional Moose Summit held in October 2002 that led to the CKMMP for Units 19A and 19B. Following the summit, ADF&G formed the Central Kuskokwim Moose Management Planning Committee (CKMC), which developed a CKMMP (ADF&G 2004) in cooperation with ADF&G. The CKMC included representatives of the Central Kuskokwim and other Fish and Game advisory committees, guides, transporters, conservationists and Native organizations, and sought to achieve consensus on moose management recommendations to ADF&G, the Alaska Board of Game, and the Federal Subsistence Board (FSB).

The CKMC conducted meetings in Aniak in February, March, April, August, and October 2003 to develop the draft plan. The preliminary ideas of the CKMC were circulated for public review and comment in July and August 2003. The draft plan was available for public review and comment from November 2003 through February 2004. There was additional opportunity for public comment through the Alaska Board of Game and FSB regulatory processes.

The CKMC agreed on a broad mission for the plan, the main issues of concern, overall goals and many specific action recommendations. They met in February 2004 to review public comment on the draft plan and develop final recommendations to the Board of Game. After much debate and discussion, the board adopted the CKMC majority recommendations with a few minor revisions. The board and FSB adopted regulatory proposals and endorsed the plan during their spring 2004 meetings.

The CKMMP was finalized in June 2004. The overall problem the CKMMP intended to address was how the moose population in Units 19A and 19B could be restored to avoid impending Tier II hunting restrictions and to maintain opportunities for human use of the resource. Issues and concerns related to the overall problem included moose harvest management, moose habitat, predation on moose, regulation of guides and transporters, information and education, and need for additional data. The purposes of this plan are to restore and maintain the Central Kuskokwim moose population to ensure reasonable subsistence opportunities, provide for high levels of human consumptive use, provide for a diversity of other uses of the moose resource, manage predators and moose habitat, and maintain the overall health of the ecosystem.

After much debate and discussion, the board adopted the CKMC recommendations of the majority of the committee members, with a few minor revisions. The board adopted a modified version of Alternative B that closed Unit 19A to nonresident moose hunting with a 1-year sunset provision. The board also requested ADF&G continue to monitor the moose populations in Units 19A and 19B and report back to them at the March 2005 meeting, specifically to reevaluate the need for the nonresident closure in Unit 19A. The harvest management strategies in the plan recommend that once the moose population increases, restrictions on harvest should be relaxed and hunting opportunities increased.

The draft plan also presented 2 alternative viewpoints on wolf predation control. In keeping with the recommendation of the majority of planning committee members, a proposal for a Wolf Predation Control Implementation Plan was prepared and circulated for public review and comment as part of the draft plan and went through the board public review process for proposed regulations. The Board of Game adopted the regulatory proposal for a Central Kuskokwim Wolf Predation Control Plan under 5 AAC 92.110 and adopted findings to authorize airborne or same-day-airborne shooting of wolves in Unit 19A. The board will review the wolf predation control program at its March 2005 meeting and consider if changes are needed.

The plan includes a strategy to support legislation to establish a Big Game Commercial Services Board that would have authority to limit the total number of guides, transporters and clients in each game management unit. With no limits on the number of commercial operators in specific areas, the main tool available to control hunting pressure is through adjusting resident and nonresident seasons and bag limits and methods and means. Legislation to establish a Big Game Commercial Services Board was introduced during the 2004 legislative session but did not pass.

Successful implementation of the plan and new hunting regulations will require an active wildlife regulation enforcement program in the area. It will be critical for the Alaska Department of Public Safety's Bureau of Wildlife Enforcement (formerly the Division of Fish and Wildlife Protection) to have the support necessary to maintain and/or improve enforcement capabilities in the area.

The CKMC should remain involved in monitoring implementation of the plan and making recommendations to the Board of Game and FSB. The CKMC can continue to serve a role in developing balanced and quality wildlife management recommendations by considering new information that becomes available and developing recommendations for changes, if needed. As with the process to develop this initial plan, recommendations of the planning committee will be brought before the Central Kuskokwim Advisory Committee, other interested advisory committees, federal subsistence councils, and the public for review and comment.

The CKMC has done an excellent job of identifying issues of concern, reviewing all available data, exploring alternatives to address the issues, and seeking to reach consensus on recommendations to ADF&G and the Board of Game. The Division of Wildlife Conservation greatly appreciates the dedication of extensive time and effort by the committee members in their months of deliberations. While agreement has not been reached on all issues, committee members listened to each other with respect and people with diverse interests in wildlife management learned to understand each other better.

CONCLUSIONS AND RECOMMENDATIONS

Populations over the reporting area were stable to declining, with considerable variation both within and between years. Data from the report period indicated potential declining populations in all units surveyed except Unit 19D, where the population appears to have stabilized at low densities. Unit 19D was the only area that indicated a stable population based on the number of moose observed compared to the previous reporting period. However, the bull:cow ratios in the trend area continued to decline through RY03. Calf:cow ratios were stable.

We completed density estimates in Units 21E (February 2000), 19A (March 2001), and Unit 19D (fall 2000, 2001 and 2003). This will help us further assess the status of the populations. The fall weather conditions, along with fiscal and manpower challenges, continued to challenge the McGrath moose survey-inventory program. Annual data collection efforts (trend and composition counts) in as many units as possible are the best and most cost-effective way to assess yearly changes in population composition and to monitor population trends.

We accomplished much of our objective to assess population status, trend and bull:cow ratios in portions of the units where harvest levels make significant impacts on moose populations. However, efforts will be made during the next reporting period to improve data collection in the western portion of Units 19B, 19C and 21A. This is the first step in developing sound long-term management plans for moose in this area.

We met our objective to maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C and 21A during this reporting period. This objective was designed as an index to the population status of large bulls and overall hunter success.

We made some progress on our objective to assess the accuracy of harvest reporting in portions of the area. We reviewed subsistence harvest surveys and compared them to reported harvests. During the next reporting period, efforts will be made to implement a system to better assess reporting rates in selected areas, primarily Units 19A and 21E. These units have historically poor reporting and have sparked increasing debate over the population levels, trends, and the impact of all sources of mortality, including hunting. Ongoing registration hunt reporting and subsistence surveys will probably allow us to achieve this objective during the next report period.

We accomplished our objective to encourage wildfires. We maintained communications with DNR Forestry and the local Native corporations to advocate a “let burn” policy when possible. We also worked to alter some fire management zones from the full suppression category to modified or limited suppression to increase options for land managers. We will continue to revise the Farewell prescribed burn plan that was attempted in 2000. The prescription will be changed and hopefully this burn will occur in the next reporting period.

During the next reporting period the objectives will be:

- Annually assess population status, trend, and bull:cow ratios in portions of the area where harvest levels make significant impacts on moose populations.
- Maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C, and 21A.
- Assess accuracy of harvest reporting in selected portions of the area.
- Encourage landowners to reduce fire suppression efforts on wildfires that do not threaten human life, property, or valuable resources, so that fire can fulfill its natural role in maintaining young, highly productive, and diverse habitats.

In Units 19A and 19B additional objectives, which were recommended in the CKMMP, will be:

  - Minimum fall posthunt bull:cow ratio of 2-30 bulls:100 cows.
  - Minimum fall posthunt calf:cow ratio of 30-40 calves:100 cows.
  - No less than 20% short yearlings (calves from the previous year/total adults) in late winter surveys.

In Units 19A and 19B additional activities, which were recommended in the CKMMP, will be:

- Assemble a moose biology and management educational curriculum for rural high school students in the Central Kuskokwim region. The curriculum was provided to teachers in all the schools in Unit 19A communities.

- Distribute an issue of the Central Kuskokwim Moose Planning News in April 2004 to inform local residents, hunters, and others about the actions taken by the Board of Game.

- Prepare posters about the changes in moose hunting regulations and use of registration permits.

- Fit 38 moose with radio collars in Unit 19A in the lower Holitna River (10 collars), the lower Aniak River drainage (10 collars), and in Unit 19B in the upper Holitna and Hoholitna drainages (18 collars). Conduct flights to track the locations of these radiocollared moose.

- Subsistence Division will conduct household surveys of big game harvest in Unit 19A communities and with teachers in the Kuspuk School District to involve students in collecting household subsistence use data.

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TABLE 1A Holitna-Hoholitna Count Area (Unit 19A) fall aerial moose composition counts, regulatory years 1987–1988 through 2002–2003

Regulatory year	Bulls:100 cows	Yearling bulls:100 cows	Calves: 100 cows	Calves	Percent calves	Adults	Moose	Moose/ Hour
1987–1988	22	4	72	50	36	84	140	85
1988–1989	31	16	56	103	30	240	343	95
1989–1990	24	13	55	160	30	361	528	163
1990–1991	26	10	52	139	29	336	475	162
1991–1992[a]								
1992–1993	31	15	63	172	32	360	542	169
1993–1994[a]								
1994–1995	14	2	42	209	27	568	778	251
1995–1996[a]								
1996–1997	22	10	50	146	29	355	502	152
1997–1998	14	11	34	85	23	286	371	169
1998–1999[a]								
1999–2000[a]								
2001–2002	6	3	8	13	7	183	196	59
2002–2003[a]								

[a] No survey.

TABLE 1B Farewell Burn Count Area (Unit 19C) fall aerial moose composition counts, regulatory years 1987–1988 through 2003–2004

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose	Moose/ Hour
1987–1988	53	10	19	32	13	207	242	115
1988–1989	58	20	34	47	18	218	265	126
1989–1990	47	15	22	55	13	361	416	194
1990–1991	43	8	26	58	16	315	373	159
1991–1992	44	8	29	59	17	293	352	156
1992–1993	46	8	38	58	21	220	278	100
1993–1994[a]								
1994–1995	52	10	19	45	11	353	404	170
1995–1996[a]								
1996–1997	46	11	15	43	10	411	454	158
1997–1998	30	10	27	75	17	368	443	174
1998–1999[a]								
1999–2000[b]	33	11	27	42	17	206	248	86
2000–2001[a]								
2001–2002	25	3	25	76	17	377	454	81
2002–2003[a]								
2003–2004	25	8	34	65	21	240	305	110

[a] No survey.
[b] Fall 1999 – only 77.5% of the survey area flown.

TABLE 1C Candle–Wilson A, B, C, and D count areas (Unit 19D) fall aerial moose composition counts, regulatory years 1996–1997 through 2003–2004

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose
1996–1997	18	7	34	19	21	66	95
1997–1998	13	6	52	25	32	54	79
1998–1999	13	4	34	13	23	43	56
1999–2000[a]							
2000–2001	9	2	29	16	20	61	77
2001–2002	6	2	22	14	17	68	82
2002–2003[a]							
2003–2004	5	3	29	11	21	40	51

[a] No survey.

TABLE 1D Holy Cross (Unit 21E) fall aerial moose composition counts, regulatory years 1987–1988 through 2002–2003

Regulatory year	Bulls: Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose	Moose/ hour
1987–1988	19	9	43	150	26	420	570	83
1988–1989[a]								
1989–1990	31	12	45	148	25	432	584	161
1990–1991	29	7	51	211	28	536	758	253
1991–1992[a]								
1992–1993	26	5	22	67	14	412	483	163
1993–1994[a]								
1994–1995	29	9	63	216	32	444	674	234
1995–1996[a]								
1996–1997	30	11	34	158	21	604	762	186
1997–1998[a]								
1998–1999	26	11	35	77	22	276	353	103
1999–2000[a]								
2000–2001[a]								
2001–2002[a]								
2002–2003[a]								

[a] No survey.

TABLE 2A Unit 19B moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters							Total
	Reported						Estimated	
	M	(%)	F	(%)	Unk	Total	unreported[a]	
1994–1995	163	(100)	0	(0)	0	163	54	217
1995–1996	136	(100)	0	(0)	0	136	45	181
1996–1997	166	(100)	0	(0)	0	166	55	221
1997–1998	158	(100)	0	(0)	1	159	52	211
1998–1999	152	(100)	0	(0)	1	153	50	203
1999–2000	108	(100)	0	(0)	4	112	37	149
2000–2001	152	(100)	0	(0)	1	153	50	203
2001–2002	112	(100)	0	(0)	0	112	37	149
2002–2003	80	(100)	0	(0)	1	81	27	108

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2B Unit 19A moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters							Total
	Reported						Estimated	
	M	(%)	F	(%)	Unk	Total	unreported[a]	
1994–1995	160	(95)	8	(5)	0	168	55	223
1995–1996	137	(99)	2	(1)	2	141	47	188
1996–1997	174	(96)	8	(4)	2	184	61	245
1997–1998	136	(96)	6	(4)	0	142	47	189
1998–1999	130	(90)	14	(10)	2	146	48	194
1999–2000	103	(90)	11	(10)	4	118	39	157
2000–2001	106	(100)	0	(0)	0	106	35	141
2001–2002	91	(99)	1	(1)	3	95	31	126
2002–2003	67	(100)	0	(0)	0	67	22	89

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2C Unit 19 moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest by hunters								
	Reported						Estimated	
	M	(%)	F	(%)	Unk	Total	unreported[a]	Total
1986–1987	454	(98)	8	(2)	2	464	153	617
1987–1988	530	(97)	17	(3)	2	549	181	730
1988–1989	615	(98)	15	(2)	7	637	210	847
1989–1990	546	(99)	7	(1)	6	559	184	743
1990–1991	383	(95)	20	(5)	1	404	133	537
1991–1992	461	(97)	13	(3)	2	476	157	633
1992–1993	485	(95)	24	(5)	3	512	169	681
1993–1994	542	(99)	3	(1)	2	547	181	728
1994–1995	581	(99)	8	(1)	0	589	194	783
1995–1996	527	(99)	2	(1)	6	535	176	711
1996–1997	621	(99)	8	(1)	3	632	208	840
1997–1998	561	(99)	7	(1)	4	572	189	761
1998–1999	535	(97)	14	(3)	3	552	182	734
1999–2000	442	(97)	13	(3)	11	466	153	619
2000–2001	478	(100)	0	(0)	2	480	158	638
2001–2002	420	(99)	1	(1)	3	424	140	564
2002–2003	355	(100)	0	(0)	2	357	118	475

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2D Unit 19C moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters							
	Reported						Estimated	
	M	(%)	F	(%)	Unk	Total	unreported[a]	Total
1994–1995	152	(100)	0	(0)	0	152	50	202
1995–1996	127	(100)	0	(0)	0	127	42	169
1996–1997	153	(100)	0	(0)	0	153	50	203
1997–1998	140	(100)	0	(0)	0	140	46	186
1998–1999	149	(100)	0	(0)	0	149	49	198
1999–2000	130	(99)	1	(1)	0	131	43	174
2000–2001	122	(100)	0	(0)	1	123	41	164
2001–2002	111	(100)	0	(0)	0	111	37	148
2002–2003	84	(100)	0	(0)	1	85	28	113

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2E Unit 19D moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters							
	Reported						Estimated	
	M	(%)	F	(%)	Unk	Total	unreported[a]	Total
1994–1995	106	(100)	0	(0)	0	106	35	141
1995–1996	109	(100)	0	(0)	3	112	37	149
1996–1997	102	(100)	0	(0)	1	103	34	137
1997–1998	103	(99)	1	(1)	1	105	35	140
1998–1999	86	(100)	0	(0)	0	86	28	114
1999–2000	93	(100)	0	(0)	2	95	31	126
2000–2001	84	(100)	0	(0)	0	84	–[b]	–[b]
2001–2002	96	(100)	0	(0)	0	96	–[b]	–[b]
2002–2003	116	(100)	0	(0)	0	116	–[b]	–[b]

[a] Unreported harvest estimated at 33% of total reported harvest.
[b] RM650 registration hunt.

TABLE 2F Units 21A and 21E moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1986–1987	227	(95)	11	(5)	0	238	79	317
1987–1988	251	(98)	6	(2)	0	257	85	342
1988–1989	306	(98)	6	(2)	5	317	105	422
1989–1990	277	(99)	1	(1)	0	278	92	370
1990–1991	304	(99)	3	(1)	3	310	102	412
1991–1992	284	(99)	4	(1)	0	288	95	383
1992–1993	223	(99)	2	(1)	0	225	74	299
1993–1994	241	(99)	2	(1)	0	243	80	323
1994–1995	276	(97)	10	(3)	0	286	94	380
1995–1996	273	(98)	6	(2)	0	279	92	371
1996–1997	306	(95)	15	(5)	0	321	106	427
1997–1998	316	(98)	6	(2)	1	323	106	429
1998–1999	298	(97)	8	(3)	0	306	101	407
1999–2000	288	(98)	6	(2)	4	298	98	396
2000–2001	300	(99)	4	(1)	0	304	100	404
2001–2002	245	(91)	24	(9)	3	272	90	362
2002–2003	220	(93)	17	(7)	2	239	79	318

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2G Unit 21A moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	124	(99)	1	(1)	0	125	41	166
1995–1996	116	(100)	0	(0)	0	116	38	154
1996–1997	130	(100)	0	(0)	0	130	43	173
1997–1998	113	(100)	0	(0)	0	113	37	150
1998–1999	111	(100)	0	(0)	0	111	37	148
1999–2000	123	(100)	0	(0)	1	124	41	165
2000–2001	103	(100)	0	(0)	0	103	34	137
2001–2002	89	(99)	1	(1)	3	93	31	124
2002–2003	81	(99)	1	(1)	0	82	27	109

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2H Unit 21E moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	152	(94)	9	(6)	0	161	53	214
1995–1996	157	(96)	6	(4)	0	163	54	217
1996–1997	176	(92)	15	(8)	0	191	63	254
1997–1998	203	(97)	6	(3)	1	210	69	279
1998–1999	187	(96)	8	(4)	0	195	64	259
1999–2000	165	(96)	6	(4)	3	174	57	231
2000–2001	197	(98)	4	(2)	0	201	66	267
2001–2002	156	(87)	23	(13)	0	179	59	238
2002–2003	139	(90)	16	(10)	2	157	52	209

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 3 Permit hunt results from Lime Village Tier II (TM684) and Unit 19C (RM655) and Unit 19D (RM650), regulatory years 1992–1993 through 2002–2003

Unit/ Hunt no.	Regulatory year	Successful hunters	Unsuccessful hunters	Did not hunt	Total reports
19A/TM684	1992–1993	9	4	3	16
	1993–1994	12	2	6	20
	1994–1995	7	1	6	14
	1995–1996	5	3	7	15
	1996–1997	4	1	9	14
	1997–1998	5	2	7	14
	1998–1999	7	5	16	28
	1999–2000	3	9	14	26
	2000–2001	2	3	11	16
	2001–2002	5	8	6	19
	2002–2003	1	4	9	14
19C/RM655	1997–1998	1	0	0	1
	1998–1999	2	1	0	3
	1999–2000	0	3	1	4
	2000–2001	4	2	0	6
	2001–2002	6	2	1	9
	2002–2003	7	7	4	18
19D/RM650	2001–2002	73	137	67	277
	2002–2003	98	127	40	265

TABLE 4A Unit 19 moose hunter residency and success, regulatory years 1986–1987 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	89	191	119	47	446 (54)	101	183	77	15	376 (46)	822
1987–1988	121	245	162	21	549 (54)	95	280	94	6	475 (46)	1024
1988–1989	110	285	188	54	637 (54)	132	271	105	28	536 (46)	1173
1989–1990	114	134	185	36	469 (45)	95	305	162	5	567 (55)	1036
1990–1991	81	189	111	23	404 (37)	94	329	232	20	675 (63)	1079
1991–1992	87	259	123	7	476 (47)	122	266	141	5	534 (53)	1010
1992–1993	100	256	113	41	510 (48)	123	257	149	18	547 (52)	1057
1993–1994	89	271	153	30	543 (53)	57	247	166	6	476 (47)	1019
1994–1995	121	276	181	18	596 (45)	124	368	224	16	732 (55)	1328
1995–1996	91	263	170	11	535 (44)	159	325	194	8	686 (56)	1221
1996–1997	113	295	212	12	632 (52)	123	258	202	2	585 (48)	1217
1997–1998	113	223	227	9	572 (48)	99	251	253	9	612 (52)	1184
1998–1999	93	221	210	28	552 (45)	69	312	289	11	681 (55)	1233
1999–2000	94	206	149	17	466 (41)	103	292	264	9	668 (59)	1134
2000–2001	77	209	184	10	480 (42)	95	268	294	5	662 (58)	1142
2001–2002	107	174	132	11	424 (35)	182	367	239	9	797 (65)	1221
2002–2003	110	111	131	5	357 (35)	191	282	167	10	650 (65)	1007

TABLE 4B Unit 19A moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	56	82	23	7	168 (46)	61	107	26	2	196 (54)	364
1995–1996	28	83	23	7	141 (46)	58	89	15	1	163 (54)	304
1996–1997	42	119	20	3	184 (54)	51	86	18	0	155 (46)	339
1997–1998	44	77	19	2	142 (51)	33	67	35	3	138 (49)	280
1998–1999	56	65	19	6	146 (50)	24	89	32	1	146 (50)	292
1999–2000	45	46	21	6	118 (43)	54	76	25	4	159 (57)	277
2000–2001	20	51	31	4	106 (36)	50	74	60	2	186 (64)	292
2001–2002	22	53	11	9	95 (32)	43	114	39	3	199 (68)	294
2002–2003	19	29	18	1	67 (26)	61	90	31	4	186 (74)	253

TABLE 4C Unit 19B moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	0	71	88	4	163 (40)	0	128	108	9	245 (60)	408
1995–1996	0	66	69	1	136 (41)	0	82	107	5	194 (59)	330
1996–1997	0	54	107	5	166 (47)	0	79	103	2	184 (53)	350
1997–1998	0	41	114	4	159 (40)	0	83	147	5	235 (60)	394
1998–1999	0	48	100	5	153 (37)	0	80	175	6	261 (63)	414
1999–2000	0	44	59	9	112 (32)	0	78	159	5	242 (68)	354
2000–2001	1	59	88	5	153 (36)	7	99	161	1	268 (64)	421
2001–2002	1	42	68	1	112 (31)	2	106	134	4	246 (69)	358
2002–2003	1	14	65	1	81 (35)	1	66	80	1	148 (65)	229

TABLE 4D Unit 19C moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	0	98	53	1	152 (52)	0	85	53	1	139 (48)	291
1995–1996	0	78	49	0	127 (49)	0	88	42	0	130 (51)	257
1996–1997	0	89	62	2	153 (60)	0	61	41	0	102 (40)	255
1997–1998	1	68	69	2	140 (58)	0	64	37	0	101 (42)	241
1998–1999	1	75	72	1	149 (52)	0	82	53	1	136 (48)	285
1999–2000	0	79	50	2	131 (50)	0	81	48	0	129 (50)	260
2000–2001	0	69	54	0	123 (50)	0	69	50	2	121 (50)	244
2001–2002	0	74	37	0	111 (44)	0	106	34	2	142 (56)	253
2002–2003	0	48	35	2	85 (42)	0	93	23	0	116 (58)	201

TABLE 4E Unit 19D moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	57	38	6	5	106 (45)	56	49	21	5	131 (55)	237
1995–1996	53	38	19	2	112 (43)	84	44	16	2	146 (57)	258
1996–1997	56	33	14	0	103 (49)	67	22	18	0	107 (51)	210
1997–1998	54	34	17	0	105 (54)	55	23	12	1	91 (46)	196
1998–1999	28	28	15	15	86 (49)	34	45	10	3	92 (51)	178
1999–2000	45	35	15	0	95 (46)	37	52	24	0	113 (54)	208
2000–2001	48	32	3	1	84 (60)	26	26	4	0	56 (40)	140
2001–2002	70	14	12	0	96 (35)	124	40	15	0	179 (65)	275
2002–2003	85	22	8	1	116 (42)	117	29	11	3	160 (58)	276

TABLE 4F Units 21A and 21E moose hunter residency and success, regulatory years 1986–1987 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	43	135	45	15	238 (75)	10	63	7	0	80 (25)	318
1987–1988	21	164	43	29	257 (68)	9	83	20	9	121 (32)	378
1988–1989	13	177	69	58	317 (75)	2	62	28	16	108 (25)	425
1989–1990	19	178	53	28	278 (73)	9	66	18	9	102 (27)	380
1990–1991	40	203	52	15	310 (72)	13	80	25	3	121 (28)	431
1991–1992	41	200	42	4	287 (64)	22	104	34	0	160 (36)	447
1992–1993	20	152	35	19	226 (63)	8	91	26	5	130 (37)	356
1993–1994	39	141	45	14	239 (67)	9	71	36	1	117 (33)	356
1994–1995	35	184	47	17	283 (67)	8	87	43	2	140 (33)	423
1995–1996	40	191	46	2	279 (70)	10	74	31	2	117 (30)	396
1996–1997	42	206	71	2	321 (73)	8	78	31	0	117 (27)	438
1997–1998	33	212	67	11	323 (74)	7	61	41	4	113 (26)	436
1998–1999	39	194	59	14	306 (70)	3	63	62	2	130 (30)	436
1999–2000	44	152	87	15	298 (62)	16	85	82	3	186 (38)	484
2000–2001	39	171	86	8	304 (63)	8	89	78	1	176 (37)	480
2001–2002	32	152	81	7	272 (59)	9	94	84	2	189 (41)	461
2002–2003	38	120	79	2	239 (58)	12	82	80	2	176 (42)	415

TABLE 4G Unit 21A moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	0	83	39	3	125 (52)	0	76	37	1	114 (48)	239
1995–1996	3	76	36	1	116 (64)	1	37	26	1	65 (36)	181
1996–1997	1	78	51	0	130 (65)	0	45	25	0	70 (35)	200
1997–1998	1	57	50	5	113 (63)	0	36	29	1	66 (37)	179
1998–1999	0	64	39	8	111 (58)	0	30	48	2	80 (42)	191
1999–2000	0	55	67	2	124 (53)	1	47	63	0	111 (47)	235
2000–2001	0	51	51	1	103 (47)	0	52	63	0	115 (53)	218
2001–2002	0	38	55	0	93 (42)	0	59	69	0	128 (58)	221
2002–2003	0	39	43	0	82 (45)	0	47	51	1	99 (55)	181

TABLE 4H Unit 21E moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	40	106	8	7	161 (86)	8	17	1	0	26 (14)	187
1995–1996	34	118	10	1	163 (76)	6	40	5	1	52 (24)	215
1996–1997	31	138	20	2	191 (80)	4	37	6	0	47 (20	238
1997–1998	28	159	17	6	210 (83)	2	30	12	3	47 (17)	257
1998–1999	37	132	20	6	195 (80)	3	33	14	0	50 (20)	245
1999–2000	38	103	20	13	174 (70)	13	40	19	3	75 (30)	249
2000–2001	39	120	35	7	201 (77)	8	37	15	1	61 (23)	262
2001–2002	32	114	26	7	179 (75)	8	36	15	2	61 (25)	240
2002–2003	38	81	36	2	157 (67)	12	35	29	1	77 (33)	234

TABLE 5A Unit 19 moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1986–1987	44	<1	44	2	3	<1	1	5	0	446
1987–1988	38	<1	44	3	7	2	<1	5	0	549
1988–1989	45	<1	43	2	5	1	<1	4	0	637
1989–1990	47	<1	41	2	2	<1	<1	5	0	469
1990–1991	53	1	35	2	4	<1	<1	4	0	404
1991–1992	49	<1	41	3	4	<1	<1	1	0	476
1992–1993	41	1	45	2	9	0	<1	2	0	510
1993–1994	57	1	33	3	2	<1	<1	3	0	543
1994–1995	47	<1	38	5	6	<1	<1	3	0	589
1995–1996	50	2	38	6	<1	<1	<1	3	0	535
1996–1997	50	2	39	5	2	<1	<1	<1	0	632
1997–1998	53	2	34	5	5	<1	<1	<1	0	572
1998–1999	50	2	35	7	5	<1	<1	<1	<1	552
1999–2000	51	1	34	8	4	<1	0	1	<1	466
2000–2001	54	1	37	6	1	0	0	<1	<1	480
2001–2002	46	1	41	8	2	<1	<1	1	0	424
2002–2003	44	<1	44	8	2	<1	0	1	0	357

TABLE 5B Unit 19A moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									Total
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	
1994–1995	14	0	65	<1	17	0	<1	3	0	168
1995–1996	17	0	74	<1	2	<1	0	6	0	141
1996–1997	13	0	80	<1	5	<1	0	0	0	184
1997–1998	17	0	64	2	16	0	0	<1	0	142
1998–1999	13	<1	67	1	15	0	1	1	1	146
1999–2000	21	0	59	1	14	0	0	5	<1	118
2000–2001	27	0	70	1	1	0	0	0	1	106
2001–2002	14	1	81	3	1	0	0	0	0	95
2002–2003	28	0	61	6	0	0	0	4	0	67

TABLE 5C Unit 19B moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									Total
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	
1994–1995	79	0	18	0	<1	0	0	2	0	163
1995–1996	85	1	11	2	0	0	1	0	0	136
1996–1997	90	0	8	1	0	0	0	1	0	166
1997–1998	92	0	5	0	1	0	2	0	0	159
1998–1999	90	0	7	1	0	0	1	1	<1	153
1999–2000	88	0	8	3	0	0	0	1	0	112
2000–2001	87	0	12	0	0	0	0	1	0	153
2001–2002	85	0	12	1	0	0	2	0	0	112
2002–2003	84	0	14	2	0	0	0	0	0	81

TABLE 5D Unit 19C moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									Total
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	
1994–1995	74	3	5	15	0	2	0	1	0	152
1995–1996	75	4	3	15	0	<1	2	<1	0	127
1996–1997	76	7	0	16	0	<1	0	<1	0	153
1997–1998	73	8	2	15	<1	1	0	0	0	140
1998–1999	64	6	1	25	2	1	0	1	0	149
1999–2000	70	4	0	24	0	1	0	1	0	131
2000–2001	71	3	1	21	4	0	0	0	0	123
2001–2002	64	5	0	24	5	1	0	1	0	111
2002–2003	65	2	0	23	7	1	0	2	0	85

TABLE 5E Unit 19D moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									Total
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	
1994–1995	9	0	74	4	6	0	3	4	0	106
1995–1996	19	2	67	6	<1	0	2	4	0	112
1996–1997	17	0	71	3	4	1	4	0	0	103
1997–1998	19	0	74	2	1	0	2	2	0	105
1998–1999	20	0	79	0	1	0	0	0	0	86
1999–2000	20	0	78	2	0	0	0	0	0	95
2000–2001	5	0	92	2	0	0	0	1	0	84
2001–2002	14	0	80	3	0	0	0	3	0	96
2002–2003	9	0	88	2	1	0	0	0	0	116

TABLE 5F Units 21A and 21E moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	27	<1	61	1	6	2	0	2	0	286
1995–1996	32	<1	62	<1	3	0	<1	1	0	279
1996–1997	33	0	59	<1	6	<1	0	<1	0	321
1997–1998	29	0	66	<1	3	0	0	<1	0	323
1998–1999	34	0	61	<1	3	0	0	<1	0	306
1999–2000	34	<1	60	<1	4	<1	<1	2	0	298
2000–2001	30	0	65	<1	3	0	<1	2	0	304
2001–2002	38	1	48	0	10	1	1	1	0	272
2002–2003	35	0	54	<1	8	1	1	1	0	239

TABLE 5G Unit 21A moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	57	<1	33	2	<1	5	0	2	0	125
1995–1996	66	0	29	2	0	0	<1	2	0	116
1996–1997	68	0	30	2	0	0	0	<1	0	130
1997–1998	70	0	28	<1	<1	0	0	<1	0	113
1998–1999	69	0	30	0	<1	0	0	0	0	112
1999–2000	70	1	24	1	0	1	1	2	0	124
2000–2001	68	0	28	1	0	0	1	2	0	103
2001–2002	76	0	18	0	1	0	1	3	0	93
2002–2003	71	0	22	1	0	2	2	1	0	82

TABLE 5H Unit 21E moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method: Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	4	0	83	<1	10	0	0	2	0	161
1995–1996	8	<1	86	0	4	0	0	1	0	163
1996–1997	10	0	79	<1	9	<1	0	<1	0	191
1997–1998	8	0	87	0	4	0	0	<1	0	210
1998–1999	14	0	79	<1	5	0	0	2	0	195
1999–2000	7	0	85	0	6	0	0	2	0	174
2000–2001	10	0	84	0	4	0	0	2	0	201
2001–2002	18	1	64	0	14	1	1	1	0	179
2002–2003	16	0	71	0	13	0	0	<1	0	157

TABLE 6 Units 19A, 19D, and 21E potlatch moose harvest history, regulatory years 1999–2000 through 2003–2004

Regulatory	Potlatch harvest: Unit 19A		Unit 19D		Unit 21E	
year	M	F	M	F	M	F
1999–2000				1		
2000–2001						
2001–2002						
2002–2003	2			1		2
2003–2004						

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 20A (6796 mi^2)

GEOGRAPHIC DESCRIPTION: Tanana Flats, Central Alaska Range

BACKGROUND

Moose are found throughout the Tanana Flats and adjacent Alaska Range foothills at exceptionally high densities relative to similarly sized areas throughout North America. Unit 20A moose are a world-class wildlife resource. Gasaway et al. (1983) presented a detailed history of the Unit 20A moose population through 1978, while Boertje et al. (1996) presented a history through 1995.

Preferred moose habitat is composed of riparian willow, poorly drained meadows, shallow lakes, early successional forest, and subalpine shrub communities. Approximately 5040 mi^2 of the unit is suitable moose habitat (the area below 4000 feet in elevation exclusive of large lakes).

Moose numbers increased in Unit 20A during the 1950s and reached high densities in the early 1960s, perhaps 4–5 moose/mi^2. Reported annual moose harvests averaged 311 moose between 1963 and 1969 (McNay 1993). During 1969–1974, reported harvest increased to an average of 617 moose per year. Cow moose composed 34% of the annual harvest during 1963–1974.

Similar to numerous other ungulate populations in Alaska, the moose population declined beginning in the late 1960s and reached its lowest point in the mid 1970s. Beginning in 1975, seasons and harvests were dramatically reduced and taking of cows was prohibited. Between February 1976 and April 1982 the division reduced wolf numbers. During 1975–1978, mean annual reported moose harvest was 64 bulls.

During the 1976–1982 wolf reduction efforts in Unit 20A, the moose population increased rapidly and has increased or remained stable most years since 1982. During 1979–1982, reported harvests averaged 226 bulls per year (McNay 1993). During 1983–1993 the mean

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

annual harvest increased to 358 bulls. A wolf control program to reduce predation on the declining Delta caribou herd began in October 1993, but was discontinued in December 1994. Division staff reduced wolf numbers by trapping and snaring, and this may have influenced moose population dynamics. Antlerless hunts were resumed in 1996, suspended in 1999, and again resumed in 2000, but harvests ($\bar{x}$ = 72.5 antlerless moose) accounted for only a small portion of the overall harvest. Reported harvest of bulls reached all-time highs in the late 1990s ($\bar{x}$ = 623 bulls, 1996–1999). As a result, seasons were shortened in 2000, and antler restrictions were imposed in 2002 to reduce harvests to sustainable levels.

Regulations have provided for a wide variety of hunting opportunities in Unit 20A. For example, the southwestern portion of the unit currently includes the Wood River Controlled Use Area (WRCUA; no motorized access except aircraft), the Ferry Trail Management Area (FTMA; motorized access, but antler restrictions since 1988), the Healy Lignite Management Area (HLMA; bowhunting only), the Yanert Controlled Use Area (YCUA; no motorized access except aircraft, antler restrictions since 1988), and the Nenana Controlled Use Area (NCUA; no airboats for hunting moose).

Approximately one-third of Unit 20A is military land, including 1003 mi^2 of Fort Wainwright Army property, 893 mi^2 of Fort Greely Army property, and 17 mi^2 of Clear Air Force Station property. A variety of access restrictions, both spatial and temporal, apply to portions of these military lands.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide the greatest sustained opportunity to participate in hunting moose.
- Provide an opportunity to view and photograph moose.

MANAGEMENT OBJECTIVES

- Manage for a November population of between 10,000 and 12,000 moose.
- Manage for a posthunting sex ratio of ≥30 bulls:100 cows overall and ≥20 bulls:100 cows in the Tanana Flats, Western Foothills, and Eastern Foothills areas.

METHODS

POPULATION STATUS AND TREND

2001 Population Estimation Survey

We surveyed 78 (50 high-density and 28 low-density; 455 mi^2) of 987 sample units (SU; 5747 mi^2) during 31 October–18 November. We used the Geostatistical Population Estimator method (GSPE; Ver Hoef 2001), a modification of the standard Gasaway et al. (1986)

technique. A simple random sample of SUs was selected from each stratum using Microsoft®Excel Windows®98 software. “Tanana Flats” and “Foothills” portions of Unit 20A, which were treated as separate geographic strata in 1996, 1997, and 1998 surveys, were combined after 1998.

The GSPE method does not yet employ a sightability correction factor (SCF), thus does not correct for moose not seen during the survey. Rather, the GSPE method employs greater search intensity, 8–10 min/mi^2 versus 4–6 min/mi^2 (Gasaway et al. 1986), resulting in a higher level of sightability. Preliminary work with the sightability of collared moose known to be in sample units indicates that a SCF of 1.1 to 1.15 is appropriate for most of Unit 20A GSPE surveys, but more work is needed.

Search intensity averaged 6.9 min/mi^2, slightly less than the recommended 8–10 min/mi^2. However, search intensity was not corrected for areas of nonmoose habitat (e.g., >4500 feet in elevation or large bodies of water) that were not searched. Therefore, actual search intensity was certainly greater and probably reached recommended levels. Survey conditions (Gasaway et al. 1986) with regard to snow (age and cover), light (intensity and type), and wind (strength and turbulence) were reported primarily as good (70%), with the remainder reported as excellent (18%) or poor (12%). Snow conditions tended to deteriorate as the survey period progressed. Turbulence was not a factor, although surveys were suspended several days due to high or turbulent winds.

2002 Population Estimation Survey

Population estimation surveys were not conducted in 2002 due to insufficient snow accumulation.

2003 Population Estimation Survey

We surveyed 112 (65 high-density and 47 low-density; 649 mi^2) of 987 SUs (5747 mi^2) during 21 November–11 December using the methods described above.

Search time per SU averaged 45 minutes. Adjusted search intensity (search time/estimated percentage of moose habitat in the SU/5.8 mi^2 per SU) averaged 9.0 min/mi^2. Survey conditions (Gasaway et al. 1986) with regard to snow (age and cover), light (intensity and type), and wind (strength and turbulence) were reported primarily as good (67%), with the remainder reported as excellent (25%), fair (4%), or unclassified (4%).

Twinning Surveys

Twinning rates in 2002 and 2003 were estimated from surveys conducted in traditional twinning survey trend count areas in the central Tanana Flats. Surveys consisted of roughly parallel transects flown at approximately ½-mile intervals at ≤500 feet above ground level in PA-18 or Scout aircraft by experienced contract pilots. All moose observed were classified as bull, yearling cow, adult cow without a calf, or adult cow with single, twin or triplet calves. Twinning rate surveys were flown on 24–25 May 2002 (7.1 hr) and 27–28 May 2003 (6.6 hr) during or within a few days after the median calving date (R. Boertje, ADF&G files). When the median calving date was unknown and <15% of the cows had calves, we terminated surveys, excluded the data, and flew a few days later. For statistical reasons we established, a priori, a minimum sample size of 50 cows with calves. Twinning rate was calculated as the proportion of cows with twins or triplets from the sample of all cows with calves.

Browse Surveys

We conducted moose browse surveys in Unit 20A in spring 2003, sampling 20 sites in the eastern (*n* = 11) and southwestern (*n* = 9) portions of the unit. Sites were selected, a priori, from U.S. Geological Survey topographic maps based primarily on physiographic (i.e., valley bottom vs. side slope vs. ridgetop) and habitat (i.e., riparian vs. upland; shrubland vs. open forest vs. closed forest; wet vs. dry) features. We attempted to select a highly dispersed, representative sample of sites relative to the above physiographic and habitat parameters that also had a high proportion of preferred browse species (i.e., *Salix* spp., birch and aspen). Sampling of plant architecture (i.e., Broomed Index) at individual sites followed the methods of Seaton (2002).

HARVEST

We estimated annual harvest from mandatory harvest report cards. This included data from report cards from the general season hunt and from several drawing hunts, e.g., drawing hunts for bulls in the eastern portion of the WRCUA, antlerless moose in the central portion of Unit 20A, and calves unitwide. Reminder letters were sent to nonreporting general season hunters, and up to 2 letters were sent to permit holders who failed to report. We summarized data on hunter residency, hunter success, harvest chronology, and transport methods. When antler size of bulls was reported, we considered bulls with antler spreads <30 inches to be yearlings. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

We estimated other mortality from Department of Public Safety records of collisions with motor vehicles and Alaska Railroad records of collisions with trains.

WEATHER

We evaluated weather (snowfall and temperature) using National Weather Service records and personal observations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

GSPE estimates of 11,205 (9636–12,774; 90% CI) moose in 1999, 10,557 (8657–12,457; 90% CI) in 2000, 11,511 (9784–13,238; 90% CI) in 2001, and 14,684 (12,801–16,566; 90% CI) in 2003 (Table 1) indicate that the Unit 20A moose population has increased since 1999. Applying a preliminary SCF of 1.12 results in population point estimates of 12,550 (1999), 11,824 (2000), 12,892 (2001), and 16,446 (2003). The 2003 corrected estimate yields a density of >3 moose/mi^2 (16,446 moose/5040 mi^2 of suitable moose habitat).

Dale (1998) reported that the Unit 20A moose population grew at an average annual finite growth rate of 1.027 between 1988 and 1996. Young (2002) reported that between 1996 and 2001 the population had likely stabilized. However, comparing the 1999 estimate of 7213 cows with the 2003 estimate of 9106 cows reveals an average annual finite growth rate of 1.066 during that period.

Population Composition

In 2001 we classified 887 moose and estimated 26 calves:100 cows and 26 bulls:100 cows (Table 1). In 2003 we classified 1483 moose and estimated 28 calves:100 cows and 32 bulls:100 cows. The relatively low calf:cow ratios observed in 2001 and 2003 were probably the result of alternating years of low parturition rates those years (R. Boertje, ADF&G files). Sex ratios declined from 39 bulls:100 cows in 1996 to 23 bulls:100 cows in 1999 and remained below the management objective of 30:100 through 2001 (Table 1). Bull:cow ratios of 26:100 in 2001 and 32:100 in 2003 suggest that the shorter bull moose season (beginning RY00) and unitwide antler restrictions (beginning RY02) were effective in improving the bull:cow ratio.

We met our objective of ≥20 bulls:cows in the Tanana Flats, Western Foothills, and Eastern Foothills portions of Unit 20A. In 2001 bull:cow ratios were similar in the Tanana Flats (26:100) and Western Foothills (22:100), but higher in the Eastern Foothills (40:100). In 2003 sex ratios were more similar across the Tanana Flats (32:100), Western Foothills (31:100), and Eastern Foothills (34:100).

In the southwestern portion of Unit 20A, where numerous trails provide motorized access, the bag limit has been 1 bull with spike-fork or 50-inch antlers (subsequently referred to as SF50) since RY88. This antler restriction was adopted in response to declining bull:cow ratios between RY84 (23–42 bulls:100 cows; Jennings 1986) and RY87 (13–27 bulls:100 cows; McNay 1989). Bull:cow ratios improved during the early 1990s, presumably because of the antler restriction. For example, bull:cow ratios exceeded the management objective for the Western Foothills of 20 bulls:100 cows in 1993 (31 bulls:100 cows in the Walker Dome trend area). However, since the mid 1990s, bull:cow ratios in the FTMA declined from an estimated 26:100 in 1994 to 9:100 in 2001. In addition, in the Western Tanana Flats, bull:cow ratios were at or below 20 bulls:100 cows in both 2000 (20:100) and 2001 (17:100). Unitwide antler restrictions that went into effect in RY02 appeared to improve bull:cow ratios in those areas (2003: FTMA = 24:100; Western Tanana Flats = 36:100).

Twinning Rates

Twinning rates remained poor at 9% to 10% in 2002 and 2003, but similar to the mean of 9% (range 3–18%) observed during 1994–2001 (Table 2). This is consistent with other measures of poor productivity observed in Unit 20A moose, such as low parturition rates, reproductive pauses, and delayed age of first reproduction. All these factors indicate the Unit 20A moose population is nutritionally stressed (Boertje et al. 1999) because of high moose densities and, presumably, declining habitat quality.

Distribution and Movements

Moose distribution varies widely across Unit 20A. Boertje et al. (2000) reported that a 2598-mi^2 study area in central Unit 20A contained about 50% of the moose habitat, but about 67% of the moose in November. For example, in 1996 he found 30% higher moose density in the study area compared to the total Unit 20A moose density. In addition, the moose population consists of nonmigratory and migratory subpopulations (Gasaway et al. 1983). From February to April many bull and cow moose migrate from the surrounding foothills (Alaska Range and Chena and Salcha River drainages) to calving areas on the Tanana Flats in Unit 20A. They remain there at least through June in most years and return to the foothills from July through October. Although we do not know what proportion of the moose migrate, Gasaway et al. (1983) estimated that the seasonal migrants probably increase the density of moose on the Tanana Flats 2- to 4-fold over the density of resident Unit 20A moose. R Boertje (ADF&G files) also estimated that in the 1807 mi^2 Tanana Flats portion of his central study area, calving and summer density were 1.7 to 2.0 times the November (1996) density.

MORTALITY

Harvest

Seasons and Bag Limits. Seasons and bag limits in Unit 20A during RY01 were as follows:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 20A, the Ferry Trail Management Area and the Yanert Controlled Use Area		
RESIDENT HUNTERS: 1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on 1 side.	1 Sep–20 Sep (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–20 Sep
Unit 20A within the Nenana Controlled Use Area		
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–20 Sep

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Remainder of Unit 20A 1 moose per regulatory year only as follows:		
RESIDENT HUNTERS: 1 bull; or	1 Sep–20 Sep (General hunt only)	
1 antlerless moose by drawing permit only; up to 300 permits may be issued; or	1 Sep–25 Sep (General hunt only)	
1 bull by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued.	1 Nov–30 Nov (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side; or		1 Sep–20 Sep
1 antlerless moose by drawing permit only; up to 300 permits may be issued; or		1 Sep–25 Sep
1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued.		1 Nov–30 Nov

Seasons and bag limits in Unit 20A during RY02 were as follows:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 20A, the Ferry Trail Management Area, Wood River Controlled Use Area, Healy–Lignite Management Area, and the Yanert Controlled Use Area.		
RESIDENT HUNTERS: 1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on 1 side; or	1 Sep–20 Sep (General hunt only)	

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
1 antlerless moose by drawing permit only; up to 300 permits may be issued in Unit 20A; a recipient of a drawing permit is prohibited from taking an antlered bull moose in Unit 20A; or	1 Sep–25 Sep (General hunt only)	
1 calf moose by drawing permit only; up to 300 permits may be issued in Unit 20A; a recipient of a drawing permit is prohibited from taking an antlered bull moose in Unit 20A; or	1 Sep–25 Sep (General hunt only)	
1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on 1 side; by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued	1 Nov–30 Nov	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side; or		1 Sep–20 Sep
1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side; by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued		1 Nov–30 Nov
Unit 20A within the Nenana Controlled Use Area.		
RESIDENT HUNTERS: 1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on 1 side; or	1 Sep–20 Sep (General hunt only)	
1 antlerless moose by registration permit only during the season to be announced by emergency order; a recipient	1 Sep–25 Sep (General hunt only)	

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
of a registration permit is prohibited from taking an antlered bull moose in Unit 20A; or		
1 calf moose by drawing permit only; up to 300 permits may be issued in Unit 20A; a recipient of a drawing permit is prohibited from taking an antlered bull moose in Unit 20A; or	1 Sep–25 Sep (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–20 Sep
Remainder of Unit 20A		
1 moose per regulatory year only as follows:		
RESIDENT HUNTERS: 1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on 1 side; or	1 Sep–20 Sep (General hunt only)	
1 antlerless moose by drawing permit only; up to 300 permits may be issued in Unit 20A; a recipient of a drawing permit is prohibited from taking an antlered bull moose in Unit 20A; or	1 Sep–25 Sep (General hunt only)	
1 calf moose by drawing permit only; up to 300 permits may be issued in Unit 20A; a recipient of a drawing permit is prohibited from taking an antlered bull moose in Unit 20A	1 Sep–25 Sep (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. In RY91 the bag limit for the FTMA and YCUA was 1 bull moose with spike-fork or 50-inch antlers or antlers with 3 or more brow tines on 1 side (SF50/3). During RY92–RY95 the bag limit for the FTMA and YCUA was 1 bull moose with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on one side (SF50/4). During RY96–RY99 the bag limit was changed back to 1 bull moose with SF50/3. Then in RY00 the Board of Game again increased the brow tine requirement to SF50/4 in these areas. At that time, the board also restricted the bag limit for nonresident hunters in all of Unit 20A to 1 bull moose with 50-inch antlers or antlers with 4 or more brow tines on 1 side. Those bag limits remained in effect through the RY02 hunting season. The board took action to restrict resident bag limits for moose throughout Unit 20A in RY02. The resident bag limit for the FTMA, HLMA, WRCUA, and YCUA was 1 bull moose with SF50/4, and for the remainder of Unit 20A, 1 bull moose with SF50/3. The nonresident bag limit was unaffected and remained 1 bull moose with 50-inch antlers or antlers with 4 or more brow tines on 1 side.

The board adopted 3 antlerless moose hunts by drawing permit (up to 300 permits) in RY96. Two (DM760 and DM762) occurred on the northcentral Tanana Flats near Fairbanks where moose densities were high. The third antlerless hunt (DM764) occurred in the eastern portion of the WRCUA. The antlerless hunts were suspended in RY99 because of an agreement with local advisory committees that cows would only be hunted when the population was increasing, and in 1999 the population was believed to be stable. These 3 hunts were resumed in RY00 when advisory committees and the board agreed to authorize the hunts as long as the moose population was stable or increasing. In RY02, the board also authorized an antlerless hunt by registration permit, 1–25 September, for the Unit 20A portion of the NCUA (i.e., the Western Tanana Flats) and up to 300 drawing permits for calf moose for the period 1–25 September. The calf hunt was experimental and was revisited and eliminated by the board in 2004. Finally, in RY02 the board authorized that recipients of antlerless drawing registration permits and calf drawing permits be prohibited that year from hunting for antlered bull moose in Unit 20A.

The board made no changes during the past 2 reporting periods to muzzleloader permit hunt DM766 created in RY96. This bulls-only hunt allows the department to issue up to 75 permits for hunters using muzzleloaders in a portion of the WRCUA during November. Seventy-five permits were issued in RY99, but none were issued RY00–RY02 because of an agreement with local advisory committees not to issue permits until bull:cow ratios recovered.

The board created the NCUA in portions of Units 20A and 20C in RY96, which prohibited the use of airboats for hunting or transporting moose hunters or their gear during 1–25 September. The NCUA was modified in RY98 to allow the use of airboats for hunting moose within the main channels of the Teklanika, Toklat, and Nenana Rivers, and at the public boat launch in Nenana.

The board modified the common boundary between the FTMA and WRCUA from the Totatlanika River to Tatlanika Creek in RY98. The boundary was changed back to the Totatlanika River in RY00. Although there was action at the spring 2002 board meeting to move the boundary back again to Tatlanika Creek, the proposal failed.

Intensive Management (IM) deliberations for Unit 20 were postponed during the spring 2000 meeting until November, at which time the board adopted IM population (10,000–12,000 moose) and harvest (500–720 moose) objectives for Unit 20A.

Alaska Board of Game Actions, March 2004 — The board took the following actions for moose in Unit 20A:

- Extended the general bull season to 1–25 September;
- Established a registration permit hunt for antlerless moose from 1 September to 10 December in all Unit 20A and eliminated the antlerless and calf moose drawing hunts;
- Eliminated the regulation prohibiting recipients of antlerless drawing permits, calf drawing permits, and registration permits from hunting that year for antlered bull moose in Unit 20A;
- Eliminated the NCUA; and
- Increased the Unit 20A IM Harvest Objective to 1400–1600 moose.

<u>Hunter Harvest</u>. Reported harvest of bull moose during the general season increased 66% between RY90–RY91 ($\bar{x}$ = 376 bulls) and RY96–RY97 ($\bar{x}$ = 613 bulls), and then remained relatively stable through RY99 (Table 3). Liberalizing the general season from 20 to 25 days in Unit 20A in RY95 likely contributed to the increased harvest. Average annual reported harvest RY00–RY01 declined to 540 bulls after the general season was reduced by 5 days (1–20 Sep) and unitwide antler restrictions were adopted for nonresident hunters. Reported harvest declined even further to 363 bulls after unitwide antler restrictions were imposed on resident hunters in RY02.

<u>Permit Hunts</u>. Hunter participation and harvest was lower than expected for antlerless drawing permit hunts through RY01 (Table 4). This may partly be explained by many permittees choosing to take bull moose rather than filling their antlerless permit. To increase participation and harvest in permit hunts, the board adopted a regulation prohibiting recipients of drawing and registration permits for antlerless and calf moose from taking an antlered bull moose in Unit 20A. As a result, reported harvests of antlerless moose increased from a mean of 68 (range 61–76; RY96–RY98 and RY00–RY01) to 94 in 2002. Likewise, success rates (reported harvest/number permits issued) jumped from 23% (68/300) RY96–RY98 and RY00–RY01 to 46% (94/205) in RY02.

<u>Hunter Success and Residency</u>. Hunter success rates during the general hunting season tended to be higher in Unit 20A (Table 5) than surrounding subunits (i.e., 20B, 20C, 20F and 25C; Selinger 2000; Young 2000*a,b*). Success rates reached their highest level in 10 years in RY99 (42%). In RY00 and RY01, success rates were lower than those reported for the previous 5 regulatory years (RY95–RY99). This was probably a function of reduced season length; success rates were higher in years with a 25-day season (RY95–RY99) than years with a 20-day season (RY90–RY94 and RY00–RY01). Success rates dropped to 30% after unitwide

antler restrictions went into effect in RY02. Nonresidents had higher success rates than residents. For example, in RY02 the most comparable year in terms of bag limits between nonresidents (SF50/4 unitwide) and residents (SF50/4 in SW mountains, SF50/3 remainder of Unit 20A), 55% of the nonresident hunters were successful, compared to 26% for resident hunters.

The number of hunters who reported hunting moose during the general season in Unit 20A increased during the early to mid 1990s, but then remained relatively stable during RY96–RY01. A 40% increase between RY94 (n = 1166) and RY96 (n = 1636) was likely due, at least in part, to the liberalization of the general moose season in RY95 from 20 to 25 days. However, a reduction in season length from 25 to 20 days beginning in RY00 did not result in a commensurate reduction in the number of moose hunters. However, a sharp reduction in the number of hunters in RY02 (n = 1181) was probably because of unitwide antler restrictions being imposed on resident hunters.

Harvest Chronology. Moose harvest in Unit 20A has traditionally been well distributed throughout the season (Table 6). However, when the general season was shortened to 20 days in RY00–RY02, fewer bulls were reported taken 6–10 Sep ($\bar{x}$ = 19%) than 1–5 Sep ($\bar{x}$ = 24%), 11–15 Sep ($\bar{x}$ = 27%) or 16–20 Sep ($\bar{x}$ = 27%).

Transport Methods. During the last 10 regulatory years, approximately two-thirds of the successful moose hunters used airplanes or boats (including airboats; Table 7). Hunting by horseback was popular in the YCUA and the southern portion of the WRCUA. Three- and 4-wheeler use increased during the early to mid 1990s, but appears to have stabilized. The FTMA continued to be a popular place for hunters using 3- and 4-wheelers. In addition, hunters increasingly used boats to transport these vehicles to the Tanana Flats.

Airboat use remains controversial. Since RY97, airboats have been distinguished as a transportation category on harvest report cards. The percentage of successful moose hunters in Unit 20A that used airboats increased slightly during the RY01–RY02 reporting period ($\bar{x}$ = 7.5%) compared to the RY97–RY00 reporting period ($\bar{x}$ = 5.7%, Table 6). That trend will probably continue as a result of the board eliminating the NCUA (restricted use of airboats for moose hunting in the western Tanana Flats portion of Unit 20A) beginning in RY04.

Other Mortality

A study of moose mortality began in 1996, and a progress report is available (Boertje et al. 1999). The number of moose killed in accidents with motor vehicles and trains has been substantial in some years (Dale 1998), but was relatively low during RY01–RY02 (Table 3). This may be the result of below average snowfall (long-term mean for Fairbanks = 68 in) during winters 2001–2002 (48.8 in) and 2002–2003 (41.4 in).

WEATHER

Unusual weather may have influenced moose population dynamics during RY90–RY02. Winter 1990–1991 had the highest snowfall on record in Fairbanks (147.3 in) and was closely followed by 1992–1993 (139.1 in). These record snowfalls are over twice the long-term average (68 in). In contrast, winters 1997–1998 (46.0 in), 1998–1999 (31.0 in), 2000–2001

(56.6 in), 2001–2002 (48.8 in), and 2002–2003 (41.4 in) received less than normal accumulations of snow ($\bar{x}$ = 44.8 in). An example of extreme deviation from the norm in terms of snow accumulation occurred in late winter 2002–2003 when a large portion of Unit 20A was snow free due to low snow accumulations and unseasonably warm temperatures.

Summer 1992 was probably the shortest on record. It was bracketed with snowfall in mid May and in September (24 inches of snowfall, 3 times the previous record, and cold temperatures, 13 degrees colder than previous record). Conversely, 1993 was probably the longest summer on record, with an early spring leaf-out, warm summer temperatures, and a late fall.

More recently, summer 2000 was short, had relatively few snow-free days, and was relatively cool with the lowest number of growing degree-days (n = 754) since 1965 (Boertje and Kellie 2003). By comparison, the growing degree-days index for summers 1996 through 1999 averaged 845.

HABITAT

There has been considerable discussion in recent years about the potential for Unit 20A to support many more moose, given the poor reproductive condition. We remain concerned about the population exceeding the habitat capability and becoming vulnerable to severe weather patterns. Already we have documented that this population has the lowest productivity of studied moose populations in North America (Boertje et al. 2000). Therefore, a higher moose density is not desirable until habitat improves. Two large wildfires (114,000-acre Survey Line Burn and 85,000-acre Fish Creek Burn) occurred on the Tanana Flats during summer 2001, but potential benefits to the moose population will probably not be realized for many years. Mortality research implemented in 1996 is evaluating many factors influencing the status of the moose population relative to habitat, predators, and sustainable harvest.

NONREGULATORY PROBLEMS/ISSUES

An electric intertie constructed between Healy and Fairbanks that bisects important moose habitat in western Unit 20A will probably affect moose in 2 ways. First, the intertie corridor may improve access, and changes in regulations to prevent local overharvest of bulls may be necessary. More importantly, increased fire suppression near the corridor may adversely affect habitat capability for moose over time.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates indicate the Unit 20A moose population increased between 1999 and 2003 and has exceeded the upper limit of the population objective. Estimates indicate the adult (≥1 year of age) cow population, our most reliable estimate of population growth, increased at a rate of 6–7% annually. Low twinning rates, 0% yearling pregnancy rates, delayed age of first reproduction, and reproductive pauses are all indicative of a relatively unproductive moose population. Current research indicates that moose production in

Unit 20A is reduced because of high moose densities and, presumably, declining habitat quality. Therefore, I recommend we liberalize (i.e., convert from drawing to registration permit hunts, lengthen the season, and expand the hunt area) antlerless moose hunts to increase harvest to 600 antlerless moose in RY04. Harvest goals for antlerless moose in RY05 should be reevaluated based on RY04 harvest levels and 2004 moose population estimates. My objective in the absence of large, landscape-scale improvements in habitat is to reduce the moose population to within the IM population objective of 10,000–12,000 moose. Antlerless (cow and calf) moose harvest should continue to be evaluated as a tool to prevent an overabundance of moose that are vulnerable to the synergistic effects of adverse weather and increased predation. In addition, it is important to improve habitat quality and determine the status of the Unit 20A moose population relative to nutrient and climate limitations, and increasing predator numbers (Boertje et al. 1996).

We met our management objectives of 20 bulls:100 cows in the Tanana Flats, Western Foothills and Eastern Foothills and 30 bulls:100 cows unitwide. Therefore, I recommend extending the season 5 days (1–25 Sep), but retaining unitwide antler restrictions for both resident and nonresident hunters. In addition, I recommend a harvest rate for bulls of approximately 15% of the prehunt bull population or 450–550 bulls in RY04 and RY05. We should continue to closely monitor bull:cow ratios both at unitwide and lesser spatial scales (e.g., management area, controlled use area, and subareas) to monitor the effects of current regulatory changes on bull:cow ratios.

We met the harvest objective of 500–720 moose in RY01, but not in RY02. To meet the current harvest objective of 1400–1600 moose annually, it will be necessary to harvest calves at a relatively high rate (~10%). Once the population is reduced below 12,000 moose, I recommend a selective harvest strategy (i.e., antler restricted bull hunts, cow hunts, and calf hunts) with a harvest ratio of approximately 60 bulls:20 cows:20 calves to maximize yield.

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TABLE 1 Unit 20A aerial moose fall composition counts and estimated population size, 1990–2003

Calendar year	Bulls:100 Cows	Yearlings: 100 Cows	Calves:100 Cows	Percent calves	Adults	Moose observed	Moose/mi^2	Estimated population size (90% CI)
1990[a]	23, 24, 26	15	48	27	584	292, 180, 158	2.0	10,100
1991[b]	22, 32	15	34	21	1954	949, 1531	2.2	11,100
1992[a]	28, 31, 36	14	36	21	274	107, 105, 137	2.2	11,300
1993[b]	29, 30	19	38	23	1340	852, 883	2.4	11,900
1994[c]	35	23	46	25	1038	1391	2.6	13,300
1995[d]		--	--	28	--	575	--	--
1996	39	24	42	23	2578	3343	2.3[e]	11,532 (± 13%)
1997	33	28	34	21	816	1037	2.6[e]	12,935 (± 27%)
1998 --	31	18	31	18	1035	1268	2.2[e]	11,144 (± 19 %)
1999	23	13	33	21	760	965	2.2[f]	11,205 (± 14%)[f]
2000	23	10	33	21	1089	1377	2.1[f]	10,557 (± 18 %)[f]
2001	26	18	26	17	737	887	2.3[f]	11,511 (± 15%)[f]
2002[g]								
2003	32	22	28	18	1212	1483	2.9[f]	14684 (± 13%)[f]

[a] Windy, Walker Dome, and Japan Hills trend areas, respectively.
[b] Central Tanana Flats and Western Foothills, respectively.
[c] Central Tanana Flats and Western Foothills combined.
[d] Lack of snow prevented early winter surveys.
[e] Corrected for sightability (SCF) =1.178 for 1996 and 1.15 for 1997–1998.
[f] Geo-statistical Population Estimation method does not yet incorporate a SCF, but preliminary work suggests a SCF of 1.1 to 1.15 will be appropriate for Unit 20A (see methods).
[g] Surveys were not conducted due to lack of snow.

TABLE 2 Unit 20A Tanana Flats moose twinning rates from transect surveys, 1987–2003

Calendar year	Date	Cows w/Single calf	Cows w/Twins	Cows Total	% Twins[a]
1987	20, 22, 23 May	43	5	48	10
1988	21, 23 May	52	8	60	13
1989	20, 21, 24 May[b]	43	8	51	16
1990	24 May	25	7	32	22
1991	20, 22 May	19	5	24	21
1992[c]					
1993	21-24, 28 ,29 May	50	0	50	0
1994	22 May	42	9	51	18
1995	21-22 May	47	3	50	6
1996	24, 26 May	66	12	78	15
1997	21, 25 May	48	4	52	8
1998	26, 30 May	51	4	55	7
1999	25–26 May	62	2	64	3
2000[d]	14 May–9 June	27	3	30	10
2001[d]	14 May–6 June	30	1	31	3
2002	24–25 May	52	6	58	10
2003	27–28 May	53	5	58	9

[a] Percentage of cows with calves that had twins.
[b] Includes data from surveys when paired helicopter/fixed-wing observations were made (24 May) and when only fixed-wing observations were made (20–21 May).
[c] No calving data available.
[d] No transect surveys were flown in 2000 and 2001. These data were derived from radiocollared cows ≥ 5 years old plus 4 3- or 4-year-old moose with single calves to simulate the population structure observed in transect surveys. Radiocollared 3- and 4-year-old cows did not produce viable twins during 1996–2003 (R. Boertje, ADF&G files).

TABLE 3 Estimate of Unit 20A moose harvest[a] and accidental death, regulatory years 1990–1991 through 2002–2003

Regulatory year	Harvest by hunters: Reported					Harvest by hunters: Estimated				Accidental death			
	M	F	Unk	Total		Unreported[b]	Illegal/Other[c]	Total		Road[d]	Train[e]	Total	Total
1990–1991	370	0	0	370				65					435
1991–1992	382	0	0	382				68					450
1992–1993	246	0	0	246				44					290
1993–1994	386	0	0	386	65			68					454
1994–1995	399	0	0	399	68			71					470
1995–1996	526	0	0	526	44			93					619
1996–1997	617	61	0	678	68	120		120					798
1997–1998	629	68	2	699	71	124	11	135		2	17[e]	19	853
1998–1999	613	74	4	691	93	122	3	125		3	15[e]	18	834
1999–2000	660	1	16	677		120	5	125			11[e]	14	816
2000–2001	539	70	4	613		109	9	118		2	34[e]	36	767
2001–2002	541	70	4	615		109	62	171	3	3	4[f]	7	793
2002–2003	363	115	1	479		85	61	146		7	6[f]	13	638

[a] Includes general and permit hunt harvest.
[b] Based on 17.7% unreported harvest (including wounding loss) estimated by Gasaway et al. (1992).
[c] Includes illegal, DLP, dispatched, potlatch, stickdance, and other reported deaths.
[d] Documented kills; actual number killed by vehicles is certainly greater.
[e] Confirmed dead between Alaska Railroad (ARR) mileposts 327.0 and 411.7 (ARR mileposts 327.0 through 369.9 are located in Unit 20C near the Unit 20A border); “Missing” moose (moose hit but not recovered) are not included. Data provided by the Alaska Railroad.
[f] Confirmed dead between ARR mileposts 371.0 and 411.7; “Missing” moose (moose hit but not recovered) are not included. Data provided by the Alaska Railroad.

TABLE 4 Unit 20A moose harvest data by permit hunt, regulatory years 1996–1997 through 2002–2003

Permit hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Male (%)	Female (%)	Unk (%)	Harvest
DM750	2002–2003	65	39 (60)	20 (77)	6 (23)	2 (33)	4 (67)	0 (0)	6
DM752	2002–2003	65	44 (68)	13 (62)	8 (38)	3 (38)	5 (63)	0 (0)	8
DM754	2002–2003	37	23 (62)	9 (64)	5 (36)	2 (40)	3 (60)	0 (0)	5
DM755	2002–2003	30	6 (20)	16 (67)	8 (33)	5 (63)	3 (38)	0 (0)	8
DM756	2002–2003	5	1 (20)	2 (50)	2 (50)	0 (0)	2 (100)	0 (0)	2
DM757	2002–2003	20	10 (50)	9 (90	1 (10)	1 (100)	0 (0)	0 (0)	1
DM758	2002–2003	33	27 (82)	5 (83)	1 (17)	0 (0)	1 (100)	0 (0)	1
DM759	2002–2003	20	16 (80)	3 (75)	1 (25)	1 (100)	0 (0)	0 (0)	1
Total DM750–DM759	2002–2003	275	166 (60)	77 (71)	32 (29)	14 (44)	18 (56)	0 (0)	32
RM767	2002–2003	30	3 (10)	12 (44)	15 (56)	0 (0)	15 (100)	0 (0)	15
DM760	1997–1998	75	17 (23)	32 (55)	26 (45)	0 (0)	26 (100)	0 (0)	26
	1998–1999	75	13 (17)	32 (52)	30 (48)	0 (0)	30 (100)	0 (0)	30
	1999–2000	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	2000–2001	75	14 (19)	32 (52)	29 (48)	1 (3)	28 (97)	0 (0)	29
	2001–2002	75	22 (29)	25 (47)	28 (53)	0 (0)	28 (100)	0 (0)	28
	2002–2003	50	4 (8)	13 (28)	33 (72)	0 (0)	33 (100)	0 (0)	33
DM762	1997–1998	75	23 (31)	24 (46)	28 (54)	4 (14)	24 (86)	0 (0)	28
	1998–1999	75	22 (29)	23 (43)	30 (57)	3 (10)	27 (90)	0 (0)	30
	1999–2000	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	2000–2001	75	18 (24)	27 (47)	30 (53)	2 (7)	28 (93)	0 (0)	30
	2001–2002	75	22 (29)	26 (49)	27 (51)	3 (11)	24 (89)	0 (0)	27
	2002–2003	50	14 (28)	9 (25)	27 (75)	0 (0)	27 (100)	0 (0)	27
DM764	1997–1998	150	107 (71)	34 (79)	9 (21)	1 (11)	8 (89)	0 (0)	9
	1998–1999	150	87 (58)	54 (86)	9 (14)	0 (0)	9 (100)	0 (0)	9
	1999–2000	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0

Permit hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Male (%)	Female (%)	Unk (%)	Harvest
		150	100 (67)	37 (74)	13 (26)	1 (8)	12 (92)	0 (0)	13
		150	96 (64)	33 (61)	21 (39)	2 (10)	18 (86)	1 (5)	21
		75	36 (48)	20 (51)	19 (49)	0 (0)	19 (100)	0 (0)	19
Total RM767–	1997–1998	300	147 (49)	90 (59)	63 (41)	5 (8)	58 (92)	0 (0)	63
DM764	1998–1999	300	122 (41)	109 (61)	69 (39)	3 (4)	66 (96)	0 (0)	69
	1999–2000	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
2000–2001		300	132 (44)	96 (57)	72 (43)	4 (6)	68 (94)	0 (0)	72
2001–2002		300	141 (47)	84 (53)	75 (47)	5 (7)	70 (92)	1 (1)	76
2002–2003		205	57 (28)	54 (36)	94 (64)	0 (0)	94 (100)	0 (0)	94
DM766	1997–1998	75	43 (57)	18 (56)	14 (44)	14 (100)	0 (0)	0 (0)	14
		75	39 (52)	25 (69)	11 (31)	11 (100)	0 (0)	0 (0)	11
		75	32 (43)	23 (54)	20 (46)	20 (100)	0 (0)	0 (0)	20
2000–2001		0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
2001–2002		0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
2002–2003		0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
Totals for all 1998–1999	1997–1998	375	190 (51)	108 (58)	77 (42)	19 (25)	58 (75)	0 (0)	77
permit hunts 1999–2000	1998–1999	375	161 (43)	134 (63)	80 (37)	14 (18)	66 (83)	0 (0)	80
2002–2003	1999–2000	75	32 (43)	23 (53)	20 (47)	20 (100)	0 (0)	0 (0)	20
2000–2001	2000–2001	300	132 (44)	96 (57)	72 (43)	4 (6)	68 (94)	0 (0)	72
2001–2002		300	141 (47)	84 (53)	75 (47)	5 (7)	70 (92)	1 (1)	76
		480	223 (46)	131 (51)	126 (49)	14 (11)	112 (89)	0 (0)	126

2001–2002
2002–2003

TABLE 5 Unit 20A moose hunter[a] residency and success, regulatory years 1990–1991 through 2002–2003

	Successful					Unsuccessful					
Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
1990–1991	257	43	61	9	370 (31)	651	122	52	15	840 (69)	1210
1991–1992	264	62	48	8	382 (33)	566	148	48	10	772 (67)	1154
1992–1993	150	51	32	13	246 (25)	549	113	59	15	736 (75)	982
1993–1994	281	54	39	12	386 (34)	571	108	32	24	735 (66)	1121
1994–1995	270	67	45	17	399 (34)	605	103	43	16	767 (66)	1166
1995–1996	390	68	64	4	526 (38)	709	107	37	8	861 (62)	1387
1996–1997	427	102	73	5	607 (37)	830	134	61	4	1029 (63)	1636
1997–1998	406	110	98	5	619 (39)	738	163	65	10	976 (61)	1595
1998–1999	367	131	108	2	608 (37)	816	158	64	6	1044 (63)	1652
1999–2000	369	153	129	6	657 (42)	660	180	67	7	914 (58)	1571
2000–2001	326	138	73	4	541 (34)	713	213	115	2	1043 (66)	1584
2001–2002	350	131	56	2	539 (35)	705	219	81	7	1012 (65)	1551
2002–2003	190	77	85	1	353 (30)	567	190	70	1	828 (70)	1181

[a] Excludes hunters in permit hunts.
[b] Residents of Unit 20.

TABLE 6 Unit 20A moose harvest[a] chronology percent by month/day, regulatory years 1990–1991 through 2002–2003

Regulatory year	Harvest chronology percent by month/day					Unk/Other	*n*
	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	9/21–9/25		
1990–1991	27	12	27	29	1	3	370
1991–1992	24	19	28	25	0	3	382
1992–1993	45	24	13	16	0	2	246
1993–1994	34	19	25	17	1	4	386
1994–1995	27	20	23	25	0	5	382
1995–1996	19	17	21	22	15	4	526
1996–1997	26	15	19	22	14	4	607
1997–1998	24	15	17	22	18	4	619
1998–1999	22	15	17	24	19	3	608
1999–2000	20	15	25	22	15	2	657
2000–2001	26	18	25	27	0	3	541
2001–2002	24	21	24	28	0	3	539
2002–2003	22	18	31	26	0	2	353

[a] Excludes permit hunt harvest.

TABLE 7 Unit 20A moose harvest[a] percent by transport method, regulatory years 1990–1991 through 2002–2003

Regulatory year	Harvest percent by transport method									n
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Unknown	
1990–1991	37	6	31	9	0	9	4		3	370
1991–1992	34	5	29	14	0	10	5		3	382
1992–1993	33	4	27	16	2	10	7		2	246
1993–1994	34	2	37	12	0	6	7		2	386
1994–1995	29	3	33	22	0	8	5		0	399
1995–1996	30	4	35	17	0	7	4		2	526
1996–1997	28	3	32	20	0	10	4		3	607
1997–1998	32	4	22	23	0	5	6	5	3	619
1998–1999	37	3	19	22	0	7	4	7	1	608
1999–2000	36	5	18	20	0	11	4	5	1	660
2000–2001	37	5	19	19	0	10	3	5	1	541
2001–2002	34	5	19	20	0	10	3	7	1	539
2002–2003	36	5	14	23	0	8	3	8	2	353

[a] Excludes permit hunt harvest.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 20B (9114 mi^2)

GEOGRAPHIC DESCRIPTION: Drainages into the north bank of the Tanana River between Delta Creek and Manley Hot Springs

BACKGROUND

Moose numbers increased in Unit 20B throughout the 1950s and early 1960s after extensive wildfires improved moose habitat and federal predator reduction programs reduced wolf predation on moose (McNay 1993). Moose numbers declined following severe winters in 1965, 1970, 1971, and 1974. Increasing wolf predation and liberal either-sex hunting seasons contributed to the moose population decline. By 1976 moose densities were low, and the hunting season had been reduced to 10 days in most of Unit 20B. Moose populations again increased following wolf reduction programs conducted from 1980 to 1986. Hunting seasons were extended from 10 days in 1981 and 1982 to 20 days during 1983 through 1987. Reported harvests increased to approximately 300 bulls per year during 1983 through 1986. Harvests increased further from nearly 400 bulls in 1987 and 1988 to more than 700 bulls in 1998 and 2002, despite a 5-day reduction in the season.

Demand for moose hunting opportunities is high in Unit 20B. Extensive road systems and trails provide overland access, and numerous waterways such as the Tolovana, Tatalina, Chatanika, Goldstream, Salcha, and Chena Rivers provide boat access.

There were 2 permit moose hunts in Unit 20B during this reporting period, 1 in the Minto Flats Management Area (MFMA) and 1 in the Fairbanks Management Area (FMA). The MFMA was established in 1979 to restrict harvest in a low-density moose population. In 1988 the Alaska Legislature established the Minto Flats State Game Refuge to ensure the protection and enhancement of habitat and the conservation of fish and wildlife; and to guarantee the continuation of hunting, fishing, trapping, and other compatible public uses within approximately 900 mi^2 of the Minto Flats area.

[a] This unit report also includes data collected after the reporting period ended at the discretion of the reporting biologist.

The FMA was established in 1983 to provide moose hunting opportunities around the Fairbanks urban area by bow and arrow only. This area was closed to hunting in the late 1970s and early 1980s to prevent excessive harvest. Boundaries of the FMA changed numerous times, and the most recent changes went into effect in July 2002. The FMA currently encompasses about 300 mi^2, of which about 50 mi^2 has a relatively dense human population. Even though harvest is generally low, this permit hunt is popular.

For management purposes, Unit 20B is divided into 3 geographic zones: Unit 20B West (2942 mi^2), including the Minto Flats, Tatalina Creek drainage, Tolovana River drainage, and areas west; Unit 20B East (2425 mi^2) including the Little Salcha and Salcha River drainages; and Unit 20B Central (3829 mi^2), the remainder. Game management unit boundaries changed in 1981, increasing the size of Unit 20B and creating Unit 25C. Prior to 1981, the eastern and western portions of present-day Unit 20B and all of Unit 25C were considered part of Unit 20C. In 1993 the Unit 20B Central boundary was shifted westward. During regulatory year (RY) 2000, which begins 1 July and ends 30 June (e.g., RY00 = 1 Jul 2000–30 Jun 2001), Unit 20B West and Unit 20B Central boundaries were modified to coincide with Uniform Coding Unit (UCU) boundaries. As a result, the area of Unit 20B West decreased by approximately 1000 mi^2 and Unit 20B Central increased by that same amount.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide for continued subsistence use of moose by Alaska residents who have customarily and traditionally used the population.
- Provide the greatest sustained opportunity to participate in hunting moose.
- Provide an opportunity to view and photograph moose.
- Protect human life and property in human–moose interactions.

MANAGEMENT OBJECTIVE

- Manage for a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each count area (i.e., Unit 20B East, Unit 20B Central, Unit 20B West, and MFMA).

METHODS

POPULATION STATUS AND TREND

2001 Population Estimation Survey

We surveyed 138 (54 low and 84 high density; 780 mi^2) of 1628 sample units (SU; 9196 mi^2) in Unit 20B during 6–26 November. We used the Geostatistical Population Estimator method

(GSPE; Ver Hoef 2001), a modification of the standard Gasaway et al. (1986) technique. A simple random sample of SUs was selected from each stratum using Microsoft®Excel for Windows®98 software. Previous analyses suggest survey effort and the precision of population estimates are optimized when the survey effort includes approximately 40% low density and 60% high-density sample units.

The GSPE method does not yet employ a sightability correction factor (SCF), so does not correct for moose not seen during the survey. Rather, the GSPE method employs greater search intensity of 8–10 min/mi^2 vs. 4–6 min/mi^2 (Gasaway et al. 1986), resulting in a higher level of sightability.

Preliminary work on sightability of collared moose indicates that a SCF of about 1.15 will eventually be applied to GSPE estimates in Unit 20B. Search intensity averaged 7.8 min/mi^2, slightly less than the recommended 8–10 min/mi^2. Survey conditions with regard to snow (age and cover), light (intensity and type), and wind (strength and turbulence) were reported primarily as fair (34%) and good (46%) with the remainder reported as excellent (13%) or poor (7%). Snow conditions tended to deteriorate as the survey period progressed. Turbulence was not a factor, although surveys were suspended several days due to high or turbulent winds.

2002 Population Estimation Survey

Surveys were not conducted due to insufficient snow accumulation in November.

Twinning Rate Surveys

Twinning rates were estimated from surveys conducted in traditional twinning survey trend count areas on Minto Flats. Surveys consisted of roughly parallel transects flown at approximately ½-mile intervals at ≤500 feet AGL in PA-18 or Scout aircraft by experienced contract pilots. All moose observed were classified as bull, yearling cow, adult cow without a calf, or adult cow with single, twin or triplet calves. Twinning rate surveys were flown for 4.8 hours on 29 May 2002 and 5.7 hours on 29 May 2003. In past years, we terminated surveys and excluded the data if <15% of the cows had calves. For statistical reasons, we established, a priori, a minimum sample size of 50 cows with calves. Twinning rate was calculated as the proportion of cows with twins or triplets from the sample of all cows with calves.

Browse Surveys

We conducted moose browse surveys in Unit 20B (MFMA) in spring 2003. We sampled 9 sites in the MFMA. Sites were selected, a priori, from U.S. Geological Survey topographic maps based primarily on physiographic (valley bottom vs. side slope vs. ridgetop) and habitat (riparian vs. upland; shrubland vs. open forest vs. closed forest; wet vs. dry) features. We attempted to select a highly dispersed, representative sample of sites relative to the above physiographic and habitat parameters that also had a high proportion of preferred browse species (i.e., *Salix* spp., birch and aspen). Sampling of plant architecture (i.e., Broomed Index) at individual sites followed the methods of Seaton (2002).

MORTALITY

We estimated harvest based on mandatory harvest report cards. This included data from report cards from the general season, the FMA drawing hunt, and the MFMA Tier II permit hunt. Reminder letters were sent to nonreporting general season hunters, and up to 2 letters were sent to permit holders who failed to report. When antler size of bulls was reported, we considered bulls with antler spreads of <30 inches to be yearlings. Harvest data were summarized by regulatory year.

We estimated accidental mortality from Department of Public Safety records of collisions with motor vehicles and Alaska Railroad records of collisions with trains.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The 2001 population estimate for Unit 20B was 10,261 moose (8517–12,005; 90% CI) or about 1.1 moose/mi^2. However, because snow conditions for surveys were marginal, the estimate may have been low. In spite of this, it is not likely we met the Intensive Management population objective of 12,000–15,000 moose established by the Board of Game for Unit 20B.

Prior to 2001 a unitwide population estimate had not been conducted since 1990 (McNay 1993). The population at that time was estimated at 9800 moose or about 1.1 moose/mi^2. Error bounds could not be calculated for that estimate because it included extrapolation; thus, the 1990 and 2001 estimates cannot be statistically compared. However, moose densities appeared similar between years.

Estimated moose densities were higher in Unit 20B West than in Units 20B Central or 20B East (Table 1). High moose density in the MFMA (1.9 moose/mi^2) probably influenced the overall Unit 20B estimate. Moose densities in Unit 20B West outside the MFMA were probably similar to densities observed throughout the remainder of Unit 20B. In Unit 20B Central, estimated densities were lower in 2001 (1.0 moose/mi^2) than in 1990 (1.2 moose/mi^2; McNay 1993) and 1994 (1.3 moose/mi^2). In contrast, estimated moose densities in Unit 20B West were higher in 1999 and 2001 (1.3–1.4 moose/mi^2) than in 1990 (0.9 moose/mi^2; McNay 1993).

Moose densities in the MFMA appeared to increase between 1989 (1.65 moose/mi^2; McNay 1993) and the mid 1990s (3 moose/mi^2 in 1997) and decline thereafter (Table 1). Productivity and/or early calf survival estimates support this observation. For instance, calf:100 cow ratios declined from 47:100 in 1994 and 1996 to 28:100 in 2001. Despite the apparent declines observed in the late 1990s, moose densities remained relatively high. Gasaway et al. (1992) reported that areas of Interior Alaska and the Yukon have densities of 0.1–1.1 moose/mi^2 where predators are lightly harvested. Higher densities occurred where wolves and/or bears were below food-limited levels. The MFMA has had relatively intensive wolf trapping efforts compared with most of Interior Alaska, and black bear harvest is also relatively high in roadside areas of Unit 20B.

Moose densities of 1.9 moose/mi^2 observed in the MFMA in 1999 and 2001 were lower than observed in 2000 (2.4 moose/mi^2). This difference probably resulted from low survey intensity (1999) and marginal snow conditions (2001). As a result, actual moose densities in the MFMA during those years were probably higher than estimated and probably exceeded 2 moose/mi^2. However, surveys in the MFMA also may have been influenced by changes in moose distribution due to the migratory nature of moose in the area and the timing of the October or November migration (P. Valkenburg and R. Boertje, ADF&G, personal observation). Therefore, inconsistent results may occur regardless of sampling effort. This problem was exacerbated by the relatively small size of the survey area. In addition, surveys were not directly comparable across years. For instance, the 1996 survey included 898 mi^2; whereas the 1997 survey included 967 mi^2, and most of the additional area (7.7%) included habitat with lower moose densities. Furthermore, the 1999 and 2001 surveys (951 mi^2) used the GSPE method, whereas previous surveys used Gasaway et al. (1986) methodology.

Moose densities in the FMA followed a trend similar to that observed in the MFMA (i.e., a decline in densities and productivity and/or early calf survival between the mid 1990s and 2001; Table 1). However, density in the FMA remained high, approaching or exceeding 1.5 moose/mi^2 since at least 1993.

I am uncertain whether the apparent trends in density, productivity and/or early calf survival observed in the MFMA and FMA occurred throughout Unit 20B, because unitwide surveys were conducted too infrequently to evaluate long-term trends in the data.

Population Composition

Bull:Cow Ratios. McNay (1993) reported that the overall Unit 20B bull:cow ratio averaged 40:100, well above the management objective of ≥30:100. The ratios varied by harvest intensity within the unit. For instance, the less intensively harvested Salcha River had bull:cow ratios of 44:100 (1990) and the MFMA had 49:100 (1989) and 47:100 (1994) (McNay 1993). In contrast, the more intensively harvested Chena River had 28:100 (1990), and the most intensively harvested FMA had 9–14:100 (1989–1994).

Surveys conducted in 2001 indicate a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each count area (i.e., Unit 20B East, Unit 20B Central, Unit 20B West, and MFMA), except in the FMA (Table 1). Bull:cow ratios in the FMA have been low (≤15 bulls:100 cows) since the early 1990s (Table 1). Hunting pressure in the FMA was intense during the fall prior to surveys, and most bulls killed were yearlings. Low yearling bull:cow ratios observed during November surveys (e.g., 4:100 in 1993, 3:100 in 1994, 7:100 in 2001) resulted largely from the high proportion of yearling bulls killed in September and did not reflect poor calf recruitment. For example, we observed 39 calves:100 cows in 2001.

Calf:Cow Ratios. In general, calf:cow ratios declined between the mid 1990s and 2001 (Table 1). Calf:cow ratios tended to be higher in Unit 20B Central than Units 20B East and 20B West. The lowest ratios were observed in Unit 20B East (2001) and the highest were in the FMA (1994 and 1996). Elevated calf:cow ratios in the FMA and central Unit 20B were probably a function of lower predation rates resulting from lower predator abundance. Also, improved habitat existed in the FMA compared with Unit 20B East.

Twinning Rates

Twinning rates in the MFMA appeared to decline dramatically between 1997 and 2001 (Table 2). Higher estimates in 1997 and 1998 may be an artifact of low sample sizes, although the apparent decline in the MFMA was consistent with a similar decline observed on the Tanana Flats in Unit 20A, where twinning rates fell from 18% in 1996 to 3% in 1999 (Young 2000). Twinning rates improved in 2002 and 2003.

Distribution and Movements

Moose are distributed throughout Unit 20B, consisting of nonmigratory and migratory subpopulations (Gasaway et al. 1983). From February to April, some bull and cow moose migrate from the Chena and Salcha River drainages to calving areas on the Tanana Flats in Unit 20A. Most remain there for the summer and return to the foothills from August through October. Although we do not know what proportion of the moose migrate, Gasaway et al. (1983) estimated that seasonal migrants probably increase the density of moose on the Tanana Flats 2- to 4-fold. Therefore, the spring and summer densities in Unit 20B are probably much lower than during winter.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits in Unit 20B in RY01 were:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Fairbanks Management Area.		
1 antlerless moose by bow and arrow by drawing permit; or	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
1 bull with antlers by bow and arrow.	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
Minto Flats Management Area.		
1 moose by Tier II permit only; or	1 Sep–20 Sep 10 Jan–28 Feb	No open season
1 bull with spike-fork or 50-inch antlers, or with at least 4 brow tines on 1 side.	11 Sep–20 Sep	No open season
Middle Fork drainage of Chena River, and Salcha		

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
River drainage upstream from and including Goose Creek.		
1 bull.	1 Sep–20 Sep	1 Sep–20 Sep
Remainder of Unit 20B.		
1 bull.	1 Sep–15 Sep	5 Sep–15 Sep

Seasons and bag limits in Unit 20B in RY02 were:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Fairbanks Management Area.		
1 antlerless moose by bow and arrow by drawing permit;	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
or		
1 bull with antlers by bow and arrow.	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
Minto Flats Management Area.		
1 moose by Tier II permit only;	1 Sep–20 Sep 10 Jan–28 Feb	No open season
or		
1 bull with spike-fork or 50-inch antlers, or with at least 4 brow tines on 1 side.	11 Sep–20 Sep	No open season
Middle Fork drainage of Chena River, and Salcha River drainage upstream from and including Goose Creek.		
1 bull by permit (TACH);	3 Aug–6 Aug	3 Aug–6 Aug
or		
1 bull;	1 Sep–20 Sep	1 Sep–20 Sep

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
or 1 bull by bow and arrow.	21 Sep–30 Sep	21 Sep–30 Sep
Remainder of Unit 20B. 1 bull by permit (TACH);	3 Aug–6 Aug	3 Aug–6 Aug
or 1 bull.	1 Sep–15 Sep	5 Sep–15 Sep

Alaska Board of Game Actions and Emergency Orders.

Historical Board of Game Actions — In the MFMA, the department issued 150 Tier II permits per year from RY90 through RY92 to provide for an annual harvest quota of 50 bulls. However, harvests were only 28–42 per year. In spring 1993 we calculated a new harvest quota of 100 bulls and recommended the Board of Game authorize up to 250 permits. The board passed our recommendation, and the department issued 200 permits in RY93 and RY94. In spring 1995 the board approved changes for the MFMA and FMA. The Tier II bag limit was changed from any bull to any moose, and the number of permits was reduced to 60. A general hunt was added for bulls with spike-fork or 50-inch antlers or antlers with 4 or more brow tines with a shorter season than the Tier II hunt. In RY96 the number of Tier II permits was increased to 100, where it remained through RY03.

The board also approved a drawing hunt for antlerless moose in the FMA beginning in RY95 and replaced the registration hunt with a general season. In RY00 the number of FMA antlerless moose permits that could be issued was increased from 25 to 100 in response to high moose densities and the increasing number of moose–vehicle collisions and moose–human conflicts in the Fairbanks area. Also, the FMA antlerless moose hunt was liberalized to include a 21–27 November season to align the bull and antlerless seasons, increase the harvest of cows, and provide additional hunting opportunity. In addition, the FMA was enlarged from approximately 217 mi^2 to 318 mi^2 to clarify boundaries in the Cripple Creek and Goldstream areas and to address safety issues in developed areas in the Goldstream Valley and Chena Hot Springs Road/Nordale areas (*FMA boundary description: that portion of Unit 20(B) bounded by a line from the confluence of Rosie Creek and the Tanana River, northerly along Rosie Creek to Isberg Road, then northeasterly on Isberg Road to Cripple Creek Road, then northeasterly on Cripple Creek Road to the Parks Highway, then north on the Parks Highway to Alder Creek, then westerly along Alder Creek to its confluence with Emma Creek, then upstream along Emma Creek to its headwaters, then northerly along the hydrographic divide between Goldstream Creek drainages and Cripple Creek drainages to the summit of Ester Dome, then down Sheep Creek to its confluence with Goldstream Creek, then easterly along Goldstream Creek to Sheep Creek Road, then north on Sheep Creek Road to Murphy Dome Road, then west on Murphy Dome Road to Old Murphy Dome Road, then east on Old Murphy Dome Road to the Elliot Highway, then south on the Elliot Highway to Goldstream Creek, then easterly along Goldstream Creek to its confluence with First Chance Creek, then up First Chance Creek to*

Tungsten Hill, then southerly along Steele Creek to its confluence with Ruby Creek, then upstream along Ruby Creek to Esro Road, then south on Esro Road to Chena Hot Springs Road, then east on Chena Hot Springs Road to Nordale Road, then south on Nordale Road to the Chena River, then along the north bank of the Chena River to the Moose Creek dike, then southerly along Moose Creek dike to its intersection with the Tanana River, and then westerly along the north bank of the Tanana River to the point of beginning). However, during the spring 2002 meeting, the Board of Game again modified the boundaries of the FMA in the Cripple Creek, Fox, and Steele Creek areas (*FMA boundary description: that portion of Unit 20(B) bounded by a line from the confluence of Rosie Creek and the Tanana River, northerly along Rosie Creek to the middle fork of Rosie Creek through Section 26 to the Parks Highway, then east along the Parks Highway to Alder Creek, then upstream along Alder Creek to its confluence with Emma Creek, then upstream along Emma Creek to its headwaters, then northerly along the hydrographic divide between Goldstream Creek drainages and Cripple Creek drainages to the summit of Ester Dome, then down Sheep Creek to its confluence with Goldstream Creek, then easterly along Goldstream Creek to Sheep Creek Road, then north on Sheep Creek Road to Murphy Dome Road, then west on Murphy Dome Road to Old Murphy Dome Road, then east on Old Murphy Dome Road to the Elliot Highway, then south on the Elliot Highway to Davidson Ditch, then southeasterly along the Davidson Ditch to its confluence with the tributary to Goldstream Creek in Section 29, then downstream along the tributary to its confluence with Goldstream Creek, then in a straight line to First Chance Creek, then up First Chance Creek to the summit of Tungsten Hill, then southerly along Steele Creek to its intersection with the trans-Alaska pipeline right-of-way, then southeasterly along the easterly edge of the trans-Alaska pipeline right-of-way to the Chena River, then along the north bank of the Chena River to the Moose Creek dike, then southerly along Moose Creek dike to its intersection with the Tanana River, and then westerly along the north bank of the Tanana River to the point of beginning*).

Report Period Board of Game Actions — The Board of Game adopted intensive management population (12,000–15,000 moose) and harvest (600–1500 moose) objectives for Unit 20B in November 2000, and at the spring 2002 meeting added a 21–30 September hunt by bow and arrow only in the drainage of the Middle (East) Fork of the Chena River and Salcha River upstream from and including Goose Creek, and created a 3–6 August Take a Child Hunting youth (8–17 years of age) hunt for any bull in Unit 20B, excluding the FMA and MFMA.

Spring 2004 Alaska Board of Game Actions — The board eliminated the Take a Child Hunting early season hunt for moose in Unit 20B; created a new winter (21–27 Nov) drawing permit hunt for antlerless moose by muzzleloader only in Creamer’s Refuge; increased the number of antlerless drawing permits for the FMA from 100 to 150, and prohibited drawing permit winners for antlerless hunts in the area from taking an antlered bull in the management area; and in the MFMA changed the Tier II hunt to a registration hunt and lengthened the fall seasons (general and registration) to 1–25 September.

<u>Hunter Harvest</u>.

General Season — The reported harvest of 506 bulls in RY01 was 15% lower than the average reported harvest of 598 bulls during RY97–RY02 (Table 3). This appeared to be the combined result of reduced effort and lower success rates. The reduced effort may be explained by the large number of soldiers from Fort Wainright deployed outside of Alaska during September

2001. Lower success rates of 18% versus 20% for the period RY97–RY02 was likely a function of weather.

The majority of harvest was in Unit 20B Central, followed by Unit 20B West, then Unit 20B East (Table 3). Harvest density (moose harvested/mi^2) in Unit 20B Central was over 2.5 times that reported in Units 20B East and 20B West. Like calf:cow ratios, this is probably a function of higher moose densities due to lower predator densities and better habitat in Unit 20B Central than in Unit 20B West and 20B East.

Drawing Permit Hunts — Few trends were apparent in harvest, effort or success rates from RY97 through RY02 in hunts DM788 or TM785 (Table 4). However, the proportion of DM788 permit holders choosing not to hunt increased from 7% (RY97–RY00) to 16% in RY01–RY02. Harvest rates of bulls and cows remained stable in hunt TM785.

<u>Hunter Residency and Success</u>. Primarily local residents hunted moose in Unit 20B (Table 3). Participation by nonlocal residents and nonresidents was relatively low.

Hunter success during the general season was generally lower in Unit 20B than elsewhere in Unit 20. For example, between RY97 and RY02, 18–23% of the hunters in Unit 20B were successful (Table 3), whereas annual success rates in Units 20A and 20C typically exceed 35% (Young 2000). Success rates in RY01 and RY02 were similar to the average success rate of 20% reported for the period RY97–RY02. During the previous reporting period, Unit 20B Central had lower success rates ($\bar{x}$ = 19%) than Units 20B West ($\bar{x}$ = 23%) and Unit 20B East ($\bar{x}$ = 28%). Typically, success rates are lower in areas with higher hunter densities and/or lower bull:cow ratios, such as Unit 20B Central, and higher in areas with lower hunter densities and/or higher bull:cow ratios, such as Unit 20B East. However, during this reporting period Unit 20B East ($\bar{x}$ = 21.5%), Unit 20B Central ($\bar{x}$ = 20%), and Unit 20B West ($\bar{x}$ = 21%) all had similar success rates.

In the FMA, harvests were relatively high during the past 8 years (Young 2002; this report). The high harvests were probably the result of high densities and survival rates of moose in the FMA during that period. Population estimates and anecdotal information indicate that moose densities, productivity, and early calf survival were high in the FMA between 1993 and 2001 (Table 1).

<u>Harvest Chronology</u>. Between RY97 and RY00, more bull moose were killed during the first 5 days of the season than during any other 5-day period (Table 5). However, during the RY01–RY02 reporting period, harvest shifted slightly towards the later part of the season (i.e., 11–15 Sep).

<u>Transport Methods</u>. Highway vehicles were the primary method of transportation used by successful hunters (Table 6). Since RY97 the proportion of successful hunters using 3- or 4-wheelers and boats (traditional and airboats) increased slightly, while the proportion using highway vehicles and airplanes declined somewhat. No other trends were apparent.

Other Mortality

The number of moose killed in accidents with motor vehicles and trains has been substantial in some years (Table 7). The number of moose reported killed on highways in the FMA averaged

100 animals annually RY97–RY02. By comparison, an average of only 64 moose was reported harvested annually by hunters in the FMA during that same period. An additional 65.5 moose were killed each year on roads in the remainder of Unit 20B. Few moose were reported killed by trains during RY97 through RY02, with the exception of RY99 when 61 were reported killed.

HABITAT

Assessment/Enhancement

Surveys conducted in spring 2003 indicated that moose utilization of preferred browse species in the MFMA was higher than any other area sampled in Interior Alaska (Fig 1). As a result, I recommended the Board of Game increase harvest of moose in the MFMA to limit population growth.

The department is planning and/or conducting moose habitat enhancement for portions of the Fairbanks area. These efforts include use of prescribed fire and regeneration of decadent willows by planting willows in recently logged areas. In addition, existing habitat improvement projects for grouse in Unit 20B have positive benefits for moose.

The proposed Nenana Basin Gas Lease could potentially fragment important moose habitat in the Minto Flats area. Development could affect moose in 2 ways. First, pipelines and roads may improve access. More important, increased fire suppression near wells and structures may adversely affect habitat capability for moose. The Division of Wildlife Conservation forwarded these concerns via comments submitted in response to the Alaska Department of Natural Resources, Division of Oil and Gas Preliminary Best Interest Finding.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

During this reporting period we collected systematic information on nonhunting mortality of moose because of its potential influence on harvest quotas and population trends. Motor vehicle and railroad kills continue to be an important source of mortality (Table 7). Within the Fairbanks urban area, we also received a considerable number of complaints about human–moose conflicts, such as moose in gardens or yards, moose attacking dogs along dogsled trails, and moose "trapped" within the confines of the urban area. For instance, in RY01 and RY02 the department recorded 71 and 114 complaints, respectively, involving moose within Unit 20B. Department policy for the treatment of nuisance moose should be formalized for public consideration. Mitigation measures, including public education, are continuing.

CONCLUSIONS AND RECOMMENDATIONS

Surveys conducted in 2001 indicate we met our management objective of a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each count area (i.e., Unit 20B East, Unit 20B Central, Unit 20B West, and MFMA), except in the FMA. Low bull:cow ratios in the FMA, a relatively small area, are of less concern than in larger areas because the FMA is small in relation to the annual home range of moose. If not enough bulls are available in the FMA for breeding, cows in estrous can easily move to the periphery or outside the FMA where bull:cow ratios are higher, and bulls seeking females can readily migrate into the FMA. High calf:cow ratios also indicate there have been sufficient bull moose in the FMA to breed cows in estrous.

We probably did not meet the intensive management population objective of 12,000–15,000 moose established for Unit 20B by the Board of Game, although the actual total population (estimated observed moose × sightability correction factor) probably approached 12,000 moose. Reported harvest reached the intensive management harvest objective lower limit of 600 moose in RY02 (n = 788), but not in RY01 (n = 590).

I concur with Dale (1998) that we need to collect unitwide population data on an annual basis to better assess the status of the population, then reevaluate management objectives and gain public approval of those management objectives.

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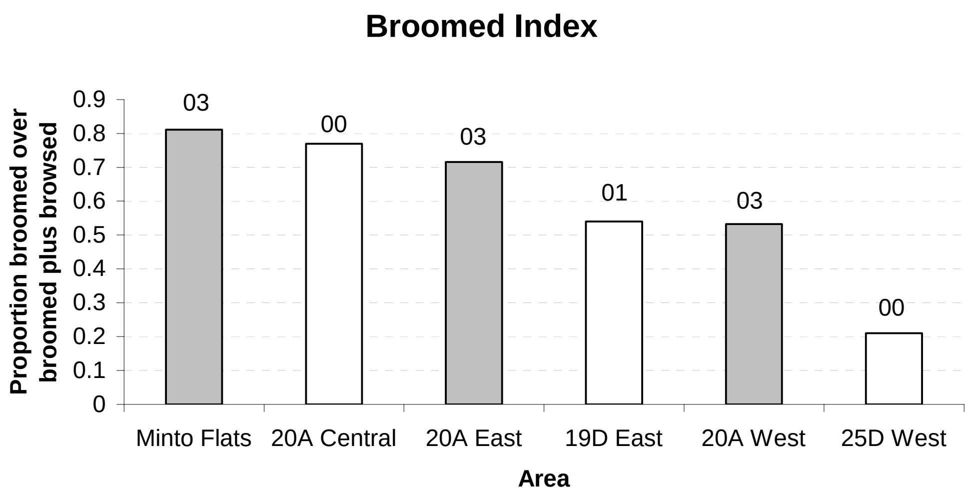

FIGURE 1 Index of proportion of preferred browse species (*Salix* spp., birch and aspen) that were broomed in the Minto Flats Management Area in spring 2003 relative to 5 other areas sampled in Interior Alaska

TABLE 1 Unit 20B aerial moose fall composition counts and estimated population size, regulatory years 1993–1994 through 2003–2004

Count area	Regulatory year	Bulls:100 Cows	Yearlings: 100 Cows[a]	Calves:100 Cows	Percent calves	Adults	Moose observed	Moose/mi^2	Estimated population size (90% CI)
Unit 20B	2001–2002	33	15	30	18	751	914	1.1[b]	10,261 (±17%)
Unit 20B	2003–2004	34	24	37	22	399	514	1.4[b]	12,904 (±23%)
Unit 20B East[c]	2001–2002	47	15	24	11	271	305	1.0[b]	2454 (±22%)
Unit 20B Central[d]	1994–1995	18	5	47	28		428	1.3[e]	
Unit 20B Central[f]	2001–2002	27	13	34	26	205	278	1.0[b]	4005 (±25%)
Unit 20B West[g]	1999–2000	27	14	34	20	438	546	1.4[b]	4881 (±20%)
Unit 20B West[h]	2001–2002	30	16	29	17	274	331	1.3[b]	3802 (±22%)
MFMA[i,j]	1994–1995	47	11	47	24		489	2.9[k]	
MFMA[j]	1996–1997	27	27	47	27			3.0[l]	2627 (±14%)
MFMA[m]	1997–1998	33	15	34			647	2.7[l]	2604 (±45%)
MFMA[n]	1999–2000	31	16	36	19	374	463	1.9[b]	1778 (±20%)
MFMA[n]	2000–2001	31	8	39	24	546	714	2.4[b]	2200 (±14%)
MFMA[n]	2001–2002	30	16	28	17	191	230	1.9[b]	1877 (±21%)
FMA[o,p]	1993–1994	9	8	30	27		65	1.3	
FMA[q]	1994–1995	14	6	61	40		165	2.6[e]	
FMA[q]	1996–1997	15	23	52	32	101	150	1.9	
FMA[r]	2001–2002	12	13	39	28	70	99	1.4[b]	461 (±34%)

[a] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[b] Geostatistical Population Estimation method does not incorporate a SCF (see methods).
[c] A 2425-mi^2 count area.
[d] A 642-mi^2 count area north and west of Fairbanks.
[e] Corrected for sightability (SCF = 1.23).
[f] A 3829-mi^2 count area.
[g] A 3644-mi^2 count area encompassing most of Unit 20B West (3955 mi^2), including the MFMA.
[h] A 2942-mi^2 count area.
[i] Minto Flats Management Area.
[j] An 898-mi^2 count area.
[k] Corrected for sightability (SCF = 1.13).
[l] Corrected for sightability (SCF = 1.18).
[m] A 967-mi^2 count area.
[n] A 951-mi^2 count area.
[o] Fairbanks Management Area.
[p] A 52-mi^2 count area within the FMA.
[q] A 78-mi^2 count area within the FMA.
[r] A 318-mi^2 count area.

TABLE 2 Results of twinning rate surveys for moose in Unit 20B (Minto Flats Management Area), 1997–2003

		Cows			
Year	Date	w/Single calf	w/Twins	Total	% Twins[a]
1997	22 May	17	9	26	35
1998	31 May	18	5	23	22
1999	27–29 May	59	4	63	6
2000	30–31 May	74	10	84	12
2001	31 May	58	5	63	8
2002	29 May	38	10	48	21
2003	29 May	40	10	50	20

[a] Percentage of cows with calves that had twins.

TABLE 3 Unit 20B moose hunter[a] residency and success, regulatory years 1997–1998 through 2002–2003

	Successful						Unsuccessful					
Area/ Regulatory year	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	Total hunters
Unit 20B East (UCUs 601, 602, 603, 604, 605)												
1999–2000	70	12	6	1	89	27	214	17	10	2	243	332
2000–2001	76	14	9	0	99	28	222	20	9	0	251	350
2001–2002	49	3	9	1	62	20	212	18	18	0	248	310
2002–2003	78	8	7	0	93	23	260	28	22	0	310	403
Unit 20B Central (UCUs 207, 208, 209, 211, 212, 213, 301, 401, 402, 403, 404, 405, 406, 501)												
1999–2000	281	22	25	2	330	19	1263	74	77	7	1421	1751
2000–2001	269	30	28	0	327	19	1257	75	90	8	1430	1757
2001–2002	241	16	20	2	279	19	1009	77	84	4	1174	1453
2002–2003	275	40	20	1	336	21	1095	82	50	6	1233	1569
Unit 20B West (UCUs 101, 201, 202, 203, 204, 205, 206, 210)												
1999–2000	92	14	8	0	114	26	269	41	19	2	331	445
2000–2001	69	17	5	1	92	19	305	59	28	2	394	486
2001–2002	58	18	9	0	85	20	249	67	23	2	341	426
2002–2003	72	22	8	0	102	22	256	71	22	3	352	454
FMA general archery hunt (UCUs 0212, 0213, 0300, 0301, 0401, 0402, 0403, 0501; archery only)												
1997–1998[c]	44	0	0	0	44[d]							
1998–1999[c]	35	1	1	0	37[d]							
1999–2000[c]	35	0	0	0	35[d]							
2000–2001[e]	46	1	1	0	48[d]							
2001–2002[e]	38	1	1	0	40[d]							
2002–2003[e]	44	3	1	0	48[d]							
MFMA general hunt (UCUs 0201, 0205, 0210; Nonresident hunters and antlerless harvest censored)												
1997–1998	37	7	0	0	44	39	65	4	0	0	69	113
1998–1999	44	12	0	1	57	32	112	6	0	1	119	176
1999–2000	43	5	0	0	48	27	119	10	0	1	130	178
2000–2001	40	7	0	0	47	27	111	13	0	0	124	171
2001–2002	27	9	0	0	36	26	80	19	0	1	100	136
2002–2003	40	12	0	0	52	30	103	20	0	1	124	176

Area/ Regulatory year	Successful Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Unsuccessful Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	Total hunters
Unit 20B remainder general hunt (Includes FMA general archery hunt, but excludes MFMA)												
1997–1998	446	31	34	2	513	19	1925	124	92	20	2161	2674
1998–1999	529	43	46	3	621	22	1944	130	123	17	2214	2835
1999–2000	457	46	47	4	554	20	1907	156	113	13	2189	2743
2000–2001	438	69	43	0	550	20	1953	170	137	10	2270	2820
2001–2002	388	35	44	3	470	18	1845	187	145	7	2184	2654
2002–2003	475	76	43	2	596	20	1991	226	110	9	2336	2932
All general hunts												
1997–1998	483	38	34	2	557	20	1990	128	92	20	2230	2787
1998–1999	573	55	46	4	678	23	2055	137	123	18	2333	3011
1999–2000	500	51	47	4	602	21	2026	166	113	14	2319	2921
2000–2001	478	76	43	0	597	20	2064	183	137	10	2394	2991
2001–2002	415	44	44	3	506	18	1925	206	145	8	2284	2790
2002–2003	515	88	43	2	648	21	2094	246	110	10	2460	3108

[a] Excludes drawing and Tier II permit hunt harvest.
[b] Residents of Unit 20.
[c] FMA approx. 230 mi^2.
[d] Subtracted number of bulls reported harvested by bow and arrow on Eielson AFB (in UCU 0501, but outside FMA).
[e] FMA approx. 330 mi^2.

TABLE 4 Unit 20B moose harvest data by permit hunt, regulatory years 1996–1997 through 2002–2003

Hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Bulls (%)	Cows (%)	Unk (%)	Harvest
DM788	1996–1997	15	1 (7)	7 (50)	7 (50)	0 (0)	7 (100)	0 (0)	7
	1997–1998	25	2 (8)	9 (39)	14 (61)	0 (0)	14 (100)	0 (0)	14
	1998–1999	25	0 (0)	9 (36)	16 (64)	0 (0)	16 (100)	0 (0)	16
	1999–2000	25	2 (8)	12 (52)	11 (48)	0 (0)	11 (100)	0 (0)	11
	2000–2001	50	5 (10)	18 (40)	27 (60)	0 (0)	27 (100)	0 (0)	27
	2001–2002	75	14 (19)	33 (54)	28 (46)	2 (7)	26 (93)	0 (0)	28
	2002–2003	75	10 (13)	28 (43)	37 (57)	3 (8)	34 (92)	0 (0)	37
TM785	1996–1997	100	20 (20)	30 (38)	50 (62)	27 (54)	23 (46)	0 (0)	50
	1997–1998	100	17 (17)	30 (36)	53 (64)	30 (57)	23 (43)	0 (0)	53
	1998–1999	100	17 (17)	24 (29)	59 (71)	32 (54)	27 (46)	0 (0)	59
	1999–2000	100	22 (22)	21 (27)	57 (73)	34 (60)	23 (40)	0 (0)	57
	2000–2001	100	15 (15)	31 (36)	54 (64)	28 (52)	25 (46)	1 (2)	54
	2001–2002	100	17 (17)	26 (31)	57 (69)	31 (54)	26 (46)	0 (0)	57
	2002–2003	100	16 (16)	32 (38)	52 (62)	30 (58)	22 (42)	0 (0)	52
YM301	2002–2003	257	36 (14)	170 (77)	51 (23)	51 (100)	0 (0)	0 (0)	51
Totals for all permit hunts	1996–1997	115	21 (18)	37 (39)	57 (61)	27 (47)	30 (53)	0 (0)	57
	1997–1998	125	19 (15)	39 (37)	67 (63)	30 (45)	37 (55)	0 (0)	67
	1998–1999	125	17 (14)	33 (31)	75 (69)	32 (43)	43 (57)	0 (0)	75
	1999–2000	125	24 (19)	33 (33)	68 (67)	34 (50)	34 (50)	0 (0)	68
	2000–2001	150	20 (13)	49 (38)	81 (62)	28 (35)	52 (64)	1 (1)	81
	2001–2002	175	31 (18)	59 (41)	85 (59)	33 (39)	52 (61)	0 (0)	85
	2002–2003	432	62 (14)	230 (62)	140 (38)	84 (60)	56 (40)	0 (0)	140

TABLE 5 Unit 20B moose harvest[a] chronology percent by month/day, regulatory years 1997–1998 through 2002–2003

Regulatory	Harvest chronology percent by month/day						
year	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	9/21–9/25	Unk/Other	*n*
1997–1998	33	25	27	6	3	6	557
1998–1999	35	25	28	6	1	4	679
1999–2000	33	25	30	7	1	4	602
2000–2001	37	22	28	6	2	5	593
2001–2002	27	27	33	5	1	7	506
2002–2003	32	23	33	6	1	5	648

[a] Excludes drawing and Tier II permit hunt harvest.

TABLE 6 Unit 20B moose harvest[a] percent by transport method, regulatory years 1997–1998 through 2002–2003

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Other/ Unknown	*n*
1997–1998	5	0	18	26		5	42	1	3	557
1998–1999	3	0	20	30		3	41	2	2	679
1999–2000	3	1	19	29	0	4	39	2	3	602
2000–2001	3	0	21	29	0	4	35	3	4	593
2001–2002	3	0	21	31	0	4	34	3	2	506
2002–2003	3	0	21	29	0	5	36	2	3	648

[a] Excludes drawing and Tier II permit hunt harvest.

TABLE 7 Estimate of Unit 20B moose harvest[a] and accidental death, regulatory years 1997–1998 through 2002–2003

	Harvest by hunters							Accidental death					
	Reported				Estimated			Road[b]					
Regulatory year	M	F	Unk	Total	Unreported[c]	Illegal/ Other[d]	Total	FMA[e]	Unit 20B remainder	Total	Train[f]	Total	Total
1997–1998	586	37	1	624	110	79	189	97	70	167	15	182	995
1998–1999	709	43	2	754	133	65	198	93	73	166	13	179	1131
1999–2000	624	34	12	670	119	96	215	117	75	192	61	253	1138
2000–2001	611	58	9	678	120	44	164	105	52	157	9	166	1008
2001–2002	531	53	6	590	104	38	142	71	50	121	9	130	862
2002–2003	725	61	2	788	139	32	171	116	73	189	12	201	1160

[a] Includes general and permit hunt harvest.
[b] Documented kills; actual number killed by vehicles is certainly greater.
[c] Based on 17.7% unreported harvest (including wounding loss) estimated by Gasaway et al. (1992).
[d] Includes illegal, DLP, dispatched, potlatch, stickdance, and other reported deaths.
[e] Fairbanks Management Area.
[f] Confirmed dead between Alaska Railroad mileposts 411.8 and 470.0; "Missing" (moose hit but not recovered) are not included. Data provided by the Alaska Railroad.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNITS: 20C (11,902 mi^2), 20F (6267 mi^2), and 25C (5149 mi^2)

GEOGRAPHIC DESCRIPTION: Unit 20C includes drainages into the west bank of the Nenana River, and into the south bank of the Tanana River west of the Nenana River. Most of Denali National Park and Preserve is within Unit 20C. Unit 20F includes drainages into the north bank of the Tanana River west of Manley Hot Springs, and into the Yukon River drainage in the area between the village of Tanana and the Dalton Highway bridge. Unit 25C includes drainages into the south bank of the Yukon River upstream from Circle to, but not including, the Charley River drainage; the Birch Creek drainage upstream from the Steese Highway Bridge; the Preacher Creek drainage upstream from and including the Rock Creek drainage; and the Beaver Creek drainage upstream from and including the Moose Creek drainage.

BACKGROUND

Moose densities in Units 20C, 20F, and 25C have been low for many years, presumably because of combined predation from wolves and bears (Gasaway et al. 1992) and habitat limitations. Wolf and bear populations are lightly harvested. Bull moose harvest is low relative to population size, and the proportion of large bulls in the harvest remains relatively high. Therefore, harvest is a minor factor affecting population dynamics relative to predation.

These units contain some large tracts of mature black spruce that are poor quality moose habitat. However, many riparian areas, subalpine hills, and burns appear to have habitat capable of supporting moose at relatively high densities (≥2 moose/mi^2).

Trends in moose populations have been difficult to identify, but densities probably fluctuate within 0.1 and 1.1 moose/mi^2, and more likely between 0.2 to 0.7 moose/mi^2 based on Alaska and Yukon studies in large areas (>800 mi^2) with 2 or more lightly-harvested predators (Gasaway et al. 1992).

Moose within Denali National Park and Preserve (DNPP) have been studied more intensively than moose in the rest of the units. These studies include movement and behavior of radiocollared moose, composition surveys, and population estimates conducted by DNPP biologists since 1970.

Moose in these units are an important source of food and/or trophies for many local rural residents and other residents throughout Interior Alaska.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Provide for a sustained harvest of these low-density populations.
- Promote moose habitat enhancement by allowing natural fires to alter vegetation.

MANAGEMENT OBJECTIVE

- Maintain a bull:cow ratio of ≥ 30:100.

METHODS

Pilot Troy Cambier and observer Tom Seaton conducted aerial moose composition counts from a PA-18 Super Cub in the O'Brien Creek and Ophir Creek survey areas of Unit 25C on 16 November 2002. Prior to that, the last composition count in Unit 25C was conducted in 1996. The O'Brien Creek survey area was the same area surveyed in 1986–1996 surveys. To increase the sample size of moose observed for compositional analysis, we did additional composition counts in 1996 and 2002 along the riparian zones south of the O'Brien Creek count area in the drainages of Trail, O'Brien, Champion, Beaver, Ophir, Roy, Little Champion and Nome Creeks. I named this new composition count area the Ophir Creek count area. Habitat in the Ophir Creek count area was dominated by short black spruce, with the exception of riparian habitat along the creeks. The riparian zones were 5–200 meters wide, and represented a large proportion of the forage available for moose in early winter. A single pass was flown along most narrow (<50 m width) riparian zones and 2 passes were flown along most wider riparian zones.

We completed a Geostatistical Population Estimator (GSPE; Ver Hoef 2001) moose survey in Unit 25C (5000 mi^2) during November–December 1997 in cooperation with the Bureau of Land Management (BLM). This is a recently derived technique that does not yet commonly incorporate a sightability correction factor (SCF), but preliminary data suggest a SCF of 1.1 to 1.2 is appropriate for most of these units if October or November surveys are flown with good survey conditions. DNPP biologists conducted a census using Gasaway methods (Gasaway et al. 1986) during November 1994 in the Lake Minchumina Area (1007 mi^2) of Unit 20C. Stratification flights associated with the GSPE technique were completed for that portion of Unit 20C outside of DNPP on 19 December 2000.

We estimated annual moose mortality using (1) data from harvest report cards after sending reminder letters to increase response, (2) our records of telephone calls from the public concerning nonhunting mortality, (3) Bureau of Wildlife Enforcement records of moose–motor vehicle collisions, and (4) Alaska Railroad records of moose–train collisions between railroad mileposts 327–371 in Unit 20C. Also, to estimate unreported harvest in the village of Tanana, we used a 1987 study conducted by the ADF&G/Division of Subsistence. Data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Based on the 1997 GSPE without an SCF, we estimated Unit 25C moose density at 0.46 moose/mi^2 of moose habitat, with a total population estimate of 2279 moose (90% CI ±16.5%). With an SCF of 1.12, the actual moose density would be 0.5 moose/mi^2. We expected this low estimate because all large areas of Interior Alaska (>800 mi^2) with lightly harvested bear and wolf populations currently have moose densities with an average of about 0.6 moose/mi^2. Very few moose density estimates have been outside this range of 0.2–0.8 moose/mi^2 during the last 30 years, except in areas where predation is reduced by humans.

We estimated 3500–4500 moose inhabited Unit 20C moose habitat: 2000 within Denali National Park and 1500–2500 outside Denali National Park (including Denali National Preserve). These estimates assumed an average density of 0.58 moose/mi^2 inside Denali National Park [Oct 1991 census; T. Meier, National Park Service (NPS), personal communication] and 0.25 moose/mi^2 outside Denali National Park. Based on a November 1994 survey, Denali Park biologists estimated the density of the Lake Minchumina area at 0.34 moose/mi^2 (K. Stahlnecker, NPS, personal communication).

We estimated 1000–2000 moose resided in Unit 20F. This assumed 0.25–0.50 moose/mi^2, with roughly 4250 mi^2 of moose habitat (McNay 1990).

Population Composition

During the 2002 aerial moose composition counts in Unit 25C, snow cover was complete, weather was clear, and light intensity was bright to medium. There were 71 and 59 bulls per 100 cows in the O'Brien Creek and Ophir Creek survey areas, respectively, and 9 and 19 calves per 100 cows (Table 1). High annual variability in the observed number and population composition of moose throughout most of the composition surveys in Unit 25C is probably due to variations in moose distribution at survey time rather than true moose density, population composition, or search effort. Therefore, the 1997 large-scale population estimate probably best represents moose density and composition in Unit 25C. Results from the 1997 GSPE in Unit 25C included estimates of 53 bulls:100 cows and 37 calves:100 cows. We conclude that harvest has minimal impact on the Unit 25C moose population. If harvest rates of bulls were high, the bull:cow ratio would decline within a few years.

Population composition data in Units 20C and 20F were limited to the percentage of large bulls (antlers wider than 50 inches) in the harvest (Fig 1). If harvest rates of bulls were too high to be sustainable, the percentage of large bulls in the harvest would decline within a few years. The percentage of large bulls in the reported harvest was relatively stable in Unit 20C between RY95 and RY00 (30–40%), and steadily increased during RY01–RY03 to 50% in

RY03. The percentage of large bulls in the Unit 20F reported harvest was more stable RY01–RY03 than it had been over the previous decade, with a mean of 41%. These data suggest there was no danger of overharvest of bulls in these units during RY95–RY03.

MORTALITY

Harvest

Season and Bag Limit. Hunting seasons and bag limits have not changed since RY93 (Table 2).

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 20C		
RESIDENT HUNTERS: 1 bull; however, white-phased or partial albino (more than 50% white) moose may not be taken.	1 Sep–20 Sep	
NONRESIDENT HUNTERS: 1 bull; however, white-phased or partial albino (more than 50% white) moose may not be taken.		5 Sep–15 Sep
Unit 20F, drained by the Yukon River excluding the Tanana River drainage downstream from the drainage of Hess Creek.		
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep or 1 Dec–10 Dec	No open season
Unit 20F, drained by the Tanana River.		
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep	No open season
Remainder of Unit 20F		
RESIDENT HUNTERS: 1 bull.	1 Sep–15 Sep	No open season
Unit 25C		
RESIDENT HUNTERS: 1 bull.	1 Sep–15 Sep	
NONRESIDENT HUNTERS: 1 bull.		5 Sep–15 Sep

Alaska Board of Game Actions and Emergency Orders. No Board of Game actions were taken and no emergency orders were issued during this reporting period.

Hunter Harvest. Between RY98 and RY02 reported moose harvest was stable or slightly decreasing in Units 20C, 20F, and 25C (Table 2). During this time, the reported harvest was 131–140 moose in Unit 20C, 29–45 in Unit 20F, and 61–84 in Unit 25C.

Unreported Harvest and Estimated Nonhunting Mortality — We cannot easily estimate the number of unreported kills in Units 20C, 20F, and 25C. Harvest report cards returned by residents of Tanana, Rampart, Manley, Livengood, Central, Circle, and Circle Hot Springs likely represent minimal harvest reporting. For example, information collected by the Division of Subsistence indicates that only 10–20% of the actual harvest by Tanana residents was reported. The reporting rate for other rural communities in this area is unknown.

Illegal, other, and motor vehicle deaths were obtained from the Fairbanks Bureau of Wildlife Enforcement wildlife mortality logs. Data concerning deaths caused by train collisions (only applicable for Unit 20C) were obtained from the Alaska Railroad. Documented causes of accidental mortality were minimal (0–3 annually) in Unit 20F and Unit 25C, but higher in Unit 20C (0–21 annually) due to deaths caused by train collisions (Table 3).

Hunter Residency and Success. During RY98–RY02 the reported number of hunters increased while the reported number of moose killed remained stable (Table 2). Units 20C and 25C saw increases of 26% and 42% in the reported number of hunters during that 5-year period, while Unit 20F saw a decrease of 8% in the reported number of hunters. This change implies that hunter success declined significantly in Units 20C and 25C. However, this could be largely influenced by our recently increased efforts to get harvest reports from unsuccessful hunters.

During RY98–RY02, 3–6 nonresident hunters reported hunting in Unit 20F, even though the unit had no open moose season for nonresidents. Reported moose harvest by nonresidents in Unit 20F was 10% of the reported harvest in RY00. Unit 20F nonresident harvest data may be attributed to misreporting by nonresident hunters, data management errors by department staff, or legitimate harvest reports from nonresident hunters.

In Units 20C and 20F, most successful hunters resided in that unit. In Unit 25C, however, most successful hunters (92%) resided outside the unit, including residents and nonresidents of Alaska (Table 2). This difference can be attributed to 1) relatively few people reside in Unit 25C, 2) Unit 25C was road accessible and within 2 hours of the population center of Fairbanks, 3) motorized vehicle restrictions were uncommon in the area, and 4) it was one of the few road-system areas with a bag limit of any bull for residents and nonresidents.

Harvest Chronology. During RY98–RY02 the highest proportion of the harvest occurred during the second week of the season. In Units 20C and 20F, the first and third weeks shared similar proportions of the harvest (Table 4). Few moose were reported harvested during the December season in Unit 20F.

Transport Methods. In Unit 20C most successful hunters used boats, airplanes, and 3- or 4-wheelers for transportation (Table 5). Extensive river systems, many lakes, gravel bars, and an expanding trail system make these transport methods most useful. In Unit 20F boats were the primary mode of transportation for successful hunters, and in Unit 25C successful moose hunters used highway vehicles, 3- or 4-wheelers, and boats. The transportation methods used throughout this area reflected access opportunities in the area.

HABITAT

Moose densities in areas like Units 20C, 20F, and 25C are typically limited by predation rather than forage (Gasaway et al. 1992), since predators kill a large majority of all calves produced on an annual basis. However, since forage resources determine moose calving rates, good habitat can boost moose numbers during lulls in predation caused by hunting or trapping pressure, disease, or chance. In remote country such as this, the most effective means of habitat improvement is wildfire. Some wildfires and prescribed burns have occurred in the area over the last 25 years, and a map of the burned areas is available from BLM. Some small-scale habitat improvements are being completed in the area. BLM is reclaiming mine tailings within the White Mountains National Recreation Area in Unit 25C. Native willows are being planted to enhance the revegetation process and increase moose browse.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Harvest reporting in these units was poor. We need to contact more people in remote areas to emphasize the importance and benefits of reporting harvest. It would be especially helpful to contact young people in village schools to establish harvest reporting as a responsibility of all hunters and to promote the positive aspects of reporting.

Fire is an integral part of Interior ecosystems and is essential to producing good moose habitat in areas of climax spruce forests. We should continue to coordinate wildlife needs with fire suppression activities and encourage more controlled burns to enhance habitat.

CONCLUSIONS AND RECOMMENDATIONS

Moose populations in Units 20C, 20F, and 25C are at low densities. Hunting pressure was relatively low, but increasing. We met our objective to maintain a bull:cow ratio of ≥30:100 and recommend that this objective be amended during the next reporting period to read as follows. Maintain a bull:cow ratio of ≥30:100 in areas with aerial surveys and ≥20% large bulls in the harvest in areas without aerial surveys.

No regulatory changes are recommended at this time. We estimated hunting and nonhunting mortality and worked to gather information on reporting rates from rural communities to produce a more comprehensive harvest estimate. We met our goal to promote natural fires to enhance moose habitat through the department's efforts on the Interagency Fire Management Team. We met our goal of providing for sustained harvest of these low-density populations.

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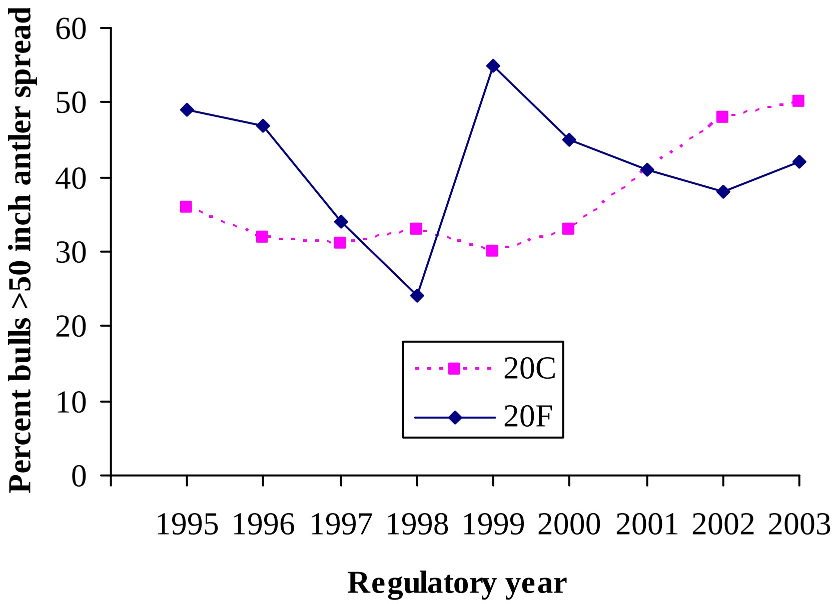

FIGURE 1 Percent of bull moose in the reported fall harvest with an antler spread >50 inches in Units 20C and 20F, regulatory years 1995–1996 through 2003–2004

TABLE 1 Unit 25C fall aerial moose composition counts, 1986–2002

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2	Survey area size (mi^2)
1986[a]	103	13	21	8	9	77	85	1.49	57
1987[a]	77	11	28	13	14	83	96	1.68	57
1988[a]	129	37	33	16	13	112	128	2.25	57
1996[a]	119	19	11	3	5	57	60	1.05	57
1996[c]	160	0	20	2	7	26	28	0.31[d]	89[e]
1997[b]	53	13	37	80	20	319	399	0.46	5000
2002[a]	71	16	9	4	5	77	81	1.42	57
2002[c]	59	31	19	6	11	51	57	0.60[d]	95[e]

[a] O'Brien Creek count area.
[b] Geostatistical Population Estimator moose population estimate.
[c] Ophir Creek count area.
[d] Moose per linear mile along a route of flight over linear riparian habitat.
[e] Linear miles.

TABLE 2 Units 20C, 20F, and 25C reported moose hunter residency and success, regulatory years 1998–1999 through 2002–2003

Regulatory year	Successful hunters					Unsuccessful hunters					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
Unit 20C											
1998–1999	87	39	14	140	(35)	185	57	13	255	(65)	395
1999–2000	98	21	13	132	(32)	196	66	17	279	(68)	411
2000–2001	87	31	13	131	(28)	222	82	25	329	(72)	460
2001–2002	89	36	16	141	(31)	198	98	24	320	(69)	461
2002–2003	85	34	12	131	(26)	237	98	31	366	(74)	497
Unit 20F											
1998–1999	29	15	1	45	(29)	83	23	3	109	(71)	154
1999–2000	25	7	1	33	(25)	69	27	2	98	(75)	131
2000–2001	27	9	4	40	(24)	89	38	2	129	(76)	169
2001–2002	20	9	0	29	(20)	80	33	3	116	(80)	145
2002–2003	25	12	2	39	(28)	70	28	4	102	(72)	141
Unit 25C											
1998–1999	5	68	11	84	(34)	23	130	13	166	(66)	250
1999–2000	8	47	14	69	(26)	21	156	19	196	(74)	265
2000–2001	7	53	19	79	(24)	29	198	20	247	(76)	326
2001–2002	2	50	9	61	(19)	23	218	26	267	(81)	328
2002–2003	7	54	13	74	(21)	23	224	33	280	(79)	354

[a] Hunters who live within the unit in which they reported hunting were considered local.

TABLE 3 Estimate of Units 20C, 20F, and 25C moose harvest and accidental death, regulatory years 1998–1999 through 2002–2003

Regulatory year	Harvest by hunters: Reported[a] M	F	Unk	Total	Estimated: Unreported[b]	Illegal/Other[c]	Total	Accidental death: Road[d]	Train[e]	Total	Total
Unit 20C											
1998–1999	140	0	0	140	25	1	26	0	3	3	169
1999–2000	125	0	0	125	22	0	22	0	21	21	168
2000–2001	130	0	0	130	23	0	23	0	0	0	153
2001–2002	142	0	0	142	25	0	25	0	1	1	168
2002–2003	131	0	0	131	23	0	23	0	0	0	154
Unit 20F											
1997–1998	29	0	0	29	5	1	6	1		1	36
1998–1999	45	0	0	45	8	1	9	0		0	54
1999–2000	33	0	0	33	6	2	8	1		1	42
2000–2001	40	0	0	40	7	0	7	0		0	47
2001–2002	29	0	0	29	5	1	6	0		0	35
2002–2003	40	0	0	40	7	1	8	0		0	48
Unit 25C											
1997–1998	57	0	0	57	10	0	10	0		0	67
1998–1999	85	0	0	85	15	0	15	3		3	103
1999–2000	66	0	0	66	11	0	11	0		0	77
2000–2001	79	0	0	79	14	1	15	0		0	94
2001–2002	62	0	0	62	11	0	11	0		0	73
2002–2003	75	0	0	75	13	2	15	0		0	90

[a] Data from ADF&G harvest reports.
[b] Based on 17.7% unreported harvest (including wounding loss) estimated by Gasaway et al. (1992).
[c] Data from Fairbanks Bureau of Wildlife Enforcement wildlife mortality logs and ADF&G records.
[d] Documented kills from Fairbanks Bureau of Wildlife Enforcement wildlife mortality logs.
[e] Confirmed dead between Alaska Railroad mileposts 327.0–370.9; "missing" (moose hit but not recovered) are not included. Data provided by the Alaska Railroad and summarized by ADF&G office in Palmer.

TABLE 4 Units 20C, 20F, and 25C reported moose harvest chronology by month/day, regulatory years 1998–1999 through 2002–2003[a]

Regulatory	Harvest chronology by month/day				
year	9/1–9/7	9/8–9/15	9/16–9/20	12/1–12/10	Total
Unit 20C					
1998–1999	35	54	42		131
1999–2000	35	52	39		126
2000–2001	41	48	36		125
2001–2002	28	58	49		135
2002–2003	33	61	31		125
Unit 20F					
1998–1999	11	25	6	3	45
1999–2000	5	18	4	5	32
2000–2001	10	21	5	4	40
2001–2002	5	13	9	1	28
2002–2003	9	21	8	1	39
Unit 25C					
1998–1999	35	47			82
1999–2000	31	37			68
2000–2001	28	50			78
2001–2002	22	36			58
2002–2003	18	55			73

[a] Does not include kills reported outside open hunting seasons.

TABLE 5 Units 20C, 20F, and 25C reported moose harvest percent by transport method, regulatory years 1998–1999 through 2002–2003

	Harvest percent by transport method								
Regulatory year	Airplane	Horse/Dogsled	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unk/Other	*n*
Unit 20C									
1998–1999	16	1	33	24	0	19	5	2	140
1999–2000	15	2	38	20	0	18	5	2	131
2000–2001	22	0	36	23	1	12	5	1	130
2001–2002	23	1	33	20	0	13	10	0	142
2002–2003	21	1	41	14	0	18	4	1	131
Unit 20F									
1998–1999	0	2	56	16	4	2	20	0	45
1999–2000	3	0	33	27	12	6	15	3	33
2000–2001	5	0	45	30	8	0	10	2	40
2001–2002	0	0	48	24	3	7	14	3	29
2002–2003	10	0	30	28	3	15	15	0	40
Unit 25C									
1998–1999	4	0	21	40	0	5	28	2	85
1999–2000	9	0	26	39	0	3	24	0	70
2000–2001	5	0	24	38	0	6	25	1	19
2001–2002	6	0	26	55	0	6	5	2	62
2002–2003	4	1	25	45	0	3	20	1	75

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 20D (5637 mi^2)

GEOGRAPHIC DESCRIPTION: Central Tanana Valley near Delta Junction

BACKGROUND

Unit 20D was created in 1971 from a portion of Unit 20C. During 1962–1970, the moose hunting season in the area that is currently Unit 20D consisted of a 70–72 day bull season and a 1–8 day antlerless moose season. Most (51–74%) of the harvest during 1964–1970 came from the highly accessible areas near Delta Junction (Clearwater Lake, Donnelly Dome, and the Delta farming area). However, several severe winters in the mid 1960s and early 1970s killed many moose throughout this unit and other portions of Interior Alaska and set the stage for predation and hunting to compound and aggravate already widespread population declines. Poor recruitment of yearlings to the population in combination with intense bulls-only hunting depressed the bull:cow ratio to only 4:100 in the more accessible portions of the unit. The moose hunting season was closed during 1971–1973 because the depressed moose population could no longer support any significant harvest (McIlroy 1974).

Despite restrictions on hunting, the moose population in Unit 20D continued to decline because of chronically high moose mortality from other causes. In 1973 the moose population in the area south of the Tanana River and between the Johnson and Delta Rivers was estimated at only 600. When limited moose hunting was resumed in 1974, it was conducted under a registration permit system for the entire unit; however, an area around Delta Junction was closed to the taking of antlerless moose. The moose population decline in the western portion of the unit was gradually reversed by a combination of continued hunting restrictions, mild winters, and wolf control efforts in adjacent Unit 20A (1976–1982) and western Unit 20D (1980–1983).

In 1978 the unit was enlarged by moving the eastern boundary from the Johnson River to the Robertson River. It was further enlarged in 1981 to include all drainages north of the Tanana River from the mouth of the Robertson River to Banner Creek.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

In 1983 the closed area around Delta Junction, which had been established in 1974, was formally named the Delta Junction Management Area (DJMA). The name of the DJMA was changed to the Delta Junction Closed Area (DJCA) in 1990 to more accurately reflect its status as an area closed to hunting. In 1991 the DJCA was reduced in size to provide more hunting opportunity in the area. In 1996 the DJCA was renamed the DJMA, and a drawing permit hunt was established in the area.

Unit 20D has been subdivided into 4 areas for moose management purposes: southwestern Unit 20D, the area south of the Tanana River from the Johnson River to the Delta River; southeastern Unit 20D, the area south of the Tanana River from the Robertson River to the Johnson River; northwestern Unit 20D, the area north of the Tanana River from Banner Creek to and including the Volkmar River; and northeastern Unit 20D, the area north of the Tanana River and east of the Volkmar River.

As moose populations recovered during the mid 1970s and early 1980s, hunting opportunities were expanded in southwestern Unit 20D by first eliminating the registration permit requirement and then by lengthening the season. In southeastern and northern Unit 20D, the seasons were also increased. Antler restrictions were implemented in southwestern Unit 20D in 1988 to stabilize the increasing harvest and to improve the age structure in the bull segment of the population. In March 1995 the Alaska Board of Game determined that the preferred use of moose in Unit 20D was for human consumption and established a moose population objective of 8000–10,000 and an annual harvest objective of 240–500. The harvest objective was increased to 500–700 moose in 2000.

The Bison Range Youth Hunt Management Area was created in 2002 to regulate moose hunting in the fields of the Delta Junction Bison Range. This drawing permit hunt was implemented, in part, to reduce the impact of moose hunting on bison management on the Bison Range.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVE

- Increase the fall moose population to 8000–10,000 moose with an annual reported sustainable harvest of 500–700 moose per year.

METHODS

Population Estimates: The Geostatistical Population Estimator (GSPE, Ver Hoef 2001) was used to conduct moose population estimates in Unit 20D. Guidelines recommended by Ver Hoef (ADF&G, personal communication) to maximize accuracy and precision of GSPE surveys were to allocate 60% of sampling effort to the high-density stratum and 40% of effort to the low-density stratum.

Sample units (SU) were stratified as having an anticipated high or low density of moose based on previous stratifications and existing knowledge of the area. In general, SUs were stratified low if I expected to count <5 moose in them. Sample units were stratified high if I expected to count ≥5 moose in them. In an attempt to keep variance as small as possible, I placed borderline SUs in the high stratum to minimize variance in the low stratum.

GSPE SUs are square in shape and drawn with boundaries every 2 degrees of latitude on even increments and every 5 degrees of longitude on multiples of 5 degrees. Sample units varied in size from approximately 5.7 to 5.9 mi^2 in Unit 20D. Each SU is identified by the latitude and longitude of its southeast corner.

Sample unit selection was modified in 2001 from previous GSPE surveys to optimize the spatial sampling design by selecting adjacent pairs of SUs distributed evenly, rather than randomly, throughout the survey area.

The number of SUs to be surveyed in each stratum was divided by 2 to determine the number of SU pairs that would be sampled. Then the total number of SUs in each stratum was divided by the number of pairs to be sampled to determine how many SUs would be grouped together to be represented by 1 sampled pair. I grouped SUs with similar anticipated moose densities, habitat types, and topographic features.

For example, in 2001 funding was available to survey 24 SUs in the high-density stratum, which consisted of 119 SUs. The 24 SUs to be surveyed in the high stratum equaled 12 paired SUs. Therefore, a pair of SUs was allocated for approximately every 10 high density SUs. I then used a map of SUs to identify SU groups, averaging 10 SUs per group (range 8–12). The following SU groups were established with the number of SUs in each: Robertson River (9), Berry Creek (10), Knob Ridge (10), Johnson–Gerstle (11), Upper Sawmill Creek (8), Cummings Road (11), Jarvis Creek (11), Delta River (10), 12-mile Crossing (10), 33-mile Loop Road (9), 1408 Road (8), and Clearwater Lake (12). Once groups were identified, an adjacent pair of SUs was randomly selected from within each group to be sampled.

This process was repeated for the low-density stratum, which had 7 SU groups ranging from 23–27 SUs each. The following low density groups and their number of SUs were established as follows: Robertson River (23), Dot Lake (26), Independent Ridge (27), Gerstle River (25), Jarvis Creek (25), Delta Agricultural Project (25), and Delta Junction (25).

Sample units were surveyed with a Piper PA-18 Super Cub and a Robinson R-22 helicopter. Aerial surveys were flown at altitudes of approximately 300–800 ft above ground level, depending on vegetative cover. Flight speed was 60–70 mph in the PA–18 and 50–60 mph in the R-22. When terrain permitted, east–west linear transects were flown every 0.15 degrees of latitude, or north–south every 0.3 degrees of longitude. A global positioning system receiver (GPS) was used to follow transect headings. In hilly or mountainous terrain, the flight path followed terrain contours within SU boundaries, rather than transects. Our goal was to spend 8–10 min/mi^2 of search effort in each SU sampled to achieve consistently high sightability of moose. However, large areas of nonmoose habitat (i.e., lakes, areas covered with ice) within an SU were not surveyed.

We circled all moose seen, to look for additional moose and to classify moose as bulls, cows, or calves. Bulls were further classified into 5 categories based on antler size and morphology that included 1) yearlings with spike-fork antlers, 2) yearlings with nonspike-fork antlers,

3) medium bulls with antler spread of 31–40 inches, 4) medium bulls with antler spread 41–49 inches, and 5) large bulls with antler spread ≥50 inches. We estimated antler spread on all medium and large bulls. We identified yearling bulls as those with antler spread <30 inches and with no antler brow palm development.

Information recorded for each SU included 1) survey start and stop times, 2) snow and light conditions, 3) major habitat type, 4) location, and 5) survey rating of excellent to poor, based on the observer's general impression.

Sample unit data were entered into a Microsoft®Excel spreadsheet and analyzed with S-PLUS 2000 software (Mathsoft, Seattle, WA, spatial statistics model) using the GSPE.

Once 5 population estimates had been calculated for southern Unit 20D from 1995 to 2003, the estimates were "smoothed" by using parametric empirical Bayes (PEB) methods (Ver Hoef 1996). PEB methods use 2 sources of variation with 1 being variation of replicate counts of SUs (i.e., sampling variance) and the other being variation around the population trend line among years (i.e., regression variance). The PEB method borrows strength from multiple surveys to fit the individual yearly estimates closer to the population trend line. Therefore, previous population estimates reported for southern Unit 20D will vary from the "smoothed" estimates calculated for this report and in the future. Also, the PEB method allows for population estimates to be calculated from the trend line for those years that surveys were not conducted. Population composition ratios were calculated from unsmoothed data.

Additional moose survey funds became available after completion of the 2001 GSPE survey and southern Unit 20D was stratified from 24 November–12 December using a Piper PA–18 Super Cub. The stratification was conducted using GSPE SUs. We stratified by flying east–west transects through the midpoint of each SU. The proportion of habitat in each SU was estimated and classified as low shrub (generally *Salix* species), tall shrub, deciduous forest, sparse spruce forest, spruce forest, or nonmoose habitat. The presence of moose tracks and number of moose seen in the SU were recorded. Before exiting the SU, it was stratified as either high or low density.

Twinning Surveys. Surveys were flown in a Piper PA–18 at an altitude of 300–700 feet above ground level and at an airspeed of approximately 70 mph by flying linear transects spaced approximately 0.5 miles apart. The survey objective was to observe a sample of 50 cows with calves. Large areas where there was little chance of spotting a moose (i.e., large agricultural grain fields, areas of dense spruce) were not surveyed.

Sample units were drawn on 1:63,360 scale U.S. Geological Survey topographic maps using topographic features as boundaries. The Sawmill Creek South SU was not flown in 2003 because it had been unproductive in previous years and the Jarvis Creek West SU was not flown because of its close proximity and partial overlap with the newly developed National Missile Defense Bed on Fort Greely Military Reservation. Some SU boundaries are still evolving to maximize efficiency. The Big Lake SU was reduced in size to approximately 19.8 mi^2 for 2003 to eliminate area that had few moose in past years. To compensate for the reduction of these SUs, the Butch Lake SU was expanded to approximately 17.7 mi^2 and the Granite–Rhodes Creek SU was expanded to approximately 12.0 mi^2. The Sawmill Creek

North (16.2 mi^2), Delta Ag Project East and Delta Ag Project West (156.0 mi^2), and Clearwater (13.0 mi^2) SUs were unchanged. In addition to surveying the SUs listed above, moose we observed while flying en route to SUs were also classified and recorded.

When moose were spotted, a low pass was made to determine the sex and to look for calves with cow moose. Moose ≥1 year old with visible antlers were classified as bulls; all others were classified as cows. If no calves were observed with cows, 2–4 additional low passes were made over the cow to improve sightability. Data recorded for each observation included the sex of the moose, the presence or absence of calves or yearling offspring, and the moose location.

Harvest Monitoring. Harvest of moose by hunters during the general hunting seasons was monitored by requiring hunters to acquire moose harvest tickets and report hunting activities that included: the location hunted, how long they hunted, their mode of transportation, whether they killed a moose, where and when they killed a moose, the antler spread and number of brow tines on moose killed, and the type of weapon used to kill the moose. Hunters who participated in permit hunts provided the same information via permit report forms. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002). Reminder letters were sent to holders of harvest tickets and permits to increase reporting rate.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

2001

A GSPE survey was flown during 4–23 November 2001 in southern Unit 20D for approximately $10,880. I estimated 3435 moose (2643–4227) at the 90% confidence interval (Table 1). Average SU search time was 46.0 minutes (7.9 min/mi^2) in the high-density stratum and 38.7 minutes (6.7 min/mi^2) in the low-density stratum. Therefore, the search effort goal was essentially met in the high density, but effort was below the goal in the low density.

The 2001 southern Unit 20D population estimate was combined with the 1999 northern Unit 20D population estimate to calculate a new Unit 20D total population estimate of 5830 moose (4956–6704). An assumption in this calculation is that the northern Unit 20D population estimate had not changed significantly since 1999. This population estimate did not meet the Unit 20D moose population goal established by the Board of Game.

Twinning surveys were flown on 29 and 31 May, and 1, 2, and 4 June 2001 for 12.6 h of survey time for $2700. Most flights began in the evening from 1815 hours to 2100 hours and concluded from 2224 hours to 2335 hours. One morning flight was conducted from 0555 to 0807 hours. Two hundred eighty-two moose were seen at the rate of 22.4 moose/h of survey time. Forty-seven cow-calf groups were seen with 7 (15%) being cows with twins.

The southern Unit 20D stratification survey occurred from 24 November to 12 December. One hundred eighty-six SUs were stratified as high density and 134 were stratified as low density.

2002

No population estimate was conducted in Unit 20D because of poor survey conditions during the entire survey period.

Twinning surveys were flown on 25, 27, 28, and 29 May 2002 for a total of 11.9 h of survey time and a cost of $2520. Flights began in the morning from 0610 to 0640 hours and concluded from 0800 to 1215 hours. Moose were seen at the rate of 22.5 moose/h and 268 total moose were seen. Sixty-one cow-calf groups were seen with 13 (21%) being cows with twins.

2003

A GPSE survey was flown in southern Unit 20D from 11–18 November 2003 for approximately $11,355. The population estimate was 5493 moose (3924–7061) at the 90% confidence interval (Table 1). The smoothed estimate was 4456 (3752–5209, Table 2). Average SU search time was 44.4 minutes (7.7 min/mi^2) in the high density and 41.5 minutes (7.2 min/mi^2) in the low-density stratum. The 2003 southern Unit 20D was not combined with the 1999 northern Unit 20D to calculate a unit estimate because the time interval between the surveys was considered too long.

Twinning surveys were flown on 25, 28, and 29 May 2003 for a total of 11.3 h of survey time and a cost of $2700. Surveys began in the morning from 0608 to 0709 hours and were completed by 1117 hours. Moose were seen at the rate of 24.2 moose/h with 273 moose observed. Fifty-one cow-calf groups were observed with 10 (20%) being cows with twins.

Population Composition

2001. Southern Unit 20D population composition from the fall 2001 GSPE survey was 16 bulls:100 cows (range = 10–22) and 24 calves:100 cows (range = 16–32, Table 1). This is the lowest bull:cow ratio recorded in southern Unit 20D since population estimates began in the area.

2002. No composition data was collected during 2002 due to poor survey conditions.

2003. Southern Unit 20D population composition from the fall 2003 GSPE survey was 23 bulls:100 cows (range = 19–26) and 32 calves:100 cows (range = 27–37, Table 1).

Distribution and Movements

No data were collected on moose distribution or movements during this reporting period.

MORTALITY

Harvest

Season and Bag Limit. Hunting seasons and bag limits are listed in Table 3.

Alaska Board of Game Actions and Emergency Orders.

2002 — At the March 2002 Alaska Board of Game meeting there were 5 proposals pertaining to moose regulations in Unit 20D. Proposal 4 was adopted by the board and created the Bison Range Youth Hunt Management Area on a portion of the Delta Junction Bison Range. The purpose of the proposal was to allow the department to better meet bison management objectives by regulating moose hunting. Proposal 5 was adopted to increase the number of drawing permits authorized for the DJMA from 10 to 30. Proposal 6 was adopted and created a nonresident moose hunting season in the upper Robertson River drainage. This area had previously been closed to nonresident moose hunters because of customary and traditional use considerations in southeastern Unit 20D. Proposal 7 to change the brow tine restriction in southwestern Unit 20D from 4 to 3 brow tines was not adopted. Proposal 12 to create a controlled use area in northern Unit 20D to regulate the use of airboats was not adopted.

2004 — At the February 2004 meeting, the board adopted regulation proposal 109 to eliminate the Tier II moose hunt TM787 in Unit 20D. The proposal was submitted by the department because overall interest and participation in the hunt was declining by local residents and it had a very low harvest. The board adopted proposal 110 submitted by the Delta Bison Working Group and the Delta Fish and Game Advisory Committee to change moose hunting regulations in the Bison Range Youth Hunt Management Area. The proposal was developed from recommendations by the Bison Range Youth Hunt Ad Hoc Committee to address public concerns about the hunt. The proposal changed the bag limit to 1 bull per lifetime with spike-fork antlers or antlers at least 50-inches wide or with at least 4 brow tines on 1 side and restricted motorized vehicles for all hunting. Proposal 111 was submitted by the president of the Dot Lake Village Council to align the moose hunting seasons between eastern Unit 20D and 12, to close the hunting season in eastern Unit 20D during 1–7 September, and to eliminate the Tier II hunt TM787 in southeastern Unit 20D. The proposal was not adopted. The board adopted proposal 112, submitted by the Healy Lake Traditional Council, to eliminate the 1 January–15 February hunt for 1 bull within the Healy River drainage. The justification was to eliminate problems with trespassing on Native lands and interference with traplines by hunters. Proposal 113 was submitted by a member of the public to establish a drawing permit hunt for 10 cow moose within the Delta Junction Management Area. The justification was to reduce the number of moose within the Delta Junction Management Area. The proposal was not adopted.

Human-Induced Mortality

RY01. Estimated moose mortality from all human causes was 263 (Table 4). This includes 182 moose reported killed by hunters during the hunting season, an estimated 32 moose harvested but not reported, 17 moose reported by Alaska Bureau of Wildlife Enforcement (ABWE) to have been killed illegally, and 32 road kills reported by ABWE. Most illegal kills and road kills occurred in southwestern Unit 20D. The total reported hunting kill of 182 was well below the harvest objective of 500–700. The reported hunting harvest was 4.6% of the smoothed population estimate. Total human-induced mortality was 6.7% of the smoothed population estimate.

RY02. Estimated moose mortality from all human causes in Unit 20D was 274 moose (Table 4). This included 228 moose reported killed by hunters, an estimated 40 unreported hunter kills, and an illegal harvest of 6 moose reported by ABWE. The number of moose killed on the road system was not available for this report. The total reported hunting harvest of 228 moose did not meet the harvest objective of 500–700 moose. The reported hunting harvest was 5.4% of the smoothed population estimate. Total known human-induced mortality was 6.5% of the smoothed population estimate.

RY03. Estimated moose mortality from all human causes increased during RY03 to 267 moose (Table 4). This included 227 moose reported killed by hunters during the hunting season and an estimated unreported harvest of 40 moose. Information on moose road kills and illegal harvest was not available for this report. The total reported hunting mortality of 227 was below the harvest objective of 500–700. The reported hunting harvest was 5.4% of the smoothed population estimate. Total known human-induced mortality was 6.1% of the smoothed population estimate.

Southwestern Unit 20D Hunter Harvest. Southwestern Unit 20D has the highest harvest in the unit. Reported hunter harvest during RY01 was 105 moose, with 101 taken during the general season (Table 5) and 4 taken during permit hunt DM790 in the DJMA (Table 6). During the general season, 425 hunters killed 101 moose (Table 5) for a 24% success rate. Hunters who participated had a 50% success rate during hunt DM790.

Reported hunter harvest during RY02 was 142 moose, with 119 killed during the general hunting season (Table 5), 6 killed during hunt DM790 (Table 6) and 17 killed during hunt DM792 (Table 7). During the general season, 426 hunters killed 119 moose (Table 5) for a 28% success rate. Hunters who possessed DM790 permits and hunted had a 60% success rate and DM792 hunters who hunted had a 71% success rate.

Reported hunter harvest during RY03 was 137 moose, with 124 killed during the general hunting season (Table 5), 6 killed during hunt DM790 (Table 6) and 7 killed during hunt DM792 (Table 7). During the general season, 447 hunters killed 124 moose (Table 5) for a 28% success rate. This is the largest number of hunters who reported since at least RY84. Southwestern Unit 20D has the most restrictive hunting regulations in the unit in the form of antler restrictions, yet moose harvest and number of hunters has continued to increase since the regulations were implemented. The increase is likely due to increased numbers of moose and good access in the area. Hunters that participated in hunt DM790 had a 75% success rate and DM792 hunters had a 37% success rate for DM792.

Southeastern Unit 20D Hunter Harvest. Moose harvest remained low in southeastern Unit 20D. During the general seasons, only 10–17 moose were killed annually during RY01–RY03 (Table 5). Hunter success rates varied from 32–44% during this period. Tier II hunt TM787 had 0–2 moose killed (Table 8). Harvest during the general hunting season was low in this area primarily because of motorized access restrictions in the Macomb Plateau Controlled Use Area, which made moose hunting difficult.

Northwestern Unit 20D Hunter Harvest. Northwestern Unit 20D has the second highest harvest in the unit. During the RY01 general season, 52 moose were killed by 221 hunters (Table 5) for a 24% success rate. During the RY02 general season, 56 moose were killed by 281 hunters (Table 5) for a 20% success rate. During the RY03 general season, 53 moose were killed by 230 hunters (Table 5) for a 23% success rate. There were no permit hunts in northwestern Unit 20D.

Northeastern Unit 20D. The number of hunters and harvest remained low in northeastern Unit 20D during the RY01–RY03 general season. Harvest ranged from only 5 to 14 moose, with the number of hunters ranging from 39 to 41, and success rates ranging from 13 to 45% (Table 5). This area is difficult to access during the hunting season except along the Tanana River, along a few small creeks and rivers flowing into the Tanana River, and at a few ridgetop airstrips.

Moose hunters did not appear to take advantage of the August and January–February moose hunting seasons in the Healy River drainage during RY01–RY03. During this reporting period, no moose were reported killed during the August season, and only 1 moose was reported killed during the January–February season when a hunter from Wasilla, Alaska killed a bull on 25 January 2003. The general season harvest in the Healy River drainage (Uniform Coding Unit 501) ranged from 1–5 moose during RY01–RY03 (Table 9).

Hunter Residency. The proportion of local hunters (residing in Unit 20D) has been decreasing since the mid 1980s (Table 10). In 1986–1987, 59% of Unit 20D hunters were local residents. That proportion was fairly stable during the 1990s ranging from 48 to 55%. However, the proportion of local hunters declined to a low of 39% in RY01. Local hunters increased in RY02–RY03 with 72% and 66% respectively (Table 10). The proportion of nonresident hunters was low with 7% in RY01, 6% in RY02, and 5% in RY03.

Hunter Effort. Mean days hunted by all hunters during RY01–RY03 was very similar to the previous 5 years (Table 11).

Permit Hunts. Tier II permit hunt number TM787 was conducted during 1 January–15 February of RY01–RY03. Fifteen permits were issued annually, with a harvest quota of 5 bulls. Participation in the hunt varied with 27–67% of permittees hunting during RY01–RY03. No moose were killed in RY01, 1 moose was killed in RY02, and 2 were killed in RY03 (Table 8).

Permit hunt DM790 (Delta Junction Management Area) had 10 drawing permits issued each year during RY01–RY03. Participation by permit recipients was generally high with 80–100% of recipients hunting. Four moose were killed in RY01, 6 were killed in RY02, and 6 were killed in RY03 (Table 6).

Permit hunt DM792 (Bison Range Youth Hunt Management Area) had 24 permits issued in RY02 and RY03. Participation was high; all recipients hunted in RY02 and 79% hunted in RY03. Seventeen moose were killed in RY02, but harvest decreased to 7 moose in RY03 (Table 7).

Harvest Chronology. During this reporting period, general season harvest chronology remained similar to previous years, with most harvest occurring during the first 5 days of the 15-day general season (Table 12).

Transport Methods. During this reporting period, 3- or 4-wheelers, highway vehicles, and boats continued to be the most common modes of transportation used by successful hunters (Table 13).

Natural Mortality

No estimates of natural mortality were calculated during this reporting period. However, predation by wolves, grizzly bears, and black bears is believed to be significant in Unit 20D. Predation is thought to limit moose population growth in the northern half of Unit 20D and account for reduced calf survival in portions of southern Unit 20D.

HABITAT

Assessment

No moose habitat assessment was conducted during this reporting period.

Enhancement

During RY01–RY03 no habitat enhancement projects were conducted.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates were completed in southern Unit 20D, and results indicated the moose population did not meet the objective established by the Board of Game but was increasing. Smoothed population estimates indicate a lower population than estimated earlier. Unitwide harvest of moose was well below the objective established by the board.

The bull:cow ratio in southern Unit 20D appears to be stable or declining slightly. This situation should be monitored closely in the future and may require further harvest restrictions of bulls if the ratio gets lower.

Participation in the Tier II permit hunt in southeastern Unit 20D continued to be low, with few moose harvested. Because of this, the board eliminated the hunt at its 2004 meeting. Extra hunting seasons in the Healy River drainage did not appear to be used, and the board eliminated the January–February season at its 2004 meeting.

The unitwide population objective needs to be subdivided, as a minimum, into northern and southern Unit 20D objectives. The unitwide population objective of 8000–10,000 moose does not account for differences in moose density, habitat quality, harvest rates, predation rates, and other factors that are substantially different between these areas. Much of southern Unit 20D is road accessible and can and does support ≥ 2 moose/mi^2 because of manipulated predator populations through hunting and trapping and excellent habitat created through agricultural land clearing and wildfire. However, it will be very challenging to achieve and maintain 1 moose/mi^2 over large areas in the more remote northern Unit 20D given the lower quality habitat and reduced take of predators, even though habitat quality will improve greatly given the extent of wildfires in this area in 2004. No large areas of remote, roadless Interior Alaska currently support moose densities of ≥ 1 moose/mi^2 because unmanipulated or slightly manipulated levels of bear and wolf predation limit moose below 1 moose/mi^2.

Southern Unit 20D and northern Unit 20D contain approximately 1890 mi^2 and 3138 mi^2 of moose habitat respectively. Therefore, without predator control programs, southern Unit 20D could support 2–3 moose/mi^2 totaling 3780–5670 moose. Northern Unit 20D could support 1 moose/mi^2 totaling 3138 moose. Therefore, with the current management programs in Unit 20D, the moose population can be expected to expand to approximately 6918–8808 moose, the upper limit of which would reach the Board of Game's population objective. Interior Alaska data indicate that additional intensive management practices, such as predator control, would be required to achieve a higher population objective.

It is likely that the number of moose in southwestern Unit 20D may reach maximum sustainable numbers before the Unit 20D population objective is achieved. In that case, it may be necessary to implement management actions to stabilize the population in southwest Unit 20D before the unit's population objective is reached.

I believe that it will also be difficult to achieve the harvest objective without harvesting cow moose. The bull:cow ratio in southern Unit 20D is currently low enough that achieving the harvest objective with a bulls-only bag limit would likely further reduce the bull:cow ratio to unacceptable levels. Also, the majority of harvest is currently coming from southwestern Unit 20D. It will be unrealistic to expect southwestern Unit 20D to provide the majority of harvest necessary to meet the harvest objective. Instead, additional harvest needs to be spread over portions of the unit that currently have low harvest rates. These are largely remote areas where access is difficult and expensive and bull:cow ratios are relatively high.

In conclusion, I believe the low end of the current Unit 20D population objective of 8000–10,000 moose is potentially achievable with the current management program. However, I do not believe the harvest objective of 500–700 is achievable without spreading a larger proportion of the harvest among northern and southeastern Unit 20D and initiating antlerless hunts in southwestern Unit 20D.

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TABLE 1 Results of population estimates for southern Unit 20D using a Gasaway[a] Method survey (GAS) and "unsmoothed" Geostatistical Population Estimator (GSPE) surveys, 1995–2003

Parameter	1995 GAS	1998 GAS	1998 GSPE	2000 GSPE	2001 GSPE	2003 GSPE
Total pop est.	2522	4050	3630	3932	3435	5493
LCI	1979	2826	2533	3245	2643	3924
UCI	3065	5275	4727	4618	4227	7061
Total calves	552	937	863	676	575	1097
LCI	411	682	630	498	453	830
UCI	693	1191	1097	855	697	1364
Total cows	1626	2580	2321	2530	2424	3476
LCI	1271	1741	1570	2021	1840	2363
UCI	1981	3418	3072	3039	3009	4588
Total bulls	343	530	479	671	392	790
LCI	249	350	305	530	281	462
UCI	437	710	653	813	504	1118
Bulls:100 Cows	21	21	21	27	16	23
LCI	17	16	16	19	10	19
UCI	25	25	25	34	22	26
Calves:100 Cows	34	36	37	27	24	32
LCI	29	32	32	22	16	27
UCI	39	41	42	31	32	37

[a] Gasaway et al. (1986).

TABLE 2 "Smoothed" moose population estimates for southern Unit 20D, 1995–2003

Year[a]	Estimate	90% Lower CI	90% Upper CI
1995	**2507**	**2037**	**2938**
1996	2751	2298	3170
1997	2992	2638	3379
1998	**3242**	**2917**	**3639**
1999	3462	3072	3854
2000	**3719**	**3324**	**4119**
2001	**3920**	**3378**	**4399**
2002	4195	3574	4838
2003	**4456**	**3752**	**5209**

[a] Years in bold text are years surveys were flown. Other years were estimated from the population trend line.

TABLE 3 Unit 20D moose hunting seasons and bag limits, regulatory years 2001–2002 through 2003–2004

Regulatory year	Area	Season		Bag limit
2001–2002	South of Tanana River and west of Johnson River, except Delta Junction Management Area.	Resident:	1–15 Sep	1 bull with spike-fork or 50-inch antlers or 4 or more brow tines on at least 1 side.
		Nonresident:	5–15 Sep	1 bull with 50-inch antlers[a].
	Within Delta Junction Management Area.	Resident:	1–15 Sep	1 bull with spike-fork or 50-inch antlers or 4 or more brow tines by drawing permits.
		Nonresident:	5–15 Sep	1 bull with 50-inch antlers[a] by drawing permit DM790.
	South of Tanana River and east of Johnson River.	Resident:	1–15 Sep 1 Jan–15 Feb	1 bull. 1 bull by Tier II permit TM787.
		Nonresident:	No open season	
	Within the Healy River drainage.	Resident:	15–28 Aug 1–15 Sep 1 Jan–15 Feb	1 bull with spike-fork antlers. 1 bull. 1 bull.
		Nonresident:	1–15 Sep	1 bull.
	Remainder of Unit 20D (north of Tanana River).	Resident:	1–15 Sep	1 bull.
		Nonresident:	1–15 Sep	1 bull.
2002–2003 and 2003–2004	South of Tanana River and west of Johnson River, except Delta Junction Management Area and the Bison Range Youth Hunt Management Area.	Resident:	1–15 Sep	1 bull with spike-fork or 50-inch antlers or 4 or more brow tines on at least 1 side.
		Nonresident:	5–15 Sep	1 bull with 50-inch antlers[a].
	Within Delta Junction Management Area.	Resident:	1–15 Sep	1 bull with spike-fork or 50-inch antlers or 4 or more brow tines by drawing permits DM790.
		Nonresident:	5–15 Sep	1 bull with 50-inch antlers[a] by drawing permit DM790.
	Within the Bison Range Youth Hunt Management Area.	Resident	1–30 Sep	1 bull by permit DM792.
		Nonresident	1–30 Sep	1 bull by permit DM792.

Regulatory year	Area	Season		Bag limit
	South of Tanana River and east of Johnson River except within the Robertson River drainage south of the confluence of east and west fork, and within 1 mile west of the west fork.	Resident:	1–15 Sep	1 bull.
			1 Jan–15 Feb	1 bull by Tier II permit TM787.
		Nonresident:	No open season	
	Within the Robertson River drainage south of the confluence of east and west forks, and within 1 mile of the west fork.	Resident	1–15 Sep	1 bull.
			1 Jan–15 Feb	
		Nonresident	5–15 Sep	1 bull with 50-inch antlers, or at least 4 brow tines on at least 1 side.
	Within the Healy River drainage.	Resident:	15–28 Aug	1 bull with spike-fork antlers.
			1–15 Sep	1 bull.
			1 Jan–15 Feb	1 bull.
		Nonresident:	1–15 Sep	1 bull.
	Remainder of Unit 20D (north of Tanana River).	Resident:	1–15 Sep	1 bull.
		Nonresident:	1–15 Sep	1 bull.

[a] 50-inch antlers defined as having a spread of at least 50 inches or at least 4 brow tines on at least 1 side.

TABLE 4 Unit 20D moose harvest and accidental death, regulatory years 1986–1987 through 2003–2004

Regulatory	Harvest by hunters										
	Reported				Estimated			Accidental death			
year	M	F	Unk	Total	Unreported[a]	Illegal	Total	Road	Train[b]	Total	Total
1986–1987	130	0	0	130	23	4	27	15	0	15	172
1987–1988	126	0	0	126	22	10	32	26	0	26	184
1988–1989	126	0	0	126	22	13	35	27	0	27	188
1989–1990	128	0	0	128	23	9	32	16	0	16	176
1990–1991	118	1	0	119	21	4	25	11	0	11	155
1991–1992	143	1	0	144	25	11	36	13	0	13	193
1992–1993	143	0	1	144	25	5	30	32	0	32	206
1993–1994	154	0	1	155	27	14	41	30	0	30	226
1994–1995	128	0	0	128	23	7	30	31	0	31	189
1995–1996	138	0	0	138	24	20	44	25	0	25	207
1996–1997	214	0	0	214	38	22	60	39	0	39	313
1997–1998	210	0	0	210	37	15	52	48	0	48	310
1998–1999	234	0	0	234	41	11	52	31	0	31	317
1999–2000	184	0	0	184	33	7	40	40	0	40	264
2000–2001	246	0	0	246	44	20	64	37	0	37	347
2001–2002	182	0	0	182	32	17	49	32	0	32	263
2002–2003	228	0	0	228	40	6	46	n/a	0	n/a	274
2003–2004	227	0	0	227	40	n/a	40	n/a	0	n/a	267

[a] Based on 17.7% unreported harvest estimated by Gasaway et al. (1992).
[b] Not applicable in Unit 20D.

TABLE 5 Southwestern (SW), southeastern (SE), northwestern (NW), and northeastern (NE) Unit 20D reported moose harvest and number of hunters during general seasons, regulatory years 1984–1985 through 2003–2004

Regulatory	Moose harvest						Hunters					
year	SW	SE	NW	NE	Unk	Total	SW	SE	NW	NE	Unk	Total
1984–1985	39[a]	[b]	[c]	[c]		102	236[a]	[b]	[c]	[c]		635
1985–1986	48[d]	[b]	60[d]	14[d]	0	130	236[d]	37[b]	272[d]	50[d]	9	604
1986–1987	76[d]	10[b]	40[d]	10[d]	1	137	250[d]	45[b]	232[d]	57[d]	12	596
1987–1988	66[d]	[b]	43[d]	[d]	0	126	296[d]	35[b]	208[d]	35[d]	17	591
1988–1989	60[e]	12[b]	39[d]	12[d]	3	126	244[e]	45[b]	201[d]	37[d]	28	555
1989–1990	60[e]	11[b]	41[d]	10[d]	5	127	303[e]	47[b]	191[d]	39[d]	40	620
1990–1991	58[f]	[c]	40[g]	[d]	4	118	270[f]	29[c]	195[g]	26[d]	28	548
1991–1992	54[f]	12[c]	66[g]	[d]	3	144	331[f]	51[c]	231[g]	26[d]	19	658
1992–1993	59[f]	12[c]	58[g]	[d]	9	143	329[f]	49[c]	257[g]	34[d]	48	717
1993–1994	74[h]	[c]	58[c]	11[c]	2	154	324	33[c]	259[c]	29[c]	47	692
1994–1995	61[h]	[c]	49[c]	[c]	2	128	339	42[c]	267[c]	33[c]	28	709
1995–1996	60[h]	14[c]	50[c]	12[c]	2	138	301	32[c]	237[c]	42[c]	33	645
1996–1997	103[h]	13[c]	74[c]	16[c]	5	211	320	40[c]	267[c]	35[c]	31	693
1997–1998	88[h]	13[c]	72[c]	19[c]	10	202	325[h]	38[c]	241[c]	46[c]	33	683
1998–1999	122[h]	17[c]	64[c]	16[i]	8	227	431[h]	43[c]	231[c]	43[i]	47	795
1999–2000	107[h]	12[c]	42[c]	12[i]	4	177	358[h]	43[c]	177[c]	29[i]	37	644
2000–2001	140[h]	12[c]	65[c]	18[i]	5	240	355[h]	41[c]	194[c]	35[i]	32	657
2001–2002	101[h]	10[c]	52[c]	14[i]	1	178	425[h]	31[c]	221[c]	41[i]	26	744
2002–2003	119[h]	17[c]	56[c]	[i]	7	204	426[h]	39[c]	281[c]	39[i]	51	836
2003–2004	124[h]	16[c]	53[c]	13[i]	6	212	447[h]	40[c]	230[c]	41[i]	36	794

[a] Season 1–6 Sep; 1 bull.
[b] Season 1–20 Sep; 1 bull.
[c] Season 1–15 Sep; 1 bull.
[d] Season 1–10 Sep; 1 bull.
[e] Season 1–15 Sep; 1 bull with spike-fork or 50-inch antlers or 3 brow tines on 1 antler.
[f] Subsistence–resident season 1–15 Sep; 1 bull with spike-fork or 50-inch antlers or 3 brow tines on 1 antler. Nonresident season 5–15 Sep; 1 bull with 50-inch antlers or 3 brow tines on 1 antler.
[g] West of pipeline season 1–15 Sep; 1 bull. Nonresident season 5–15 Sep; 1 bull with 50-inch antlers or 3 brow tines on 1 side. Remainder area 1–10 Sep; 1 bull.
[h] Resident season 1–15 Sep; 1 bull with spike-fork or 50-inch antlers or 4 brow tines on 1 antler. Nonresident season 5–15 Sep; 1 bull with 50-inch antlers or 4 brow tines on 1 antler.
[i] Resident season within 1–15 Sep; 1 bull. Within Healy River drainage: resident season 15–18 Aug, 1 bull with spike-fork antlers; 1–15 Sep, 1 bull; 1 Jan–15 Feb, 1 bull; nonresident season, 1–15 Sep; 1 bull. Remainder area is resident and nonresident 1–15 Sep, 1 bull.

TABLE 6 Unit 20D Delta Junction Management Area moose drawing permit harvest, regulatory years 1996–1997 through 2003–2004

Hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Percent bulls	Percent cows	Unk	Harvest
DM790	1996–1997	5	0	40	60	100	0	0	3
DM790	1997–1998	10	20	0	80	100	0	0	8
DM790	1998–1999	10	0	0	100	100	0	0	10
DM790	1999–2000	10	0	30	70	100	0	0	7
DM790	2000–2001	10	20	20	60	100	0	0	6
DM790	2001–2002	10	20	40	40	100	0	0	4
DM790	2002–2003	10	0	40	60	100	0	0	6
DM790	2003–2004	10	20	20	60	100	0	0	6

TABLE 7 Unit 20D Bison Range Youth Hunt Management Area moose drawing permit harvest, regulatory years 2002–2003 through 2003–2004

Hunt/ Area	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Percent bulls	Percent cows	Unk	Harvest
DM792	2002–2003	24	0	29	71	100	0	0	17
DM792	2003–2004	24	21	50	29	100	0	0	7

TABLE 8 Unit 20D moose Tier II permit harvest, regulatory years 1989–1990 through 2003–2004

Hunt number	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Percent bulls	Percent cows	Unk	Harvest
988	1989–1990	15	27	91	9	100	0	0	1
987T	1990–1991	15	20	86	14	100	0	0	1
987T	1991–1992	15	67	100	0	0	0	0	0
987T	1992–1993	15	20	91	9	100	0	0	1
787	1993–1994	15	47	100	0	0	0	0	0
787	1994–1995	15	27	91	9	100	0	0	1
TM787	1995–1996	15	47	100	0	0	0	0	0
TM787	1996–1997	15	53	86	14	100	0	0	1
TM787	1997–1998	15	73	100	0	0	0	0	0
TM787	1998–1999	15	67	100	0	0	0	0	0
TM787	1999–2000	15	47	53	0	0	0	0	0
TM787	2000–2001	15	60	100	0	0	0	0	0
TM787	2001–2002	15	73	100	0	0	0	0	0
TM787	2002–2003	15	33	90	10	100	0	0	1
TM787	2003–2004	15	40	78	22	100	0	0	2

TABLE 9 Unit 20D Healy River (Uniform Coding Unit 501) reported moose harvest, regulatory years 1993–1994 through 2003–2004

Regulatory year	Unit 20D Healy River	
	Hunters	Harvest
1993–1994[a]	9	2
1994–1995[a]	13	2
1995–1996[a]	24	2
1996–1997[a]	10	2
1997–1998[a]	14	3
1998–1999[b]	19	5
1999–2000[b]	21	7
2000–2001[b]	24	6
2001–2002[b]	23	5
2002–2003[b]	10	1
2003–2004[b]	10	5

[a] Resident moose hunting season 1–15 Sep, 1 bull.
[b] Resident moose hunting season: 15–28 Aug, 1 spike-fork bull; 1–15 Sep, 1 bull; 1 Jan–15 Feb, 1 bull.

TABLE 10 Unit 20D moose hunter residency and success[a], regulatory years 1986–1987 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	83	51	1	2	137 (23)	270	175	12	3	460 (77)	597
1987–1988	64	48	7	6	125 (21)	279	156	18	15	468 (79)	593
1988–1989	71	43	10	2	126 (23)	215	176	31	7	429 (77)	555
1989–1990	53	62	8	4	127 (20)	263	198	23	9	493 (80)	620
1990–1991	64	55	4	3	126 (21)	243	193	31	3	470 (79)	596
1991–1992	72	67	4	1	144 (22)	280	215	13	7	515 (78)	659
1992–1993	65	67	8	3	143 (20)	306	218	37	14	575 (80)	718
1993–1994	82	68	2	2	154 (22)	298	221	17	2	538 (78)	692
1994–1995	59	65	2	2	128 (18)	319	247	11	4	581 (82)	709
1995–1996	66	63	9	4	142 (21)	249	256	20	12	537 (79)	679
1996–1997	91	108	11	1	211 (29)	277	224	14	2	517 (71)	728
1997–1998	102	90	11	0	203 (29)	264	213	26	2	505 (71)	708
1998–1999	105	104	13	4	226 (28)	278	267	24	3	572 (72)	798
1999–2000	70	96	11	0	177 (22)	311	303	24	6	644 (78)	821
2000–2001	86	144	10	0	240 (27)	283	341	29	4	657 (73)	897
2001–2002	54	108	14	2	178 (19)	301	391	47	5	744 (81)	922
2002–2003	132	57	20	0	209 (25)	478	126	34	2	640 (75)	849
2003–2004	143	52	13	13	221 (27)	396	145	27	27	595 (73)	816

[a] Excludes hunters in permit hunts.
[b] Local means reside in Unit 20D.

TABLE 11 Southwestern, southeastern, northwestern, and northeastern Unit 20D moose hunter success and mean days hunted[a], regulatory years 1986–1987 through 2003–2004

Regulatory	Successful hunters					Unsuccessful hunters				
year	SW	SE	NW	NE	Total	SW	SE	NW	NE	Total
1986–1987	3.8	3.0	5.3	4.1	3.9	5.5	10.5	6.1	7.0	6.0
1987–1988	4.4	7.3	4.8	3.9	4.7	5.3	7.5	6.7	6.5	6.1
1988–1989	4.6	6.2	5.3	4.5	5.0	5.9	6.3	5.8	6.5	6.0
1989–1990	4.7	4.5	4.1	5.1	4.6	9.7	5.7	5.9	5.3	5.9
1990–1991	4.9	6.6	3.9	6.5	4.7	3.5	5.6	5.8	6.3	5.9
1991–1992	6.0	4.9	5.5	4.2	5.6	5.9	7.0	6.8	5.6	6.3
1992–1993	4.7	5.7	5.4	4.9	5.0	5.9	5.1	6.8	5.2	6.2
1993–1994	5.4	4.4	6.2	7.5	5.7	6.2	7.5	6.6	9.4	6.5
1994–1995	5.1	6.3	5.9	4.2	5.4	5.9	4.9	6.2	7.2	6.1
1995–1996	7.2	5.4	5.6	4.5	6.3	6.9	4.9	7.2	7.2	6.9
1996–1997	4.9	4.2	4.9	6.6	5.0	6.5	5.0	6.7	6.9	6.6
1997–1998	5.3	5.3	6.9	5.1	5.9	7.0	5.5	6.7	7.4	6.9
1998–1999	6.9	9.2	7.6	3.8	7.3	8.0	5.3	7.1	9.5	7.7
1999–2000	5.5	8.5	5.7	4.5	5.7	7.7	7.8	7.8	5.4	7.7
2000–2001	5.1	4.6	5.3	4.0	5.0	6.9	7.9	6.9	5.9	6.9
2001–2002	6.4	5.4	6.0	5.5	6.1	6.9	5.8	7.2	5.5	6.9
2002–2003	5.8	6.4	7.0	1.5	6.3	6.7	5.2	6.9	7.3	6.8
2003–2004	6.0	5.7	6.3	4.5	6.0	7.1	5.6	7.1	4.3	6.9

[a] Excludes permit hunt harvest.

TABLE 12 Unit 20D moose harvest[a] chronology percent by month/day, regulatory years 1990–1991 through 2003–2004

Regulatory	Harvest chronology percent by month/day				
year	9/1–9/5	9/6–9/10	9/11–9/15	Unk	*n*
1990–1991	57	20	23	0	109
1991–1992	57	22	16	5	141
1992–1993	50	30	18	3	139
1993–1994	42	26	28	4	154
1994–1995	45	25	22	8	128
1995–1996	41	20	33	6	138
1996–1997	51	23	23	3	208
1997–1998	44	24	30	3	196
1998–1999	44	30	24	2	223
1999–2000	41	30	24	5	175
2000–2001	48	28	23	1	246
2001–2002	44	34	21	2	172
2002–2003	36	37	22	5	174
2003–2004	39	30	30	1	158

[a] Excludes permit hunt harvest.

TABLE 13 Unit 20D moose harvest percent[a] by transport method, regulatory years 1987–1988 through 2003–2004

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboats	Unknown	*n*
1987–1988	8	2	27	20	0	8	29		6	126
1988–1989	10	2	24	18	0	9	29		9	126
1989–1990	10	3	29	13	0	12	29		3	127
1990–1991	7	0	25	20	0	12	33		3	118
1991–1992	13	3	23	25	0	8	24		3	144
1992–1993	8	1	26	18	<1	8	36		1	143
1993–1994	6	1	30	25	1	7	29		2	154
1994–1995	4	2	29	28	0	11	23		3	128
1995–1996	6	2	33	18	0	8	28		5	142
1996–1997	4	<1	27	28	0	8	31		2	210
1997–1998	5	1	23	32	0	5	31	<1	2	202
1998–1999	7	1	26	26	0	4	34	0	2	227
1999–2000	5	2	21	38	0	5	27	1	2	177
2000–2001	5	1	19	34	0	5	32	2	2	240
2001–2002	3	2	25	34	0	7	24	2	4	178
2002–2003	9	0	16	39	0	4	30	2	1	178
2003–2004	4	2	18	41	0	3	26	2	4	160

[a] Excludes permit hunt harvest.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 20E (10,680 mi^2)

GEOGRAPHIC DESCRIPTION: Charley, Fortymile, and Ladue River drainages

BACKGROUND

During the 1950s to the early 1960s, following federal predator control, the moose population in Unit 20E increased to a minimum of 12,000 moose. The population declined rapidly during 1965 through 1976, reaching an estimated low of 2200 moose. During 1976–2003 the moose population in Unit 20E remained at low densities (0.2–0.6 moose/mi^2). Gasaway et al. (1992) evaluated the roles that predation, nutrition, snow, harvest, and disease played in maintaining the moose population at low densities. They concluded that predation was the primary limiting factor and that other variables had little to no impact.

During the early 1980s, in response to declining moose and caribou populations, the Alaska Department of Fish and Game initiated 2 predator management programs. Between 1981 and 1983 the wolf population was reduced by 54% in a 3800-mi^2 area of Unit 20E using a combination of aerial shooting by the department and public trapping. In addition, grizzly bear hunting regulations were liberalized in 1981, causing moderate increases of grizzly bear harvest in portions of the subunit, probable local declines in grizzly bear numbers, and changes in the bear population age and sex structure (Gardner 1999).

Between 1981 and 1990 the moose population increased by about 4–9% per year. The increase was probably due to combined effects of favorable climatic conditions, reduced predation, and an increased number of alternate prey, i.e., Fortymile caribou. During this period the moose population did not increase beyond the ability of wolves and bears to maintain the population at low densities, and between 1990 and 2003 it remained at 0.5–0.6 moose/mi^2.

Prior to 1992, moose in Unit 20E were primarily hunted by local residents and residents from Fairbanks and Southeast Alaska. Historically, harvest was low in relation to the moose population and was largely restricted to the Taylor Highway corridor and the Mosquito Fork

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

drainage. During 1992–2003, more hunters from Southcentral Alaska traveled to Unit 20E to hunt moose in response to more restrictive moose hunting regulations in the southcentral units and for the opportunity to hunt both moose and caribou in Unit 20E.

During the 1960s, high moose densities supported a long hunting season and a bag limit of 1 moose. As moose numbers began to decline, harvests were first reduced by shortening the season length in 1973 and then by eliminating cow seasons in 1974. However, the population continued to decline throughout Unit 20, and in 1977 moose hunting in Unit 20E (then a portion of Unit 20C) was terminated. A 10-day bulls-only season was opened in 1982 and continued until 1991. The season was lengthened to 15 days during 1991–2000. In response to an increasing number of hunters and harvest, in most of Unit 20E, the fall moose season was split in 2001 into a 5-day August season and a 10-day September season and was managed under a registration permit. This season structure is currently in place.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population in concert with other components of the ecosystem.
- Continue sustained opportunities for subsistence use of moose.
- Maximize sustained opportunities to participate in hunting moose.
- Maximize opportunities for the nonconsumptive use of moose.

MANAGEMENT OBJECTIVE

- Maintain a posthunting ratio of at least 40 bulls:100 cows in all survey areas.

INTENSIVE MANAGEMENT OBJECTIVES

In that portion of Unit 20E within the Fortymile and Ladue River drainages.

- Population: 8000–10,000 moose.
- Harvest: 500–1000 moose annually.

METHODS

POPULATION STATUS

We conducted moose population estimation surveys in southwestern and western Unit 20E (Mosquito Flats and Tok West Study Areas) in 1981, 1988, 1992, 1995 and 1998–2003 and in southeastern and central Unit 20E (Ladue River and Tok Central Study Areas) in 1992, 1996, and 1998–2003. We used the standard Gasaway et al. (1986) technique in 1981 and 1989 and modifications of that technique developed by Mark McNay (ADF&G, personal communication) in 1992 and by Rod Boertje, Jay Ver Hoef, and Craig Gardner (ADF&G) in

1995–1996. During 1998–2003 we used a Geostatistical Population Estimator (GSPE; Ver Hoef 2001), a modification of the standard Gasaway et al. (1986) technique.

The Ladue River Study Area was expanded in 1998 and again in 2000 to include more area than was being intensively hunted during the fall and winter moose seasons. To reduce confusion regarding comparison of survey results with the smaller Ladue River Study Area, we renamed this larger area, Tok Central.

During 1999 Yukon Department of Renewable Resources staff used the spatial correlation sampling technique (Ver Hoef 2001) in a 900-mi^2 area adjacent to our Tok Central study area. This allowed us to expand the moose population size and composition estimates to include more of the White and Ladue River drainages in the Yukon.

These data were used to determine population trends and composition in the study areas and to estimate moose numbers in the entire unit. The Mosquito Flats, Tok West, and Tok Central (Alaska and Yukon) areas differed in habitat quality, wolf and grizzly bear population densities, and hunter use. These variables were considered when extrapolating moose density estimates throughout the unit.

To evaluate the effects on moose of a nonlethal wolf control program (Boertje and Gardner 1999), we surveyed portions of western Unit 20E and northern Unit 20D (referred to as the Tok West Study Area) using the GSPE (Ver Hoef 2001). This area will be surveyed annually until 2005 to determine moose population and composition trends. The nonlethal wolf control program was conducted in western Unit 20E, northern Unit 20D, and eastern Unit 20B during 1997–2001. Wolf populations are currently in the recovery stage and are expected to return to pretreatment levels in the next few years.

During 1997, 1999 and 2003 moose population trend and composition was monitored in northern Unit 20E within the Yukon–Charley Rivers National Preserve by the National Park Service (NPS) (J. Burch, NPS, personal communication).

COMPOSITION SURVEYS

Sex and age composition was estimated in 2–10 traditional trend count areas during October and November 1993, 1994, 1996, and 1999, and in 1995, 1996, 1998, and 1999–2003 while conducting population estimation surveys in the Tok West and Tok Central study areas. All moose observed were classified as large bulls (antlers >50 inches), medium bulls (antlers larger than yearlings but <50 inches), yearling bulls (spike, cerviform, or small palmate antlers without brow separation), cows without calves, cows with 1 calf, cows with 2 calves, lone calves, or unidentified moose.

HARVEST

Harvest was estimated using harvest report cards, (after reminder letters were sent) and in 2001–2003, within most of Unit 20E, by registration permit reports. Information obtained from the reports was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

HABITAT ENHANCEMENT

Natural wildfires were managed under the Alaska Interagency Fire Management Plan. Three prescribed burns were ignited in Unit 20E during 1997 and 1998 using aerial firing from a Ping-Pong sphere dispenser. Firing activities were conducted following a strict burn prescription developed specifically for each of the 3 areas and based on the Fire Weather Index and Fire Behavior Prediction modules of the Canadian Forest Fire Danger Rating System (Stocks et al. 1989).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

During 1981–1995, 4 population estimation surveys were conducted in a 964–2978 mi^2 (2500–7700 km^2) area in southwestern Unit 20E (Gardner 1998). The annual rate of increase during 1981–1987 was 1.08, and during 1988–1995 it was 1.01, indicating the moose population in southwestern Unit 20E increased through the 1980s until 1988 and remained relatively stable during 1989–1995.

In 1992 we conducted the first population estimation survey in a 735-mi^2 area in southeastern Unit 20E. The estimated moose population was 652 ± 21% (90% CI). Mean density was 0.89 moose/mi^2, 29% greater than the density found in the adjacent southwestern portion of the subunit. We conducted a population estimate survey in southeastern Unit 20E again in 1996 (944 ± 26%, 90% CI), but results are not directly comparable because during 1992 we did not estimate a sightability correction factor. Based on estimates generated from observed moose, moose numbers in this area increased by 12.9% during 1992–1996, an annual rate of increase of 1.03.

The 1998 Tok Central (Alaska only) moose population and density estimates were 1444 ± 22% (90% CI) and 0.52 moose/mi^2. Including the Yukon data, the 1999 density estimate within the White and Ladue River drainages and along the Alaska Highway in both Alaska and Yukon was 0.48 moose/mi^2. These data indicate little difference between moose densities across the border and that little change in moose numbers occurred between 1998 and 1999. The Tok Central survey area was expanded during 2000–2003, resulting in a larger portion of the survey area that was made up of high quality moose habitat (previously burned areas). This resulted in higher density estimates within this survey area. Therefore, data collected in the Tok Central survey area prior to 2000 should not be directly compared to data collected from 2000 through 2003.

NPS conducted population estimation surveys in northern Unit 20E within the Yukon–Charley Rivers National Preserve west of Washington Creek and south of the Yukon River in 1994 and 1997. They found about 0.30 moose/mi^2 during both years (Bruce Dale, ADF&G,

personal communication). The NPS surveyed both north and south of the Yukon River in 1999 and 2003 and the estimate for the entire area was 0.37 and 0.22 moose/mi^2 respectively.

No formal surveys were conducted in the northeastern portion of Unit 20E (approximately 15% of the unit). I estimated moose population size (0.3 moose/mi^2) in that area by using a combination of data, including the amount of suitable moose habitat, harvest, and the number of moose concentration areas in comparison to the areas in the subunit that were sampled.

Combining the population estimates, the 2003 population estimate for Unit 20E was 4000–4800 moose, with an estimated density of 0.5–0.6 moose/mi^2 of moose habitat (8000 mi^2). The 2001 estimate was 4500–5300 moose. Poor calf and yearling survival for the past 4 years are the main reasons for the population decline.

The Alaska Board of Game identified the moose population within the Fortymile and Ladue River drainages as important for high levels of human consumptive use under the Intensive Management Law (AS 16.05.255[e]–[g]). This designation means the board must consider intensive management if a reduction in harvest becomes necessary because of dwindling moose numbers or productivity. The board established the moose population objective within the Fortymile and Ladue River portion of Unit 20E at 8000–10,000 moose with an annual harvest objective of 500–1000 moose. In RY03 neither the population nor harvest objectives were met and, based on moose, caribou, wolf, and grizzly bear population trends, these objectives will not be met in the foreseeable future unless predation is reduced.

Gasaway et al. (1992) reported that the Unit 20E moose population was maintained at a low density dynamic equilibrium (0.1–1.1 moose/mi^2) by wolf and grizzly bear predation and that habitat, harvest, and disease were not limiting population growth. They determined predator management was necessary to increase the moose population and to maintain it at a higher abundance level. There has been much public and scientific debate over whether wolf control combined with public grizzly bear harvest would cause a moose population increase in Unit 20E. Gasaway et al. (1992) recommended altering wolf and bear predation simultaneously. Reducing predation of only 1 species may result in compensatory predation by another species. Opponents of wolf control argue that reducing wolves will not benefit the moose population because grizzly bears are the primary predator on calves, which is the major limiting factor. Additional arguments have been made that wolf control was tried and failed in Unit 20E. They based their conclusions on results of the wolf control program conducted in Unit 20E during 1981–1983. Unfortunately, this program was terminated prematurely because of political decisions.

To simulate potential consequences of different methods of intensive management on moose numbers in the Fortymile–Ladue drainages, I modeled current population status and trend data for moose and their predators using the McNay and DeLong (1998) Predprey model. Results indicate that the Unit 20E moose population continues to be primarily limited by grizzly bear predation on calves. Gasaway et al. (1992) estimated that between 1981 and 1988, 52% of calf mortality was due to grizzly bears. In order for the model to track current population status, grizzly bears had to cause 58–62% of the calf mortality during 1997–2003.

The effects of wolf predation on the Unit 20E moose trend are expected to increase. During 1997–2001, wolf control activities reduced wolf numbers in the western portion of the unit. Wolf numbers will increase substantially in that area once the effects of wolf control end. Throughout the unit, wolf numbers will probably increase because caribou numbers are high and increasing, allowing for high wolf productivity and survival. It is highly probable that the Unit 20E moose population will decline to 0.2–0.3 moose/mi^2 unless wolf numbers, grizzly numbers, or both are reduced.

Assuming grizzly bear predation rates remain relatively constant during the next 3 years, the model predicts that the effect of nonlethal wolf control will be minimal on the population trend (annual growth rates = 0.97–1.00). Calf:cow ratios will range in the high teens to low 20s:100 cows and the bull:cow ratio will decline due to harvest.

Moose numbers would remain stable or slightly increase (1–3% annually) if the number of grizzly bears or their predation efficiency were reduced by 2–3% annually and wolf predation increased at the expected rate. A more substantial decrease in grizzly bear numbers (25%) could cause a 5–10% increase in moose numbers. This was the objective for liberalizing the Unit 20E grizzly bear regulations in 1981, i.e., to reduce the grizzly bear population through harvest.

If the intensive management law is implemented in Unit 20E, bear predation rates on calves must be reduced before substantial increases in the moose population can occur. Even with liberalized grizzly bear harvest regulations during 1982–2003, harvest was not high enough to consistently improve moose calf survival.

To reduce the effects of grizzly bear predation on calves, either the number of bears would have to be reduced to a level at which compensatory bear predation is no longer a factor, or the efficiency with which bears kill calves would have to be reduced. Based on observations during moose calf mortality studies where grizzly bears were translocated (C.L. Gardner, ADF&G, personal communication), fewer bears can kill more calves per bear. There is probably a point at which bear reduction is great enough that fewer calves will be killed by grizzly bears. Since females with cubs are protected from harvest but are efficient predators on moose calves (Boertje et al. 1988), a greater percentage of males and unaccompanied females would have to be removed from the population. Beginning in RY02, grizzly bear regulations became more liberal by not requiring a trophy tag fee for Alaska residents.

Model results continue to support the recommendation that moderate reductions of both wolves and bears would better suit moose management in Unit 20E compared with strong reductions in either predator population (Gasaway et al. 1992). If 30–35% of the wolf population was harvested annually and grizzly bear numbers were reduced by 25%, moose numbers could increase 3–12% annually.

Population Composition

During 2001–2003 we collected composition data in the Tok West and Tok Central survey areas (Table 1). Calf recruitment was poor, ranging between 10–25 calves:100 cows. Calf survival to 5 months has been poor (≤25:100) since 1998.

The Unit 20E bull:cow ratio remained above the management objective, but was declining in portions of the unit. The number of hunters has increased since 1992, and access into Unit 20E increased as new trails and landing areas were pioneered. In the most popular hunting areas (Nine Mile Trail, Mitchell's Ranch, and along the Yukon River and Taylor Highway) bull populations declined most noticeably, but still met or exceeded the management objective of 40:100 during this reporting period.

Modeling data indicate that if calf recruitment remains below 30 calves:100 and harvest levels remain the same, the bull:cow ratio will decline. Even with hunting season and access restrictions, I expect the bull population to decrease and the bull:cow ratio to decline below 50 bulls:100 cows in many areas of the unit by 2005.

Distribution and Movements

Moose are distributed throughout Unit 20E below elevations of 4500 feet. Most radiocollared moose during 1984–1986 moved seasonally from lowland summer habitat to upland rutting areas, where they remained until March. In fall 1988, 1992, 1999, and 2000 early deep snowfall (>22 inches) appeared to cause moose to move to lower elevations during November.

MORTALITY

Harvest

Seasons and Bag Limit. Season and Bag Limits are summarized in Table 2.

Alaska Board of Game Actions and Emergency Orders. During the spring 2000 meeting, the Board of Game created a registration permit hunt in Unit 20E, excluding the Middle Fork Fortymile River. The board also split the moose season into 2 periods: 24–28 August and 8–17 September, except within the Yukon River drainage, where the season became 24–28 August and 5–25 September. The board also stipulated that a hunter could hunt both moose and caribou, but not hold a registration permit for both species at the same time. These actions were in response to increased harvest due to an increasing number of hunters in most of Unit 20E. Also in spring 2000, the board set the intensive management population and harvest objectives for the Unit 20E moose population within the Fortymile and Ladue River drainages as 8000–10,000 moose and 500–1000 harvested. During the spring 2002 meeting, the board reduced the season within the Yukon River drainage to match the season in the remainder of Unit 20E (24–28 Aug and 8–17 Sep). To encourage hunters to harvest more grizzly bears to benefit moose calf survival, the board also eliminated the grizzly bear tag fee requirement for resident hunters in Unit 20E except in the Yukon–Charley Rivers National Preserve.

Hunter Harvest. During RY01–RY03 the reported fall harvest in Unit 20E averaged 145 (129–169) bulls (Table 3), or about 3.3% of the 2003 estimated early winter population. The average reported harvest for the 5 years prior to RY01, or RY96–RY00, was 136 (117–150) even though the number of moose hunters in Unit 20E increased from an average of 487 during RY96–RY00 to 829 during RY01–RY03. Therefore, it appears the season structure implemented in RY01–RY03 achieved the desired result of stabilizing the harvest of moose in Unit 20E. Probable causes for the higher hunter participation include 1) hunters were displaced by stricter regulations throughout Southcentral Alaska, especially in nearby Unit 13; 2) the Fortymile caribou season was open concurrently with the moose season, which attracted hunters interested in hunting both species simultaneously; 3) maintaining a 1 bull bag limit with relatively liberal season dates gave hunters a false impression about the number of moose in the area; and 4) more hunters came to the area looking for large antlered bulls.

The Board of Game created 2 winter drawing permit hunts (DM794 and DM796) within the Ladue River Controlled Use Area in spring 1994. The harvest objective was to allow greater hunting opportunity in an area that supported a high number of bulls (bull:cow ratio >60:100) but was rarely hunted due to difficult access in the fall. We attempted to manage these hunts so winter harvest would not affect the bull numbers in areas commonly hunted during the fall; however, our efforts were largely unsuccessful.

During RY95–RY99, 10 winter permits were offered annually for DM794. Due to the low number of permits and difficult access, harvest was 0–4 bulls annually. Even though harvest was low, it was concentrated in areas that were hunted in the fall because of easier access. Many unit hunters voiced concern that the winter harvest was affecting local moose numbers. In response, the number of permits was reduced to 8 in 2000 and to 6 in 2001. During 2001, 5 of the 6 permit recipients participated and all were successful. Harvest was again concentrated in areas hunted in the fall and the number of permits was reduced to 3 for RY02–RY03. Unfortunately, the DM794 hunt area does not lend itself for subdivision to distribute hunters into areas not hunted during the fall. Reducing the number of permits to 3 should limit any impacts on moose numbers in this area regardless of where harvest occurs. During RY02–RY03, only 1 bull was harvested. Conversations with participants during RY02–RY03 indicated that hunters were searching for larger bulls during these years than participants in previous years. I plan to continue to encourage hunters to travel to the more remote areas and attempt to harvest large, trophy bulls (antlers ≥60 inches) that are not accessible in the fall.

During RY95–RY98, 50 winter permits were offered annually for DM796. Access into the central portion of this area is difficult, but the southern and northern portions are readily accessible by several snowmachine trails. Moose hunters used these trails extensively in the fall. During the first 2 seasons (RY95 and RY96) only 4 bulls were taken each year. There was no impact on bull numbers. During RY97 and RY98, 14 (35 hunters) and 10 (20 hunters) bulls were taken, and harvest was concentrated along the 2 trails used extensively by hunters during the fall hunt. This level of harvest reduced the number of large bulls along these trails.

In RY99 we attempted to reduce the winter harvest of moose along these trails by reducing the number of DM796 permits to 35 and by requesting that all DM796 permit recipients consider hunting more remote areas. The harvest was 8 bulls and half were taken in more remote areas. In RY00 the number of DM796 permits was reduced to 25 and use of the 2 most popular trails into the area was prohibited. Fifteen hunters participated, taking 9 bulls, 6 of which were taken in remote areas.

Historically, most hunters accessed the DM796 hunt area by snowmachine and the 2 best trails to access the remote areas were the 2 that were closed in RY00. In RY01 we established a hunt area within the permit area but allowed any method of legal access, including use of all trails. Because the hunt area was more confined, the number of permits was reduced to 10 to guard against overharvest. During RY01, 7 hunters participated, taking 3 bulls. To ensure against DM796 affecting moose numbers, the required hunt area will be changed periodically but will be located away from areas most hunted in the fall. During RY02 and RY03, 3 and no bulls were harvested, respectively.

Antler data indicates that restricting hunters to bulls with at least 50-inch antlers in Unit 20E would not stop a declining bull:cow ratio. Much of the bull population is composed of mature bulls that would be vulnerable to harvest. Calf recruitment has been poor since the 1970s, resulting in few bulls growing into the 50-inch class each year.

Maintaining a sustainable moose harvest has become a great management challenge in Unit 20E. Our primary concern is the increasing number of hunters. Regulatory changes reduced high incidental take of moose by caribou hunters, but as harvest regulations became more restrictive in other units along the road system, more moose hunters were displaced to Interior units including Unit 20E. Our objective by splitting the season and shortening the season along the Yukon River was to reduce hunter efficiency resulting in lower harvest. If these harvest management methods do not continue to hold the harvest at a stable level, more restrictive regulations will be necessary.

Hunter Residency and Success. Of the 138, 169, and 129 bulls harvested during the general season in RY01, RY02, and RY03, 64%, 70% and 63% were taken by nonlocal Alaska residents (Table 4). Prior to 1992, most nonlocal hunters were from Interior and Southeast Alaska, but since RY92 most of the nonlocal hunters were from Southcentral Alaska. Nonlocal hunters made up 55%, 60% and 66% of the hunters during RY01–RY03. Local hunters represented 21–34% of the hunters and took 16–24% of the harvest. Nonresident hunters were prohibited from hunting moose in Unit 20E during RY83–RY90. During RY91–RY00, nonresidents represented 8% of the hunters and accounted for an average of 9% of the harvest. During RY01–RY03, nonresidents represented 10–13% of the hunters and took 12–20% of the harvest.

Hunter success was 19%, 18%, and 16% during RY01, RY02, and RY03, respectively. The success rate has been in a decline since RY98. The average success rate declined from 28% during RY93–RY97 to 20% during RY98–RY03. This decline is primarily due to a declining moose population and implementation of more restrictive regulations. During RY01–RY03, success rates of local residents averaged 13% compared with a 20% success rate for nonlocals and 22% for nonresidents.

Harvest Chronology. During RY90–RY94, an average of 35 bulls were harvested during 1–6 September (Table 5), representing 40% (range = 27–50%) of the fall harvest. During RY95–RY00, harvest total during this time period remained the same (36 bulls) but represented only 25% (16–33%) of the harvest. Apparently, as hunter numbers increased in Unit 20E, a greater percentage chose to hunt later in the season.

In an attempt to maintain or reduce the fall harvest in Unit 20E, during RY01 the hunting season in most of the unit was split into 2 periods: 24–28 August and 8–17 September. Our intention was to reduce harvest during the 5-day August season to less than the harvest during the previous 1–5 September season. During RY93–RY00, 16–42 ($\bar{x}$ = 31) bulls were harvested during 1–5 September. In RY01–RY03, 7–14 ($\bar{x}$ = 10) bulls were harvested during 24–28 August, an average 68% reduction.

During RY91–RY98, harvest during 16–25 September in northern Unit 20E was 10–20 bulls annually. Harvest increased to 27–29 bulls during 16–25 September in RY99–RY01. The greater harvest could be attributed to more nonlocal Alaska resident hunters. During informal interviews we identified the reason for this increased harvest: The hunting season was open later than anywhere else along the road system. This portion of Unit 20E supports the lowest density of moose (0.3–0.37 moose/mi^2) in the unit and this increase was not sustainable. Beginning in RY02 the hunting season in northern Unit 20E was shortened to end the same date as the remainder of the unit.

<u>Transport Methods</u>. During RY01–RY03 we saw a significant increase in the percent of the moose harvest reported by hunters using 4-wheelers. It increased from a relatively stable average of 28% (range of 22–32%) during RY92–RY00, to an average of 43% (range of 38–49%) during RY01–RY03 (Table 6). In addition, the proportion of the harvest by hunters using highway vehicles declined significantly from an average of 21% during RY92–RY00 to an average of 10% during RY01–RY03. Again, this is an indication of the decline in the moose population and implementation of more restrictive regulations. The number of hunters using the other transportation types and harvest associated with these transportation types remained relatively constant.

In combination with the increasing number of hunters, increasing access by 4-wheelers is a growing management concern. The increasing quality and dependability of the machines allowed hunters to access areas that had previously been refugia for moose. This group of hunters tends to have a greater effect on local populations of moose because they tend to concentrate their efforts in smaller areas along trail systems rather than spreading effort more evenly over the landscape.

Other Mortality

Predation by wolves and grizzly bears was the greatest source of mortality for moose in Unit 20E and maintained the population at a low density (0.42–0.53 moose/mi^2). Using the model presented by McNay and DeLong (1998), I estimated about 33% of the postcalving moose population was killed by wolves and grizzly bears each year and harvest was about 1.6%. The percentage killed by predation increased during RY00–RY03 probably due to the increased wolf population in the central, northern, and eastern portions of the subunit.

HABITAT

Assessment

Availability of browse in Unit 20E is not limiting moose population growth. Past browse studies found that use of preferred browse plants was less than 5% (Boertje et al. 1985). The greatest expanse of excellent habitat is in the southeastern portion of the unit resulting from 2 large wildfires (>1,000,000 acres) during the mid 1960s. This area supports the greatest moose densities in the unit (0.7–1.0 moose/mi^2). Prescribed fires and wildfires burned over 400,000 acres in Unit 20E during 1998–1999. Moose used these areas during winters 2001–2002 and 2002–2003. Habitat quality in these areas is expected to improve during the next

15 years. There are still areas within the northeastern portion of the unit where the habitat has degraded to poor moose habitat due to wildfire suppression activities during the 1970s and 1980s.

Enhancement

The Alaska Interagency Fire Management Plan restored a near-natural wildfire regime to over 60% of Unit 20E. Under the plan, most state and federal land was assigned limited fire protection. This agreement allowed nearly 300,000 acres to burn naturally during 1998 and 1999. Nearly all land selected by or conveyed to Native corporations was assigned modified or full-suppression status. However, Native corporations in Units 20E and in adjacent Unit 12 have recently consented to allow fire on their land, except in areas with marketable timber. More acceptance of fire as a management tool has occurred in local communities because of the well-known increase in moose numbers near Tetlin and Tok as a result of the 1990 Tok wildfire. This change in attitude allowed us to prescribe burn 90,000 acres during 1998 and 1999 in central Unit 20E. Costs were 35 cents/acre for the 52,000-acre East Fork burn, 46 cents/acre for the 7000-acre Mosquito Flats burn, and 38 cents/acre for the 31,000-acre Ketchumstuk burn. Moose densities in these areas are expected to increase within 5–15 years.

CONCLUSIONS AND RECOMMENDATIONS

During RY01–RY03 the moose population in Unit 20E declined and was estimated at 0.41–0.45 moose/mi^2 in fall 2003. Research has shown that predation by wolves and grizzly bears was the primary factor limiting the moose population. Wolf predation on moose is expected to increase during the next few years. Wolf numbers are increasing in most of Unit 20E because of elevated productivity and survival and relatively low harvest. I recommend both wolf and grizzly bear numbers be reduced if the objective is to substantially increase moose numbers. Reducing either grizzly or wolf numbers would allow the moose population to remain stable or possibly increase slowly, depending on the level of reduction. Combined wolf and bear predation took about 33% of the postcalving moose population annually.

In an attempt to reduce effects of predation on the area's moose population, grizzly bear hunting regulations were liberalized in 1981. As a result, bear harvest increased and possibly caused bear numbers to decline and altered the male age structure toward younger bears. Moose calf survival increased during 1982–1989. Modeling indicated that the reduced bear population may have increased adult moose survival but was inadequate to consistently improve calf survival. We do not know how much a grizzly bear population must be reduced before the predation rate on moose calves will decline substantially. However, modeling predicts the moose population in Unit 20E could grow 8–10% annually if grizzly bear predation rates on calves were reduced 25% in combination with 20–25% wolf harvest by trappers.

Human-induced mortality had little impact on the unit's moose population but caused some reduction in local bull populations. Annual harvest rates were historically less than 2% of the fall population estimate but increased above 2% in RY95 and have been about 2.5–3.0% during RY97–RY03. The bull:cow ratio declined in portions of Unit 20E due to moderate harvest rates in more accessible areas.

The number of moose hunters in Unit 20E increased significantly (P = 0.001) since RY91. Most of the additional hunters were from Southcentral Alaska. The preferred transportation type became 4-wheelers.

Regulation changes in RY01 appeared to reduce hunter success and stabilize harvest. Requiring hunters to choose either to hunt moose or caribou appeared to reduce the incidental take of moose by caribou hunters. During RY01–RY02 under this regulation fewer hunters took the opportunity to hunt both moose and caribou compared to RY93–RY95.

Increased hunter participation and harvest during the Unit 20E winter drawing permit hunts caused hunt management changes during RY99–RY01. The intent to allow hunters to hunt moose in areas inaccessible during fall was no longer met. In RY99 the number of DM796 permits was reduced but harvest distribution still did not meet the management intent. Additional reductions in permit numbers and hunt area occurred in RY00 but still was insufficient to meet hunt objectives. In RY01 the hunt was limited to a small portion of the permit area and only 10 permits were offered. This limited harvest to areas not hunted in the fall. To guard against overharvest, the hunt area will be moved periodically, based on harvest success and moose population trends. The number of DM794 permits was reduced in RY01 because harvest amount and distribution became a concern.

More community acceptance of fire has occurred since the late 1990s in Unit 20E. During 1998 and 1999, 3 prescribed burns covering about 90,000 acres were completed in areas that traditionally supported high moose densities. In addition, over 300,000 acres were allowed to burn by wildfire in 1999. Under the current Division of Forestry and Bureau of Land Management leadership, the interagency fire management plan has a great chance of benefiting wildlife and people.

The Unit 20E moose objective to maintain a posthunting ratio of at least 40 bulls:100 cows in all survey areas was met during this report period. Population trends were monitored and necessary changes to hunt structure were implemented. Habitat enhancement programs were designed and will be presented to the Interagency Fire Team for possible implementation. Hunting seasons and bag limits were established that allowed maximum hunting opportunity and met subsistence needs. Moose-watching opportunities were shared with visitors and local residents and several oral presentations were given annually to local schools and tourist groups. The intensive management objectives of a population of 8000–10,000 moose and annual harvest of 500–1000 moose in the Fortymile and Ladue River drainages were not met. Before the intensive management objectives can be met, wolf and grizzly bear predation on moose must be reduced.

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TABLE 1 Unit 20E aerial moose composition counts, fall 1988–2003

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/hr
1988[a]	78	13	22	117	11	931	1048[a]	30
1989[b]	56	11	43	43	21	158	201	22
1990[b]	64	9	30	105	16	566	671	30
1991[b]	65	14	28	120	14	714	834	42
1992[c]	59	11	17	19	12	141	160	
1992[d]	75	15	28	32	14	200	232	
1993[b]	63	10	28	126	15	727	854	40
1994[c]	74	16	23	65	12	488	553	48
1995[e]	70	16	15	29	8	329	358	
1996[f]	61	10	19	44	10	377	421	
1996[b]	56	6	27	47	15	270	317	45
1997[b]	61	14	26	70	14	438	508	49
1998[g]	64 (53)[h]	18 (10)[h]	19 (23)[h]		13	242	278	
1998[i]	59 (51)[h]	14	23 (26)[h]		15	383	450	
1999[g]	80 (74)[h]	16 (17)[h]	22 (14)[h]	27	7	338	365	
1999[b]	54	13	17	38	10	340	378	60
2000[g]	60	11	14	44	8	517	561	
2000[i]	49	11	21 36	37	11	310	347	
2001[g]	76	9	14 67	38	7	493	531	
2001[i]	51	6	10	39	6	585	624	
2002[g]	59	10	25	38	10	326	364	
2002[i]	71	8	20	37	9	359	396	
2003[g]	64	9	15	27	8	328	355	
2003[i]	53	5	11	20	7	277	297	

[a] Mosquito Flats Study Area sampled using stratified random sampling (Gasaway et al. 1986).
[b] Various trend count areas were sampled using contour sampling.
[c] Mosquito Flats Study Area sampled using superstratification sampling.
[d] Ladue River Study Area sampled using superstratification sampling (Mark McNay, ADF&G, personal communication).
[e] Mosquito Flats Study Area sampled using prestratification sampling (Jay Ver Hoef and Rod Boertje, ADF&G, personal communication).
[f] Ladue River Study Area sampled using prestratification sampling (Jay Ver Hoef and Rod Boertje, ADF&G, personal communication).
[g] Tok West sampled using geostatistical population estimator sampling (Ver Hoef 2001).
[h] Number in parenthesis is the observed ratio.
[i] Tok Central sampled using geostatistical population estimator sampling (Ver Hoef 2001).

TABLE 2 Unit 20E moose hunting seasons and bag limits, regulatory years 2001–2002 and 2002–2003

Regulatory year	Area	Season		Bag limit
2001–2002 and 2002-2003	Unit 20E Fortymile.	Resident:	Registration 24–28 Aug Registration 8–17 Sep Drawing 1–30 Nov	1 bull by permit RM865, or 1 bull by permit RM865, or 1 bull by permit DM794–DM796 in the Ladue River Controlled Use Area.
		Nonresident:	8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side by permit RM865.
2001–2002	Unit 20E draining into the Yukon River upstream from and including the Boundary Creek drainages and the Taylor Highway from Mile 145 to Eagle.	Resident:	Registration 24–28 Aug Registration 5–25 Sep	1 bull by permit RM865, or 1 bull by permit RM865.
		Nonresident:	Registration 5–25 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side by permit RM865.
	Unit 20E draining into the Middle Fork Fortymile River upstream from the drainage of the North Fork Fortymile River.	Resident:	24–28 Aug 8–17 Sep	1 bull, or 1 bull.
		Nonresident:	8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.
	Remainder of Unit 20E.	Resident:	Registration 24–28 Aug Registration 8–17 Sep	1 bull by permit RM865, or 1 bull by permit RM865.
		Nonresident:	Registration 8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side by permit RM865.
2002–2003	Unit 20E draining into the Middle Fork Fortymile River upstream from the drainage of the North Fork Fortymile River.	Resident:	24–28 Aug 8–17 Sep	1 bull, or 1 bull.
		Nonresident:	8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side
	Remainder of Unit 20E.	Resident:	Registration 24–28 Aug Registration 8–17 Sep	1 bull by permit RM865, or 1 bull by permit RM865, or 1 bull by permit DM794–DM796 in the Ladue River Controlled Use Area.
		Nonresident:	Registration 8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side by permit RM865.

[a] 50-inch antlers defined as having a spread of at least 50 inches or at least 4 brow tines on at least 1 side.

TABLE 3 Unit 20E moose harvest and accidental death, regulatory years 1990–1991 through 2003–2004

Regulatory	Harvest by hunters							Drawing				
	Reported				Estimated			permit hunts		Accidental death		
year	M (%)	F (%)	Unk	Total	Unreported	Illegal	Total	DM794	DM796	Road	Total	Total
1990–1991	46 (100)	0 (0)	0	46	0–5	5–15	9–22			0	0	54–61
1991–1992	90 (99)	0 (0)	1	91	0–5	5–15	9–22			0	0	100–113
1992–1993	68 (99)	0 (0)	1	69	0–5	5–15	9–22			1	1	79–92
1993–1994	128 (99)	0 (0)	1	129	0–5	5–15	5–20			0	0	134–149
1994–1995	93 (99)	0 (0)	1	94	0–5	5–15	5–20			0	0	99–114
1995–1996	139 (99)	0 (0)	1	140	0–5	5–10	5–15	0	4	0	0	149–159
1996–1997	116 (99)	0 (0)	1	117	0–5	5–10	5–15	2	4	0	0	128–138
1997–1998	144 (99)	1 (1)	0	145	0–5	5–10	5–15	4	14	0	0	168–178
1998–1999	145 (96)	0 (0)	5	150	0–5	5–10	5–15	1	10	0	0	166–176
1999–2000	127 (97)	0 (0)	4	131	0–5	5–10	5–15	3	9	0	0	148–158
2000–2001	135 (100)	0 (0)	0	135	0–5	5–10	5–15	2	6	0	0	148–158
2001–2002	137 (99)	0 (0)	1	138	0–5	5–10	5–15	5	3	0	0	151–161
2002–2003	169 (99)	0 (0)	1	169	0–5	5–10	5–15	1	3	0	0	175–185
2003–2004	129 (100)	0 (0)	0	129	0–5	5–10	5–15	0	0	0	0	134–144

TABLE 4 Unit 20E moose hunter residency and success during the general season, regulatory years 1990–1991 through 2003–2004

	Successful					Unsuccessful					
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
1990–1991	16	28		2	46 (16)	65	176	2	6	249 (84)	295
1991–1992	34	54	3	0	91 (21)	112	219	9	3	343 (79)	434
1992–1993	15	45	4	5	69 (24)	52	135	9	24	220 (76)	289
1993–1994	38	77	14	0	129 (30)	93	188	17	2	300 (70)	429
1994–1995	27	58	9	0	94 (19)	97	272	17	7	393 (81)	487
1995–1996	36	93	9	2	140 (31)	72	208	34	4	318 (69)	458
1996–1997	40	70	7	0	117 (29)	97	165	24	0	286 (71)	403
1997–1998	42	85	18	0	145 (30)	112	189	31	0	332 (70)	477
1998–1999	47	91	12	0	150 (32)	76	205	39	2	322 (68)	472
1999–2000	36	77	17	1	131 (23)	98	299	30	4	431 (77)	562
2000–2001	36	84	15	0	135 (26)	98	255	33	1	387 (74)	522
2001–2002	33	88	16	1	138 (19)	222	323	58	4	607 (81)	745
2002–2003	29	119	20	1	169 (18)	200	449	92	3	741 (82)	944
2003–2004	21	81	26	1	129 (16)	143	448	74	4	669 (84)	798

[a] Residents of Unit 12 and Units 20E and eastern Unit 20D are considered local residents. Major population centers are Eagle, Chicken, Boundary, Northway, Tetlin, Tok, Tanacross, Slana, and Dot Lake.

TABLE 5 Unit 20E moose harvest chronology by month/day during the general hunt, regulatory years 1990–1991 through 2003–2004

Regulatory	Harvest chronology by month/day						
year	8/15–8/28	9/1–9/6	9/7–9/13	9/14–9/20	9/21–9/27	9/28–10/5	Total[a]
1990–1991		20	9	7	6	0	46
1991–1992			26	22	14	0	91
1992–1993		29	28	5	5	0	69
1993–1994			40	24	8	0	129
1994–1995			21	16	8	0	94
1995–1996	025	46	58	27	3	0	140
1996–1997	1	33	49	23	6	0	118
1997–1998	152	48	50	36	6	0	144
1998–1999	047	35	78	23	6	2	150
1999–2000	0	30	57	28	13	0	131
2000–2001	1	22	61	41	8	0	135
2001–2002	14	0	71	43	7	0	138
2002–2002	7	0	103	51	2	0	169
2003–2004	8	3	76	32	0	1	129

[a] Difference between total and summation of harvests by week represents moose taken on unknown dates.

TABLE 6 Unit 20E moose harvest and percent by transport method during the general season, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest and percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1990–1991	7 (15)	3 (7)	10 (22)	6 (13)	0 (0)	8 (17)	7 (15)	5 (11)	46
1991–1992	11 (12)	2 (2)	18 (20)	10 (11)	0 (0)	15 (16)	35 (38)	0 (0)	91
1992–1993	17 (25)	1 (1)	4 (6)	21 (30)	1 (1)	7 (10)	15 (22)	3 (4)	69
1993–1994	31 (24)	0 (0)	15 (12)	34 (26)	0 (0)	15 (12)	32 (25)	2 (2)	129
1994–1995	24 (26)	0 (0)	14 (15)	26 (28)	0 (0)	13 (14)	15 (16)	2 (2)	94
1995–1996	29 (21)	0 (0)	19 (14)	39 (28)	1 (1)	16 (11)	34 (24)	2 (1)	140
1996–1997	26 (22)	3 (3)	18 (15)	26 (22)	0 (0)	13 (11)	30 (26)	1 (1)	117
1997–1998	29 (20)	3 (2)	13 (9)	46 (32)	0 (0)	15 (10)	36 (25)	3 (2)	145
1998–1999	32 (21)	0 (0)	23 (15)	40 (27)	1 (1)	12 (8)	41 (27)	1 (1)	150
1999–2000	31 (24)	1 (1)	26 (20)	37 (28)	0 (0)	19 (15)	15 (11)	2 (2)	131
2000–2001	29 (21)	2 (1)	28 (21)	40 (30)	0 (0)	14 (10)	20 (15)	2 (1)	135
2001–2002	23 (17)	0 (0)	14 (10)	68 (49)	0 (0)	15 (11)	18 (13)	0 (0)	138
2002–2003	44 (26)	1 (1)	17 (10)	65 (38)	4 (2)	20 (12)	16 (9)	3 (2)	170
2003–2004	37 (29)	2 (2)	7 (5)	53 (41)	0 (0)	15 (12)	12 (9)	3 (2)	129

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21B (4871 mi^2)

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

BACKGROUND

In this portion of Interior Alaska, even the earliest accounts of the area mentioned the presence of moose. Moose had apparently become abundant by the time gold seekers converged on the area in the early 1900s. The village of Ruby had a population of 10,000 people during the 1910 gold rush, and many moose were hunted to supply the townsfolk and miners with meat. The area supported a large moose population from the early 1900s to late 1970s. Several severe winters in the late 1960s and early 1970s initiated widespread declines in moose populations throughout the Interior, including Unit 21B.

Historically, wildfires were a major force affecting the productivity and diversity of moose habitat in this area. Large fires burned a major portion of the area before the 1950s; effective fire suppression substantially altered this fire regime. The 1982 Tanana–Minchumina Fire Plan and more recently the 1998 Alaska Interagency Wildland Fire Management Plan allowed some fires to burn with minimal interference.

The Nowitna River to the east of Ruby is a popular hunting area for residents of Ruby, Tanana, and, to a lesser extent, Galena. It is also a popular hunting area for Fairbanks residents who use boats and aircraft for access. Because of its long history of use by both local and nonlocal hunters, this area was the focus of much of the management effort in Unit 21B over the years.

Aerial moose surveys during 1977–1979 indicated moose numbers were declining in the Nowitna. Wolves were abundant compared to the number of moose available, and predation by wolves was believed responsible for the decline in moose numbers.

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

A moose population survey in 1980, using methods described by Gasaway et al. (1986), estimated 2386 ± 429 moose in a 2774-mi^2 portion of the unit in the lower Nowitna drainage. A 1986 population estimation survey conducted in a 1596-mi^2 portion of the 1980 survey area suggested a reduction in moose numbers in a comparable area (1389 ± 375 in 1980; 878 ± 209 in 1986), but the difference was not significant at the 90% confidence level. A 1990 population estimate conducted in essentially the same area suggested that the population had increased (1560-mi^2; 1214 moose ± 219). However, once again the estimate was not significant statistically. Results of a 1995 population estimation survey in a 1338-mi^2 (1031 moose ± 206) portion of the unit were not significantly different (90% confidence) from those of the 1990 survey. More recently in 2001 a population estimation survey, the first without a sightability correction factor (SCF), indicated the population was not significantly different from the 1995 estimate. However, the 2001 estimate was conducted using different survey techniques and a substantially different statistical analysis.

In addition to the lower portion of the Nowitna drainage, Unit 21B includes the area east of the Ruby–Poorman Road, the banks of the Yukon River from Ruby to Tanana, the Blind River, and the Boney River. These areas produce 36–46% of the reported Unit 21B harvest.

MANAGEMENT DIRECTION

MANAGEMENT GOAL AND OBJECTIVES

Management was directed according to the following goal and objectives during the reporting period.

GOAL 1: Manage Unit 21B moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and that minimizes disruption of local residents' lifestyles.

Objective 1: Provide for harvest not to exceed 150 moose or 5% of the annual moose population estimate.

Objective 2: In combination with Unit 21C, implement at least 2 habitat enhancement activities every 5 years.

> Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available, and notify relevant wildlife agencies if the population declines below 3000–4000 moose.

METHODS

Established trend count areas were surveyed cooperatively with U.S. Fish and Wildlife Service (FWS) to assess population status and trend. Piper PA-18 (or equivalent) aircraft were used, and contiguous survey units of approximately 12 mi^2 each were searched at a rate of at least 4 min/mi^2 to ensure reasonably high sightability, minimal bias, and data comparability between years. A moose population estimation survey was conducted in November 1995 using a regression survey method developed by ADF&G biometricians that used a probability sample and regression estimator (Särndal et al. 1992).

Moose population estimation surveys conducted over 4754 mi^2 of Unit 21B in 2001 used Geostatistical Spatial Population Estimator (GSPE) techniques without an SCF, although preliminary studies indicate an SCF will eventually need to be applied (Ver Hoef 2001). Survey techniques were modified from those outlined by Gasaway et al. (1986). An important change from the Gasaway methodology was that, instead of geographical land characteristics, a grid system based on latitude and longitude coordinates was used to locate sample units (~5.7 mi^2 in size), with search intensity of ~6 min/mi^2.

We monitored harvest by checking moose harvest reports and operating a moose hunter check station on the Nowitna River.

Survey and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Using the results of the 1995 population estimation survey and one conducted in 1990, Woolington (1998) estimated there were 2324–3530 moose in the unit. A density of 0.20 moose/mi^2 was applied to the portion of the Little Mud River drainage not included in the population estimation survey, and a density of 0.64 moose/mi^2 was applied to the remainder of the unit that was not surveyed. Higher moose densities exist in favorable habitat along the Nowitna floodplain and immediately adjacent to the Yukon River. Densities are low to moderate away from the river.

Results from the population surveys conducted in November 2001 indicated a total of 3161 moose without an SCF (1828–4493; 90% CI) over 4754 mi^2 of Unit 21B (Table 1). This total was within the range reported for RY97–RY98. Thus, the total moose estimate for this reporting period is unchanged from the previous report, but a higher proportion of the population was calves and yearlings, which have elevated mortality rates compared with adults.

Survey data collected in early winter from established trend count areas (TCA) along the lower Nowitna suggested stable or slightly increasing moose densities during 1991–1998 (Tables 2 and 3). However, surveys conducted from 1999 to 2001 indicated the population was perhaps decreasing when looking at the point estimates for the western portion of Unit 21B. For example, recruitment indicators such as the number of calves per 100 cows began to decline; however, because of inadequate snow coverage, the 1999 results were not reliable.

Population Composition

Composition data were available from aerial surveys we conducted with FWS staff in established TCAs on the Nowitna National Wildlife Refuge (Tables 2–4). Fall 2003 survey results indicated bull:cow ratios along the river decreased from RY01 while calf:cow ratios increased. Yearling bull:100 cow ratios were relatively unchanged empirically, but the decline in the denominator value of the ratio (cows) suggests overwinter survival was still poor. The occurrence of twin calves among moose observed in these early winter surveys has been very poor since the trend areas were established in 1992, particularly at the Nowitna Mouth TCA. The cause of the spike in 2003 is unknown, but was probably a random event.

The 2001 population estimation data indicated the sex and age composition over the entire area was not as depressed as the area along the river. For the entire 2001 survey area the GSPE analysis resulted in the following: the calf:cow ratio was 18.3:100 (7.9–28.8:100; 90% CI), the yearling bull:cow ratio was 9.0:100 (2.5–15.6:100; 90% CI), and the adult bull:cow ratio was 38.2:100 (12.5–63.8:100; 90% CI). However, the Nowitna River Corridor bull:cow ratios continued to be low, and an increasing proportion of the bulls in the RY03 TCA counts were yearling bulls (50% in Nowitna Mouth TCA; 67% in Nowitna–Sulatna Confluence TCA). Although calf and yearling ratios did indicate an improvement in RY03, the observed levels are not high enough to indicate significant population growth.

Distribution and Movements

Based on movements of radiocollared cow-calf pairs, most cows spend their summer months around open grass and shrub meadows on the floodplain, but away from the river (Woolington 1998). In October they move to the riparian areas, where they remain until early May. Relatively few cow moose wintered in the hills to the north and south of the Nowitna River.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21B, that portion within the Nowitna River drainage. RESIDENT HUNTERS: 1 bull. NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.	5 Sep–25 Sep	5 Sep–20 Sep
Remainder of Unit 21B		

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
RESIDENT HUNTERS: 1 bull. NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.	5 Sep–25 Sep	5 Sep–25 Sep

<u>Alaska Board of Game Actions and Emergency Orders</u>. In 2002 the board adopted a regulation for all of Unit 21B requiring hunters to leave the meat on the bone of the 4 quarters and the ribs until the meat is transported from the field. At the 2004 board meeting, regulations were adopted to eliminate the general harvest permit and implement a resident registration hunt that requires the destruction of trophy value. Additionally, a drawing permit was implemented for resident and nonresident hunters for the entire unit. Through the discretionary authority of the department, 3 separate drawing permit areas were designated which included a 10-mile corridor on the Nowitna River as one permit area, and the lands east and west of the corridor as the other 2 permit areas.

<u>Harvest</u>. Reported harvest for the unit averaged 60 (range = 52–69) moose annually during RY97–RY03 (Table 5). In addition, the Unit 21B unreported harvest was estimated at 5 moose per year for Ruby residents, and 15 moose per year for Tanana residents. The Nowitna drainage produced 59–93% ($\bar{x}$ = 77%) of the unit's reported harvest during RY97–RY01 (Tables 6 and 7).

To estimate the unreported harvest of 20 moose, we examined the Division of Subsistence's estimated RY99 harvest by residents of Unit 21B (47 moose, Anderson et al. 2001). The estimated unreported harvest (Table 5) incorporated this moose harvest data for Ruby and Tanana (approximately 36 moose annually; 3 year $\bar{x}$), less the reported harvest by those same villages (approximately 15 moose annually). Because subsistence harvest remained relatively constant among years, we applied the difference of approximately 20 unreported moose to the reported harvest during RY01–RY03.

<u>Checkstation Results</u>. Since RY88 a moose hunter checkstation has been located at the mouth of the Nowitna River. During RY96–RY97 the checkstation was mandatory because it was the only place Nowitna River registration hunt permits were available. Except for RY97, hunter numbers and success rate of hunters passing through the Nowitna checkstation was relatively constant; however, the 3-year mean number of hunters had increased from $\bar{x}$ = 132 during RY94–RY96 up to $\bar{x}$ = 167 during RY01–RY03 (Table 6). It is unclear why there was a brief decline in the number of hunters in RY97.

Hunter Residency and Success. Based on harvest reports, the majority of Unit 21B hunters were Alaska residents who resided outside the unit, particularly Fairbanks (Table 7). Average success rate for all hunters during RY99–RY03 was 40.8% (range = 36–43%), slightly less than the average during RY97–RY01 (43.6%).

Harvest Chronology. During RY99–RY00 hunter reports indicated that most moose were shot in the last half of the September season (Table 8). This was probably due to relatively little movement of bulls in the earlier part of the season compared to the later part of the season.

Harvest was not reported for the winter months, but it was probably close to 20% of the annual kill. Winter harvest likely occurred during October–March (Anderson et al. 2001).

Transportation Methods. Not surprisingly, the majority of hunters used boats to hunt moose (Table 9). It is undetermined why a relatively large proportion of transportation methods were unknown in RY98 (33%), but I do not believe any significant changes in the mode of transportation occurred. Snowmachines were used during the winter, but winter reporting rates were low because there was no announced season, and therefore snowmachine use was underrepresented.

Other Mortality

Predation mortality on moose calves is significant in the unit (Osborne et al. 1991). During calf mortality studies of radiocollared newborn moose, black bears were the main predator, killing 38% of all calves. Wolves killed 11% of all calves, unidentified predators killed 8%, grizzly bears killed 2%, and 5% died from other natural causes. A single pack of 25 wolves was observed during the fall 1999 moose trend count survey at the mouth of the Nowitna. A reconnaissance survey flown in spring 2001 indicated wolf numbers were stable (ADF&G files, Galena). A sample unit probability estimator survey (SUPE; Becker et. al. 1998) flown in spring 2004 by the FWS indicated the wolf population estimate was similar to the previous estimate (B. Scotton, FWS, personal communication).

HABITAT

Assessment

No new data were collected on habitat conditions during this reporting period. Observations indicated browse availability was not limiting the moose population. Regeneration from a fire that burned in 1986 east of the Nowitna River in the Little Mud River drainage provided excellent moose browse. During November 1995 surveys, this area was classified as high moose density. Several adjacent sample units were classed as medium. There is a dense stand of black spruce between the 1986 burn and the Nowitna River that should be considered for a prescription burn.

CONCLUSIONS AND RECOMMENDATIONS

Density data from 1991–2001 fall surveys of permanent trend count areas was greatly variable from year to year and did not provide a clear picture of what the population trend may be. However, classification data showed the number of calves declined in 2000 and 2001. Although yearling bull:100 cow ratios appeared to be stable, the low number of cows counted heavily influenced data over the last 4 years. Bull:cow ratios were low for the last several years in both TCAs along the heavily hunted portion of the Nowitna River. Away from the river the bull:cow ratio was slightly higher. But the high proportion of yearlings that made up the bull component of the count was a biological concern. The low bull:cow ratios were instrumental in the board action to implement a drawing permit hunt on the Nowitna corridor, with the understanding that the department would issue permits to achieve at least a 50% reduction in the harvest of bulls within the corridor.

Population estimation surveys conducted in 2001 (without an SCF) indicated no clear change in population trend for all of Unit 21B since 1990. However, in the western half of the unit, point estimates for the moose numbers appeared to have declined in 1995 and again in 2001. The comparison between those years is confounded by differences in the size of the area, the statistical analysis used, and survey techniques. Based on the RY01 population survey, the current estimate for the entire unit is 3160 moose (1828–4494; 90% CI; without an SCF), which is within the range of the management objective. Preliminary data collected in other areas of the Interior suggests a sightability correction factor of 1.12 may be appropriate. The management goal was met during RY01–RY02. The moose population continued to support the consumptive demands as well as the nonconsumptive uses identified.

We also met the harvest objective. Total estimated harvest ranged from 78 to 88 moose during the reporting period, less than 3% of the total Unit 21B estimated population for RY01–RY03. For the next reporting period, that objective will be changed to read, "*Objective 1:* Provide for harvest not to exceed 150 moose or 5% of the annual moose population estimate, whichever is less."

The objective to implement habitat enhancement projects was limited to review of fire management plans and fire suppression policies. I recommend a prescribed burn in the upland area east of the Nowitna floodplain and north of the Little Mud River to Bering Creek. This area is adjacent to several old burns that are reaching peak browse production. The area west of the Nowitna in the upper Big Creek drainage is also dominated by late seral spruce and birch and should be allowed to burn to enhance potential moose habitat.

Predators remained abundant and continued to be the primary factor limiting moose abundance in the area. Harvest of wolves within the unit was low, and few black bears were harvested. The moose calf mortality study conducted in the late 1980s indicated black bears were the major predator of moose calves (Osborne et al. 1991). Efforts should be made to increase the harvest of predators if more moose are desired.

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TABLE 1 Unit 21B Lower Nowitna River moose population estimates, regulatory years 1980–1981 through 2001–2002

Regulatory year/Area	Area mi^2	Population	90% CI[a]	Bulls:100 Cows	Calves:100 Cows	Yrlg Bulls:100 Cows	Density
1980–1981/West[b]	1556	1389	27	41[c]	34[c]	13[c]	0.89
1986–1987/West[b]	1596	878	24	34[c]	40[c]	[c]	0.55
1990–1991/West[b]	1560	1214	18	39.9	39.1	9.9	0.78
1995–1996/West[d]	1338	1031	20	33.8	30.1	14.5	0.77
2001–2002/West[e]	1531	759	19.6	25.8	19.4	7.2	0.50
2001–2002/Total[e]	4754	3161	42.2	38.2	18.3	9.0	0.67

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[a] Confidence interval (% ±).
[b] Moosepop analysis
[c] Ratios calculated from observed values
[d] Moosepop analysis of Regression Survey
[e] GSPE analysis w/o SCF

TABLE 2 Unit 21B Nowitna/Sulatna confluence (75.5 mi^2) aerial moose composition counts, regulatory years 1991–1992 through 2003–2004[a]

Regulatory year	Bulls:100 cows	Yrlg bulls: 100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1991–1992	21	9	29	8	20	200	2.7
1992–1993	18	1	48	7	29	171	2.3
1993–1994	22	7	20	0	14	195	2.6
1994–1995	16	6	20	4	15	191	2.5
1995–1996	15	4	33	6	22	148	2.0
1996–1997	18	8	23	6	13	216	2.9
1998–1999	19	2	28	6	19	180	2.5
1999–2000[b]	6	1	23	12	18	106	1.5
2000–2001	30	6	7	0	5	185	2.5
2001–2002	19	9	13	0	10	137	1.8
2003–2004	17	11	27	7	19	153	2.0

[a] U.S. Fish and Wildlife Service.
[b] Poor snow conditions during survey

TABLE 3 Unit 21B Nowitna mouth (59 mi^2) aerial moose composition counts, regulatory years 1992–1993 through 2003–2004[a]

Regulatory year	Bulls:100 cows	Yrlg bulls:100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1992–1993	21	0	31	0	20	138	2.9
1993–1994	32	6	32	6	20	189	3.2
1994–1995	19	8	23	0	22	148	2.5
1995–1996	16	5	26	0	18	116	2.0
1996–1997	21	7	22	0	16	185	3.1
1998–1999	20	3	12	0	9	182	3.0
1999–2000[b]	11	8	21	0	16	87	1.4
2000–2001	22	4	8	0	7	170	2.9
2001–2002	13	6	28	2	20	154	2.6
2003–2004	13	6	45	18	28	172	2.9

[a] U.S. Fish and Wildlife Service.

[b] Poor snow conditions during survey

TABLE 4 Unit 21B Deep Creek (52.5 mi^2) aerial moose composition counts, regulatory years 1982–1983 through 2001–2002[a]

Regulatory year	Bulls:100 cows	Yrlg bulls:100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1982–1983	90	35	42	0	18	72	1.4
1987–1988	43	7	55	14	27	87	1.7
1993–1994	45	15	20	0	12	66	1.3
1995–1996	48	8	30	8	17	89	1.7
1996–1997	29	5	24	0	16	89	1.7
2001–2002	31	10	18	0	12	73	1.4

[a] U.S. Fish and Wildlife Service.

TABLE 5 Unit 21B moose harvest, regulatory years 1990–1991 through 2003–2004

Regulatory	Harvest by hunters					
year	Bull	Cow	Unk	Total	Unreported	Total
1990–1991	81	0	0	81	15	96
1991–1992	65	0	0	65	15	80
1992–1993	46	0	0	46	15	61
1993–1994	71	1	0	72	15	87
1994–1995	63	0	0	63	15	78
1995–1996	66	0	0	66	15	81
1996–1997	63	0	0	63	15	78
1997–1998	58	1	0	59	15	74
1998–1999	53	2	2	57	15	72
1999–2000	69	0	0	69	20	89
2000–2001	49	1	2	52	20	72
2001–2002	56	0	2	58	20	78
2002–2003	68	0	0	68	20	88
2003–2004[a]	60	0	0	60	20	80

[a] Preliminary results.

TABLE 6 Unit 21B Nowitna River checkstation hunters (R), harvest (H) and success (S%), regulatory years 1990–1991 through 2003–2004[a]

Regulatory	Local villages[b]			Fairbanks			Other residents			Nonresident			Total		
year	R	H	S%	R	H	S%	R	H	S%	R	H	S%	R	H	S%
1990–1991	23	7	30	67	32	48	26	12	46	14	4	29	130	55	42
1991–1992	21	9	43	72	24	33	44	11	25	17	2	12	154	46	30
1992–1993	24	3	12	38	19	50	53	10	19	10	2	20	125	34	27
1993–1994	19	7	37	58	26	45	35	19	54	20	1	5	133	53	40
1994–1995	16	6	37	63	27	43	41	16	39	13	5	38	134	54	40
1995–1996	16	3	19	63	24	38	44	9	20	9	2	22	132	38	29
1996–1997	19	2	11	54	21	39	36	12	33	20	2	10	129	37	29
1997–1998	16	1	6	57	29	51	21	8	38	7	3	43	101	41	41
1998–1999	17	4	24	57	26	46	27	17	63	22	3	14	123	50	41
1999–2000	24	3	13	57	21	37	60	17	28	14	4	29	155	45	29
2000–2001	11	2	18	59	21	36	56	18	32	28	6	21	154	47	31
2001–2002	27	0	0		21	34	48	8	17		5	22	160	34	21
2002–2003	18	3	17	62 56	25	45	45	20	44	23 15	3	20	134	51	38
2003–2004	22	4	18	80	29	36	80	19	24	26	4	15	208	56	27

[a] U.S. Fish and Wildlife Service.
[b] Tanana, Ruby, and Galena.

TABLE 7 Unit 21B moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

	Successful					Unsuccessful					
Regulatory year	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	Local resident[a]	Nonlocal Resident	Nonresident	Unk	Total	Total hunters
1990–1991	22	48	8	3	81	10	41	1	1	53	134
1991–1992	21	34	8	2	65	21	56	8	1	86	151
1992–1993	12	31	2	1	46	24	55	10	1	90	136
1993–1994	23	45	3	1	72	7	47	11	0	65	137
1994–1995	12	44	5	2	63	7	44	2	0	53	116
1995–1996	15	43	8	0	66	11	60	6	0	77	143
1996–1997	16	44	3	0	63	38	68	17	0	123	186
1997–1998	9	46	4	0	59	27	73	8	0	108	167
1998–1999	7	46	3	1	57	10	24	4	0	38	95
1999–2000	13	49	6	1	69	10	66	11	3	90	159
2000–2001	9	30	12	1	52	3	48	17	0	68	120
2001–2002	14	33	10	1	58	19	57	16	0	92	150
2002–2003	8	52	8	0	68	10	67	12	0	89	157
2003–2004[b]	11	38	7	4	60	14	75	12	5	106	166

[a] Tanana, Ruby, and Galena.
[b] Preliminary results.

TABLE 8 Unit 21B moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory year	Harvest chronology percent by month/day 9/1–9/14	9/15–9/25	*n*
1996–1997	42	58	59
1997–1998	31	69	55
1998–1999	39	61	49
1999–2000	37	63	68
2000–2001	37	63	49
2001–2002	25	75	55
2002–2003	26	74	66
2003–2004[a]	32	68	60

[a] Preliminary results.

TABLE 9 Unit 21B moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
1990–1991	11	1	78	0	0	2	6	1	81
1991–1992	9	1	75	0	0	0	10	4	65
1992–1993	10	0	76	1	0	0	8	4	46
1993–1994	9	0	82	3	1	0	3	1	72
1994–1995	21	0	69	2	0	0	6	3	63
1995–1996	12	0	79	3	0	0	4	1	66
1996–1997	4	0	92	2	0	0	0	2	63
1997–1998	5	0	88	0	0	0	5	5	59
1998–1999	4	0	60	0	0	0	4	33	57
1999–2000	7	1	78	0	0	1	9	3	69
2000–2001	31	0	67	0	0	0	0	0	52
2001–2002	14	0	67	0	2	0	14	3	58
2002–2003	16	0	81	0	0	0	1	1	68
2003–2004[a]	15	0	77	0	2	0	7	0	60

[a] Preliminary results.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21C (3671 mi^2)

GEOGRAPHIC DESCRIPTION: Dulbi River above Cottonwood Creek and Melozitna River above Grayling Creek

BACKGROUND

Moose have been present in Unit 21C throughout the recent history of Interior Alaska (S. Huntington, personal communication). Moose densities are low presumably due largely to predation by bears and wolves, (Gasaway et al. 1992), and population trends are unknown. Access into the unit is limited and is mostly by aircraft. Thus, hunter numbers and harvest have been low and probably do not adversely impact the moose population. Because of low harvest, there has been little need to extensively monitor the moose population in this area.

Terrain in the unit is hilly and mountainous, with peaks as high as 5000 feet. Corridors along 2 large rivers, the Melozitna and the Dulbi, represent the main summer habitat. Numerous fires have resulted in large expanses of potentially good winter habitat, particularly north of the Melozitna River.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.

- Provide a sustained opportunity to participate in hunting moose.

MANAGEMENT OBJECTIVE

- Maintain a harvest of bulls that is ≤6% of the estimated population.

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

METHODS

POPULATION STATUS AND TREND

We conducted a moose stratification survey on 18 and 19 April 2000 using the Geostatistical Population Estimator (GSPE), a modification of the "Gasaway" technique (Gasaway et al. 1986) using spatial statistics (Ver Hoef 2001). The stratification provided the basis for a rough population estimate of the unit and will be used to conduct population estimation surveys in the future. We conducted the stratification survey in a Cessna 206 flown at 95–120 mph at altitudes of 500–1000 ft above ground, with 2 observers in the back seat and 1 observer-recorder in the front seat. Prior to the flight, we divided Unit 21C into a grid of 658 sample units (3671 mi^2) that were approximately 5.5 mi^2. We flew on the north-south boundary between 2 sample units, and each sample unit was classified as low or high moose density, based on number of moose observed, number of tracks observed, and habitat. If moose were spotted in the sample unit during the flight, it was designated a high moose density unit. Alternatively, if no moose were observed, it was typically designated a low moose density unless it was judged to be good habitat and >5 sets of tracks were observed. We surveyed 438 sample units (1971 mi^2). The area not surveyed was primarily high mountainous terrain in the Kokrine Hills. It will be stratified based on known habitat type and type of habitat estimated from a topographic map. Sex and age of moose were not recorded. No other surveys were completed in Unit 21C.

HARVEST

We monitored harvest and hunting pressure using mandatory harvest reports submitted by hunters. Reminder letters were sent to increase response rates of harvest reports. We summarized total harvest, antler size of harvested moose, hunter residency and success rate, the chronology of harvest, and transportation used to hunt. Each of these parameters were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

No surveys were completed in Unit 21C during this reporting period. However, elsewhere where moose live with lightly harvested bears and wolves, low-density moose populations have remained at low levels since density estimates were first flown in the late 1970s (Gasaway et al. 1992, ADF&G files).

Survey conditions for the April 2000 stratification were only fair because hilly and mountainous terrain and bright light adversely affected sightability of moose. However, conditions were not poor because the bright light was an advantage for locating fresh tracks, which was a stratification criterion. Because moose distribution may be dependent on seasonal influences, this stratification will apply best to a spring survey.

During the 2000 survey, 39 sample units were identified as high density and 399 as low density from a total of 438 sample units. Moose were concentrated on the north side of the Melozitna River on the hills that divide the drainages of the Melozitna and Dulbi Rivers. Additional moose and tracks were observed on the western end of the unit within the Dulbi River drainage as we approached the Koyukuk River. However, only 31 moose were observed during the survey. This was lower than expected for the area and was likely a result of reduced sightability in spring (Gasaway et al. 1986).

Estimated moose density was 0.35–0.45/mi^2 (1284–1651 moose) using the results of the April 2000 survey and by comparing similar habitat to known densities elsewhere in the state where bears and wolves are lightly harvested (Gasaway et al. 1992). This density is lower than previously estimated (0.5–1.0 moose/mi^2; Osborne 1996).

Population Composition

Population composition data in Units 21C was limited to the percentage of large bulls (antlers wider than 50 inches) in the harvest. If harvest rates of bulls were high, the percentage of large bulls in the harvest would decline within a few years. Instead, the percentage of large bulls in the reported harvest ranged from 61 to 84% during the past 7 years (RY97–RY03). These data suggest there was no danger of overharvest of bulls in these units.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 21C. RESIDENT AND NONRESIDENT HUNTERS: 1 bull.	5 Sep–25 Sep	5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. During the March 2002 Board of Game meeting, a regulation was adopted that requires hunters to keep the meat on the bone of the 4 quarters and ribs until they remove the harvested moose from the field. During the March 2004 Board of Game meeting (after this report period), a regulation was adopted that established a drawing permit hunt and a resident registration permit hunt for the Dulbi River portion of Unit 21C. The board also adopted a regulation that allows nonresident hunters throughout the unit to only shoot bulls with 50-inch antlers or antlers with 4 or more brow tines on 1 side.

Hunter Harvest. Harvest was relatively stable with a mean kill of 27 ± 6.8 ($\bar{x} \pm 1s$) moose annually for the past 10 years (RY94–RY03; Table 1). Two years that differed significantly from the mean were RY96, when only 15 moose were harvested, and RY97, when 41 moose were harvested. In RY01, RY02 and RY03, 30, 31 and 21 moose were harvested, respectively; however the RY03 data is still preliminary. For the 10-year period (RY94–

RY03), the number of hunters averaged 46.9 ± 9.6 ($\bar{x}$ ± 1s) with a range of 27–61. Annual harvest during RY01–RY02 was <5% of the estimated number of moose in the unit.

Hunter Residency and Success. During the report period (RY01–RY02), no one lived within the unit; however, residents from Ruby in adjacent Unit 21B occasionally hunted the Melozitna River. Nonresidents composed an average of 46% ± 11% ($\bar{x}$ ± 1s) of the hunters during RY90–RY01. Nonresident hunters increased to 49% in RY01–RY03, which was the fifth consecutive 3-year period above the 10-year average (Table 1). Percent success was >58% for RY94–RY03, except in RY03 when success was 46%. Relatively high success rates were probably due to relatively low hunter numbers and concentrations of moose along the river corridors in September; however, RY03 was the fourth consecutive year hunter success declined.

Harvest Chronology. Moose were harvested throughout the season, but the highest percent of harvest occurred during mid September (Table 2).

Transport Methods. Hunters mainly used aircraft for transport (Table 3). A waterfall near the mouth of the Melozitna River restricts travel up the river and extensive sandbars often impede boat access into the upper Dulbi River at the low water levels common during the fall.

Other Mortality

Wolves and grizzly and black bears live throughout the unit. In 1995 Osborne (1996) estimated a minimum of 60 wolves in the unit and a grizzly bear density of 1/40 mi^2. Numbers of wolves and black bears have increased in adjacent Units 21D and 24 and have probably increased in Unit 21C. Predation probably influenced moose population status in the past and may be increasing (Gasaway et al. 1992). Wolf and bear harvests were low (<10 annually) because hunter access is limited.

CONCLUSIONS AND RECOMMENDATIONS

Moose density in Unit 21C was estimated at 0.35–0.45 moose/mi^2 with an estimated 1284–1651 moose present in the unit. This estimate did not change from the previous report. Human use of the moose population was low, and recent harvest could be sustained even if the population experienced a reduction. However, recent declines in hunter success indicated that moose numbers along the river corridor might be exhibiting the first signs of approaching maximum desirable levels. Therefore, ADF&G supported changes that restricted nonresidents to harvest large bulls and implemented registration and drawing permit hunts on the Dulbi River drainage portion of Unit 21C.

We achieved our first management goal to protect, maintain, and enhance the moose population and its habitat by monitoring moose harvest pressure, by maintaining open seasons for bear and wolf hunting and trapping, and by encouraging the Department of Natural Resources/Division of Forestry to let wildfires burn. We achieved our second goal to provide a sustained opportunity to participate in hunting moose by maintaining long hunting seasons. In addition, we achieved the management objective to maintain a harvest of bulls that is ≤6% of the estimated population. We estimated the harvest rate to be less than 2% annually.

Although harvest has remained low, we recommend obtaining a population estimate and/or a bull:cow ratio to more closely monitor effects of harvest on the population.

In the next reporting period, the management objective will be changed to the following: Maintain ≥ 20% large bulls in the harvest.

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TABLE 1 Unit 21C moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	
1990–1991	1	18	5	1	25 (67)	0	9	3	0	12	37
1991–1992	0	15	5	0	20 (50)	0	17	3	0	20	40
1992–1993	0	7	2	0	9 (29)	0	15	7	0	22	31
1993–1994	0	11	9	0	20 (51)	0	13	6	0	19	39
1994–1995	0	17	10	0	27 (57)	4	14	2	0	20	47
1995–1996	0	12	13	0	25 (61)	0	13	3	0	16	41
1996–1997	0	10	5	0	15 (56)	0	9	3	0	12	27
1997–1998	1	14	26	0	41 (76)	0	10	3	0	13	54
1998–1999	1	8	12	0	21 (58)	0	9	6	0	15	36
1999–2000	0	15	16	0	31 (63)	0	13	5	0	18	49
2000–2001	0	11	20	0	31 (61)	0	13	7	0	20	51
2001–2002	0	13	17	0	30 (53)	0	16	11	0	27	57
2002–2003	0	10	20	1	31 (51)	0	18	11	1	30	61
2003–2004[b]		5	16	0	21 (46)	0	19	6	0	25	46

[a] Local resident resides in Units 21C or 21B.

[b] Preliminary data.

0

TABLE 2 Unit 21C moose harvest chronology percent by month/day, regulatory years 1995–1996 through 2003–2004

Regulatory	Harvest chronology percent by month/day				
year	9/5–9/10	9/11–9/15	9/16–9/20	9/21–9/25	*n*
1995–1996	29	33	25	12	24
1996–1997	7	33	40	20	15
1997–1998	12	36	34	17	41
1998–1999	25	35	30	10	20
1999–2000	20	30	27	23	30
2000–2001	21	25	50	4	24
2001–2002	15	22	30	33	27
2002–2003	7	21	43	29	28
2003–2004[a]	19	14	43	24	21

[a] Preliminary data.

TABLE 3 Unit 21C moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory	Harvest percent by transport method							
year	Airplane	Horse	Boat[a]	3- or 4-wheeler	Snowmachine	ORV	Unknown	*n*
1990–1991	90	0	10	0	0	0	0	21
1991–1992	83	0	4	0	0	0	13	23
1992–1993	89	0	11	0	0	0	0	9
1993–1994	70	10	20	0	0	0	0	20
1994–1995	89	0	11	0	0	0	0	27
1995–1996	84	0	4	0	0	0	12	25
1996–1997	93	7	0	0	0	0	0	15
1997–1998	85	0	10	0	0	0	5	41
1998–1999	90	0	10	0	0	0	0	21
1999–2000	74	0	23	3	0	0	0	31
2000–2001	60	0	40	0	0	0	0	25
2001–2002	60	0	37	0	0	3	0	30
2002–2003	71	0	29	0	0	0	0	31
2003–2004[b]	76	0	14	0	0	0	10	21

[a] Includes airboats.
[b] Preliminary data.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21D (12,113 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon River from Blackburn to Ruby and Koyukuk River drainage below Dulbi Slough

BACKGROUND

Moose are abundant in much of Unit 21D. However, high densities are a relatively new occurrence. Local residents first reported seeing occasional moose tracks during winters in the 1930s. During the 1940s and early 1950s, numbers of moose and wolves slowly increased (Huntington 1993). During the 1950s, federal wolf control and aerial shooting reduced the wolf population, allowing a rapid expansion of the moose population during the late 1950s and on through the 1960s. Expansion may have begun slowing in 1959 when statehood brought an end to federal wolf control. The moose population reached peak numbers about 1970 (S. Huntington, personal communication to T. Osborne, ADF&G) and then stabilized or declined slightly in localized areas in response to increased predation and hunting pressure. Increased predation may have been related to passage of the Federal Airborne Hunting Act in 1972, which halted aerial shooting of predators.

Moose trend count areas (TCAs) established in 1981 in the Lower Koyukuk and Yukon Rivers floodplain areas indicated generally increasing moose densities through about 1993 (Tables 1–8). Initially, we thought this increase was due to better surveys, but a population estimation survey of the Kaiyuh Flats and the lower Koyukuk River in 1987 supported data from the TCAs (Osborne 1996). Moose densities were high along the Yukon River floodplain (3–6 moose/mi^2) and were very high on the Koyukuk River in the Three Day Slough TCA, where densities reached 13.3 moose/mi^2 in early winter 1993. We estimated that 6340 moose inhabited the survey area, and extrapolation of the data suggested a unitwide population of 9000–10,000 in 1993.

Results from a survey in fall 1997 in the lower Koyukuk drainage and the Kaiyuh Flats indicated moose numbers were similar to the 1993 estimate (Huntington 1998). However,

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

declining recruitment parameters observed in the TCAs since 1997 and a population estimation survey conducted in 2001 indicated the population had declined to 8500–9500 moose by winter 2001–2002. Our population estimate did not change substantially by winter 2003–2004 except that yearlings and calves made up a larger proportion of the population, with fewer adult bulls and cows.

There are 4 villages within Unit 21D (Kaltag, Nulato, Koyukuk, and Galena), and the residents of each village have traditional hunting areas. However, Galena residents tend to travel farther afield in the direction of the Koyukuk River. Nonresidents and Alaskans residing outside Unit 21D primarily hunt the Koyukuk River between the Kateel River and the Dulbi Slough. Hunting pressure appears to be gradually shifting farther upriver as hunters from outside the unit learn to deal with the logistics of accessing the area. In 1979 the Koyukuk Controlled Use Area (KCUA) was established in an attempt to reduce participation of nonlocal hunters by prohibiting the use of aircraft. However, by 1986 the hunters arriving by boat from outside the unit equaled the number of hunters who previously accessed the area by aircraft.

Reported harvest prior to 1981 was largely inaccurate because many local residents either did not obtain licenses or failed to report. In 1981 a program was initiated that made it easier for residents of the area to obtain hunting licenses and harvest reports. Educational and enforcement efforts improved the reporting rate by local residents, but at least 25% of the harvest is still unreported.

A hunter checkstation has been operating on the Koyukuk River since 1983. In 1990 the Ella's cabin checkstation on the Koyukuk River became a mandatory stop for all hunters. The checkstation enables accurate determination of the number of hunters using the river to access the KCUA within Unit 21D. It is also used to educate local residents concerning licensing and reporting requirements and to inform nonlocal hunters about regulations specific to the area and about the locations of private property near the river.

The fall hunting season dates changed several times between 1975 and 1981. From 1981 through 1996 there was a 21-day fall season for the entire unit. Harvest of cows was allowed during the last 5 days. A 10-day season in early March also provided hunting opportunity for Alaska residents. In 1991 nonresidents were restricted to bulls with an antler spread of ≥50-inches, or at least 3 brow tines on 1 side. In 1992 the minimum number of brow tines on 1 side was increased to 4. Also beginning in 1992, meat of the hindquarters, forequarters, and ribs of any moose taken in the KCUA had to remain on the bone. In 1996, due to increasing moose hunter numbers and moose harvest, subsistence and general registration hunts were established for the KCUA, downstream from Huslia. In 2000, 2 resident and 2 nonresident drawing hunts replaced the general registration hunt, and the subsistence registration hunt was shifted to open 5 days earlier.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

Koyukuk River Drainage

Management was directed according to the following management goals and objectives during the reporting period.

GOAL 1: Manage Koyukuk River drainage moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and minimizes disruption of local residents' lifestyles.

Objective 1: Maintain a moose population of 9000–10,000.

Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available.

Objective 2: Provide for a harvest of moose not to exceed 700 moose or 7% of the annual moose population estimate each regulatory year.

Activity 1: Monitor hunter use levels in the Koyukuk River drainage.

Activity 2: Monitor impacts (social and environmental) to private property and local residents by Koyukuk River moose hunters.

Activity 3: Develop programs to improve population and harvest data for moose in Unit 21D.

Objective 3: Provide for moose hunting opportunity not to exceed 950 hunters per regulatory year.

GOAL 2: Protect and enhance moose habitat.

Objective 1: In combination with Unit 24, implement at least 2 habitat enhancement activities every 5 years.

GOAL 3: Reduce meat spoilage by hunters.

Objective 1: Reduce the amount of spoiled meat observed at Ella's cabin and at hunting camps by 10% each regulatory year.

Activity 1: Implement a program at Ella's cabin checkstation to monitor percentage of meat lost due to spoilage.

GOAL 4: Maintain opportunities for wildlife viewing, photography and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

Objective 1: Increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year.

Activity 1: Implement a program to monitor long-term trends and establish a baseline of the current level of nonconsumptive use through collaboration with the Koyukuk–Nowitna National Wildlife Refuge and commercial operations in Unit 21D.

METHODS

Previously established TCAs, of 4–6 contiguous "Gasaway" sample units, were surveyed from small fixed-wing aircraft (PA-18 or similar aircraft) to assess moose population parameters (Gasaway et al. 1986). Surveys were flown at an altitude of approximately 500 feet and at ground speeds of 70–80 mi/hr. Moose were classified as cows, calves, yearling bull (<30" antler spread and no brow tine definition), medium bull (30" to 49" antler width), or large bull (≥50" antler width). Sample units of approximately 12 mi^2 each were searched at a rate of approximately 5 min/mi^2 to ensure reasonably high sightability (approximately 85%), minimal bias, and data comparability among years. Data were recorded on standard data forms and moose locations were also recorded on 1:63,000 U.S. Geological Survey quadrangle maps and as global positioning system (GPS) waypoints. Surveys were not conducted until a minimum snow cover of approximately 12 inches had accumulated. This level of snow cover is important because snow depth influences both sightability and moose distribution.

A population estimation survey was conducted in October and November 2001 and 2002 using similar techniques described by Gasaway et al. (1986) but modified for analysis using the Geostatistical Spatial Population Estimator (GSPE; Ver Hoef 2001). Sample units averaged 5.6 mi^2 in size, with search intensity of ~6 min/mi^2. Sample units were located by latitude–longitude coordinates using in-flight GPS units. Of the 975 sample units in the survey area, 291 sample units were surveyed intensively with an average survey time of 30.8 minutes per 5.6 mi^2 sample unit. Nine hundred seventy-five sample units were stratified in advance of the intensive survey; 255 of the sample units were classified as high moose density and the remaining 720 sample units were classified as low moose density (Bryant and Stout 2003).

Twinning surveys were flown in May to determine the proportion of moose calf twins in the TCA. Search and survey techniques and sample units were similar to those used in early winter. Observation of 50 cows with calves was the desired minimum, but funding and weather often prevented us from achieving that goal. Moose were classified as bull, yearling, calf, cow, cow with 1 calf, or cow with 2 calves. The timing of the surveys was critical. The surveys were flown when approximately 50% of the cows observed had calves. We flew at this time to avoid early mortality factors such as black bear predation, which could strongly influence the results.

Hunting mortality and harvest distribution was monitored through the statewide harvest ticket system, registration permits, drawing permits, door-to-door subsistence surveys, and a hunter checkstation. General season hunters received 1 reminder letter to report harvest. Hunters with registration, drawing, or Tier II permits received 1 postcard reminder, a telephone call, and a certified letter. Report and survey information obtained was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Data collected at the checkstation included hunter residency, harvest chronology, time in the field, hunting party size, sex and age structure of harvest (tooth extraction), antler size, method of harvest, location of harvest, caliber of firearm, and method of transportation. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001 through 30 Jun 2002).

We also evaluated meat care at the checkstation by ranking the level of dryness, cleanliness, smell, overall care, and days in the field. Rankings were subjectively scored on a scale of 1–5, with a score of 1 being a low performance score. Every moose checked at Ella's cabin was evaluated. Hunters coming through the checkstation were also given a wildlife viewing survey card that consisted of 8 brief questions about wildlife observed during their days in the field. Typically, one person per boat was given the voluntary questionnaire. Meat evaluation and wildlife viewing surveys were conducted to evaluate Goals 3 and 4.

We evaluated predation by interviewing trappers, by field observations, and through aerial wolf surveys flown in cooperation with the U.S. Fish and Wildlife Service (FWS).

Vegetation surveys were conducted in spring 2002 in the Lower Koyukuk River drainage. Several browse communities were evaluated to determine species that occur, vigor of the stand, current annual production and the amount of browsing that plants had incurred (C.T. Seaton, ADF&G, personal communication).

We continued with the planning process during this reporting period to address concerns related to the continued increase of hunters in the Koyukuk River drainage. The planning process was initiated in winter 1999, and a Koyukuk River Moose Hunter's Working Group (KWG) was formed from members of the state’s advisory committees, the federal Western Interior Subsistence Council, and a local guide representative. The planning group developed a draft 5-year Koyukuk River Moose Management Plan (ADF&G files) that was submitted to the Alaska Board of Game during the March 2000 meeting. The draft plan was used as a guide for management goals, objectives, activities, and biological decision-making criteria in this management report. The board, at its January 2001 meeting, endorsed the plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

As noted in the previous report, the unitwide moose population increase observed for almost 2 decades had ended and some localized areas showed marked declines. Peak densities of moose were apparently reached between 1993 and 1997, but declining calf numbers and recruitment of yearlings began to be apparent in fall 1998 and 1999 in most TCAs (Tables 1–8). Estimates of poor recruitment during 1998–2001 in the Three Day Slough area suggested a decline of as much as 25%. Since 1997 the Unit 21D population may have declined by 10–15%, and the population trend was downward. Counts from several TCAs during 1999–2003 supported this conclusion, as did the 2001 population estimation survey. However, declines seemed to be largest in the high-density areas, while the low-density areas appeared to remain relatively stable. The proportionally larger low-density areas may have mediated the decline over the whole population.

My population estimate of 8500–9500 moose is based on previously reported values, trend count surveys conducted in RY03, and the population estimation survey completed in 2001. Declining moose recruitment among the trend areas was a key indicator of the apparent overall decline in the population. However, the 2001 survey showed that in low-density areas not surveyed annually, moose numbers apparently remained relatively stable. In fall 2001, 5526 mi^2 were surveyed in Unit 21D and the southern portion of Unit 24. Of the 975 sample units in the survey area, 291 sample units were surveyed intensively. We counted 4524 moose during the intensive surveys with an average survey time of 30.8 minutes per 5.6 mi^2 sample unit. Nine hundred seventy-five sample units were stratified in advance of the intensive survey, with 255 of the sample units classified as high moose density, while the remaining 720 sample units were classified as low moose density. In the 3577-mi^2 portion of Unit 21D that was surveyed, we estimated 5203 moose, not including a sightability correction factor (Table 9). In the remaining 8536 mi^2 of Unit 21D not surveyed, I estimated an average density of 0.45 moose/mi^2 or 3841 moose.

Population Composition

The following guidelines were used to interpret sex and age indices (Franzmann and Schwartz 1998).

- Bull:cow ratios in some of the high density TCAs were in excess of 30–40 bulls:100 cows after the fall hunting season. Ratios of 15 bulls:100 cows are sufficient for breeding (Woolington 1998) in these areas, with higher ratios providing increased harvest or trophy hunting opportunity. High numbers of bulls are sometimes misleading in terms of harvest effects on the population because Unit 21D is subject to either-sex hunting which can inflate bull ratios.

- The calf:cow ratio observed during November surveys provides an index to calf survival during the calves' first 5 months. Black bears, grizzly bears, and wolves were the primary predators that reduced calf numbers (Osborne et al. 1991). A November calf:cow ratio of 20–40 calves:100 cows may allow a population to remain stable. Calf:cow ratios may indicate population change if subsequent overwinter mortality is either consistent or negligible. Ratios of <20 calves:100 cows may indicate a decreasing population and ratios of >40 calves:100 cows can be found in growing populations.

- The percentage of yearling bulls within the herd provides an index of the recruitment of young adults to the breeding population. It can also provide an indication of overwinter survival of calves, if the calf:cow ratio for the previous fall is known. Generally, the yearling bull percentage averages 4–8%, with anything less indicating poor recruitment and with anything higher indicating good recruitment.

Since 1995 the posthunt bull:cow ratio for the Three Day Slough TCA was generally declining, with the fall 2003 ratio being the lowest recorded (Table 1). Bull:cow ratios vary widely among other TCAs (Tables 2–8), but most indicate some level of decline since 1995 or 1996. The percentage of large bulls (antlers ≥50") observed in the Three Day Slough TCA was 15–30% in the 1990s, while the percentage of large bulls in the harvest from Three Day Slough was 40–68% (Table 10). Bull:100 cow ratios from the 2001 GSPE survey were estimated at 33:100, well above the minimum needed for adequate productivity. For the area surveyed in 2001, the calf:100 cow ratio was estimated at 18:100. That calf ratio was lower than the target range (20–40:100) for maintaining a stable population. Data from most of the TCAs had even lower ratios however, which suggested the low density areas away from the TCAs maintained higher levels of productivity and recruitment to 5 months and probably acted to moderate the overall decline of the population. Although a GSPE survey was not conducted in RY02 or RY03, and no TCA surveys were conducted in RY02, TCA data in RY03 demonstrated substantial improvements in calf:cow ratios and yearling bull:cow ratios.

Calf twinning rates in spring 2003 and 2004 suggested improving productivity in Unit 21D (Tables 11 and 12) and the Huslia Flats–Treat Island TCAs area just to the north in Unit 24. We suggest this improvement is related to the 3 to 4 prior consecutive mild winters and the corresponding length of the intervening snow-free seasons. Although no objective measurements of habitat were conducted during this period, I observed no dramatic changes in vegetative characteristics that would account for the apparent improvements in twinning rates. Thus, I do not believe a density-dependent effect was acting on the population because twinning rates declined only temporarily while the moose population maintained relatively high and stable densities.

Distribution and Movements

Movement patterns of moose in the Three Day Slough area are based on data from radiocollared animals (Osborne and Spindler 1993). Most adult and young moose remain in the floodplain area of Three Day Slough from late August until May each year. During May most moose move 10–60 miles north or south to upland areas where they spend the summer. In August they return to the floodplain area.

Moose movements are unknown in other portions of the subunit. However, local residents suspect some moose observed on the Kaiyuh Flats migrate seasonally to the south.

Generally, moose congregate along the river corridors in late fall with the approach of peak rutting season. With the accumulation of snow, moose are in high concentrations within the riparian corridor of the Yukon and Koyukuk Rivers, where they remain throughout the winter. With spring breakup, bulls are the first to leave the riparian areas, followed by cows that have calved. Osborne and Spindler (1993) found approximately 58% of the cows migrated after calving and approximately 83% of all moose were migratory.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21D, that portion within the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 moose per regulatory year, only as follows:		
1 moose by registration permit only; or	27 Aug–31 Aug (Subsistence hunt only)	
1 bull by registration permit only; or	1 Sep–20 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 320 permits may be issued in combination with Unit 24, that portion within the Koyukuk Controlled Use Area; or	5 Sep–25 Sep (General hunt only)	
1 moose during a 5-day season to be announced by emergency order during 1 Feb–28 Feb; a person may not take a cow accompanied by a calf.	(To be announced) (Subsistence hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit; up to 80 permits may be issued in combination with Unit 24, that portion within the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Remainder of Unit 21D		
RESIDENT HUNTERS: 1 moose per regulatory year; however, antlerless moose may be taken during 21 Sep–25 Sep and during a 5-day season during the period 1 Feb–28 Feb to be announced by	5 Sep–25 Sep (To be announced)	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
emergency order; a person may not take a cow accompanied by a calf.		
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. The antlerless moose hunting seasons were reauthorized by the Alaska Board of Game for RY02 and RY03, but we notified the board that the antlerless season would be closed by emergency order for the fall 2004 season because of conservation concerns. Also at the March 2002 meeting, the board expanded the meat-on-the bone salvage requirement in the Koyukuk CUA to all of Unit 21D.

At the 2004 meeting, the board adopted changes to the moose regulations in Unit 21D that implemented drawing and registration hunts in the Gisasa and Kateel River drainages and the Bear Creek drainage. The board also closed the February any-moose season and opened a 10-day December bulls-only season.

Hunter Harvest. During the reporting period, harvest of moose in Unit 21D was reduced and stabilized compared to the increases observed during the 1990s (Tables 13–15). The decline in the bull segment of the population in some TCAs was probably linked to the harvest during that period. Cow harvest was further reduced in RY03 primarily due to elimination of the antlerless moose seasons in the KCUA. However, much of the cow harvest occurred during the winter, when harvest reporting was poor.

Checkstation Results. Ella’s cabin checkstation, located 15 miles upstream from the village of Koyukuk on the Koyukuk River, was made mandatory in RY90. Hunters checking in at Ella’s reached an all-time high in RY99, but the number dropped significantly with the implementation of the drawing hunts in RY00. During the period of increase, the additional hunters in the KCUA were primarily nonlocal Alaska residents and, secondarily, nonresidents (Table 15). Numbers of local residents (residents of Unit 21D) remained relatively constant. Harvest success was high (>60%) for nonresidents and nonlocal residents. Local resident harvest success reported for the fall hunt was lower, in part, because they could easily hunt the winter season if they were unsuccessful in the fall. Success rates generally remained high except for RY01, but that was probably due to the extremely warm weather during the fall hunting season.

The Three Day Slough area is well known as an excellent area to hunt for large (≥50-inch antlers) moose. One-fifth to one-third of the bulls observed in the Three Day Slough TCA had large antlers (Table 10). Consistently over the past 23 years, more than 17% of the bulls checked at Ella’s cabin had antler spreads >60 inches.

Three regulations monitored closely at the checkstation were antler width, salvage of meat, and destruction of trophy value of bulls harvested under subsistence registration permits. The regulation requiring meat to be left on the bone improved enforcement efforts to stop waste of moose meat. This regulation was passed in 1992 to address the increase of moose hunters and harvest in the KCUA, and to address the problem of some hunters removing only part of the meat from the carcass so they could carry lighter loads in their boats. All hunters who came through the checkstation were notified of this regulation at the time permits were distributed. Hunters were checked for compliance of the regulation upon departure. Destruction of the trophy value of antlers at the checkstation was a controversial regulation when applied and seldom resulted in a positive public contact for the department. Beginning in RY00, hunters were required to cut the antlers at the kill site, which improved that aspect of the hunter contact.

Antler widths for the moose harvested in the KCUA were analyzed across all age classes from RY81 through RY03. Analysis showed variation on an annual basis with no apparent similarities to trends in other population data until RY97. Beginning in RY97 through RY00, all mean antler widths of the 5 age classes (3–7 yr olds) were below the 23-year mean antler widths for the respective age classes (Fig 1). Among those 20 data points (5 age classes × 4 years), 10 of 20 of the mean antler widths were significantly lower than the 23-year mean widths for the respective age classes. Antler widths for age classes below 3 years old or above 7 years old did not show consistent differences from their 23-year mean widths. After RY00, antler widths appeared to return to the range of the 23-year mean values for all age classes, with the exception of the 1993 cohort. The 4-year decrease in antler widths coincided with the observed decline in the twinning rates during that period. Declines in antler development and twinning rates have similarly been associated with energetic deficits, and the 4-year declines in both of these measurements for the KCUA suggest a temporary environmental effect was influencing both parameters.

Meat evaluation surveys conducted at the checkstation indicated meat care was generally very good with the average scores of 4.3 and 4.2 for RY02 and RY03 respectively (Table 16). In RY03 the majority of hunters (69%) had their meat out of the field in 4 days or less. In RY02, 16 hunters (8.6%) had their meat out 7 days or longer, and in RY03 there were 25 hunters (12.6%) that kept their meat out that long, 1 hunter staying out with meat for 12 days. Cooler weather during fall RY03 allowed for longer stays without meat spoilage, but meat quality measurements do show a decline after 5 or 6 days in the field. In RY02, 27 hunters (15%) were given scores of 3 or less, while that number increased to 43 hunters (22%) in RY03.

Wildlife viewing surveys were conducted voluntarily at the checkstation. There were 96 and 80 people who filled out the wildlife-viewing questionnaire at Ella's cabin in 2002 and 2003. The survey was printed on a 3×5 card with 8 questions. Typically, we handed out 1 card per party rather than for each individual. We presented the card to hunters while we were checking them on their way out of the area. In 2003, 507 hunters registered at Ella's, so this was roughly a 16% sample (down from 25% in 2002) of registered hunters who went through the checkstation.

Not all hunters answered all of the questions, so many of the percentage values presented are with the respect to the number of responses to the particular question. The questions asked and the answers given are summarized below for RY02–RY03:

Question 1: How many days spent viewing wildlife?

Respondents reported spending an average of 7.0 days in RY02 and 6.9 days in RY03 viewing wildlife. This question was slightly different in RY03 from the 2 similar questions from RY02, the second of which read "…how many days were you in the KCUA?" I think the question was less redundant in RY03 than the 2 questions on the RY02 survey.

Question 2: Why were you visiting the Koyukuk?

The majority (55% in both RY02 and RY03) of the people said they were "Hunting and Viewing," while 43% in RY02 and 49% in RY03 said they were hunting only, while 2% in RY02 and 1% in RY03 said they were viewing only. This question and the number of days spent viewing may be the 2 most obvious measures for future comparison to determine if the viewing activities are increasing. I felt it was a very good indicator to demonstrate that hunters were not just there to shoot something. The consistency in the data from 2002 was remarkable.

Question 3: Did you view any wildlife that you were not hunting?

The majority (83% in RY02 and 81% in RY03) of respondents said yes, while only 17% in RY02 and 19% in RY03 said no.

Question 4: What wildlife species did you see and how many?

There were 62 people who listed some of the animals they saw. In both RY02 and RY03, very few people were willing to write down a comprehensive list of all the wildlife they observed. Only a few (less than 12) filled in the "how many" section. Moose, beaver, ducks, geese, porcupine, and gray jays were the top species listed. There were 32 species identified in RY03 compared to 23 listed in RY02. For RY03 this question did not appear to try the patience of hunters as I thought it did in RY02. I think hunters were probably more comfortable with the idea of filling out the form in RY03.

Question 5: Viewing which of these animals was most important to you?

This question got a variety of responses both years and there were a variety of ways it was filled out in RY03. However, with some improved wording, I think reporting in RY03 was much better than it was in RY02. The top 5 species people wanted to see during RY02 and RY03 were as follows; moose = 74% and 86% of first place rank, bears = 58% and 75% of the second place rank, wolves = 57% and 56% of the third place rank, waterfowl = 54% and 62% of the fourth place rank, and furbearers = 59% and 71% of the fifth place rank. In addition, I identified an error in the RY02 calculation and recalculated those values, which resulted in a switch in the ranking of waterfowl and furbearers. The percentage calculation is actually a cumulative percentage and more accurately represents the ranking of the individual species/wildlife classes. Caribou, songbirds, and small mammals were ranked sixth, seventh, and eighth respectively.

Question 6: How important was the activity of viewing wildlife for you?

This question was revised and obviously improved in RY03 to include only 3 categories. Of the people who responded during RY03, 62% said viewing was VERY IMPORTANT, 33% said it was SOMEWHAT important, and only 5% said it was NOT IMPORTANT.

Question 7: How important was seeing wildlife sign to your overall experience?

Like question 6 this question was improved from RY02. Of the people who responded during RY03, 52% said viewing was VERY IMPORTANT, 44% said it was SOMEWHAT important, and only 4% said it was NOT IMPORTANT.

Question 8: Where did you get information about the Koyukuk?

FRIENDS was the number one source both years at 45% and 51%, second was PERSONAL KNOWLEDGE (i.e., I live here) at 23% and 18%, ADF&G at 17% and 9%, FAMILY at 4% and 9%, INTERNET at 3% and 5%, FWS at 4%, and a variety of other answers for the remaining 4%.

With the establishment of the baseline data for the meat evaluation and wildlife viewing, efforts to improve the activities can be implemented according to management goals 3 and 4.

Permit Hunts. Use of the subsistence registration permit (RM832) hunt was required in the fall within the entire Koyukuk Controlled Use Area. The number of RM832 permits issued for RY02 decreased by 10.9% from RY01 and then increased by 11.7% in RY03 (Table 17). So, it appears that use of the RM832 permit has stabilized. It is apparent that use of the registration permit has increased among Unit 21D residents while use of the permit by other Alaska residents is down somewhat (Table 14). Increases in the number of Alaska resident hunters using the subsistence permit alternative may exceed the sustainable yield of the moose population and has been a critical management issue. With the implementation of the 4 drawing hunts DM827, DM828, DM829 and DM830, hunter numbers were better regulated. As compared to their predecessor, the RM830 permit, the number of drawing permits issued was stable and not increasing without control. Hunters who did not want to destroy the trophy value of their bull moose applied for a drawing permit. An added benefit to hunters awarded a drawing permit was that they did not need to be concerned with whether permits were available at the checkstation. Also, hunters commented favorably on the changes to season dates that separated drawing hunters from registration hunters and evenly distributed drawing hunters in either the first or second half of the season.

Hunter Residency and Success. Hunter residency and success can be misleading because Unit 21D residents often did not report unsuccessful hunt information (Table 18). Harvest and hunter participation by Unit 21D residents was relatively constant according to Subsistence Division surveys (Anderson et al. 1998; Table 18). In contrast, nonresident and nonlocal resident hunter participation increased steadily from 1983 through 1999. The increase in nonlocals created tension among user groups in the area and was the impetus for creating the KWG. With the implementation of drawing permits within the KCUA in RY00, local hunter participation appeared to increase in that area and their success rates improved for 3 consecutive years (RY01–RY03) in the KCUA. However, success rates in RY01 (42%) and RY02 (45%) are still low compared to the early 1990s (RY90–RY97) when success rates averaged 62%. Maintaining high success rates for local hunters in the fall is particularly important, because if they do not get their moose in the fall, they are more likely to hunt in the winter seasons when more than 60% of the moose harvested are cows.

Harvest Chronology. Harvest reporting rate was low during the winter seasons and was probably 20% of the annual harvest (Table 19). Much of the unreported harvest was likely taken during October–March (Anderson et al. 1998).

Transportation Methods. The presence of the KCUA and the area's extensive river system made boats the primary transportation method (Table 20). Snowmachines were the main transportation during the winter hunt.

Other Mortality

Unit 21D has high populations of wolves and black bears. Grizzly bears were common in the upland areas of the Nulato Hills and Kaiyuh Mountains. Wolves and grizzly bears prey heavily on both calf and adult moose. Black bears were shown to kill more than 40% of moose calves annually (Osborne et al. 1991). Hunters continued to report increased observations of grizzly bears during the fall moose season. Anecdotal reports from Unit 21D residents also suggested grizzly bears were increasing and becoming more common intruders at fish camps.

We estimated 208–304 wolves in 37 packs in a portion of Unit 21D during 1994 (Becker et al. 1998). Local residents with intimate knowledge of the unit's game populations report wolf numbers substantially increased since then. Packs in excess of 20 wolves were observed during fall 1999 moose surveys. We counted 126 wolves during a wolf reconnaissance survey in March 1999. This minimum count indicates an increase of at least 17% from the number of wolves in packs also observed during the 1994 survey.

HABITAT

Assessment

Feltleaf willow is an important browse species for moose due to its nutritional quality and use (Kielland 1997). Chemical analysis of 0.08- to 0.32-inch diameter twigs typically browsed by moose in Three Day Slough found crude protein was 8–12%, twice as much as found in the same willow species on the Tanana River. Consumption in Three Day Slough survey areas was 24–28% of the annual twig production (Kielland 1997). These factors may partly explain the sustained high numbers of moose in the Three Day Slough area. Annual forage production for a measurable area is unknown.

In April 2002 we conducted 6 browse transects in Unit 21D to evaluate sampling techniques that could potentially be used in the Galena Management Area.

MANAGEMENT PLANNING

The KWG met twice in RY01 and RY02, and the management plan (ADF&G files) developed by the working group was formally endorsed by the Board of Game at its winter 2001 meeting. The plan was the basis for developing goals and activities for moose management in Unit 21D. Although the KWG's area of concern was specifically within the Koyukuk River drainage, the issues were characteristic of concerns throughout Unit 21D and nearby Unit 24.

CONCLUSIONS AND RECOMMENDATIONS

Moose were relatively numerous in the riparian lowlands of Unit 21D. I estimated 8500–9500 moose in the unit. Unitwide populations probably declined as a result of declining recruitment, at least during 1998–2002. Declining recruitment parameters such as calf:cow ratios and yearling bull:cow ratios indicated predation had a negative influence on the moose population. Also, 4 years of liberalized cow harvest removed an important reproductive component of the population. This decline in moose numbers is supported by the increase in wolf numbers observed during the aerial wolf reconnaissance survey in 1999, observations of black bears in the field, and increased observations of grizzly bears by hunters. The population will likely continue to decline unless an effort to control predation is implemented and the harvest of antlerless moose continues to decrease.

The 3 key management issues facing Unit 21D include (1) area-specific concentration of hunting activities, (2) cow harvest, and (3) the repercussions of declining fall success rates by local hunters. Concentration of hunters in the portion of the KCUA between the Kateel River and the Dulbi Slough area has impacted the bull:cow ratio in that area. As a result of the low bull:cow ratio in Three Day Slough, a decision was made to reduce the number of drawing permits from the 258 issued in RY03 down to 50 permits for RY04. The Koyukuk River Moose Management Plan objectives call for a ratio of 30 bulls:100 cows in the KCUA, so conservative management strategies were implemented to decrease the number of bulls harvested. Although normal breeding activity can occur at ratios of 20–30 bulls:100 cows when moose are at high densities, ratios below 20 are cause for concern biologically, especially when the trend is continuing downward. Cow harvest must continue to decrease, especially during the winter seasons. Actions were taken to close all the fall cow seasons by emergency order in RY02 and RY03, and in RY04 the winter season was shifted to December and only bulls were legal to harvest. However, it is clear that dependency on moose harvested during the winter will continue as long as fall hunting success declines. The repercussion of the dependency on winter harvest is that more than two-thirds of the moose harvested are cows. Management efforts must continue to improve fall success rates by local hunters in order to reduce the winter harvest of cows.

The objective of maintaining the population at 9000–10,000 moose was probably achieved by a narrow margin; however, without survey data at the end of RY02 that evaluation was not clear. Analysis of RY03 data indicated improved recruitment, which supports the conclusion that we met the objective. Poor recruitment prior to RY02, due in part to high predation, appears to be the primary factor causing the apparent decline. The objective to provide for a harvest of moose not to exceed 700 moose was achieved. From RY01–RY03, estimated total harvest was highest in RY02 at 490 moose, a harvest rate of no more than 5.8%, even if the population was at its lowest point of 8500 moose. The objective to provide for moose hunting opportunity, not to exceed 950 hunters per regulatory year was achieved with a total of only 737 hunters in RY01, 650 hunters in RY02 and a preliminary count of 773 in RY03.

The long-term objective of implementing at least 2 habitat enhancement activities was not achieved directly during RY01–RY02, but coordination with the FWS concerning potential treatment is in progress.

In RY02 and RY03 we monitored the objective of reducing spoiled meat observed at Ella's cabin and at hunting camps by 10% each regulatory year. I believe regulations adopted by the board in 1992 that required meat to remain on the bone of all 4 quarters and the ribs was a positive move toward achieving the objective of reducing spoiled meat. This requirement was expanded to all of Unit 21D in RY02. We established baseline data to monitor our success in meeting this objective in RY02 and RY03. Finally, a monitoring program to evaluate the number of people engaged in nonconsumptive activities was developed and baseline data were established so we will be able to determine whether we meet the objective to increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year. Coordination with the FWS on this objective took place during the report period, and survey forms were developed to monitor nonconsumptive wildlife activities.

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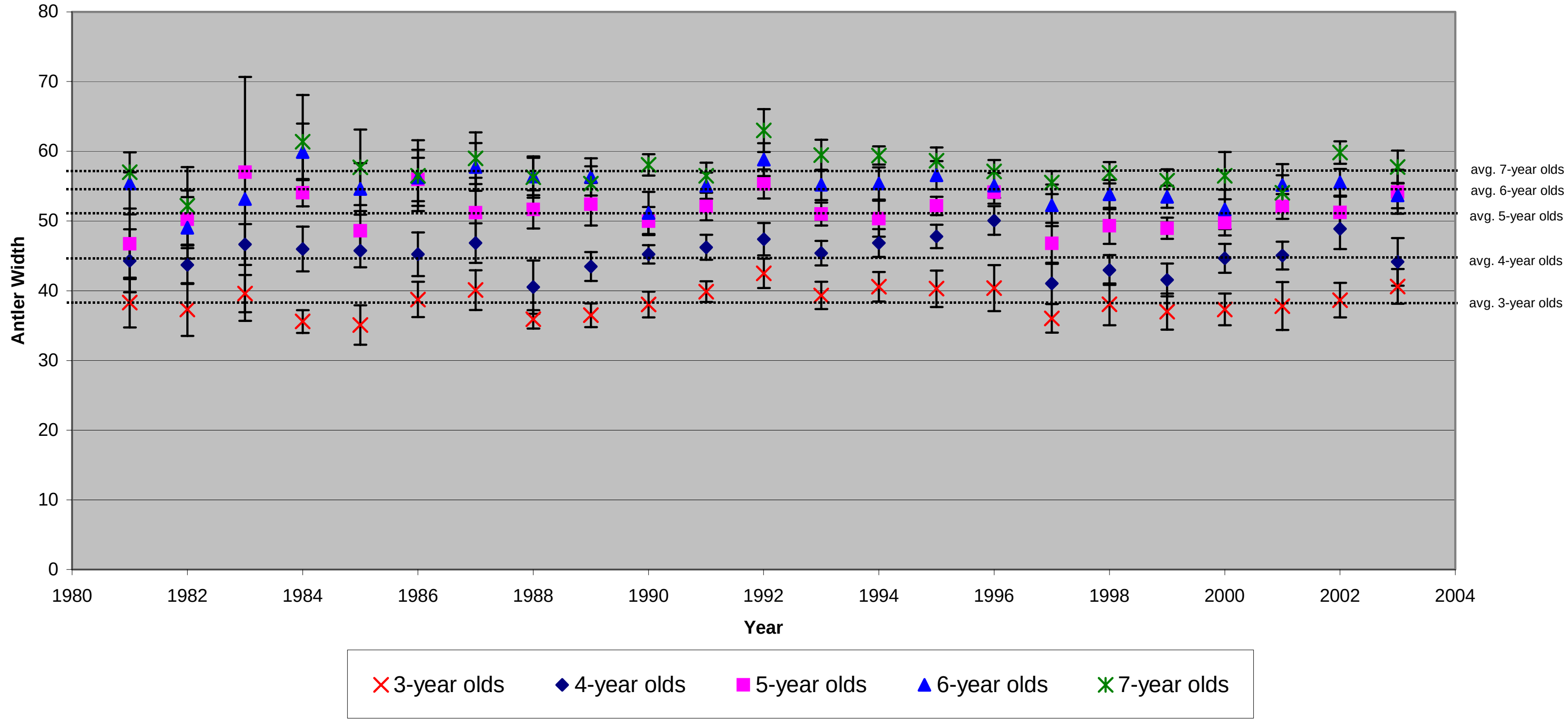

FIGURE 1 Moose antler widths and ages determined by incisor cementum annuli for 3- to 7-year-old moose checked at Ella's cabin, regulatory years 1983–1984 through 2003–2004

TABLE 1 Unit 21D Three Day Slough trend count area aerial moose composition counts, regulatory years 1981–1982 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1981–1982[a]	85.1	35	12	42	10	24	327	3.8
1982–1983[a]	85.1	43	13	24	2	14	415	4.9
1983–1984	84.8	31	9	37	12	22	530	6.3
1984–1985	57.8	30	13	31	10	19	332	5.7
1985–1986	83.3	39	11	17	4	11	501	6.0
1986–1987	83.3	39	7	45	13	25	660	7.9
1987–1988[a]	83.3	36	13	32	11	19	791	9.5
1988–1989	83.3	33	13	45	14	25	832	10.0
1989–1990	83.3	28	8	25	11	16	763	9.2
1991–1992[a]	83.3	34	10	31	6	19	909	10.9
1992–1993	83.3	35	10	31	7	18	1088	13.1
1993–1994[a]	83.3	38	8	25	4	16	1106	13.3
1994–1995	83.3	36	9	28	5	17	1026	12.3
1995–1996	83.3	23	7	36	6	23	1054	12.7
1996–1997	83.3	24	8	23	4	15	928	11.1
1997–1998	83.3	20	9	24	3	17	721	8.7
1998–1999	83.3	30	9	13	0	9	990	11.9
1999–2000	83.3	17	3	17	18	13	568	6.9
2001–2002	85.0	22	7	13	0	8	678	8.0
2003–2004	85.0	15	8	21	14	14	586	6.9

[a] Huntington and Spindler 1997.

TABLE 2 Unit 21D Dulbi River mouth trend count area aerial moose composition counts, regulatory years 1982–1983 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1982–1983	42.1	36	7	29	12	17	166	3.9
1983–1984	57.1	39	7	29	8	17	230	4.0
1984–1985	42.1	36	4	44	10	24	184	4.4
1987–1988	38.9	55	17	44	15	22	283	7.3
1992–1993	51.7	41	6	43	21	23	271	5.2
1996–1997	51.7	34	11	36	6	21	281	5.4
1997–1998	52.4	28	6	32	4	20	283	5.4
1999–2000	52.4	24	2	42	2	25	225	4.3
2000–2001	52.4	16	6	15	6	12	307	5.9
2001–2002	52.4	25	6	14	5	10	217	4.1
2003–2004	52.4	21	8	21	3	15	235	4.5

TABLE 3 Unit 21D Kateel River mouth aerial moose composition counts, regulatory years 1984–1985 through 1997–1998 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	47.8	21	8	54	5	31	68	1.4
1987–1988	38.0	41	20	41	12	23	84	2.2
1996–1997	49.4	46	15	29	14	16	152	3.1
1997–1998	61.1	26	10	34	0	21	188	3.1

TABLE 4 Unit 21D Long Stretch (Koyukuk River) aerial moose composition counts, regulatory years 1984–1985 through 1997–1998 (Huntington and Spindler 1997)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	51.5	94	31	31	25	14	36	0.7
1996–1997	51.3	36	6	61	25	31	65	1.3
1997–1998	62.5	47	7	33	0	18	77	1.2

TABLE 5 Unit 21D Koyukuk River mouth aerial moose composition counts, regulatory years 1984–1985 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	65.5	27	10	41	5	25	183	2.8
1987–1988	37.8	28	8	49	12	28	69	1.8
1993–1994	51.2	43	10	36	6	20	175	3.4
1996–1997	51.2	42	6	45	7	24	181	5.1
1997–1998	66.5	35	6	50	10	27	284	4.3
1999–2000	66.5	36	10	19	6	13	288	4.4
2001–2002	66.5	41	8	17	0	11	267	4.0
2003–2004	66.5	26	11	41	9	25	372	5.6

TABLE 6 Unit 21D Squirrel Creek aerial moose composition counts, regulatory years 1981–1982 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1981–1982	40.7	93	49	34	8	15	93	2.3
1982–1983	37.3	57	18	41	0	21	87	2.3
1983–1984	37.3	58	14	35	14	18	137	3.7
1985–1986	49.3	78	30	11	13	6	185	3.8
1987–1988	38.4	76	20	67	20	27	131	3.4
1993–1994	37.2	49	4	22	0	13	195	5.2
1995–1996	48.8	43	14	31	8	18	222	4.6
1997–1998	48.6	54	24	32	8	17	253	5.2
1998–1999	48.6	41	12	31	13	18	283	5.9
1999–2000	48.6	69	19	24	3	13	246	5.1
2000–2001	48.6	47	9	14	6	9	223	4.6
2001–2002	48.6	46	5	25	2	15	289	6.0
2003–2004	48.6	34	8	23	44	15	227	4.7

TABLE 7 Unit 21D Pilot Mountain Slough aerial moose composition counts, regulatory years 1983–1984 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1983–1984	36.5	21	8	52	11	30	133	3.6
1984–1985	36.5	11	2	47	39	30	84	2.3
1985–1986	36.5	27	11	9	0	7	90	2.5
1987–1988	35.7	36	18	49	11	26	185	5.2
1991–1992	23.2	24	8	54	14	30	161	6.9
1993–1994	35.4	21	1	39	10	24	135	3.8
1995–1996	34.3	20	14	57	14	32	203	5.9
1997–1998	47.3	12	4	32	11	22	222	4.7
1998–1999	47.3	18	6	28	2	19	297	6.3
1999–2000	47.3	18	8	39	3	25	243	5.1
2001–2002	47.3	26	9	40	7	24	238	4.8
2003–2004	47.3	13	10	45	14	28	259	5.5

TABLE 8 Unit 21D Kaiyuh Slough aerial moose composition counts, regulatory years 1985–1986 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1985–1986	50.8	54	17	8	0	5	78	1.5
1987–1988	39.1	28	7	33	7	20	74	1.9
1992–1993	50.8	36	18	24	22	15	72	1.4
1994–1995	50.8	44	12	31	0	18	119	2.3
1996–1997	64.3	60	13	67	6	30	125	1.9
1997–1998	64.3	35	12	39	10	23	146	2.3
1998–1999	64.3	42	18	48	10	25	173	2.7
1999–2000	64.3	39	12	22	13	14	129	2.0
2000–2001	64.3	41	9	31	15	18	127	2.0
2001–2002	64.3	55	4	7	0	5	112	1.8
2003–2004	64.3	46	19	42	23	22	130	2.1

TABLE 9 Unit 21D moose population estimates of 1997 and 2001 population estimation surveys (Bryant and Stout 2003)

Survey area	1997 Population estimate[a]	1997 Survey area (mi^2)	2001 Population estimate[b]	2001 Survey area (mi^2)
Kaiyuh Slough Sub-Area	1335 ± 230	1582	1800 ± 591	1843
Western Galena Sub-Area	3250 ± 403	1508	3403 ± 603	1734
Upper Koyukuk Sub-Area[c]	n/a	n/a	3642 ± 572	1949
Total Survey Area	4585 ± 633	3090	8924 ± 1161	5526

[a] Regression analysis estimate.
[b] Spatial analysis estimate.
[c] Predominantly within Unit 24.

TABLE 10 Unit 21D large bull[a] moose percent harvested and number measured during the hunting season and percent counted during aerial surveys in the Three Day Slough area (UCU 0804), regulatory years 1990–1991 through 2003–2004

Regulatory year	% Harvested (Sep)	Number measured (Sep)	% Counted (Nov)
1990–1991	54	91	–[b]
1991–1992	45	134	15
1992–1993	54	88	15
1993–1994	53	107	18
1994–1995	67	88	28
1995–1996	61	150	27
1996–1997	68	123	20
1997–1998	63	120	16
1998–1999	61	209	30
1999–2000	65	220	21
2000–2001	37	119	–[b]
2001–2002	40	83	30
2002–2003	46	97	–[b]
2003–2004	57	108	25

[a] 50-inch or greater antler spread.
[b] No survey.

TABLE 11 Unit 21D moose aerial twinning surveys in the Three Day Slough trend count area, regulatory years 1989–1990 through 2003–2004

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates in May
1989–1990		24	21	47		21–25
1991–1992		22	23	51		22–23
1992–1993	296	23	19	44	100	23–25
1993–1994	110	39	11	22	55	23–24
1994–1995	78	37	18	33	38	22
1995–1996	200	39	13	26[b]	51	22,24
1996–1997	180	30	9	23	58	23–24
1997–1998	70	29	4	12	11	20–30
1998–1999	28	37	3	8	14	4–7[c]
1999–2000	101	53	8	13	47	27–29
2000–2001		38	6	14		28–30
2001–2002	30	13	3	19	2	29–6/1
2002–2003	18	37	14	27	21	27,28
2003–2004	44	35	25	42	31	26,27

[a] Percent of cows with calves that had twins.
[b] Including 1 cow w/3 calves.
[c] The 1999 survey was delayed to 4–7 June due to weather.

TABLE 12 Unit 21D moose aerial twinning surveys in the Pilot Mountain Slough to Kaiyuh Slough trend count areas, regulatory years 2003–2004 (FWS)

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates in May
2003–2004	52	32	18	36	28	24,25

[a] Percent of cows with calves that had twins.

TABLE 13 Unit 21D moose harvest, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest by hunters				Unreported Harvest[a]	Potlatch/ Stickdance	Total
	Bull	Cow	Unk	Total			
1990–1991	258	24	1	283	40	4	327
1991–1992	269	34	0	303	40	11	354
1992–1993	193	22	1	216	40	11	267
1993–1994	235	23	2	260	40	9	309
1994–1995	248	26	1	275	40	8	323
1995–1996	329	21	1	351	40	4	395
1996–1997	315	110	1	426	150	4	580
1997–1998	336	73	1	410	150	4	564
1998–1999	340	80	3	423	150	1	574
1999–2000	336	127	3	466	150	3	619
2000–2001	320	35	0	355	150	10	515
2001–2002	247	49	2	298	150	13	461
2002–2003	316	10	0	326	150	14	490
2003–2004[b]	317	9	1	327	150	13	490

[a] Unreported harvest based on Subsistence Division's door-to-door survey.
[b] Preliminary data.

TABLE 14 Ella's cabin checkstation moose harvest, regulatory years 1990–1991 through 2003–2004[a]

Regulatory year	Bull	Cow	% Cow	Total
1990–1991	177	6	3	183
1991–1992	199	10	5	209
1992–1993	161	6	4	167
1993–1994	179	6	3	185
1994–1995	192	10	5	202
1995–1996	279	8	3	287
1996–1997	263	90	25	353
1997–1998	257	49	16	306
1998–1999	284	61	18	345
1999–2000	275	94	25	369
2000–2001[b]	266	11	4	278
2001–2002[b]	183	3	2	187
2002–2003	217	0	0	217
2003–2004	248	0	0	248

[a] Contains moose harvested in Units 21D and 24.
[b] 1 moose unknown sex

TABLE 15 Ella's cabin checkstation[a,b] moose hunter residency and success, regulatory years 1983–1984 through 2003–2004

Regulatory	Unit 21D resident		Alaska resident[c]		Nonresident		Total	
year	Hunter	Moose	Hunter	Moose	Hunter	Moose	Hunter	Moose
1983–1984[d]	132	43	29	20	3	2	164	65
1984–1985[d]	92	61	67	36	9	9	168	106
1985–1986[d]	117	32	74	37	4	3	195	72
1986–1987[d]	140	48	80	51	9	7	229	106
1987–1988[d]	151	68	92	61	21	16	264	145
1988–1989[d]	158	73	121	88	20	20	299	181
1989–1990	154	55	125	89	23	14	302	158
1990–1991	137	48	133	105	36	30	306	183
1991–1992	136	49	189	121	55	38	380	208
1992–1993	145	45	173	103	39	19	357	167
1993–1994	115	48	132	109	34	28	281	185
1994–1995	106	34	194	127	56	41	356	202
1995–1996	124	49	260	188	63	50	447	287
1996–1997	213	90	306	198	89	66	608	354
1997–1998	157	66	278	185	89	55	524	306
1998–1999	155	58	344	213	126	74	625	345
1999–2000	180	68	383	210	173	91	736	369
2000–2001	203	77	261	175	43	26	507	278
2001–2002	199	49	287	124	35	14	521	187
2002–2003	215	70	227	130	41	18	483	218
2003–2004	230	80	326	148	40	20	596	248

[a] Includes hunters from both Units 21D and 24.
[b] Includes hunters reporting at Huslia.
[c] Other than Unit 21D residents.
[d] Check not mandatory prior to 1990.

TABLE 16 Overall scores for meat evaluation at Ella's cabin, regulatory years 2002–2003 and 2003–2004

Regulatory year	Avg. no. days hanging	Avg. clean score[a]	Avg. dry score[a]	Avg. smell score[a]	Avg. overall score[a]	Sample size (*n*)
2002–2003	3.3	4.3	4.3	n/a	4.3	184
2003–2004	3.3	4.2	4.4	4.8	4.2	199

[a] Subjective ranking scale of 1–5, with a score of 1 being lowest.

TABLE 17 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2003–2004[a]

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Unk	Total harvest
RM832	1998–1999	295	8	45	55	125	(77)	38	(23)	0	163
	1999–2000	356	9	49	51	127	(70)	54	(30)	1	182
	2000–2001	355	14	45	55	157	(93)	11	(7)	1	169
	2001–2002	403	15	62	38	126	(97)	3	(2)	1	130
	2002–2003	359	17	51	49	145	(100)	0	(0)	0	145
	2003–2004	401	12	55	45	155	(99)	0	(0)	2	157
RM830	1998–1999	330	5	45	55	159	(87)	23	(13)	0	182
	1999–2000	380	3	51	49	148	(79)	39	(21)	0	187
DM827	2000–2001	26	19	52	48	10	(100)	0	(0)	0	10
	2001–2002	26	19	68	32	5	(83)	1	(7)	0	6
	2002–2003	20	35	31	69	9	(100)	0	(0)	0	9
	2003–2004	26	19	63	37	7	(100)	0	(0)	0	7
DM828	2000–2001	103	51	22	78	38	(100)	0	(0)	0	38
	2001–2002	103	63	54	46	17	(100)	0	(0)	0	17
	2002–2003	79	56	45	55	17	(100)	0	(0)	0	17
	2003–2004	103	48	40	60	27	(100)	0	(0)	0	27
DM829	2000–2001	26	15	27	73	16	(100)	0	(0)	0	16
	2001–2002	26	15	50	50	8	(100)	0	(0)	0	8
	2002–2003	20	45	0	100	11	(100)	0	(0)	0	11
	2003–2004	26	12	38	62	13	(100)	0	(0)	0	13

Table 17 continued

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Unk	Total harvest
DM830	2000–2001	103	41	25	75	45	(100)	0	(0)	0	45
	2001–2002	103	51	43	57	26	(100)	0	(0)	0	26
	2002–2003	79	38	16	84	41	(100)	0	(0)	0	41
	2003–2004	103	36	24	76	44	(100)	0	(0)	0	44
Total	1998–1999	625	7	41	59	284	(82)	61	(18)	0	345
	1999–2000	736	5	46	54	275	(75)	93	(25)	1	369
	2000–2001	613	25	39	61	266	(96)	11	(4)	1	278
	2001–2002	661	29	59	41	182	(97)	4	(2)	1	187
	2002–2003	557	27	46	54	217	(100)	0	(0)	1	218
	2003–2004	659	22	50	50	246	(99)	0	(0)	2	248

[a] RM832 ended in RY00 and was replaced by Drawing Hunts DM827, 828, 829, and 830.

TABLE 18 Unit 21D moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	
1990–1991	103	135	35	10	283	34	27	4	6	71	354
1991–1992	105	150	42	6	303	60	97	16	3	176	479
1992–1993	72	111	23	10	216	56	82	14	15	167	383
1993–1994	87	141	24	8	260	55	27	7	2	91	351
1994–1995	80	148	44	3	275	47	68	13	0	128	403
1995–1996	90	203	54	4	351	41	77	9	0	127	478
1996–1997	135	218	70	3	426	127	143	34	1	305	731
1997–1998	127	226	57	0	410	110	104	52	0	266	676
1998–1999	100	232	88	3	423	124	180	76	1	381	804
1999–2000	126	232	104	4	466	140	202	121	1	464	930
2000–2001	111	198	45	1	355	78	107	48	0	233	588
2001–2002	105	167	26	0	298	145	231	63	0	439	737
2002–2003	108	171	47	0	326	133	171	19	1	324	650
2003–2004[b]	95	164	52	16	327	185	190	59	11	445	772

[a] Subunit resident only.
[b] Preliminary data.

TABLE 19 Unit 21D moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory	Harvest chronology percent by month/day			
year	9/1–9/14	9/15–9/25	2/1–2/10	*n*
1996–1997	53	43	4	423
1997–1998	59	37	4	446
1998–1999	50	49	1	386
1999–2000	48	47	5	456
2000–2001	48	47	4	348
2001–2002	29	63	8	282
2002–2003	32	64	5	306
2003–2004[a]	46	48	6	309

[a] Preliminary data.

TABLE 20 Unit 21D moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method								Total
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	
1990–1991	4	0	88	0	3	0	2	2	283
1991–1992	5	0	86	0	5	0	2	2	303
1992–1993	3	0	88	1	3	0	2	3	216
1993–1994	3	0	88	1	5	0	1	2	260
1994–1995	4	0	85	0	7	1	2	1	275
1995–1996	3	0	91	1	2	1	2	0	351
1996–1997	2	0	91	1	4	0	2	1	426
1997–1998	4	0	90	1	4	0	1	0	410
1998–1999	5	0	88	0	3	1	2	1	423
1999–2000	2	0	90	0	5	1	1	2	466
2000–2001	3	0	90	1	4	1	1	1	355
2001–2002	3	0	89	1	7	0	1	0	298
2002–2003	5	0	87	0	4	1	1	2	326
2003–2004[a]	7	0	87	0	6	0	0	1	327

[a] Preliminary data.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 22 (25,230 mi^2)

GEOGRAPHIC DESCRIPTION: Seward Peninsula and the adjacent mainland drained by all streams flowing into Norton Sound

BACKGROUND

Before 1930 very few moose were observed on the Seward Peninsula. However, by the late 1960s much of the suitable habitat in Unit 22 contained moose. Moose populations grew rapidly in the 1960s through the early 1980s and peaked in the mid 1980s in most parts of the unit. Severe winters in 1989, 1990 and 1992 caused declines in moose densities because winter browse was insufficient to maintain such large populations in Units 22B and 22D (Nelson 1995). Populations in these areas never recovered and recent data indicates these populations and others in the unit are currently declining. Habitat is no longer believed to be a major limiting factor at current population levels; rather, brown bear predation on calves is thought to be a significant factor suppressing Unit 22 moose populations.

Although moose have been present in Unit 22 for a relatively short time, they rapidly became an extremely important food source for many Seward Peninsula residents, and demand for moose by subsistence and sport hunters is high throughout the unit. Gravel roads, trails, navigable rivers and snowmachines provide hunters with easy access to suitable moose habitat (Machida 1997). Annual harvests reported from 1969 through 2002 ranged from a low of 44 moose in 1972 to a high of 408 moose in 1986 (Table 1). However, in recent years declining moose populations prompted the Board of Game to implement restrictions intended to reduce harvest in many parts of Unit 22. Unit residents account for the majority of the annual reported harvest.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

The following population objectives and bull:cow ratios presented to the Board of Game are the management goals for Unit 22:

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[a] This unit report also includes data collected after the reporting period at the discretion of the reporting biologist.

- Unit 22 unitwide: Maintain a combined population of 5100–6800 moose.
    - Unit 22A: Maintain a population of 600–800 moose.
    - Unit 22B West: Increase and stabilize the population at 1000–1200 moose.
    - Unit 22B East: Insufficient data exists to develop a specific management goal; however, increased recruitment rates and population growth are desired.
    - Unit 22C: Slightly reduce and maintain a population of 450–475 moose.
    - Unit 22D: Increase and stabilize the population at 2000–2500 moose.
    - Unit 22E: Increase and stabilize the population at 200–250 moose.
- Maintain a minimum bull:cow ratio of 30:100 in Units 22A, 22B, 22D, and 22E.
- Maintain a minimum bull:cow ratio of 20:100 in Unit 22C.

The Unit 22 population objective (5100–6800 moose) recommended by the department was adopted by the Board of Game in November 2001. This objective was revised downward slightly from our previous management goal of 5700–7300 moose, which may be slightly larger than the habitat can support. In Units 22A, 22B, 22D and 22E our goal is to increase and stabilize the population from a period of steady decline in moose numbers. In Unit 22C, the goal is to slightly reduce numbers and maintain a population within winter browse carrying capacity. We attempt to maintain a minimum bull:cow ratio of 30:100 in all units except Unit 22C where a minimum bull:cow ratio of 20:100 is acceptable.

MANAGEMENT OBJECTIVES

The management objectives for survey and inventory activities in Unit 22 are:

- In selected areas of the unit make annual estimates of moose abundance, sex and age composition, and yearling recruitment and determine trends in population size and composition.
    - Complete censuses in the 5 subunits of Unit 22 on a 3-year rotational basis to estimate moose abundance.
    - Complete late fall and/or early spring aerial surveys in selected portions of the unit to provide an index of moose population status and trends, sex and age composition, and yearling recruitment.
- Monitor human and natural mortality factors affecting the population.
    - Evaluate hunting mortality by analyzing all moose harvest data.

- Improve harvest reporting through public education, vendor support and improved communication, and by conducting community-based harvest assessment surveys in selected villages.

- Evaluate hunting regulations and recommend changes if necessary for conservation purposes.

- Improve public understanding of hunting regulations and the reasons they are necessary.

METHODS

We conducted aerial surveys in the spring and fall to estimate sex and age composition and short yearling recruitment in portions of Unit 22 during the report period. In March of 2002, a moose census of Unit 22D was completed using the geostatistical population estimator technique (J. VerHoef, ADF&G, personal communication). In March of 2003 the same technique was used to census moose in the Unalakleet River drainage in Unit 22A and in Unit 22E. We summarized harvest reports returned by hunters and harvest data collected during big game harvest surveys in Golovin, Unalakleet and Stebbins. The department implemented registration moose hunts in the most heavily hunted areas along the Nome road system in Units 22B and 22D. Public meetings were held in Unit 22A to discuss declining moose populations and to form recommendations to the Board of Game for changes to hunting regulations.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

In Unit 22A, a census of the Unalakleet River drainage, completed during 6–10 March 2003, estimated 75 moose (90% ± 38.6%), showing a significant decline in moose numbers since previous censuses in 1989 and 1994 (Table 2). Spring 2000 and 2003 recruitment surveys found very low recruitment rates in other Unit 22A drainages north of the Golsovia River drainage. In the portion of the unit southwest of the Golsovia River drainage recruitment rates were higher, but overall numbers of moose were low. These data indicate the population is well below our management goal of 600–800 moose for the unit. Historically moose densities have been lower in Unit 22A than in many other parts of the unit, possibly due to higher predator densities and/or less suitable habitat. Currently, however, there appears to be considerable unused habitat. Comparison of low moose numbers found in winter censuses and surveys to relatively high numbers observed during fall composition surveys substantiates reports from longtime local residents that some moose migrate from summer and fall range in the Unalakleet River drainage to wintering areas in the Anvik and Yukon River drainages in Unit 21.

Moose densities in Units 22B and 22D have declined since the dramatic increases observed in the 1980s. The winters of 1989, 1990, and 1992 were particularly severe on moose, and winter mortality was reported to be higher than normal during those years. Census data from western Unit 22B show a 50% decline between 1987 and 1999 with continued low recruitment (Table 2). The 1999 population estimate for western Unit 22B was 797 moose (90% C.I. ±19%). Although we have no density estimates for eastern Unit 22B, recruitment estimates in 1999 and 2000 in the Koyuk drainage were similar to those in the western portion of the unit. Based on this information and comments by local residents, we suspect poor calf survival may also be affecting moose densities in eastern Unit 22B.

A 2002 moose census in Unit 22D estimated 1594 moose (90% C.I. +/-12.2%), indicating a 45% population decline since the area was first censused in 1988 (Table 2). The 2002 census documented an 18% decline since 1997 in the Kuzitrin River drainage portion of Unit 22D, while the population in the American/Agiapuk portion of the census area remained relatively stable between 1997 and 2002.

The Unit 22C moose population grew steadily throughout the 1990s and in spring 2001 was estimated at 557 moose. This estimate exceeds our management goal by 18% and adds to concern that the population may exceed the carrying capacity of the winter range. Yearling recruitment is highest in Unit 22C and generally exceeds 20%. However, the bull:cow ratio is low, varying between 10–20 bulls:100 cows.

The first stratified census of Unit 22E was completed in March 2003, yielding an estimate of 504 moose (90% C.I. ±10%). This estimate is higher than all previous estimates and well above our management goal of 200–250 moose (Table 2). Past radiocollar studies have shown considerable seasonal migration between Units 22E and 22D, and the increase observed is probably due to unusually sparse snow cover enabling moose that normally winter in Unit 22D drainages to remain on their summer range in Unit 22E. It is unlikely that there has been a significant overall increase in moose numbers in this area. In the future we will attempt to account for yearly differences in distribution of moose by censusing both Units 22D and 22E in the same year.

Population Size

A 5–12 March 2002 census of Unit 22D was completed using the geostatistical population method developed by Jay VerHoef. The estimate for the entire 2500 mi^2 census area was 1594 moose (90% C.I. 1399–1790 ±12 %). This estimate indicates population size declined by 45% since the area was first censused in 1988, and a 13% decline was indicated between the previous census in 1997 and 2002 (Table 2). The calf:adult ratio was 14 calves:100 adults (90% C.I. ±21).

Separate estimates were generated for the Kuzitrin River drainage and the Agiapuk River drainage portions of the census area. The estimate for the Kuzitrin River drainage was 1028 moose (90% C.I. ±14%), indicating a 47% decline in population size since the 1988 census and an 18% decline since 1997. The calf:adult ratio was 12 calves:100 adults (90% C.I. ±25%). The recruitment rate was 11%.

The estimate for the Agiapuk River drainage was 567 moose (90% C.I. ±21%), indicating a 40% decline since 1988 and a relatively stable population since 1997 (point estimate showed a 2% decline, which is not statistically significant). The calf:adult ratio was 17 calves:100 adults (90% C.I. ±31%). The recruitment rate was 14%. The census results showing a continued decline in the Kuzitrin drainage and a fairly stable population in the Agiapuk drainage were consistent with expectations based on data from recruitment and composition surveys in recent years and with impressions of many local residents.

In 2003 a geostatistical population census of the approximately 2000 mi^2 Unalakleet River drainage in Unit 22A was completed 6–10 March. We obtained an estimate of 75 moose (90% C.I. 46–103 ±39%). The calf:adult ratio was 15 calves:100 adults (90% C.I. ±75%). We do not have previous estimates for the entire drainage; however, when compared to the 1989 census estimate of 325 moose in a 1124 mi^2 portion of the drainage, more than a 3-fold decline is indicated. These results are consistent with results of spring surveys showing very low recruitment rates and with concerns of many local residents.

During 9–11 March 2003 we conducted the first geostatistical population census in Unit 22E. Previous estimates were minimum direct counts obtained during moose surveys of riparian habitat. The 2003 estimate was 504 moose (90% C.I. 456–551 ±10%), and 23 calves:100 adults. The recruitment rate was 19%. This estimate is above our management goal of 200–250 moose and higher than all previous Unit 22E estimates. It would suggest a reversal in the decade-long trend of declining moose numbers and low recruitment rates in Unit 22E; however, we believe the estimate reflects an unusual abundance of moose wintering in the unit instead of an actual increase in the overall population in Unit 22E. Collaring studies in the mid 1980s showed considerable seasonal movement of moose between Unit 22E and the American/Agiapuk River drainages in Unit 22D, and many moose that typically wintered in Unit 22D moved to Unit 22E during summer months. During the winter of 2002–2003 snow cover was very sparse and shallow. We found many moose in coastal areas where they have not been found during previous winter surveys. Snow depth was likely insufficient to drive many moose to their typical wintering areas in the river bottoms in Unit 22E and to the American and Agiapuk River drainages in Unit 22D. However, the 19% recruitment rate was higher than in previous years (8% in 2000) and the March 2003 recruitment rate in the American/Agiapuk River drainages in Unit 22D was also higher (23% short yearlings) than in recent years, indicating a widespread improvement in calf survival.

Population Composition

In November 2001, fall composition surveys were conducted in portions of Units 22B, 22C and 22D. Results from those surveys were reported in the previous management report. In November 2002, we surveyed the Snake and Stewart River drainages in Unit 22C, and in November 2003 composition surveys were flown in Kuzitrin and Agiapuk River drainages in Unit 22D. These surveys were done using a Robertson R44 helicopter, which greatly improves our ability to find moose when snow cover is minimal. In October 2003 we flew composition surveys in Unit 22A in the Unalakleet and Golsovia River drainages using a Cessna-185. Results of all composition surveys are found in Table 3. In spring 2003, recruitment surveys were flown in Units 22A, 22B, and 22D (Table 4).

<u>Unit 22A</u> In March 2003 spring recruitment surveys were flown in the Unalakleet, Golsovia and Pikmiktalik River drainages of Unit 22A. We surveyed the main stem of the Unalakleet River immediately after the census to address Unalakleet residents' skepticism about our low count. We found 19 moose with 16% short-yearlings, which was consistent with census results. In the Golsovia River drainage 29 moose were counted with 21% short-yearlings. In the lower Pikmiktalik River drainage, we found 17 moose and 35% short-yearlings.

In early October 2003 (after the reporting period) department and BLM staff flew composition surveys in the Unalakleet and Golsovia drainages of Unit 22A for the first time. Sightablility in the trees was poor without snow cover, but we were able to ascertain some important information. In the Unalakleet drainage where our observations were limited to a small portion of total moose habitat, we classified 68 moose, which is close to the March 2003 census estimate of 46–103 moose for the entire drainage. This supports local claims that more moose are present in the drainage in the fall than in winter months. We found 69 bulls:100 cows and 20 calves:100 cows. Our survey occurred close to the peak of rut and bulls were more visible than cows, thus our bull:cow ratio is likely skewed upward. However, rutting groups were small with few cows per bull, indicating a fairly high bull:cow ratio. It is unlikely that depletion of bulls by excessive hunting pressure is responsible for the dramatic decline in moose numbers. Also of note were the overall low density of moose and the vast amount of unused habitat.

In the Golsovia River drainage we found 26 moose, 50 bulls:100 cows and 67 calves:100 cows. Here, too, moose density appears very low with much vacant habitat; however, the fall calf:cow ratio and the calf:adult ratios seen in previous winter surveys are higher than those documented in most parts of Unit 22.

Unit 22B. In spring 2003 we flew a Niukluk River recruitment survey, finding 65 total moose, and 6 short-yearlings. The recruitment rate was 9%. In 2003, in other parts of Unit 22 where we surveyed, we documented higher recruitment rates than we have seen in recent years, but this was not the case in western Unit 22B, where the recruitment rate has remained at 10% or lower since 1991.

Unit 22C. In November 2002 we surveyed the Snake River drainage in Unit 22C and classified 95 moose, finding 18 bulls:100 cows and 52 calves:100 cows. In the Stewart River drainage we found 30 moose, 42 bulls:100 cows and 16 calves:100 cows. Combining these adjacent drainages we classified 125 moose, finding 24 bulls:100 cows and 43 calves:100 cows. This is the highest calf:cow ratio we have documented in Unit 22C. The bull:cow ratio in the Stewart River drainage is considerably higher than that documented in the more accessible adjoining drainages and helps alleviate concerns about excessive bull harvest in Unit 22C.

Unit 22D. In March of 2003 we flew Kuzitrin River drainage recruitment surveys along the main stems of the lower Kougarok River drainage, the Noxapaga/Kuzitrin River drainages above the Taylor Highway bridge and the main stem of the Kuzitrin River below the bridge. Results were similar in all three areas (Table 4). We recorded 19 short-yearlings:100 adults and a 16% recruitment rate (n=644). A higher portion of yearlings were found in this area than in the previous recruitment survey in 2000 or in the 2002 Unit 22D census. We also surveyed the Agiapuk River survey area and there too found a higher than usual proportion of short-yearlings with 30 short-yearlings:100 adults and a 23% recruitment rate (n=320).

In November 2003 (after the reporting period) we flew composition surveys in portions of the Kuzitrin River drainage in Unit 22D, finding 26 bulls:100 cows (n=232). This represents a substantial increase since 2000 and 2001 when 15–16 bulls:100 cows were observed. Most of the bulls seen were yearling or 2-year-old bulls, with very few large bulls. However, the overall increase in bull numbers is a positive indication that the harvest quota for this area, imposed in 2002, is having the desired effect of increasing the bull:cow ratio. We found 15 calves:100 cows, which is similar to calf:cow ratios documented in this area since 2000.

A November 2003 (after the reporting period) survey of the American and Agiapuk River drainages documented 24 bulls:100 cows (n=223) which is below ratios documented previously in that area. However, fog prevented observations in the upper Agiapuk portion of the survey area where we have consistently found the highest concentration of bulls. It is likely that the lack of observations from that area reduced the observed bull:cow ratio and unlikely that there was a sudden large reduction in bull numbers. We found 27 calves:100 cows, which is the highest calf:cow ratio we have documented in this survey area.

Distribution and Movements

No studies were undertaken during this reporting period to evaluate distribution or movements of moose in Unit 22.

MORTALITY

Harvest

Season and Bag Limit. The 2001–2002 seasons and bag limits were unchanged from the previous reporting period. In 2002–2003, changes were implemented in Units 22B, 22D, and 22E.

2001–2002 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22A		
Residents: 1 bull	1 Aug–30 Sep 1 Dec–31 Jan	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side		1 Aug–30 Sep
Unit 22B, that portion east of the Darby Mountains, including the drainages of the Koyuk and Inglutalik Rivers		
Residents: 1 bull	1 Aug–30 Sep 1 Nov–31 Dec	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side		1 Nov–31 Dec
Remainder of Unit 22B		
Residents: 1 bull	1 Aug–30 Sep 1 Dec–31 Jan	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side		1 Sep–30 Sep

2001–2002 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22C		
Residents: 1 bull	1 Sep–14 Sep	
Or one antlerless moose by registration permit	15 Sep–30 Sep	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side		1 Sep–14 Sep
Unit 22D, that portion within the Kougarok, Kuzitrin and Pilgrim River drainages		
Residents: 1 antlered bull	1 Aug–31 Jan	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side		1 Sep–30 Sep
Remainder of Unit 22D		
Residents: 1 antlered bull or	1 Aug–31 Jan	
1 moose	1 Dec–31 Dec	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side; however, antlerless moose may be taken only from 1 Dec–31 Dec.		1 Aug–31 Jan
Unit 22E		
Residents: 1 moose; however, no person may take a cow accompanied by a calf	1 Aug–31 Mar	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side		1 Aug–31 Mar

2002–2003 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22A		
Residents: 1 bull	1 Aug–30 Sep 1 Dec–31 Jan	

2002–2003 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side		1 Aug–30 Sep
Unit 22B, that portion east of the Darby Mountains, including the drainages of the Koyuk and Inglutalik Rivers		
Residents: 1 bull	1 Aug–30 Sep 1 Nov–31 Dec	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side		1 Nov–31 Dec
Remainder of Unit 22B		
Residents: 1 antlered bull by registration permit only; or	10 Aug–23 Sep	
1 bull by registration permit only	1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season
Unit 22C		
Residents: 1 bull; or	1 Sep–14 Sep	
1 antlerless moose by registration permit	15 Sep–30 Sep	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side		1 Sep–14 Sep
Unit 22D, that portion within the Kougarok, Kuzitrin and Pilgrim River drainages		
Residents: 1 antlered bull by registration permit only; or	20 Aug–14 Sep	
1 bull by registration permit only	1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season

2002–2003 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22D Southwest, that portion west of the Tisuk River drainage, west of the west bank of the unnamed creek originating at the unit boundary opposite the headwaters of McAdam's Creek to its confluence with Tuksuk Channel		
Residents: 1 antlered bull by registration permit only; or	20 Aug–14 Sep	
1 bull by registration permit only	1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season
Remainder of Unit 22D		
Residents: 1 antlered bull or 1 moose; however, antlerless moose may be taken only from 1 Dec through 31 Dec. A person may not take a cow accompanied by a calf	10 Aug–14 Sep 1 Oct–31 Jan	
Nonresidents: 1 bull with 50–inch antlers or with 4 or more brow tines on at least 1 side		1 Sep–14 Sep
Unit 22E		
Residents: 1 antlered bull	1 Aug–31 Dec	
Nonresidents:		No open season

<u>Board of Game Actions and Emergency Orders</u>. In November 2001 the Board of Game addressed concerns about declining moose populations in parts of Unit 22 by making a number of changes to moose seasons and bag limits in Units 22B, 22D and 22E that went into effect in regulatory year 2002–2003. In Unit 22B west of the Darby Mountains (remainder of Unit 22B), fall and winter resident registration permit hunts with harvest quotas were established from 10 August to 23 September for any antlered bull and from 1 January to 31 January for any bull. The nonresident moose season in western Unit 22B was closed.

In the portion of Unit 22D that includes the Kuzitrin drainage and the area west of the Tisuk River drainage a resident registration hunt for bull moose was established with a separate quota for each area. The season is 20 August–14 September for any antlered bull. If the quotas for these areas are not reached, a winter season from 1 January to 31 January may be announced.

The nonresident moose season in these portions of Unit 22D was closed. In the remainder of Unit 22D the resident season was shortened to 10 August–14 September and 1 October–31 January. The nonresident season is 1 September–14 September.

In Unit 22E the resident moose season was shortened by 3 months to 1 August–31 December, and the bag limit was changed from 1 moose to 1 antlered bull. The nonresident season was closed.

In July 2001, prior to the board actions described above, we issued an emergency order shortening the 2001 resident and nonresident moose seasons in the most heavily hunted parts of Units 22B and 22D. In western Unit 22B, Unit 22D in the Kuzitrin River drainage and in southwestern Unit 22D, the resident season was shortened to 20 August–14 September. The nonresident season was reduced to 1–14 September. In Unit 22E the shortened season for all hunters was 1 August–31 December and the bag limit was changed from 1 moose to 1 antlered bull.

In December 2002 an emergency order was issued announcing 1–31 January seasons for bull moose by registration permit in western Unit 22B and southwestern Unit 22D. Quotas of 10 bulls in western Unit 22B and 3 bulls in 22D southwest were announced, but neither was filled so the seasons ran to the published closure date.

In November 2003 (after the reporting period) the board made additional changes in moose regulations in Units 22A, 22B, 22C, and 22D, effective in regulatory year 2004–2005. In Unit 22A seasons were shortened and 3 hunt areas with differing seasons and bag limits were established to take into account the different hunting patterns in different parts of Unit 22A. In Unit 22A north of and including the Shaktoolik and Tagoomenik River drainages, the resident season was shortened to 1 August–30 September, and the nonresident season was shortened to 1–14 September. In Unit 22A in the Unalakleet drainage and all drainages flowing into Norton Sound north of the Golsovia drainage and south of the Tagoomenik and Shaktoolik drainage, the resident season was shortened to 15 August–25 September, and the nonresident season was closed. In the remainder of Unit 22A the resident season was shortened to 1 August–30 September and 1–31 December, and the bag limit was changed to 1 antlered bull. The nonresident season was reduced to 1–30 September.

In western Unit 22B the winter registration moose hunt from 1–31 January was put into permanent regulation, so emergency order openings will no longer be necessary. The bag limit was changed from 1 bull to 1 antlered bull to prevent accidental harvest of cows.

A registration hunt for bull moose was established in Unit 22C to simplify permit requirements in the Nome area. People hunting in all areas along the Nome road system will need only 1 registration permit, which will be valid in 4 hunt areas: Unit 22C, western Unit 22B, the Kuzitrin drainage in Unit 22D, and Unit 22D southwest. No changes were made to seasons or bag limits in Unit 22C.

In Unit 22D remainder, where hunting pressure has recently increased, a nonresident registration hunt was established with a limit of up to 10 permits.

In November 2003, following the board meeting, we issued an emergency order that closed the winter moose season in Unit 22A north of the Golsovia River drainage and shortened the winter season by 1 month to the month of December in the remainder of Unit 22A and changed the bag limit to 1 antlered bull. Data showing steep declines in the Unit 22A moose population prompted us to put the board's actions into effect immediately rather than waiting for the 2004 regulatory year. The Federal Subsistence Board mirrored this action with a "Special Action." The November emergency order also announced the opening of a 1–31 January season in western Unit 22B and 22D southwest with a quota of 10 bulls in Unit 22B and 3 bulls in 22D southwest.

Hunter Harvest. During the 2001–2002 season, harvest ticket data shows that 421 hunters harvested 127 moose (119 males and 8 females). A harvest of 172 moose (160 males and 12 females) was reported taken by 563 hunters during the 2002–2003 season (Table 1).

In 2001 and 2002, moose harvests and success rates were the lowest reported in Unit 22 since the mid 1970s. Declining numbers of moose; fewer hunters in the field in 2001; an emergency order in 2001 shortening seasons in western Unit 22B, Unit 22D in the Kuzitrin River drainage, southwestern Unit 22D and Unit 22E; and permanent regulation changes shortening seasons and restricting harvest in the same areas in 2002 contributed to reduced hunter effort and harvest. In 2002 more people reported hunting in Unit 22 than in recent years, but the increase is attributed to the strictly enforced reporting requirements in the new registration hunts, rather than an actual increase in the number of hunters in the field.

Compliance with license and harvest reporting requirements by Nome residents is believed to be high, but harvest reporting by village residents has always been incomplete. During this reporting period, the department and Kawerak Inc. continued a community-based harvest assessment program begun in April 1999 to obtain more accurate big game harvest data from Unit 22 villages. In April 2002 household surveys were conducted in Golovin, and no moose harvest was reported. In May 2003 we surveyed Unalakleet and Stebbins. Unalakleet residents reported harvesting 29 moose, and 31% of the households that reported hunting moose were successful. Only 41% (12 moose) of the moose taken by Unalakleet residents were reported by harvest ticket. Stebbins households reported a harvest of 20 moose. The success rate in Stebbins was 46%. Twenty percent of the Stebbins harvest (4 moose) was reported by harvest ticket. (Georgette 2004).

In 2001–2002, 7% (8 cows) of the reported harvest was cows and in 2002–2003 the cow harvest was 8% (12 cows) of the total (Table 1). Ninety-five percent of these cows were harvested in the antlerless moose registration hunts in Unit 22C. Although no cow harvest was reported during village harvest surveys in this reporting period, harvest surveys in previous years have shown that more cows are harvested than are reported by harvest ticket. However, now that antlerless seasons have been closed in most parts of Unit 22, we believe that cow harvest is minimal.

Permit Hunts. Two registration permit hunts for antlerless moose are administered in Unit 22C. Hunt RM850 occurs in the portion of Unit 22C in the Nome and Snake River drainages with up to 5 available permits. RM852 is in the remainder of Unit 22C and up to 15 permits may be available. In 2001 only 10 permits were issued (3 in RM850 and 7 in RM852) due to concern about higher than normal winter mortality in spring 2001. In RM850, 3 cows were harvested and

5 cows were harvested in RM852. In 2002 all 20 permits were issued, and 3 cows were taken in RM850 and 8 cows were harvested in RM852 (Table 5).

In 2002 registration hunts with harvest quotas were implemented for bull moose in the heavily hunted portions of Units 22B and 22D along the Nome road system (Table 5). In Unit 22B west of the Darby Mountains, 204 people reported hunting in fall registration hunt (RM846) and 38 bulls were taken from a 42 bull quota. The western Unit 22B winter hunt (RM848) had a harvest quota of 10 bulls (6 bulls reserved for the winter hunt plus 4 from the unfilled portion of the fall quota). Nine people reported hunting, and 2 bulls and 1 cow (accidental harvest) were taken.

In Unit 22D the fall registration hunt (RM856) contained 2 separate hunt areas with separate quotas, one encompassing the entire Kuzitrin River drainage and the other in southwestern Unit 22D along the Nome-Teller highway. A combined total of 209 people reported hunting in RM856, and 30 bulls were taken out of a 33 bull quota in the Kuzitrin drainage and 1 bull out of an 8 bull quota was taken from Unit 22D southwest. A Unit 22D winter registration hunt (RM858) was opened only in Unit 22D southwest and no one reported hunting or taking a moose.

The registration hunts with harvest quotas require reporting within 3 days of harvesting a moose, and hunters must turn in the lower jaw for aging and tooth analysis. The public has been impressively compliant with these new requirements. Reporting by people who hunt but fail to harvest a moose has typically been lax in the past, but increased emphasis on the need to report has increased the reporting rate in the registration hunts.

Hunter Residency and Success. During 2001–2002 Unit 22 residents accounted for 68% of the harvest and in 2002–2003, 80% of the harvest (Table 6). For 10 years prior to this reporting period the proportion of the harvest attributable to local residents remained remarkably constant ranging from 69%–74%. In 2002 the regulatory changes that closed nonresident seasons in large parts of the unit and harvest quotas that tend to discourage nonlocal hunters from flying to Unit 22 were probably responsible for the decrease in nonlocal harvest. Nonresidents accounted for 15% of the harvest in 2001 and 10% in 2002, compared to 11–13% during the previous reporting period.

Harvest Chronology. Shortened season lengths have consolidated much of the harvest into the months of August and September in most parts of the unit (Table 7). Previously, long seasons that ran from August through January in many parts of the unit and through March in Unit 22E allowed harvest to occur over a period of up to 8 months. During this reporting period, most of the hunter effort and reported harvest occurred during September (72%) and August (13%). In October moose season was only open in remote portions of Unit 22D and in Unit 22E. In November eastern Unit 22B was the only place in Unit 22 with an open season. Some hunting activity also occurred in December and January during open seasons in Unit 22A and remote parts of Unit 22D and in December in Unit 22E. In Unit 22E, where there are no roads, and river access to moose habitat is limited, most of the harvest prior to 2001 occurred during January, February and March when hunting is possible by snowmachine.

Data from community-based harvest assessment in Koyuk, Shaktoolik, Elim and White Mountain indicate August is the favored month for moose harvest in those villages. Most of the remaining harvest there occurs in September or December (Georgette 1999 and 2000). Surveys of Teller, Brevig, Shishmaref and Wales found different harvest timing in the western villages. In Teller, October was the favored month for moose harvest, followed by September and August. In Brevig the highest harvest was in September, followed by December and October. In Shishmaref and Wales harvests were highest in March, but March moose harvest was no longer legal during this reporting period (Georgette 2001). Survey data show September is the preferred month for moose harvest in Unalakleet, and in Stebbins most of the harvest occurs in December (Georgette 2004).

<u>Transport Methods</u>. During this reporting period 33% of successful moose hunters used boats, 32% used 4-wheelers, 15% used highway vehicles and 9% used snowmachines (Table 8). Only 5% of the harvest was by hunters using airplanes. The number of moose harvested by hunters using only highway vehicles for transportation has declined steadily over the last decade. Moose densities are now very low along the road corridor and hunters often must travel to areas far from the road system for successful hunts. Four-wheel-drive 4-wheelers provide access to remote areas, particularly areas characterized by open terrain, such as Unit 22D.

Other Mortality

No surveys were attempted to determine natural mortality rates of Seward Peninsula moose. We believe that bear density in Unit 22 has increased over the last decade and that predation by bears on calf and adult moose is a significant factor suppressing moose populations in many parts of the unit. Recruitment rates are generally very low in most parts of the unit. A 1996–1998 radiocollar study of cow moose in western Unit 22B found that up to 75% of the moose calves observed died within 3 months of birth and 71% of calf mortality occurred within a month of birth. Although calf viability may be a factor, such high mortality shortly after birth suggests predation (Persons 1998). During years when deep, soft snow persists well into May, bear predation on adult moose may be significant; however, during this reporting period winter conditions in most parts of the unit appeared to be fairly easy on moose. Wolves are becoming more numerous on the Seward Peninsula, especially in areas occupied by wintering caribou from the Western Arctic herd. Predation by wolves was not previously believed to be a significant factor in moose mortality, but that may be changing as wolves become more abundant.

HABITAT

Assessment

A browse survey of the Snake River drainage in Unit 22C was organized for April 2003, but early breakup prevented the work from occurring. The project is rescheduled for March 2004. The growing moose population in Unit 22C and the increasingly heavy use of winter habitat there raises concerns that the carrying capacity may be exceeded. In the past during winters of heavy snow accumulation, winter ranges have been heavily browsed, but at current population levels in most parts of the unit we do not believe that habitat limitations are suppressing moose populations.

Enhancement

There were no habitat enhancement activities conducted in Unit 22 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

In Units 22B and 22D the Federal Subsistence Board adopted regulations or special actions that differ from state moose regulations. While this has not resulted in biological problems, it has increased the complexity of the regulations and created public confusion. State and federal managers need to work cooperatively to produce and distribute maps and simplified explanations on which regulations apply where.

In January 2002 Unit 22 staff began collaborating with Fairbanks researchers Dr. Julie Maier (University of Alaska) and Dr. Raphaela Stimmelmayr (Tanana Chiefs Conference) to investigate the causes of cracked and broken teeth frequently observed in the jaws of moose harvested on the Seward Peninsula. Such breakage is not known to occur in other Alaska moose populations. Previous investigations initiated by former Unit 22 Area Biologist Bob Nelson in the late 1980s were inconclusive.

The 55 jaws examined in 2002 indicate oral bone loss and periodontal disease are common in Seward Peninsula moose (74% of jaws were affected). Fluorosis was initially suspected, but results from bone mineral analysis corroborate previous analyses and do not support that hypothesis. However, in our study high lead and zinc levels were highly correlated to severity of tooth breakage and are known to cause anomalies in enamel formation in laboratory rodents. Other possible explanations for elevated bone loss include cadmium exposure, inbreeding and a founder effect. Investigations of these and other possibilities will continue. It is possible that poor tooth condition may be associated with lowered productivity and reproductive potential of affected animals.

CONCLUSIONS AND RECOMMENDATIONS

The moose population on the Seward Peninsula grew steadily from the 1960s through the early 1980s and began to decline during the late 1980s and early 1990s. We estimate the population reached a maximum size of 7000–10,000 moose on the Seward Peninsula during the mid to late 1980s. Subsequent declines likely caused by a combination of winter mortality, reduced productivity, low recruitment and increased predation reduced the population size to between 4500 and 6500 animals. Survey and inventory projects during this reporting period show continuing population declines and low recruitment rates in much of Unit 22A, 22B, and the Kuzitrin drainage in Unit 22D, indicating a widespread problem with calf survival in the unit. In a large portion of Unit 22 it is likely that harvest and natural mortality are exceeding recruitment and that populations are declining. Census and survey results were more optimistic in the Agiapuk River drainage in Unit 22D where the 2002 census showed the population to be stable. In this area healthy recruitment rates were found in March 2002 and 2003, and a high proportion of calves was found in November 2003. In Unit 22E 2003 census results also showed a much improved recruitment rate.

Results from a research study in western Unit 22B in the late 1990s indicate several factors are contributing to low recruitment in that portion of the unit. Predators, especially bears, are abundant in the area, and bear predation on calves is probably the most significant factor in calf mortality. However, the factors of a population dominated by older cows, frequent severe winter snow conditions, poor winter range quality, periodontal disease and factors responsible for it may be acting in combination to lower productivity and produce calves that are less vigorous at birth and have subsequent lowered survival (Persons 1998). Some or all of these factors may influence recruitment in other parts of the unit.

In November 2001 concern about declining moose numbers in the most accessible parts of Units 22B, 22D and 22E led the Board of Game to adopt significant changes to hunting regulations in the most heavily hunted portions of these units. The nonresident seasons were closed, resident seasons were shortened, registration hunts with quotas were established in Units 22B and 22D, and in Unit 22E the antlerless season was closed. Additionally, brown bear hunting regulations were liberalized in Unit 22. In November 2003 (after this reporting period) the board dealt with declining moose populations in Unit 22A by shortening seasons and adopting an antlered bull bag limit. In Unit 22D remainder where harvest pressure has increased as a result of restrictions elsewhere, the board made a preemptive move and limited nonresident harvest by establishing a registration hunt with a limited number of permits. The public is well aware of declining moose numbers and played an active role in developing all regulations adopted by the board.

Unit 22C is the only portion of Unit 22 where consistently high recruitment rates have allowed the population to exceed our management goal. An antlerless moose hunt in Unit 22C was initiated in 2000 to help stabilize the population and prevent overuse of the limited winter habitat. A Unit 22C census and browse survey planned for March 2004 will help us determine if further reduction of numbers is advisable. Although we believe that at current population levels, habitat is not a significant limiting factor for moose in other parts of the unit, we hope to apply the habitat assessment techniques learned from habitat specialist Tom Paragi (ADF&G, Fairbanks) in Unit 22C to other parts of the unit with chronic low recruitment rates and long term population declines such as western Unit 22B and the Kuzitrin drainage in Unit 22D.

During this reporting period we implemented a change to moose survey and inventory procedures by increasing the frequency of moose censuses in each of the units to once every 3 years rather than once every 5 years. Declining population trends and the importance of moose to local users necessitated more frequent population estimates so we can identify and respond more promptly to downward trends. Although this required a reduction in time and money devoted to muskox and reduced funds for fall and spring moose composition surveys, obtaining frequent moose population estimates is our best method for monitoring this important resource.

Compliance with regulations and harvest reporting is thought to be reasonably high in the Nome area and has improved as a result of education efforts associated with the new registration hunts. However, in the remainder of the unit some residents do not acquire licenses and/or harvest tickets prior to hunting and much of the harvest is unreported. Public education programs and a visible enforcement effort improve compliance with regulations, but we have found the community-based harvest assessment programs started in 1999 to be the most effective way to collect accurate harvest data from village residents. This data has been essential in providing the board with a realistic picture of moose harvest and timing in Unit 22 and has greatly influenced the board in its regulatory decisions. This program should be continued and expanded to provide ongoing estimates of moose harvest and subsistence use of moose by village residents.

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Table 1 Unit 22 historical moose harvest by sex, hunter effort, and success rate for regulatory years 1969–2002

Regulatory year	Males	Females	Unknown sex	Total harvest	Total hunters[a]	Percent success
1969–1970	69	1	2	72	182	40
1970–1971	70	0	1	71	139	51
1971–1972	59	0	1	60	168	36
1972–1973	44	0	0	44	99	44
1973–1974	103	32	1	136	317	43
1974–1975	149	72	1	222	479	46
1975–1976	136	0	2	138	389	25
1976–1977	186	51	3	240	611	39
1977–1978	151	88	5	244	457	53
1978–1979	198	97	2	297	596	50
1979–1980	193	75	2	270	760	36
1980–1981	156	71	1	228	492	46
1981–1982	225	72	1	298	696	43
1982–1983	244	100	0	344	904	38
1983–1984	291	68	46	405	1292	31
1984–1985	298	91	6	395	1086	36
1985–1986	279	92	3	374	876	43
1986–1987	306	101	1	408	892	46
1987–1988	286	20	4	310	775	40
1988–1989	332	36	7	375	748	50
1989–1990	208	82	0	290	713	41
1990–1991	280	70	0	350	700	50
1991–1992	207	95	0	302	656	46
1992–1993	217	72	0	289	645	45
1993–1994	225	21	1	247	553	45
1994–1995	201	10	0	211	486	43
1995–1996	169	13	3	185	469	39
1996–1997	176	20	2	198	456	43
1997–1998	197	6	0	203	423	48
1998–1999	195	13	3	211	510	41
1999–2000	244	5	3	252	581	43
2000–2001	194	27	0	221	536	41
2001–2002	119	8	0	127	421	30
2002–2003	160	12	0	172	563	31

[a]Minimum known number of hunters.

Table 2 Summary of Unit 22 spring moose censuses, 1987–2003

Area	Year	Size (mi²)	Census estimate (Nr.) Adults	Calves	Total	Density (Nr./mi²) Adult	Total	Calves per 100 Adults	Percent calves	Methods
Unit 22A Unalakleet Drainage	1989	1124	273	52	325	0.24	0.29	19	16	Gasaway
Unit 22A Unalakleet Drainage	2003	2000	64	11	75	0.04	0.04	15	15	Geostatistical
Unit 22B West	1987	2105	1676	218	1894	0.80	0.90	13	11.5	Gasaway
Unit 22B West Reduced area	1992	859	603	95	698	0.70	0.81	16	14	Modified Gasaway
Unit 22B West	1999	2105	749	49	797	0.36	0.38	7	6	Geostatistical
Unit 22B West Reduced area	1999	859	448	28	476	0.52	0.58	6	6	Geostatistical
Unit 22C	1990	1368	322	85	407	0.24	0.30	26	21	Gasaway
Unit 22C	1995	1368	394	85	479	0.29	0.35	22	18	Modified Gasaway
Unit 22C	2001	1368	413	139	557	0.30	0.41	34	25	Geostatistical
Unit 22D Kuzitrin Drainage	1988	1456	1673	278	1951	1.14	1.34	17	14	Gasaway
Unit 22D Kuzitrin Drainage Reduced Area	1993	856	943	153	1096	1.10	1.28	16	14	Modified Gasaway
Unit 22D Kuzitrin Drainage	1997	1456	1019	232	1251	0.70	0.86	23	19	Modified Gasaway

Table 2 Summary of Unit 22 spring moose censuses, 1987–2003 (continued)

Area	Year	Size (mi^2)	Census estimate (Nr.) Adults	Census estimate (Nr.) Calves	Census estimate (Nr.) Total	Density ($Nr./mi^2$) Adult	Density ($Nr./mi^2$) Total	Calves per 100 Adults	Percent calves	Methods
Unit 22D	2002	1456	915	113	1028	0.63	0.71	12	11	Geostatistical
Kuzitrin Drainage Unit 22D	1988	1041	782	159	941	0.75	0.90	20	17	Gasaway
Agiapuk Drainage Unit 22D	1993	723	406	77	483	0.56	0.66	19	16	Modified Gasaway
Agiapuk Drainage Reduced Area Unit 22D	1997	1041	451	127	578	0.43	0.56	28	22	Modified Gasaway
Agiapuk Drainage Unit 22D	2002	1041	485	82	567	0.47	0.54	17	14	Geostatistical
Agiapuk Drainage Unit 22E	1991	NA	208	18	226	NA	NA	9	8	Riparian Survey
Unit 22E	1996	NA	164	32	196	NA	NA	20	16	Riparian Survey
Unit 22E	2001	NA	157	12	169	NA	NA	8	7	Riparian Survey
Unit 22E	2003	4500	408	96	504	0.09	0.11	23	19	Geostatistical

Table 3 Unit 22 aerial moose composition surveys, fall of 1992, 1994, and 2000–2003

Survey area	Year	Bulls per 100 cows	Calves per 100 cows	Total calves	Percent calves	Total adults	Total moose
Unit 22A							
Unalakleet River	2003	69	20	7	10	59	66
Golsovia River	2003	50	67	8	31	18	26
Unit 22B							
American Creek	1992	58	10	4	10	38	42
		28	28	8	18	37	45
Niukluk River	2000	27	8	7	6	108	115
		30	14	8	10	73	81
Unit 22C							
Snake River	1992	11	30	11	21	41	52
1994		14	32	12	22	42	54
		10	25	16	20	69	85
2001		17	24	17	17	83	100
		18	52	29	31	66	95
Stewart River	2001	39	17	7	11	57	64
		42	16	3	10	27	30
1994							
2000							
2001							
2002							

Table 3 Unit 22 aerial moose composition surveys, fall of 1992, 1994, and 2000–2003 (continued)

Survey area	Year	Bulls per 100 cows	Calves per 100 cows	Total calves	Percent calves	Total adults	Total moose
Unit 22D							
Henry/Washington Ck.	1994	40	23	22	14	133	155
Kougarok/Noxapaga	2000	16	11	19	9	197	216
		15	19	16	14	98	114
		26	15	24	10	208	232
Agiapuk	2000	44	23	43	14	275	318
		30	6	5	4	107	112
		24	27	40	18	183	223

2001

2003

2001

2003

Table 4 Unit 22 short yearling recruitment surveys, spring 1991–2003

Survey area and survey year	Nr. calves	Nr. adults	Total	Percent Calves
Unalakleet, main stem (Unit 22A)				
2000	7	77	84	8
2003	3	16	19	16
Shaktoolik, main stem (Unit 22A)				
2000	5	40	45	11
2003	2	11	13	15
Ungalik, main stem (Unit 22A)				
2000	1	28	29	3
2003	0	1	1	0
Golsovia drainage (Unit 22A)				
2000	4	11	15	27
2003	6	23	29	21
Pikmiktalik main stem (Unit 22A)				
2000	2	4	6	33
2003	6	11	17	35
Fish River (Unit 22B)				
1991	12	202	214	6
1993	11	227	238	5
1994	15	255	270	6
1995	16	384	400	4
Niukluk River (Unit 22B)				
1991	30	319	349	9
1995	13	133	146	9
1997	6	77	83	7
2000	9	81	90	10
2003	6	59	65	9
Koyuk River (Unit 22B)				
1999	21	208	229	9
2000	19	223	242	8
Snake River (Unit 22C)				
1993	15	63	78	19
1994	18	39	57	32
1999	33	92	125	26
2000	21	98	119	18
2001	20	76	96	21

Table 4 Unit 22 short yearling recruitment surveys, spring 1991–2003 (continued)

Survey area and survey year	Nr. calves	Nr. adults	Total	Percent calves
Lower Kougarok River (Unit 22D)				
1991	14	103	117	12
1994	33	153	186	18
1995	42	227	269	16
2000	16	168	184	9
2003	32	180	212	15
Kuzitrin/Noxapaga River (Unit 22D)				
1991	23	191	214	11
1994	16	71	87	18
2000	14	203	217	6
2003	52	276	328	16
Kuzitrin Below Bridge (Unit 22D)				
2000	17	271	288	6
2003	16	87	103	15
American River (Unit 22D)				
1995	51	248	299	17
Agiapuk/American (Unit 22D)				
2003	74	246	320	23

Table 5 Unit 22 Registration moose hunt statistics for regulatory years 2001–2002

Year	Hunt	Total permits	Reported	Males killed	Females killed	Unknown killed	Hunted	Did Not Hunt
2001	RM850	3	3	0	3	0	3	0
2001	RM852	8	8	0	5	0	8	0
2002	RM850	5	5	0	3	0	5	0
2002	RM852	15	15	0	8	0	14	1
2002	RM846	399	391	38	0	0	204	187
2002	RM848	15	15	2	1	0	9	6
2002	RM856	416	406	31	0	0	209	197
2002	RM858	3	2	0	0	0	0	2

Table 6 Residency and success of moose hunters in Unit 22, regulatory years 2001–2002 and 2002–2003

Regulatory	Residency of successful hunters					Residency of unsuccessful hunters				
Year/Unit	Unit[a]	State[b]	Nonresident	Unknown	Total	Unit[a]	State[b]	Nonresident	Unknown	Total
2001–2002										
22A	13	1	5	1	20	25	7	1	0	33
22B	14	7	8	0	29	41	27	6	1	75
22C	32	5	0	0	37	71	9	3	0	83
22D	20	5	6	0	31	62	18	9	0	89
22E	7	3	0	0	10	5	0	0	0	5
22 unknown	0	0	0	0	0	7	1	1	0	9
Total	86	21	19	1	127	211	62	20	1	294
2002–2003										
22A	20	1	4	0	25	16	4	5	0	25
22B	37	6	7	0	50	176	13	2	0	191
22C	37	4	1	0	42	131	17	3	0	151
22D	36	6	6	0	48	166	19	5	0	190
22E	7	0	0	0	7	6	1	0	0	7
22 unknown	0	0	0	0	0	3	0	0	0	3
Total	137	17	18	0	172	498	54	15	0	567

[a] Resident of Unit 22

[b] Other Alaska resident

Table 7 Chronology of Unit 22 moose harvest, regulatory years 2001–2002 and 2002–2003

Regulatory year/ Unit	Month of harvest									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Unknown	Total
<u>2001–2002</u>										
22A	1	15	1	0	2	1	0	0	0	20
22B	3	20	0	6	0	0	0	0	0	29
22C	0	37	0	0	0	0	0	0	0	37
22D	3	24	0	0	2	1	0	0	1	31
22E	0	4	2	0	4	0	0	0	0	10
Total	7	100	3	6	8	2	0	0	1	127
<u>2002–2003</u>										
22A	3	16	0	0	4	2	0	0	0	25
22B	8	32	0	8	0	2	0	0	0	50
22C	0	42	0	0	0	0	0	0	0	42
22D	20	20	5	0	0	2	0	0	1	48
22E	1	4	1	0	1	0	0	0	0	7
Total	32	114	6	8	5	6	0	0	1	172

Table 8 Means of transportation reported by successful Unit 22 moose hunters, regulatory years 1999–2002

Regulatory Year/Unit	Aircraft	Horse	Boat	3 or 4 Wheeler	Snowmobile	Off-road vehicle	Highway vehicle	Air boat	Unknown	Total
1999–2000										
22A	1	0	23	11	5	0	1	0	0	41
22B	6	0	25	24	5	1	5	0	1	67
22C	1	0	10	10	0	2	14	0	1	38
22D	3	0	17	42	4	0	22	0	4	92
22E	0	0	2	0	12	0	0	0	0	14
Total	11	0	77	87	26	3	42	0	6	252
2000–2001										
22A	0	0	12	3	0	0	0	0	0	15
22B	4	0	18	18	10	0	3	0	1	54
22C	0	1	10	13	0	5	23	0	1	53
22D	1	0	15	30	7	7	16	0	0	76
22E	0	0	4	2	15	1	0	0	0	22
Unknown	0	0	0	1	0	0	0	0	0	1
Total	5	1	59	67	32	13	42	0	2	221
2001–2002										
22A	1	0	8	9	2	0	0	0	0	20
22B	0	0	9	11	6	2	1	0	0	29
22C	0	0	7	15	0	3	12	0	0	37
22D	3	0	8	10	3	4	1	1	1	31
22E	0	0	2	4	4	0	0	0	0	10
Total	4	0	34	49	15	9	14	1	1	127
2002–2003										
22A	0	0	14	4	6	1	0	0	0	25
22B	7	0	17	16	3	0	6	0	1	50
22C	0	0	2	19	0	2	19	0	0	42
22D	2	0	25	9	2	5	5	0	0	48
22E	1	0	5	0	1	0	0	0	0	7
Total	10	0	63	48	12	8	30	0	1	172

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003

LOCATION

GAME MANAGEMENT UNIT: 23 (43,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Western Brooks Range and Kotzebue Sound

BACKGROUND

Moose began to recolonize the eastern portion of Unit 23 during the 1920s (J. Magdanz, personal communication) and expanded their range to the Chukchi Sea coast by the mid to late 1940s (W. Uhl and L. Davis, personal communication). Moose currently rank second to caribou as a source of terrestrial meat for most residents of the unit. Moose are also avidly sought primarily for recreation by resident and nonresident hunters who live outside Kotzebue Sound. Commercial services associated with moose hunting provide substantial income to guides, outfitters and transporters who operate in Unit 23. The wide distribution and accessibility of moose throughout the unit makes them important to nonconsumptive users, e.g., viewers and photographers.

From the time moose reappeared in Unit 23 through the late 1980s, public comments, trend count surveys and observations by department staff suggested moose populations increased throughout the region. Severe winters and extensive spring flooding occurred during 1988–1991. These factors, combined with high populations of grizzlies and wolves, probably caused moose populations to stabilize or decline throughout the Kotzebue Basin.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain healthy age and sex structures of moose populations within Unit 23.
- Determine size, trend and composition of Unit 23 moose populations.

MANAGEMENT OBJECTIVES

- Monitor the size and sex/age composition of moose populations in the Noatak, Squirrel, Kobuk and Selawik/Tagagawik Rivers and Northern Seward Peninsula drainages through aerial censuses.
- Maintain a minimum November ratio of 40 bulls:100 cows and a minimum density of 0.5 moose/mi^2 in each major drainage within Unit 23.

METHODS

Population trend and sex/age composition data were obtained from aerial moose censuses. No fall moose censuses were conducted during this reporting period because of poor survey conditions. The department (ADF&G) censused moose in that portion of Unit 23 west of and including the Buckland River drainage during April–May 2002. ADF&G and National Park Service (NPS) censused moose in that portion of the Kobuk drainage east of and including the Shungnak and Pick River drainages during March 2003. All spring censuses used the geostatisical (spatial) population census technique (Ver Hoef, unpublished) where: 1) sample units were stratified as “high” or “low” density; 2) “desktop” stratification with aerial confirmation of questionable sample units (SUs) was employed; and 3) sightability was not estimated.

Harvest information was derived from statewide moose harvest ticket reports for nonlocal hunters. Community-based harvest assessments were used to estimate moose harvests by unit residents. The term “nonlocal hunter” refers to all hunters who reside outside Unit 23 and “local hunter” refers to residents of Unit 23.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Spring census results indicate Unit 23 moose densities are currently 0.1–0.3 moose/mi^2 in large portions of Unit 23 (Table 1). Maximum moose density is probably <1 moose/mi^2 throughout the unit. This is lower than many other portions of Alaska (Hicks 1998).

Interpreting moose census data from Unit 23 is difficult (Tables 1 and 2). Although we began conducting rigorous Gasaway-type censuses in Unit 23 in 1992 (Gasaway, et al. 1986), most areas have been censused only once or twice since that time. Therefore, results for individual census areas reveal little about population trends. In the middle and lower Noatak drainage where we have multiple years of census data (Tables 1 and 2), density estimates have been confounded by repeated modification of the census area (Dau 2002). Perhaps most important, spring census results from the middle and lower Noatak drainage suggest census areas of <2000 mi^2 may be affected as much by snow-induced movements of moose as by changes in population size. Finally, relatively small census areas (i.e., <2000 mi^2) containing a high proportion of high quality habitat, as we originally delineated in various portions of Unit 23, are probably relatively insensitive to changes in moose population size. By disproportionately selecting these areas, moose maintain high local densities even as overall population levels decline and they disappear from marginal habitat.

To counter these problems, in 2001 the department substantially increased the size of spring moose census areas in the Noatak drainage (including the upper portion of the Squirrel drainage), the upper Kobuk drainage and on the northern Seward Peninsula (Table 1). Expanding these areas should minimize the effects of moose movements on census results and preclude the need to repeatedly modify census areas to include newly discovered high-use areas. Additionally, these expansions will include a greater proportion of marginal and even poor moose habitat than the original census areas.

Because moose census data for Unit 23 are difficult to interpret, we rely heavily on reports from the public and on opportunistic observations by agency staff. These sources of information are consistent with recent spring census data that suggest moose populations have substantially declined in large portions of Unit 23. Similarly, moose density has declined almost 50% in large portions of Unit 22 since about 1990 (K. Persons, personal communication). Moose may be stable in the Selawik drainage (Selawik National Wildlife Refuge, unpublished information); however, my observations of fewer moose and fewer shed antlers in marginal habitat compared to the early 1990s suggests they have slowly declined in this area, too. Moose have reportedly declined in the upper Kobuk drainage since the early 1990s (G. Bamford, personal communication; Tables 1 and 2).

Population Composition

Although census data are of limited value for monitoring moose density in Unit 23, estimates of population composition (i.e., bull:cow, calf:cow and calf:adult ratios) are probably reasonably accurate. With one exception (1997 Tagagawik drainage census), spring censuses have consistently indicated low calf recruitment for Unit 23 (Table 1). This is consistent with my opportunistic observations and reports from many local residents and some long-term commercial operators. Parturition rates appear to be high (B. Shults, personal communication), and I have observed more twins since 1998 than prior to that time. My opportunistic observations and reports from many local hunters and some commercial operators suggest bear predation on neonates is substantially reducing recruitment of moose.

Recruitment during spring 2003 in at least the western portion of Unit 23 was probably higher than suggested by the upper Kobuk moose census in that year (Table 1). For example, on 9 April 2003, department staff surveyed most of the main stem of the Kobuk River between the mouth of Melvin Channel and the mouth of the Shungnak River. At that time moose were highly concentrated along the main stem of the Kobuk River; we observed almost no moose or tracks >1–2 mi from the river. Although we merely "high graded" the riparian corridor to maximize the sample size, we still saw 1150 moose (968 adults and 182 calves) with 19 calves:100 adults and 10 sets of twins. Although not comparable to a rigorous census, it suggests recruitment was probably better following the winter of 2002–2003 than during the previous 6–8 years. This is consistent with many reports from residents of Unit 23 and from some commercial operators.

We have no recent fall composition data to evaluate bull:cow ratios. There is no indication that bull:cow ratios are currently a management concern.

Distribution and Movements

As densities have generally declined throughout Unit 23, moose have essentially disappeared from some localized areas. Examples of this are Aklumayak Creek and the Kaluktavik River, both small tributaries of the middle Noatak River that held many moose in the late 1980s and early 1990s. In contrast, moose density in some localized areas appears to be similar to that before the decline. Examples are the Mulgrave Hills and the northeast portion of the Selawik

Hills. This contraction of moose distribution is probably influenced by habitat quality and possibly by behavior of moose as well (e.g., movement to traditional rutting areas during fall).

Reports from elder Inupiaq hunters in the upper Kobuk villages (e.g. Wesley Woods and Neal Sheldon) and old time pilots (e.g. Nelson Walker) indicate moose were never abundant in the Noatak drainage above the Cutler and Aniuk Rivers. Currently, almost no moose reside year-round in this area. In April 2001, while on a snowmachine trip from Kotzebue to the headwaters of the Noatak River, I saw a total of 2 moose (both bulls) and no other tracks east of the Cutler River. On a similar trip in April 2003, I saw 1 cow with a calf in the Imelyak River and tracks of perhaps 4–5 other individuals. Although large riparian willow thickets occur in this portion of the unit, the absence of spruce probably renders this marginal moose habitat. Additionally, both wolves and brown bears have appeared abundant in the upper Noatak drainage during recent years.

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
<u>*2001–2002*</u>		
Unit 23 north of and including the Singoalik River drainage One moose; cows with calves may not be taken	1 Jul–31 Mar	
One antlered moose with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–20 Sep
Noatak drainage One moose; however, antlerless moose may be taken only from 1 Nov–31 Mar.; cows with calves may not be taken	1 Aug–15 Sep 1 Oct–31 Mar	
One antlered moose with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–15 Sep
Remainder of Unit 23		

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
One moose, cows with calves may not be taken	1 Aug–31 Mar	
One antlered moose with spike-fork or 50 inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–20 Sep
2002–2003		
Unit 23 north of and including the Singoalik River drainage		
One moose; calves and cows with calves may not be taken	1 Jul–31 Mar	
One antlered moose with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–20 Sep
Noatak drainage		
One moose; however, antlerless moose may be taken only from 1 Nov–31 Mar. Calves and cows with calves may not be taken	1 Aug–15 Sep 1 Oct–31 Mar	
One antlered moose with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on 1 side		6 Sep–15 Sep
Remainder of Unit 23		
One moose; calves and cows with calves may not be taken	1 Aug–31 Mar	
One antlered moose with spike-fork or 50 inch antlers or antlers with 4 or more brow tines on 1 side		1 Sep–20 Sep

Board of Game Actions and Emergency Orders. The board reauthorized antlerless moose seasons for the 2001–2002 and 2002–2003 regulatory years. At the November and December 2003 meetings (after this reporting period) the board adopted several regulatory changes for moose regulations in Unit 23. The board:

1) lengthened the nonresident moose season in the Noatak drainage to 1–20 September beginning during the 2004–2005 regulatory year;

2) restricted the nonresident bag limit to 1 bull with 50-inch or 4+ brow tine antlers (i.e., eliminated nonresident take of spike-fork bulls) beginning during the 2004–2005 regulatory year;

3) established nonresident drawing permit hunts for moose; 7 permit hunts with boundaries corresponding to existing Guide-Outfitter Areas will go into effect beginning September 2005;

4) established a registration permit hunt for resident hunters beginning during the 2004–2005 regulatory year; season will be 1 August–31 December and the bag limit will be 1 moose, but antlerless moose can only be taken 1 November–31 December; permits will only be issued in person within Unit 23 during 1 June–15 July; and

5) restricted the general season and bag limit for resident hunters beginning during the 2004–2005 regulatory year; the season will be 1–20 September and the bag limit will be 1 bull with 50-inch or 4+ brow tine antlers.

These restrictions were imposed in response to low numbers of moose in large portions of Unit 23.

Hunter Harvest. Community-based harvest assessments indicate approximately 350 moose are harvested annually by unit residents (Table 3). This is substantially higher than the 28 and 40 moose that unit residents reported taking through the statewide harvest ticket system in 2001–2002 and 2002–2003, respectively. Although moose harvest ticket data appear to capture ≤10% of the actual harvest by unit residents, it probably reflects temporal trends in local harvests reasonably well. Harvest ticket data is probably reasonably accurate for nonlocal hunters based on reports from Department of Public Safety staff that most nonlocal hunters get a moose harvest ticket before hunting. Combining harvest ticket data and community harvest assessments indicates total annual harvest was ~500 moose in 2001–2002 and in 2002–2003.

All community-based estimates of unit resident moose harvest were determined when caribou were abundant and generally available at least sometime during the year. If caribou availability decreases through shifts in distribution or population decline, harvest of moose by local residents will almost certainly increase. Most unit residents explain the decline in local moose harvest during 1979–1994 (Fig 3) as a result of increased caribou availability during that time. Currently, the subsistence need for moose in Unit 23 is 325–400 moose annually.

Total reported harvest increased from 1979–1980 through 1988–1989. A general trend of slowly declining harvest began after that time (Table 4, Fig 1). In contrast, the total number of moose hunters has generally increased from 1979–1980 through this reporting period. As in the past, the reported harvest of female moose was small during 2001–2002 and 2002–2003 in terms of absolute numbers (9 and 10 females reported taken, respectively; Table 4), and in relation to total harvest (6% of the total harvest each year).

The decline in hunter numbers that occurred in the Noatak drainage from 1992–1993 through 1999–2000 may have stabilized or reversed (Fig 2). Hunter numbers continued to increase in the Kobuk and Selawik drainages and more hunters used each of these drainages than the Noatak drainage. The Selawik drainage is roughly half the size of the Kobuk or Noatak drainages, and much of the Selawik drainage is open tundra (i.e., poor moose habitat). Besides the social problems that stem from hunter crowding, the moose population in this drainage may be subject to overharvest if this trend in hunter numbers continues. Numbers of moose hunters remained low and stable in Wulik/Kivalina drainages and in northern Seward Peninsula drainages.

Permit Hunts. There were no permit hunts for moose in Unit 23 during the reporting period.

Hunter Residency and Success: Numbers of nonresident and nonlocal Alaska resident moose hunters continued to increase during this reporting period ($R^2 = 0.88$; Fig 3). The strength of this relationship is surprising given annual variability in hunting conditions (weather, onset of freeze-up, water levels, etc), regulatory changes, availability of commercial services, economic considerations (e.g., the cost of airline tickets) and other factors that affect hunting in Unit 23. Factors contributing to this trend include: 1) increasing commercial services in Unit 23; 2) increasingly restrictive hunting regulations for moose and other species outside of Unit 23, especially for nonresident hunters; 3) word of mouth advertisement of good hunting in Unit 23; and 4) the scarcity of trophy bulls in other units.

Harvest ticket data suggest numbers of unit resident moose hunters were low during this reporting period compared to levels reported during the late 1970s and early 1980s (Fig 3). These data also suggest the number of local moose hunters generally declined from 1979–1980 through 1994–1995. This is consistent with reports from unit residents that dependence on moose declined with the recovery of the Western Arctic Caribou Herd after the mid 1970s. This trend may have stabilized or reversed since that time. Of course, these trends should be viewed with caution given the historically low proportion of local hunters that participate in the harvest ticket system.

Success rates peaked in 1988 at 69% but have slowly declined since that time. Success rates have been <50% every regulatory year since 1992–1993 ($n = 10$ years). Prior to that time hunter success was <50% in only 2 of 14 years (1982 and 1983). During 1998–1999, 38% of all moose hunters were successful, and in 2000–2001 success was 42%. Trends in success rates have been similar among unit resident, nonlocal resident and nonresident hunters (Fig 4).

Recent widespread use of float-equipped airplanes by transporters, greater use of 4-wheelers by guides and an increasing numbers of village residents transporting nonlocal hunters via boat continued to reduce the number of refugia available to moose in Unit 23. Nonlocal demand for transporter services continued to exceed availability despite growth of this industry within the unit. The large disparity between transporter supply and demand by nonlocal hunters means Unit 23 could experience rapid and substantial increases in numbers of nonlocal hunters if transporter services suddenly increased. This could further reduce the quality of hunting in Unit 23, intensify conflicts between local and nonlocal hunters and increase moose harvests.

Harvest Chronology. As in the past, during this reporting period the majority of moose were harvested in September despite an 8-month-long moose season in most of the unit. Virtually all sport hunting occurs during this time because weather is mild and conducive to airplane and boat access, it entirely encompasses the nonresident season, and bulls have completely developed antlers free of velvet. In 2001–2002, 85% of the reported harvest occurred during September, and in 2002–2003 this percentage was 81%. The percentage of total harvest taken during September has generally increased since the 1979–1980 regulatory year. This probably reflects increasing numbers of nonlocal hunters in Unit 23.

Transport Methods: Airplanes continued to be the primary mode of transportation for most hunters who reported hunting moose in Unit 23 (Table 5). Sixty-seven percent of all hunters reported using airplanes to access moose hunting areas in 2001–2002; in 2002–2003 this percentage was 66%. As in the past, boats were the next most commonly used means of transportation for hunting moose during this reporting period. Most unit residents hunt moose using boats or snowmachines, while most nonlocal hunters at least initially access hunting areas using airplanes.

Other Mortality

From 1992 to 1997 the mean annual adult cow mortality rate was 15% in the Noatak moose telemetry study. No collared cows were harvested by hunters during the study; therefore, this estimate represents natural mortality. The age structure of the collared sample of moose was older than the overall population because we did not collar cows <24 months old or collar moose annually. Even so, we think these limitations did not substantially bias our estimate of adult cow mortality.

HABITAT

Assessment

Moose habitat was not evaluated by ADF&G in Unit 23 during this reporting period. In 2000 the NPS began to monitor moose browse through range exclosures in portions of the Noatak National Preserve (B. Shults, personal communication).

Enhancement

There were no habitat enhancement activities for moose in Unit 23 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Conflicts among user groups, including local subsistence hunters, nonlocal hunters and commercial operators, continued to be the major nonregulatory management problem in Unit

23 during this reporting period. The nature and reasons behind these conflicts have been previously described (Dau 2002). Department of Public Safety staff report that waste of meat by trophy hunters during the fall hunting season declined as a result of the meat-on-bone regulation imposed during the 2002–2003 regulatory year.

CONCLUSIONS AND RECOMMENDATIONS

Declining moose and increasing hunter effort necessitate we improve our biological understanding of moose populations in Unit 23. I recommend we:

1. Census large areas (4000–10,000 mi^2) to minimize the effects of moose movements on density estimates and to include marginal habitat in addition to high quality habitat in census areas.

2. Census moose every 2–3 years in each census area. Potential census areas include 1) lower Noatak/upper Squirrel drainages, 2) Selawik drainage, 3) upper Kobuk drainage, and 4) northern Seward Peninsula.

3. Tighten confidence intervals around density and composition estimates through intensive sampling and by incorporating trend information into point estimates as soon as possible.

4. Conduct spring and fall censuses to prevent long gaps between density estimates. Supplement spring censuses with low-intensity fall surveys to monitor bull:cow ratios.

5. Resume the Unit 23 user issues planning process once a planner has been hired for Region V.

6. Continue community-based harvest assessments in villages throughout Unit 23 to monitor local harvests, and employ the statewide harvest ticket system to monitor nonlocal harvests.

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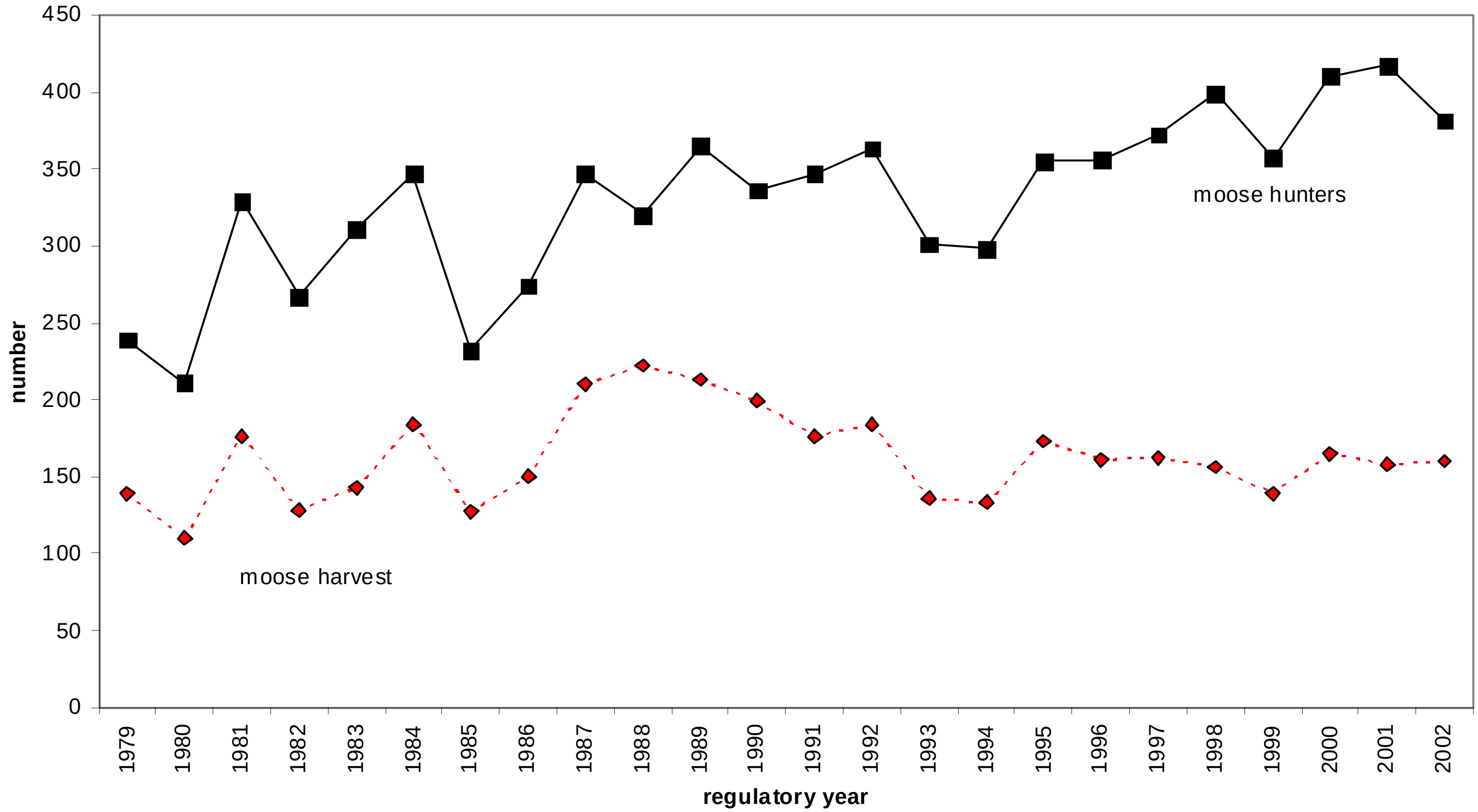

Figure 1 Unit 23 moose hunters and harvests reported through the statewide harvest ticket system, 1979–1980 through 2002–2003

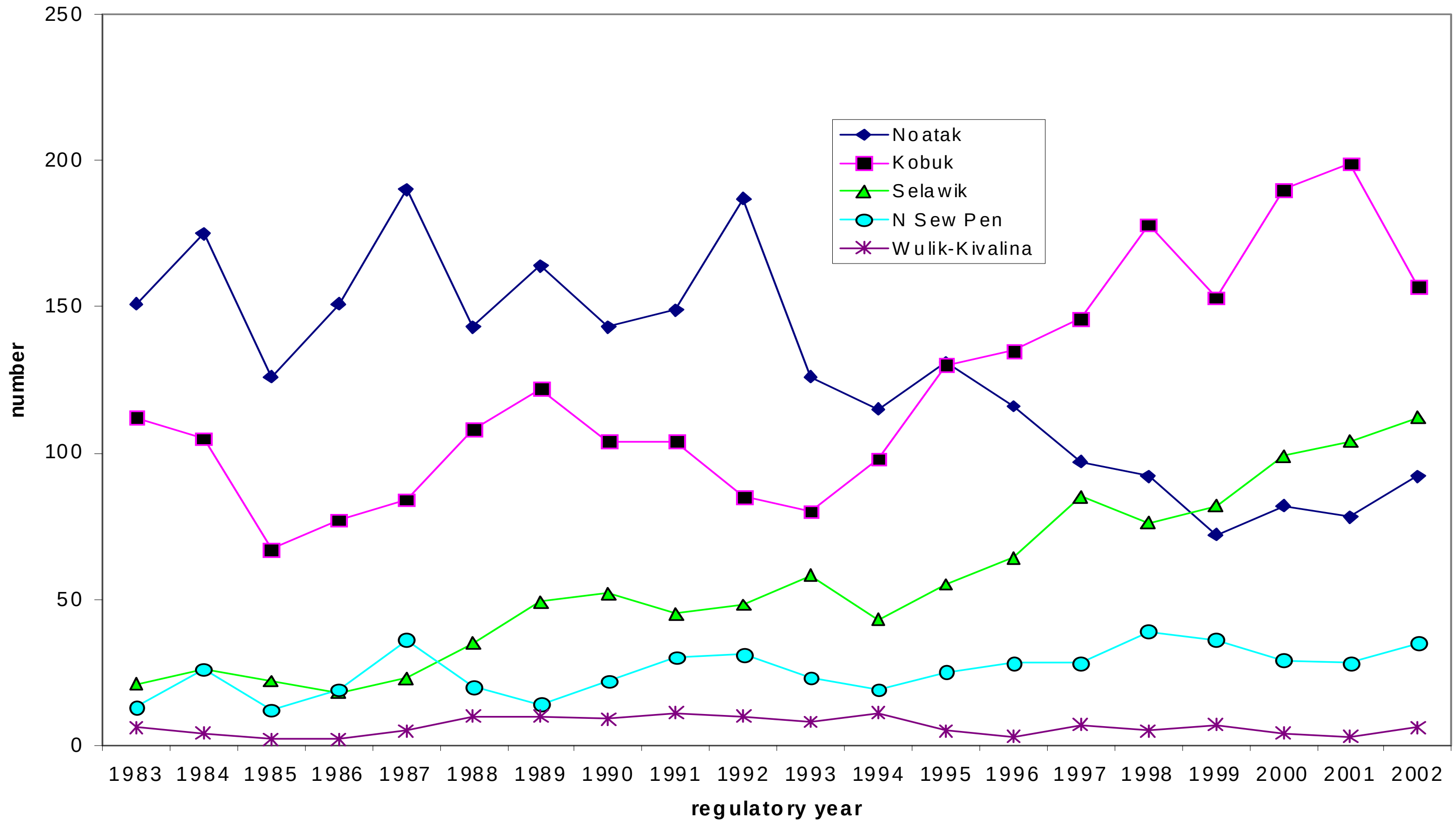

Figure 2 Unit 23 moose harvest by drainage (statewide harvest ticket data), 1983–1984 through 2002–2003

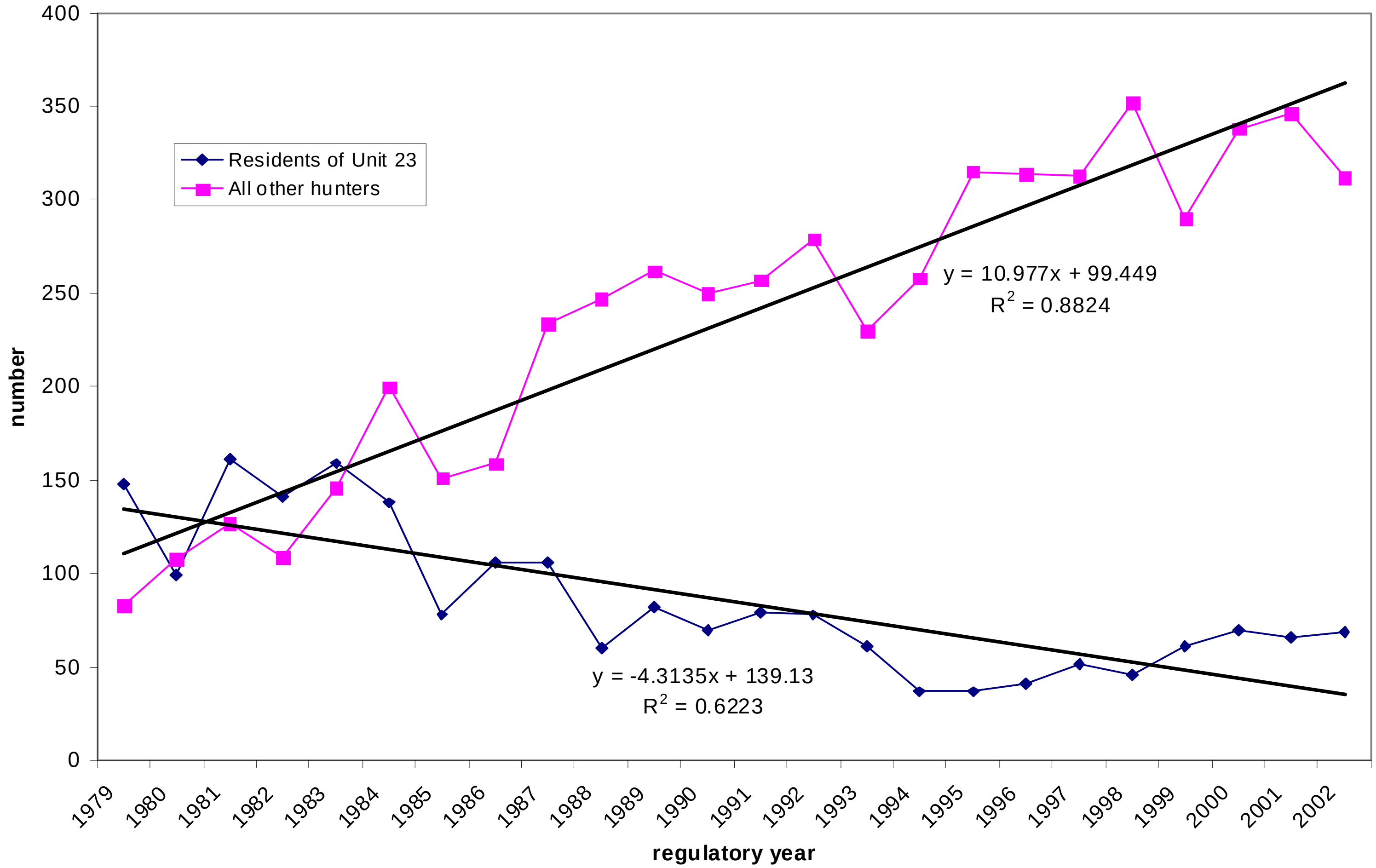

Figure 3 Numbers of Unit 23 moose hunters by residence (harvest ticket data), 1979–1980 through 2002–2003

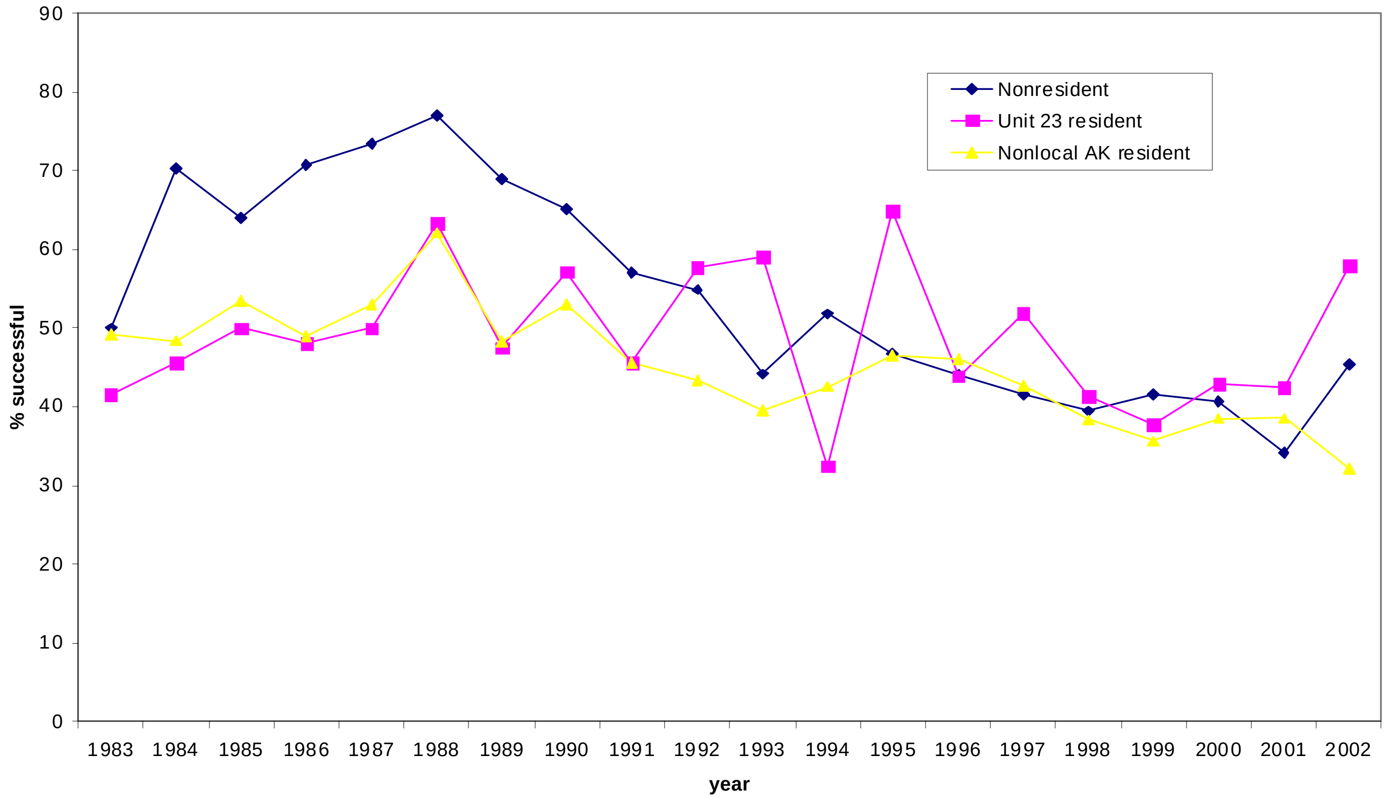

Figure 4 Unit 23 moose hunter success rate by residence (harvest ticket data), 1983–1984 through 2002–2003

Table 1 Unit 23 spring moose censuses, 1997–2003

Area	Year	Size (mi^2)	Census estimate (Nr.) Adults	Calves	Total	Density ($Nr./mi^2$) Adult	Total	Calves:100 Cows	Method
Tagagawik	1997	1000.9	952	191	1145	0.95	1.14	20	Standard Gasaway
Tagagawik	2001	1692.6	1259	115	1374	0.70	0.76	9	Standard Gasaway
Lower Noatak	1997	1627.9						8	Modified Gasaway
Lower Noatak	1998	1627.9						12	Modified Gasaway
Lower Noatak	1999	2111.2	1126	65	1191	0.53	0.56	6	Modified Geostatistical
Lower Noatak	2000	2111.2	710	59	779	0.34	0.37	8	Modified Geostatistical
Lower Noatak	2001	2111.2	1325	130	1453	0.63	0.69	10	Modified Geostatistical
Noatak/Squirrel	2001	5230.2	1580	151	1731	0.30	0.33	10	Modified Geostatistical
N. Seward Pen.	2002	5888.5	576	38	614	0.10	0.10	7	Modified Geostatistical
Upper Kobuk	2003	4001.5	765	91	856	0.19	0.21	12	Modified Geostatistical

Table 2 Unit 23 fall moose censuses, 1992–2003

Area	Year	Size (mi^2)	Est. Nr. adults	Est. Nr. calves	Total estimate	Adult density (nr. mi^2)	Total density (nr./mi^2)	Bulls:100 Cows	Calves: 100 Cows	Methods
Squirrel	1992	1440.9	1110	262	1372	0.77	0.95	37	33	Std. Gasaway
Squirrel	1998	1440.9	1304	233	1537	0.90	1.07	50	27	Geostatistical
Middle Noatak	1993	1627.9	956	169	1125	0.59	0.69	43	24	Std. Gasaway
Salmon	1995	891.4	594	186	780	0.67	0.87	78	56	Mod. Gasaway
Salmon	1997	891.4	895	129	1024	1.00	1.15	60	23	Std. Gasaway
Upper Kobuk	1995	1438.0	730	85	815	0.51	0.57	62	19	Linear Regression
Upper Selawik	1999	1045.9	569	80	648	0.54	0.62	68	23	Std. Gasaway

Table 3 Estimated moose harvest in Unit 23 villages from community harvest estimates (Subs. Div. unpub. data except as noted)

Village	Year of survey	Village pop. in survey year	Nr. moose reported harvested	Per capita moose harvest	Estimated village pop. in 2001–2003	Estimated annual moose harvest in 2001–2003
Kotzebue	1986	2681	65	0.024	3076	74
Noatak	1999	423	4	0.005		3
Noatak	2002	455	3	0.007	469	
Kivalina	1992	344	17	0.049	388	19
Point Hope[a]	1992	685	14	0.020	725	14
Noorvik[b]	1998	598	37	0.062		
Noorvik	2002	677	56	0.083	649	54
Kiana	1999	388	8	0.021	408	9
Ambler[c]				0.082	291	24
Shungnak	1998	257	21	0.082	264	22
Kobuk[c]				0.082	125	10
Selawik	1999	772	64	0.083	821	68
Buckland[d]				0.102	410	42
Deering	1994	148	15	0.102	131	13
Total					7757	352

[a] North Slope Borough, unpub. data
[b] Noorvik IRA, unpub. data
[c] estimated from Shungnak 1998 data
[d] estimated from Deering 1994 data

Table 4 Number of moose hunters by residency and success, and moose harvests by sex for Unit 23, 1979–1980 through 2000–2001

	Hunter residency					Hunter success			Sex of moose harvested		
Year	Unit 23 resident	Nonlocal resident	Non-resident	Unk	Total hunters	Succ.	Unsucc.	Succ. rate	Males	Females	Unk. Sex
1979–1980	148	51	32	8	239	139	100	58	129	10	0
1980–1981	99	61	47	4	211	110	101	52	97	6	7
1981–1982	161	80	47	41	329	176	153	53	160	15	1
1982–1983	141	81	28	17	267	128	139	48	119	8	1
1983–1984	159	116	30	6	311	143	168	46	131	12	0
1984–1985	138	126	74	9	347	184	163	53	162	17	5
1985–1986	78	101	50	3	232	127	105	55	112	12	3
1986–1987	106	94	65	9	274	150	124	55	142	8	3
1987–1988	106	102	132	7	347	210	137	61	194	15	1
1988–1989	60	116	131	15	320	222	98	69	207	15	6
1989–1990	82	120	142	21	365	213	152	58	200	11	2
1990–1991	70	115	135	16	336	199	137	59	185	14	1
1991–1992	79	136	121	11	347	176	171	51	143	33	0
1992–1993	78	157	122	6	363	184	179	51	159	25	0
1993–1994	61	144	86	10	301	136	165	45	118	17	1
1994–1995	37	148	110	3	298	133	165	45	127	6	0
1995–1996	37	189	126	3	355	173	182	49	164	8	1
1996–1997	41	178	136	1	356	161	195	45	145	15	1
1997–1998	52	171	142	7	372	162	210	44	154	8	0
1998–1999	46	167	185	1	399	156	243	39	146	8	2
1999–2000	61	129	161	6	357	139	218	39	127	11	1
2000–2001	70	166	172	2	410	165	245	40	154	11	0
2001–2002	66	153	193	5	417	158	259	38	148	9	1
2002–2003	69	162	150	0	381	160	221	42	168	10	1

Table 5 Number of moose hunters by transportation type in Unit 23, 1983–1984 through 2000–2001

Year	Airplane	Boat	Snow machine	Horse/dog team	3- or 4-wheeler	Off-road vehicle	Highway vehicle	Unknown	Total hunters
1984–1985	173	103	17	1	2	3	2	46	347
1985–1986	137	59	10	1	6	0	0	19	232
1986–1987	121	89	14	1	6	2	3	38	274
1987–1988	165	93	25	0	21	0	4	39	347
1988–1989	207	63	13	1	13	0	1	22	320
1989–1990	229	89	16	1	7	0	2	21	365
1990–1991	224	61	19	0	10	1	1	20	336
1991–1992	231	65	28	2	7	0	3	11	347
1992–1993	248	63	23	1	7	0	3	18	363
1993–1994	193	72	17	0	9	1	2	7	301
1994–1995	191	74	13	2	5	1	4	8	298
1995–1996	240	77	11	0	16	0	1	10	355
1996–1997	234	77	20	1	16	0	2	6	356
1997–1998	250	74	19	2	13	0	2	12	372
1998–1999	289	76	10	1	11	1	0	0	388
1999–2000	245	78	18	2	11	0	2	0	356
2000–2001	260	113	17	3	7	1	2	0	403
2001–2002	278	112	12	0	7	1	2	0	412
2002–2003	268	113	13	1	6	0	2	0	403

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 24 (26,055 mi^2)

GEOGRAPHIC DESCRIPTION: Koyukuk River drainage above Dulbi River

BACKGROUND

Moose are broadly distributed throughout much of Unit 24, with local densities (0.25–2.0 moose/mi^2) typical of Interior Alaska. Anecdotal evidence indicates the population was low prior to the 1930s, but increased during the 1930s–1950s (Huntington 1993). The rate of increase was probably slow until predator control efforts in the 1950s allowed rapid expansion of local populations, especially in the southern third of the unit. During the early 1970s the population reached a peak and mortality started to exceed recruitment in some areas. Populations apparently climbed again in the late 1980s, peaked around 1992, and then fell gradually through the remainder of the 1990s.

Naturally occurring wildfires and floods are major forces affecting the productivity and diversity of moose habitat in this area. Habitat is excellent along most of the Koyukuk River lowlands, providing extensive areas of winter browse. Lightning-caused fire is a frequent event and large areas of the burned uplands are productive browse communities. Based on personal observations, browse production does not appear to be limiting the size of the moose population at current moose densities.

The Koyukuk River and major tributaries are popular moose hunting areas for unit residents, other Alaska residents, and nonresidents. The lower portion of the Koyukuk within Unit 24 has been the focus of most of our management effort because of the long history of use, higher moose densities, and increasing hunting activity. Hunting activity was also increasing in other areas of the unit, including rivers accessible from the Dalton Highway. Two controlled use areas (CUA), the Koyukuk CUA and the Kanuti CUA, restrict use of aircraft for moose hunting activities. The Dalton Highway Corridor Management Area (DHCMA)

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

prohibits use of off-road vehicles and firearms for hunting within 5 miles on either side of the Dalton Highway. Access to portions of the unit increased with the opening of the highway.

There are several moose hunting seasons in Unit 24 that reflect the variety of moose densities and human-use patterns. In addition to the usual September hunting season, open seasons in December and March also provide hunting opportunity for residents of Alaska. A registration permit moose hunt was established in 1996 in the Koyukuk CUA, downstream from Huslia. Drawing hunts were established in the Koyukuk CUA in 2000, the DHCMA in 2002, and drainages around the Koyukuk CUA in 2004.

Annual reported harvests during the past 25 years were 44–230, but did not exceed 100 moose until 1980. Unreported harvests during this period probably were 160–300 moose per year (Woolington 1998). Since 1980, reported harvests have exceeded 100 moose each year. Local residents have become more aware of the importance of harvest reporting, resulting in increased compliance with reporting requirements.

MANAGEMENT DIRECTION

Management was directed according to the following management goals and objectives during the reporting period.

GOAL 1: Manage Koyukuk River drainage moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and minimizes disruption of local residents' lifestyles.

Objective 1: Maintain a moose population of 10,000–12,000.

Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available.

Objective 2: Provide for a harvest of moose not to exceed 360 moose or 5% of the annual moose population estimate each regulatory year.

Activity 1: Monitor hunter use levels in the Koyukuk River drainage.

Activity 2: Monitor impacts (social and environmental) to private property and local residents by Koyukuk River moose hunters.

Activity 3: Develop programs to improve population and harvest data for moose in Unit 24.

Objective 3: Provide for moose hunting opportunity not to exceed 500 hunters per regulatory year.

GOAL 2: Protect and enhance moose habitat.

Objective 1: In combination with Unit 21D, implement at least 2 habitat enhancement activities every 5 years.

GOAL 3: Reduce meat spoilage by hunters.

Objective 1: Reduce the amount of spoiled meat observed at Ella's Cabin and at hunting camps by 10% each regulatory year.

Activity 1: Implement a program at Ella's Cabin checkstation to monitor percentage of meat lost due to spoilage.

GOAL 4: Maintain opportunities for wildlife viewing, photography and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

Objective 1: Increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year.

Activity 1: Implement a program to monitor long-term trends and establish a baseline of the current level of nonconsumptive use through collaboration with the Koyukuk–Nowitna and Kanuti National Wildlife Refuges, the Gates of the Arctic National Park and Preserve, and commercial operations in Unit 24.

METHODS

We surveyed established trend count areas (TCAs) of 4–6 contiguous "Gasaway" sample units from small fixed-wing aircraft (PA-18 or similar aircraft) to assess moose population parameters (Gasaway et al. 1986). We also established TCAs using a grid system based on latitude and longitude coordinates used to locate sample units (~5.7 mi^2 in size; Ver Hoef 2001). Surveys were flown approximately 500 ft above ground level at ground speeds of 70–80 mi/hr in fall. Moose were classified as cows, calves, yearling bulls (<30" antler width and no brow tine definition), medium bulls (<50" antler width), or large bulls (≥50" antler width). Sample units of approximately 12 mi^2 each were searched at a rate of approximately 5 min/mi^2 to ensure reasonably high sightability, minimal bias, and data comparability among years. Data was recorded on standard data forms, and moose locations were also recorded on 1:63,000 U.S. Geological Survey quadrangle maps. Surveys were not conducted until a minimum snow cover of approximately 12 inches had accumulated. This level of snow cover is important because snow depth influences sightability and moose distribution. Surveys were not completed in the southern TCAs in 2002 due to low snowfall.

We conducted a population estimation survey covering 8390 mi^2 (ADF&G files, Galena, 12 May 2000) in fall 1999 in the northern portion of Unit 24. Data from that survey were analyzed using the Geostatistical Population Estimator method (GSPE; Ver Hoef 2001). Survey techniques were modified from those outlined by Gasaway et al. (1986). An important change from the Gasaway methodology was, instead of geographical land characteristics, a grid system based on latitude and longitude coordinates was used to locate sample units (~5.7 mi^2 in size), with search intensity of ~6 min/mi^2. We also conducted a GSPE population estimation survey in the southern portion of Unit 24 downstream from the Hogatza River in 2001 (Bryant and Stout 2003).

Twinning surveys were flown in May to determine the proportion of moose calf twins in the TCA. Search and survey techniques and sample units were similar to those used in early winter. Observation of 50 cows with calves was the desired minimum, but funding and weather often prevented us from achieving that goal. Moose were classified as bull, yearling, calf, cow, cow with 1 calf, or cow with 2 calves. The timing of the surveys was critical. The surveys were flown when approximately 50% of the cows observed had calves. We flew at this time to avoid early mortality factors such as black bear predation, which could strongly influence the results.

Hunter harvest was monitored through mandatory moose harvest reports and a moose hunter checkstation operated on the lower Koyukuk River. We encouraged local residents to increase their harvest reporting by providing information at public meetings, checkstations, and village meetings. Hunting mortality and harvest distribution were also monitored through the statewide harvest ticket system, registration permits, drawing permits, and door-to-door subsistence surveys. General season hunters were sent 1 reminder letter to return their harvest reports. Hunters who had harvest permits (drawing and registration hunts) were sent 1 reminder postcard, then called via telephone, and then sent a certified letter. Names of hunters who possessed drawing permits were withdrawn from the following year's drawing permit hunts if no response was received. Information obtained from the reports and surveys was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002).

Predation was evaluated by interviewing trappers, field observations, and aerial wolf reconnaissance surveys conducted in cooperation with the U.S. Fish and Wildlife Service.

We discontinued the planning effort implemented in 1998 to address concerns over increasing numbers of hunters in the Koyukuk River drainage. The planning process was initiated in winter 1999–2000, and a Koyukuk River Moose Hunters' Working Group (KWG) was formed with representatives from the state’s advisory committees, the federal Western Interior Regional Advisory Council, and local commercial hunting guides. The planning group developed a draft 5-year Koyukuk River Moose Management Plan (ADF&G files) that was submitted to the Alaska Board of Game during its March 2000 meeting. The finalized plan was used as a guide for management goals, objectives, activities, and biological decision-making criteria in this management report, and was endorsed by the Board of Game at its winter 2001 meeting. A public meeting was hosted by the department in January 2004 to update interested individuals concerning the status of activities related to the moose management plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Status and trends of the moose population in an area as large and diverse as Unit 24 are difficult to determine with any degree of certainty. Most often, population size is described using generalities, and trends are discernible only for the few areas surveyed.

During RY01–RY02, moose were numerous in the Koyukuk River lowlands in the southern third of the unit (south of Hughes). Based on recruitment parameters, the population probably declined in the Dulbi Slough, Huslia River Flats, and Treat Island areas (Tables 1–3). Moose densities usually exceeded 4 moose/mi^2 in these areas, and although recruitment parameters were generally low, the yearling bull:cow ratios and calf:cow ratios improved from previous surveys. Further upriver, in the Kanuti Canyon, Henshaw/Peavey Creek, and Middle Fork TCAs, moose densities were 0.72, 0.63 and 0.92 moose/mi^2 respectively (Tables 4–6) in RY03. In 2003, yearling bull:cow ratios increased in all 3 TCAs, while calf counts continued to be low.

Population Size

In the RY99–RY00 management report (Stout 2002), the Unit 24 population estimate of 8100 moose ±1350 (6750–9450) was based on population estimation surveys (Martin and Zirkle 1996; Huntington 1998; Woolington 1998), extrapolations (Dale et al. 1995), and the use of trend area data that demonstrated declines in productivity and recruitment parameters. Most of that information was collected during the early and mid 1990s, when the population was high, and the data was collected over relatively small areas within the unit. Recent surveys have helped to refine the overall estimate within the unit and indicate the population estimate in the northern portion of Unit 24 north of Bettles was too high, but the estimate for the far southern portion south of Hughes was low.

The 2001 GSPE survey conducted in the area from Dulbi Slough and the lower Huslia River up to the lower Hogatza River estimated 3642 moose ± 572, not including a sightability correction factor, over a 1949 mi^2 survey block within the Koyukuk CUA. That was higher than the previously reported estimate. Surveys on the upper Huslia, upper Dakli, upper Indian and upper Hogatza River drainages had estimated densities averaging 0.25 moose/mi^2 based on stratified sample units that were considered habitat with low moose density in the 2001 survey. For the total of 6268 mi^2 in that area, I estimated 1567 moose during the current reporting period, which was similar to the previous estimate. The estimate for the 1999 GSPE survey block of 8390 mi^2 was 3036 moose, not including a sightability correction factor (±647, Table 8). Incorporating an estimated decline of 10% based on TCA data, I estimated 2732 moose in that portion of Unit 24 at the end of RY03. Using information collected during a reconnaissance survey in 2003 (ADF&G files, Galena) and data reported by Lawler et al. 2003, I estimated 375 moose in the 5732 mi^2 Gates of the Arctic portion of Unit 24. Extrapolating data from the 2003 GSPE survey conducted in the southern hills of the Brooks Range in Unit 23 (Lawler et al. 2003), I estimated 630 moose (0.20 moose/mi^2) in the remaining 3121 mi^2 of Unit 24 for the upper drainages of the Alatna, John, and Wild Rivers and a small portion of the area south of the 1999 survey block in the upper Kanuti River drainage and east of the Dalton Highway. For the later 2 areas, the estimate was lower than previously calculated. Therefore, the total Unit 24 population was estimated to be 9120 moose ±1520 (7600–10,640) at the end of RY02.

Although the population estimate for RY01–RY02 increased, it was due to a refinement in the estimate. In fact, during RY01–RY02, recruitment parameters such as calf:cow ratios and yearling bull:cow ratios throughout the area indicated the population was declining, which I believe to be accurate.

Population Composition

Composition data were available from aerial surveys conducted in cooperation with U.S. Fish and Wildlife Service staff from the Koyukuk National Wildlife Refuge and Kanuti National Wildlife Refuge (Tables 1–7). Results from surveys conducted through RY03 were variable. Bull:cow ratios were generally high in the Huslia River Flats and Henshaw–Peavy Creek TCAs and on the Kanuti Refuge. However, the Dulbi Slough, Treat Island, Kanuti Canyon, and Middle Fork TCAs' bull:cow ratios were typically lower than the broader area, as estimated by the population estimation surveys. I believe this is mostly explained by the influence of hunting pressure in these relatively higher density moose areas. The higher density moose areas typically attracted higher levels of hunting pressure and are generally more accessible. Franzmann and Schwartz (1998) suggested a ratio of 20–30 bulls:100 cows is needed to ensure breeding of all available cows, indicating normal breeding activity was unaffected. Ratios for RY01–RY02 in the Middle Fork TCA were questionable due to small sample size. In general, most ratios in the TCAs with counts of less than 100 moose tended to have larger variations that made interpretation more tenuous.

Calf twinning rates in spring 2003 and 2004 suggested improved productivity in Unit 24 (Table 9) in the Huslia Flats–Treat Island TCAs. We suggest this improvement is related to the 3 to 4 prior consecutive mild winters and the corresponding length of the intervening snow free seasons. Although no objective measurements of habitat were conducted during this period, I observed no dramatic changes in vegetative characteristics that would account for the apparent improvements in twinning rates. Thus, I do not believe a density-dependent effect was acting on the population because twinning rates declined only temporarily while the moose population maintained relatively high and stable densities.

Distribution and Movements

Little date is available on movements of moose within the unit. Thirteen moose radiocollared in winter 1984–1985 in northern Unit 21D migrated into the southwestern parts of Unit 24 during each summer. Generally, moose are found at treeline in the northern part of Unit 24 in early winter and move into the river bottoms during late winter and summer. In the southern portion of the unit, moose occupy the broad riparian habitats year-round with much shorter seasonal migrations.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 24, that portion within the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 moose per regulatory year, only as follows:		
1 moose by registration permit only;	27 Aug–31Aug (Subsistence hunt only)	
or		
1 bull by registration permit only;	1 Sep–20 Sep (Subsistence hunt only)	
or		
1 bull by drawing permit only; up to 320 permits may be issued in combination with Unit 21D that portion within the Koyukuk Controlled Use Area; or	5 Sep–25 Sep (Subsistence hunt only)	
1 moose.	1 Dec–10 Dec 1 Mar–10 Mar (Subsistence hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit; up to 80 permits may be issued in combination with Unit 21D, that portion within the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Unit 24, that portion of the John and Alatna River drainages within the Gates of the Arctic National Park.		
1 moose.	1 Aug–31 Dec	No open season
Unit 24, all drainages to the north of the North Fork Koyukuk River drainage within the Gates of the Arctic National Park.		

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
1 moose	1 Sep–25 Sep 1 Mar–10 Mar	No open season
Unit 24, all drainages to the north of the Koyukuk River upstream from the Henshaw Creek drainage, to and including the North Fork Koyukuk River, except that portion of the John River drainage within Gates of the Arctic Park.		
RESIDENT HUNTERS: 1 moose; however, antlerless moose may be taken only during the period 21 Sep–25 Sep.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 24, all drainages to the north of the Koyukuk River between and including the Alatna River and Henshaw Creek drainages, except that portion of the Alatna River drainage within Gates of the Arctic National Park.		
RESIDENT HUNTERS: 1 moose; however, antlerless moose may be taken only during the periods 21 Sep–25 Sep and 1 Mar–10 Mar.	1 Sep–25 Sep 1 Mar–10 Mar	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 24, that portion in the Dalton Highway Corridor Management Area.		
RESIDENT HUNTERS: 1 bull by	1 Sep–25 Sep	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
drawing permit; up to 70 permits may be issued in combination with Unit 25A, that portion within the Dalton Highway Corridor Management Area.		
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit only; up to 70 permits may be issued in combination with Unit 25A, that portion within the Dalton Highway Corridor Management Area.		5 Sep–25 Sep
Remainder of Unit 24.		
RESIDENT HUNTERS: 1 bull.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. Subsistence and general registration hunts were established in the Koyukuk CUA downstream of Huslia by the Board of Game in March 1996 to counter a moose hunting closure by the Federal Subsistence Board. The federal board closed federally managed lands within one-half mile of the Koyukuk River in nearby Unit 21D from the Kateel River to 40 miles upstream from the mouth of the Koyukuk for all but local rural residents. This closure was prompted by perceived declines in moose availability for local residents and by an increase in moose hunters. Two separate registration hunts were established. A subsistence registration hunt was opened to all Alaska residents during 1 September–25 September, with a bag limit of 1 moose. All the meat had to remain on the bones, the head had to be salvaged, and the antlers were cut to destroy the trophy value. A general registration hunt was opened to all hunters during 5 September–25 September, with a bag limit of either 1 antlerless moose or 1 bull with antlers at least 50 inches wide, or at least 4 brow tines on at least 1 side. Seasons and bag limits for the remainder of the unit were unchanged.

Several changes were made to the regulations during the 2000 and 2002 Board of Game meetings, due mostly to recommendations proposed by the KWG. Foremost among the changes was implementation of limited drawing hunts for the Koyukuk Controlled Use Area in RY00 and for the Dalton Highway Corridor Management Area in RY02. In RY00 the antlerless moose season for the general season drawing hunts, formerly RM830, was closed, and the antlerless season for the subsistence registration hunt RM832 was reduced to the first 5 days of the season. The RM832 hunt was also shifted forward 5 days so it opened on 27 August and closed on 20 September. Additional restrictions applied by department discretionary authority required hunters to saw through the middle of the palm of one of the antlers of bulls harvested under a RM832 permit. In RY00 and RY01 an emergency order closed the March season in the area north of the Koyukuk River between the Alatna and North Fork Rivers. Unexpected increases in hunter participation made it necessary to close that season early because of the excessive harvest of the relatively low number of moose in that area, especially in the lower portion of the Wild River drainage. In RY02–RY03, fall antlerless moose seasons in Unit 24 were closed by emergency order due to concerns over continued declines in recruitment parameters.

At the 2004 Board of Game meeting, drawing and registration hunts during the fall season were expanded to drainages surrounding the Koyukuk Controlled Use Area. The new hunts were adopted by the board to respond to the concentration of hunters around the perimeter of the CUA and to improve success rates of local hunters during the fall hunting seasons so they would be less dependent on winter hunts. A large proportion of the moose harvested during the winter seasons have been cows. March seasons were also closed and replaced with a bulls-only December season.

Hunter Harvest. Hunting seasons in the unit were diverse and reflected various moose densities and consumptive use patterns. Annual reported harvest during RY93–RY02 averaged 190 moose (142–240, Table 10).

Illegal and unreported harvests by local residents continued to hamper department efforts to manage moose. During some years, actual harvest was estimated to be about twice the reported harvest (Table 10). Moose taken during winter were rarely reported, even when the season was open. Several villages have never had a license vendor. This contributed to the problem of hunters hunting without licenses or harvest tickets. Checkstation results, including the meat evaluation survey and the hunter viewing survey, can be found in the RY01–RY02 Unit 21D Moose Management Report (Stout 2004).

Harvest Chronology. Over 95% of reported harvest occurred in the September seasons (Table 11). However, much of the unreported harvest probably occurred during October–March (Anderson et al. 1998).

Permit Hunts. Beginning in RY00 in the Koyukuk CUA, drawing permit hunts DM827, DM828, DM829, and DM830 replaced the general registration permit RM830. Either subsistence registration permit RM832 or one of the drawing permits were required for the fall hunt in the Koyukuk CUA. The number of RM832 permits issued for RY02 decreased by 10.9% from RY01 and then increased by 11.7% in RY03 (Table 12). So it appears that use of the RM832 permit has stabilized. Use of the registration permit increased among Unit 21D residents while other Alaska residents' use of the permit was down somewhat. Increases in the number of Alaska resident hunters using the subsistence permit alternative and the potential to exceed the sustainable yield of the moose population has been a critical management issue. With the implementation of the 4 drawing hunts, DM827, DM828, DM829 and DM830, hunter numbers can be better regulated.

Within the DHCMA, drawing permit hunts DM920 and DM922 resulted in a reduction of moose harvested compared to harvest under the general harvest ticket. Rates for successfully drawing a DHCMA permit were relatively high in RY02–RY03, at 19.2% for DM920 and 33.1% for DM922. However, hunting success rates among the permitted hunters was low at 0% north of Slate Creek (DM920) and an average of 13% south of Slate Creek (DM922) (Table 13). Hunter comments about the new permit hunts were positive in terms of the aesthetics of the hunt, but often negative among the hunters if they were unable to successfully draw a permit.

<u>Hunter Residency and Success</u>. Based on harvest reports, there was an average of 361 moose hunters during RY93–RY03, the majority of whom were Alaska residents (Table 14). The number of hunters was probably underreported because Unit 24 residents often did not report unsuccessful hunt information. Harvest and hunter participation by Unit 24 residents was relatively constant, according to Division of Subsistence surveys (Anderson et al. 1998). However, nonresident and nonlocal resident hunter participation increased steadily since RY88. The increase in nonlocal hunters created tension among user groups and was the impetus for creating the KWG.

The estimated annual harvest by residents of Unit 24 was about 172 moose, according to Marcotte (1986) and Marcotte and Haynes (1985). They estimated residents of Huslia, Hughes, Allakaket–Alatna, Bettles, and Wiseman annually took 84, 33, 35, 10, and 5 moose, respectively. I estimated an additional 5 moose taken by unit residents not living in a village. Data reported by Anderson et al. (1998) was similar to earlier results. The estimated unreported harvest incorporated recent Subsistence Division data, less the reported harvest by unit residents (Table 10).

<u>Transportation Methods</u>. In RY01–RY03, boats continued to be the primary transportation method in Unit 24 because of the extensive river system, lack of roads, and restrictions on the use of aircraft within the 2 CUAs (Table 15). Highway vehicles were only used on the Dalton Highway where it crosses the eastern part of the unit. Snowmachines were the main transportation method used during the winter.

The Dalton Highway was closed to the public at the Yukon River Bridge after construction was completed, but was opened to public use throughout Unit 24 in 1981. The number of hunters and moose harvest for hunters accessing Unit 24 by the Dalton Highway during RY02–RY03 declined by more than 50% after implementation of permit hunts DM920 and DM922 (Table 13).

Other Mortality

A minimum of 400–440 wolves in 55–60 packs and a large population of black bears inhabit the middle and southern portions of the unit. Grizzly bears are common throughout the montane areas. Predation on moose was thought to be high, keeping the moose population low throughout much of the central portion of the unit.

HABITAT

Assessment

No habitat assessment work was conducted during this reporting period.

MANAGEMENT PLANNING

The KWG was essentially disbanded in RY02, due to the turnover of advisory committee membership. The plan was the basis for developing goals and activities for moose management in Unit 24. Although the KWG's area of concern was specifically within the Koyukuk River drainage, the issues were characteristic of concerns throughout Unit 24 and nearby Unit 21D. One public meeting was hosted by the department in January 2004 to provide an update on the status of management related activities outlined in the moose management plan.

CONCLUSIONS AND RECOMMENDATIONS

Unit 24 is larger than some states, with a wide range of habitats available to moose. Moose densities range from quite high in small portions of the unit to the typical low densities expected in large areas of rural Interior Alaska. Hunting activity was typically concentrated in areas accessible by boat, with the potential for creating conflicts between local subsistence hunters and nonlocal hunters. Conflicts between user groups, whether real or perceived, have the potential to greatly affect future management decisions.

Habitat was excellent throughout much of the unit, with an abundance of successional willow regrowth due to either fire or riverine erosion. Availability of browse was not limiting the moose population during the report period.

With the exception of limited areas around Allakaket, Bettles, and Huslia, predation on moose by wolves and bears was likely the major factor limiting Unit 24 moose populations. Unit residents met their wild food requirements, but hunting opportunities cannot be expanded for people living outside the unit until moose numbers increase. Where predators have been lightly harvested for long periods, predation seems to keep moose densities low (0.1–1.1 moose/mi^2 in areas >800 mi^2, Gasaway et al. 1992).

We still need to obtain population estimates for the Hogatza River, upper Huslia River, and Indian River drainages and the northern portion of Unit 24, including Gates of the Arctic National Park. A population estimation survey should be undertaken in cooperation with National Park Service when funding is available. Trend data should also be collected in popular hunting areas such as the South Fork Koyukuk River upstream from the Dalton Highway, Alatna River, John River, and Kanuti River areas.

For the first goal concerning harvest within sustained yield principles, my estimated population of 9120 moose, not including a sightability correction factor, did not achieve the objective to maintain a population of 10,000–12,000 moose for the second consecutive reporting period. We achieved the objective to provide for an adequate moose harvest without exceeding 360 moose or a 5% harvest rate. We also achieved the objective to provide for hunting opportunity that did not exceed 500 hunters.

The long-term objective of implementing at least 2 habitat enhancement activities was not achieved directly during RY01–RY02, but coordination with the U.S. Fish and Wildlife Service concerning potential treatment is in progress. The objective of reducing spoiled meat was monitored in RY02 and RY03. I believe regulations adopted by the board that required meat to remain on the bone on all 4 quarters and the ribs in all of Unit 24 was a positive move toward achieving this objective. We also developed a program at the Ella's cabin checkstation to establish baseline meat salvage data for fall hunters. Finally, as with the previous objective, a monitoring program to evaluate the number of people engaged in nonconsumptive activities was developed and baseline data was collected.

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TABLE 1 Unit 24 Dulbi Slough aerial moose composition counts, regulatory years 1982–1983 through 2001–2002

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1982–1983	35.0	45	5	7	0	4.5	111	3.2
1983–1984	39.0	17	8	33	14	22.5	113	2.9
1984–1985	48.1	19	8	20	6	14.6	130	2.7
1985–1986	54.2	19	9	10	0	7.7	170	3.1
1989–1990	48.7	53	7	23	18	13.1	298	6.1
1996–1997	86.4	24	8	37	1	23.0	443	5.1
1999–2000	89.0	11	3	22	5	16.1	411	4.6
2001–2002	89.0	18	7	25	0	17.4	327	3.6

TABLE 2 Unit 24 Huslia River Flats aerial moose composition counts, regulatory years 1983–1984 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1983–1984	80.0	36	7	23	3	14.6	212	2.7
1985–1986	64.5	45	17	10	25	6.7	254	3.9
1989–1990	38.2	50	2	30	7	16.7	90	2.4
1993–1994	80.2	81	15	24	8	11.8	483	6.0
1997–1998	80.2	58	15	24	9	13.2	438	5.5
2000–2001	80.2	35	3	17	4	11.2	259	3.2
2001–2002	80.2	44	7	14	0	8.7	378	4.7
2003–2004	80.2	42	11	29	3	16.9	354	4.4

TABLE 3 Unit 24 Treat Island aerial moose composition counts, regulatory years 1985–1986 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1985–1986	41.0	35	13	17	5	10.9	192	4.7
1993–1994	40.3	39	11	25	7	15.1	317	7.9
1998–1999	67.1	25	6	19	2	13.5	379	5.7
1999–2000	67.1	21	5	15	11	10.8	279	3.6
2000–2001	67.1	16	4	13	5	10.0	430	5.6
2001–2002	67.1	32	4	12	4	8.4	321	4.3
2003–2004	67.1	22	9	20	9	14	338	5.0

TABLE 4 Unit 24 Henshaw–Peavy Creek aerial moose composition counts, regulatory years 1991–1992 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1991–1992	67	80		30		14	42	0.62
1992–1993	67	58	11	5		3	64	0.85
2000–2001	106	129	18	24	67	9	43	0.41
2001–2002	106	106	0	31	0	13	38	0.36
2002–2003	106	72	6	28	0	14	36	0.34
2003–2004	106	68	15	29	22	15	67	0.63

TABLE 5 Unit 24 Kanuti Canyon aerial moose composition counts, regulatory years 1988–1989 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1988–1989	96	118		41		16	101	1.05
1992–1993	79	77	8	27		1	106	1.34
2000–2001	86	38	7	7	0	5	87	1.01
2001–2002	86	40	9	23	0	14	57	0.66
2002–2003	86	16	4	13	0	10	72	0.84
2003–2004	86	29	11	9	0	6	62	0.72

TABLE 6 Unit 24 Middle Fork aerial moose composition counts, regulatory years 1988–1989 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1987–1988	78.1	49	5	21	0	13	104	2.16
2000–2001	77	13	0	43	10	27	62	0.81
2001–2002	77	36	9	18	0	12	34	0.44
2002–2003	77	0	0	33	0	25	24	0.31
2003–2004	113	23	9	24	0	16	104	0.92

TABLE 7 Unit 24 Kanuti National Wildlife Refuge population estimation surveys, regulatory years 1989–1990 through 1999–2000

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1989–1990[a]	2615	64	4.1	16.5	n/a	9.2	1172 (878–1467)	0.45
1993–1994[a]	2644	61	8.0	33.0	n/a	17.0	2010 (1716–2304)	0.76
1999–2000	2714	61	4.3	27.8	n/a	14.7	1188 (879–1497)	0.39

[a] Martin and Zirkle 1996.

TABLE 8 Unit 24 population estimation survey summaries, regulatory years 1989–1990 through 1999–2000[a]

Survey area	Area mi^2	Total sample units	Bulls:100 Cows	Calves:100 Cows	Population estimate
Management Zone 1 - **Subtotal**	4696				4000 ± 500
Management Zone 2					
1999 Survey block	8390	1585	65:100	28:100	3036 ± 647 (90% CI)
Moose habitat Unit 24/North[b]	4752		65:100	28:100	1720 ± 353
Remainder Unit 24/North[c]	8217		65:100	28:100	244 ± 50
Subtotal	21,359				5000 ± 1050
Unit 24 – **Total**	26,055				9000 ± 1500

[a] Stout 2000.

[b] The estimated area of Unit 24 that could potentially support moose year-round.

[c] The area remaining in Unit 24 with very little year-round moose habitat, primarily the high altitude mountainous portion within Gates of the Arctic National Park.

TABLE 9 Unit 24 moose aerial twinning surveys in the combined areas of Huslia Flats and Treat Island trend count areas, regulatory years 2001–2002 through 2003–2004

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates
2001–2002	--	17	2	11	3	29 May–1 Jun
2002–2003	144	53	22	29	41	28–30 May
2003–2004	58	55	23	29	34	29 and 30 May

[a] Percent of cows with calves that had twins.

TABLE 10 Unit 24 moose hunter harvest, regulatory years 1988–1989 through 2003–2004

Regulatory	Harvest by hunters				Unreported	
Year	Bull	Cow	Unk	Total	harvest	Total
1988–1989	132	5	0	137	131	268
1989–1990	119	8	1	128	132	260
1990–1991	141	2	1	144	129	273
1991–1992	141	2	1	144	129	273
1992–1993	118	5	0	123	124	247
1993–1994	139	12	0	151	116	267
1994–1995	134	8	0	142	135	277
1995–1996	161	8	0	169	129	298
1996–1997	176	14	0	190	117	307
1997–1998	168	10	2	180	100	280
1998–1999	213	17	0	230	100	330
1999–2000	228	10	2	240	100	340
2000–2001	211	7	1	219	100	319
2001–2002	183	5	1	189	100	289
2002–2003	186	4	0	190	100	290
2003–2004[a]	149	5	1	155	100	255

[a] Preliminary data.

TABLE 11 Unit 24 moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory	Harvest chronology percent by month/day				
year	9/1–9/14	9/15–9/25	12/1–12/10	3/1–3/10	*n*
1996–1997	48	46	2	5	187
1997–1998	49	46	1	4	170
1998–1999	49	47	0	5	219
1999–2000	43	52	0	4	231
2000–2001	46	49	0	4	205
2001–2002	37	60	2	2	179
2002–2003	43	55	0	2	174
2003–2004[a]	48	48	0	5	145

[a] Preliminary data.

TABLE 12 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2003–2004[a]

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Unk	Total harvest
RM832	1998–1999	295	8	45	55	125	(77)	38	(23)	0	163
	1999–2000	356	9	49	51	127	(70)	54	(30)	1	182
	2000–2001	355	14	45	55	157	(93)	11	(7)	1	169
	2001–2002	403	15	62	38	126	(97)	3	(2)	1	130
	2002–2003	359	17	51	49	145	(100)	0	(0)	0	145
	2003–2004	401	12	55	45	155	(99)	0	(0)	2	157
RM830	1998–1999	330	5	45	55	159	(87)	23	(13)	0	182
	1999–2000	380	3	51	49	148	(79)	39	(21)	0	187
DM827	2000–2001	26	19	52	48	10	(100)	0	(0)	0	10
	2001–2002	26	19	68	32	5	(83)	1	(17)	0	6
	2002–2003	20	35	31	69	9	(100)	0	(0)	0	9
	2003–2004	26	19	63	37	7	(100)	0	(0)	0	7
DM828	2000–2001	103	51	22	78	38	(100)	0	(0)	0	38
	2001–2002	103	63	54	46	17	(100)	0	(0)	0	17
	2002–2003	79	56	45	55	17	(100)	0	(0)	0	17
	2003–2004	103	48	40	60	27	(100)	0	(0)	0	27
DM829	2000–2001	26	15	27	73	16	(100)	0	(0)	0	16
	2001–2002	26	15	50	50	8	(100)	0	(0)	0	8
	2002–2003	20	45	0	100	11	(100)	0	(0)	0	11
	2003–2004	26	12	38	62	13	(100)	0	(0)	0	13
DM830	2000–2001	103	41	25	75	45	(100)	0	(0)	0	45
	2001–2002	103	51	43	57	26	(100)	0	(0)	0	26
	2002–2003	79	38	16	84	41	(100)	0	(0)	0	41
	2003–2004	103	36	24	76	44	(100)	0	(0)	0	44

Table 12 continued

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
Total	1998–1999	625	7	41	59	284 (82)	61 (18)	0	345
	1999–2000	736	5	46	54	275 (75)	93 (25)	1	369
	2000–2001	613	25	39	61	266 (96)	11 (4)	1	278
	2001–2002	661	29	59	41	182 (97)	4 (2)	1	187
	2002–2003	557	27	46	54	217 (100)	0 (0)	1	218
	2003–2004	659	22	50	50	246 (99)	0 (0)	2	248

[1] RM830 ended in regulatory year 2000–2001 and was replaced by Drawing Hunts DM827, 828, 829, and 830.

TABLE 13 Unit 24 Dalton Highway Corridor Management Area moose harvest by permit hunt, regulatory years 2002–2003 through 2003–2004

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
DM920	2002–2003	20	30	100	0	0 (0)	0 (0)	0	0
	2003–2004	20	40	100	0	0 (0)	0 (0)	0	0
DM922	2002–2003	50	29	88	12	4 (100)	0 (0)	0	4
	2003–2004	50	54	86	14	3 (100)	0 (0)	0	3

TABLE 14 Unit 24 moose hunter residency and success, regulatory years 1988–1989 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	
1988–1989	41	57	16	23	137	13	63	18	25	119	256
1989–1990	40	68	17	3	128	28	107	16	4	155	283
1990–1991	43	71	22	8	144	17	81	16	9	123	267
1991–1992	43	77	23	1	144	14	138	16	3	171	315
1992–1993	48	62	7	6	123	27	129	27	3	186	309
1993–1994	56	68	25	2	151	24	94	23	1	142	293
1994–1995	37	78	25	2	142	10	90	21	3	124	266
1995–1996	43	97	30	0	170	12	93	18	0	123	293
1996–1997	55	95	38	2	190	24	98	26	0	148	338
1997–1998	40	97	41	2	180	18	81	20	0	119	299
1998–1999	41	125	59	5	230	20	120	25	2	167	397
1999–2000	40	119	77	4	240	25	143	39	3	210	450
2000–2001	57	124	38	1	220	36	141	55	0	232	452
2001–2002	32	101	48	1	182	20	181	57	0	258	440
2002–2003	32	90	68	0	190	26	130	56	2	214	404
2003–2004[b]	36	76	35	8	155	20	104	50	10	184	339

[a] Unit resident only.
[b] Preliminary data.

TABLE 15 Unit 24 moose harvest percent by transport method, regulatory years 1988–1989 through 2003–2004

Regulatory year	Harvest percent by transport method								n
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	
1988–1989	23	1	49	1	0	3	13	9	137
1989–1990	19	1	44	1	1	1	24	9	140
1990–1991	16	3	56	3	1	2	16	3	144
1991–1992	25	2	44	3	1	2	17	5	144
1992–1993	16	0	56	3	5	1	13	6	123
1993–1994	15	0	60	6	5	2	7	4	151
1994–1995	17	2	53	3	5	3	12	4	142
1995–1996	13	2	59	2	6	2	15	2	170
1996–1997	12	1	62	3	6	1	13	4	190
1997–1998	19	1	51	7	6	1	11	6	178
1998–1999	17	0	62	2	4	0	10	5	230
1999–2000	17	1	56	3	4	0	18	1	240
2000–2001	16	0	61	3	4	1	14	2	220
2001–2002	19	1	62	2	3	0	14	0	182
2002–2003	18	1	69	1	2	0	7	2	190
2003–2004[a]	19	1	69	1	5	0	5	1	155

[a] Preliminary results.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNITS: 25A, 25B, and 25D (47,968 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Yukon River Valley

BACKGROUND

Historically, moose have been relatively scarce in the upper Yukon River valley. Long-time residents of the area report moose were hard to find in the early 1900s, but were more common in recent years (F. Thomas, H. Petersen, K. Peter, personal communication). However, moose density continues to be low compared with many other areas in Interior Alaska. A few population surveys were done in the late 1970s, and more extensive surveys began in 1981 when the Alaska Department of Fish and Game (ADF&G) established a Fort Yukon area office. Estimates of population density in survey areas on the Yukon Flats in Unit 25D have ranged from a low of 0.1 moose/mi^2 in the west in 1984 to 0.64 moose/mi^2 in the east in 1989 (ADF&G files). Extrapolations from trend surveys and stratification efforts resulted in estimates of 1253 moose in 1984 and 2000 moose in 1989 in a 5400-mi^2 area in Unit 25D East (Maclean and Golden 1991). Survey techniques have been modified to reflect advances in sampling techniques and to accommodate the area's relatively low moose density.

Population surveys and observations by local residents suggest that moose numbers increased somewhat during the 1970s and 1980s in Unit 25D. Trend counts and population estimates, as well as anecdotal information, indicate moose numbers were stable or declining in Unit 25D West and declining in Unit 25D East during the 1990s. Numbers currently appear to be declining in both areas. Moose densities continue to be low compared to other areas in Alaska, making it difficult to simplify regulations.

Recent population trends in Units 25A and 25B are not well understood. Composition surveys were last conducted in Unit 25B in 1987. Reports from experienced guides and pilots indicate moose numbers in Unit 25B have declined and are currently at a low level. Population surveys in Unit 25A suggest that numbers have also declined in this area during the past decade.

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[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Based on knowledge of wolf numbers and food habits and moose mortality studies, limiting factors include predation by black bears, grizzly bears and wolves, as well as hunting. A recent moose calf mortality study showed that predation by black bears and grizzly bears is the major cause of calf moose mortality during summer (Bertram and Vivion 2002). During 1999 and 2000, 30 radiocollared cows and their calves were monitored over a 2-year period in Unit 25D West. The results showed that only about 20% of calves born survived until 30 November. Major sources of mortality included black bears (45%), brown bears (39%), wolves (3%), drowning (8%), and abandonment (5%). Average annual survival of adult cows averaged 88%. In the first year, 2 cows were killed by brown bears and 1 was killed illegally by a hunter. Four were killed by wolves during the second year. The pregnancy rate was 89%, and 63% of the cows had twins. Vegetation surveys indicate that moose browse is abundant and browsing intensity is low (ADF&G, unpublished data; C. Fleener, personal communication). The area is characterized by low to moderate snowfall.

Unit 25D was divided into Units 25D West and 25D East in the early 1980s to allow the use of regulatory schemes that reflected the different status of moose populations. The boundary between the 2 areas lies along Preacher and Birch Creeks south of the Yukon River and along the Hadweenzic River north of the Yukon. Low moose density in Unit 25D West, combined with the relatively high demand for moose by local residents, resulted in the use of permit systems that limited hunting largely to residents of the area.

A registration permit hunt was established in Unit 25D West in 1983, with a bag limit of 1 bull and a 25 August–5 October open season. Sixty permits were issued to residents of the 3 communities in the area. The fall season was shortened and 2 winter hunting periods were added in 1984. A harvest quota of 35 bull moose was established in 1986. A Tier II permit hunt was established in regulatory year (RY) 1990 because the harvestable surplus was deemed insufficient to support all subsistence uses, and restrictions were thought to be necessary (RY = 1 Jul–30 Jun, e.g., RY90 = 1 Jul 1990–30 Jun 1991).

A harvest quota of 35 bull moose was established in Unit 25D West in 1986. Since 1990, moose have been hunted under a Tier II permit system with up to 125 Tier II permits issued each year. In 1990 the Federal Subsistence Board promulgated regulations for subsistence use on federal lands. These regulations took effect 1 July 1991, when a federal subsistence moose permit system was established in Unit 25D West. It provided an unlimited number of permits to residents of the 3 communities in Unit 25D West to hunt bull moose on federal lands. The state Tier II permit system remained in effect and applied to both private and federal lands. A maximum of 30 federal permits and 125 state Tier II permits were issued each year beginning in 1993. In 1993 there also was a change in the way regulations were applied in Unit 25D West. Federal permits were required on federal land and were issued only to residents of the 3 communities in the unit. However, state Tier II permits issued to residents of Unit 25D West were again recognized as valid on federal lands beginning in 2000, when 60 federal and 75 state Tier II permits were available, with a harvest quota of up to 60 bull moose.

Dual management also affected regulations in Units 25A, 25B, and 25D East. Seasons for eligible local residents hunting on federal land were longer (generally 25 Aug–25 Sep and

1 Dec–20 Dec) than the state season. The state season applied to all hunters on private and state lands and to nonlocal hunters on federal lands.

The cumulative effect of various annual permit application requirements, confusion over geographic boundaries, and other circumstances have resulted in low reporting and limited participation in the harvest management system. Discussions with local residents during 1999 helped identify a number of steps that could improve moose management on the western Yukon Flats. They included revising the harvest quota for moose, reducing the maximum number of Tier II permits available, and aligning state and federal hunting seasons.

A study of local opinions on moose management issues in Fort Yukon during 1995–1996 indicated there was substantial concern about the status of moose populations, opposition to the taking of cow moose, and support for increased enforcement, biological studies, predator control and local involvement in moose management (C. Fleener, unpublished report).

In March 2000 the Alaska Board of Game lengthened the state season in Unit 25D West to 25 August–28 February, aligning it with the season on federal public lands, and agreed with the department's recommendations to increase the harvest guideline from 35 to 60 bull moose and reduce the number of Tier II permits available from 125 to 75. A proposal to include a maximum of 20 cow moose in the harvest quota was not approved by the board. The board also approved a regulation that established a Community Harvest Permit program for part of Unit 25D East, under which individual bag limits could be pooled so more than 1 moose could be taken by an individual hunter. The board established the Chalkyitsik Community Harvest Area and a community harvest bag limit for moose in the portion of Units 25D and 25B included in the community harvest area.

In early 2001 the department initiated a cooperative effort to develop a moose management plan for the Yukon Flats. In 2002 the Yukon Flats Cooperative Moose Management Plan was completed, and it was endorsed by the Board of Game. The plan was developed under the sponsorship of the Alaska Department of Fish and Game/Division of Wildlife Conservation, in cooperation with the Yukon Flats Fish and Game Advisory Committee through the Yukon Flats Moose Management Planning Committee, a temporary group created specifically for the planning project. Other stakeholders involved in the project include the Council of Athabascan Tribal Governments, individual tribal governments, the U.S. Fish and Wildlife Service (FWS)/Yukon Flats National Wildlife Refuge, the FWS/Office of Subsistence Management and other interested users of the Yukon Flats moose resource. This effort focused on community and agency initiatives that together could maintain or increase moose abundance, especially in key hunting areas near local communities, as well as the interest of nonlocal hunters and other interested parties. The Yukon Flats Cooperative Moose Management Plan was designed to promote increasing the Yukon Flats moose population in the following ways: 1) improve moose harvest reporting to better document subsistence needs and improve management; 2) reduce predation on moose by increasing the harvest of bears and wolves; 3) minimize illegal cow moose harvest and reduce harvest of cows for ceremonial purposes so that more calves are born; 4) inform hunters and others about the low moose population on the Yukon Flats and ways people can help in the effort to increase moose numbers; and 5) use both scientific information and traditional knowledge to help make wise management decisions. Management goals and objectives have been revised to incorporate goals and objectives developed by the Yukon Flats Moose Management Planning Committee.

MANAGEMENT GOALS

Unit 25 Overall

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.

Unit 25A

- Provide an opportunity to hunt under aesthetically pleasing conditions and provide for subsistence use.

Units 25B and 25D

- Provide for subsistence use and for the greatest opportunity to harvest moose.
- Protect, maintain, and enhance the Yukon Flats moose population and habitat, maintain traditional lifestyles and provide opportunities for use of the moose resource.
- Increase the harvestable surplus of bull moose in key hunting areas near local communities by reducing mortality from bear and wolf predation.

MANAGEMENT OBJECTIVES

Unit 25 Overall

- Double the size of the moose population in key hunting areas and, if possible, within the entire planning area, in the next 10 years. A secondary objective is to increase the number of moose in Unit 25D from 4000 moose to 8000 by 2012.
- Maintain a minimum of 40 bulls per 100 cows as observed in fall surveys.
- Improve moose harvest reporting to attain 90% or greater reporting compliance during the next 3 years.
- Minimize cow moose harvest while the population is rebuilding, recognizing that some cows will probably be taken for ceremonial purposes when bull moose are in poor condition.

ACTIVITIES

- Continue efforts to communicate with and educate local residents about moose management and the effects of cow moose harvest.
- Work with natural resource offices in local communities to obtain and exchange information on moose populations and management issues.
- Develop cooperative management programs involving state, federal, and tribal management organizations to help improve local harvest monitoring and reporting.
- Monitor moose population status through annual surveys.

METHODS

A moose population survey (Gasaway et al. 1986) was conducted in November 1992 in Unit 25D West using multiple PA-18 aircraft and a C-185 for stratification. Population surveys using similar techniques, including regression analysis (J. Ver Hoef, ADF&G, personal communication), were conducted in Unit 25D West in 1996, 1999, 2000, and 2001, spring 1999, 2003 and 2004, and in Unit 25D East in fall 1995, 1997, 1999, 2000 and 2001 and spring 2004. A lack of snow precluded fall surveys in 2002 and 2003. Ninety percent confidence intervals were calculated for most estimates. Beginning in 1999, population surveys were conducted using a spatial analysis technique referred to as the Geostatistical Population Estimator (GSPE), recently developed by Ver Hoef (2001). A sightability correction factor (SCF) has not yet been developed for this technique, but an SCF was applied to survey estimates prior to 1999. Previous studies of sightability indicate that current survey techniques underestimate the number of moose by about 5–15% in most Interior habitats (ADF&G, unpublished data), and recent survey estimates may be revised upward in the future after an SCF is developed for the GSPE survey method. Survey areas were stratified according to moose density using C-185 or C-206 aircraft. Randomly selected sample units were counted with PA-18 or Scout aircraft flown at 70 miles per hour about 500 feet above ground level. We circled moose to determine sex, age, and antler size of bulls, and to locate other moose. Moose habitat in established count areas or sample units was searched systematically at an intensity of at least 4 minutes/mi^2. Sex and age composition observed during trend surveys is presented, as well as observed and estimated sex and age composition based on data collected during population surveys. Population sex and age composition were estimated using statistical and spatial analyses based on bull:cow, calf:cow, and yearling bull:cow ratios observed in different density strata and the area extent of each strata (Ver Hoef 2001). Population surveys in Unit 25A involved counting discrete survey areas that encompassed the major moose habitat in a large area in the eastern part of the unit.

Harvest reports provided information on hunter effort, residency, success, transportation, and antler size. Harvest data were summarized by regulatory year. Informal visits and interviews with area residents provided additional insight into hunter effort and concerns about moose management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Units 25A and 25B. A population survey was completed in eastern Unit 25A in fall 2000 (Arctic National Wildlife Refuge, unpublished data). The survey area was identical to that used in 1989 and 1991, and survey conditions were excellent. The number of moose observed was about 50% lower than in the 1989 and 1991 surveys, suggesting that moose numbers declined during the last decade (Table 1). Reports from some knowledgeable observers indicate moose numbers in southern Unit 25A also declined during this period. No population surveys were completed in Unit 25B during RY99–RY02. Reports from hunters in Unit 25B indicate that moose have declined south of the Porcupine River and in the upper Black River drainage, and are also relatively scarce north of the Porcupine River. Surveys in Yukon–

Charley Rivers National Preserve in the southern part of Unit 25B resulted in estimated densities of 0.34 moose/mi^2 in 1994 and 0.23 moose/mi^2 in 1997 and 1999 (Burch 1999).

Unit 25D East. A population survey in Unit 25D East in 1995 resulted in an estimate of 704 moose (±33%) in a 1534-mi^2 area (0.46 moose/mi^2) encompassing important hunting areas near Fort Yukon (Table 2). Estimated moose density varied considerably among 3 subunits in the sample area, ranging from 0.12 moose/mi^2 around Fort Yukon to 0.75 moose/mi^2 in the Graveyard Lakes area. A similar survey in 1997 resulted in an estimate of 625 moose (±36%) and a density of 0.40 moose/mi^2. In fall 1999 the moose population in a 2936-mi^2 survey area was estimated at 829 (±20%, no SCF) with an overall density of 0.28 moose/mi^2. A fall 2000 survey resulted in an estimate of 726 (±25%, no SCF). The survey area used beginning in 1999 encompassed the smaller area surveyed in 1995 and 1997. The lower estimated density probably reflected a decline in numbers, lack of a SCF, and the addition of primarily low-density habitat to create the expanded survey area.

The fall 2001 population survey in the 2936-mi^2 area resulted in an estimate at 514 ± 27%. This is lower than 1999 and 2000 estimates. Estimated density in high and low strata was 0.37 and 0.03 moose/mi^2, respectively, with an overall density of 0.18 moose/mi^2 (Table 2). We also calculated a population estimate based on data from sample units representing the area surveyed in 1995 and 1997. This resulted in an estimate of 305 ± 32% moose (0.20/mi^2) in the 1550-mi^2 area. This compares to the 1999 and 2000 estimates of 516 ± 20% and 385 ± 26% and 1995 and 1997 estimates of 704 ± 33% (0.46/mi^2) and 625 ± 36%. These estimates suggest population density has declined from about 0.40 moose/mi^2 in 1995 to 0.20/mi^2 in 2001. Limited snow cover and reduced sightability may have contributed to the relatively low estimate in 2001. A lack of snow precluded fall population surveys in 2002 and 2003, but a spring survey was completed in late March 2004. This resulted in an estimate of 382 ± 20% (0.13/mi^2). This is lower than the most recent fall population estimate of slightly over 500 moose, but sightability in March is significantly lower than during fall surveys (ADF&G, unpublished data).

The total population in Unit 25D East in 1999 was estimated at 2000–3000 moose (no SCF), assuming the population densities estimated in the 1999 survey area (0.13 moose/mi^2 in low strata and 0.28 moose/mi^2 overall) represented the upper and lower limits of moose density in the remaining 8000 mi^2 outside the survey area. Subsequent surveys indicate the total population is currently near or below the lower end of this range.

The apparent downward trend in moose numbers in Unit 25D East probably reflects relatively high adult mortality from predation by wolves and grizzly bears, high hunter harvests and continued predation by bears on moose calves. Many local residents have also reported a decline in moose numbers during the last decade. The population has the potential to increase if cow and calf mortality can be reduced. Encouraging a reduction in predation by increasing local harvest of predators is one of the strategies for increasing moose numbers outlined in the Yukon Flats Cooperative Moose Management Plan.

Unit 25D West. In 1992 a population survey indicated there were an estimated 619 moose (± 21%) in 4544 mi^2 of Unit 25D West (Table 2). Density was 0.14 moose/mi^2. In 1996 we estimated a density of 0.44 moose/mi^2 in a 1531-mi^2 portion of the subunit. The survey area established in 1996 encompassed much of the high quality moose habitat in the subunit. Poor survey conditions in fall 1998 precluded surveys, but a survey was conducted in Unit 25D West in March 1999. This survey marked a transition to the recently developed spatial analysis survey (GSPE) technique, and employed a somewhat larger survey area that encompassed the previous area. The March survey resulted in an estimate of 735 ± 17%, or 0.32 moose/mi^2, in the 2269-mi^2 survey area (no SCF). A fall 1999 survey in the same area resulted in a population estimate of 862 ± 19%, with a density of 0.38 moose/mi^2 (no SCF, Bertram and Vivion 1999). Data gathered in the part of the area that had been surveyed in 1996 were used to generate an estimate of 0.40 moose/mi^2 (no SCF), which compares to the 1996 estimate of 0.44 moose/mi^2. A fall 2000 survey (no SCF) resulted in an estimate of 670 ± 24% moose in the 2269-mi^2 area, and 555 ± 24% in the original 1774-mi^2 area, suggesting the population was lower than in previous years. A fall 2001 survey (no SCF) yielded an estimate of 668 ± 24% in the 2269-mi^2 area, and 543 ± 25% in the 1774-mi^2 survey area, indicating little change in numbers compared to the previous year. A lack of snow precluded fall surveys in 2002, but a GSPE survey was completed in March 2003 (no SCF; Bertram and Vivion 2003). The area was stratified prior to the survey, which yielded an estimate of 508 ± 29% or 0.22 moose/mi^2 in the 2269-mi^2 survey area, which is lower than the March 1999 estimate of 735 ± 17%. Poor snow conditions again precluded a fall survey in 2003, but a March 2004 survey (no SCF) resulted in a population estimate of 632 ± 20%.

Moose population density in Units 25D East and 25D West continued to be low relative to habitat potential, but it appears that recent population trends and composition may be different in the 2 areas. Survey data suggest moose numbers have declined since 1995 in both Unit 25D East and Unit 25D West, with the steepest decline on the eastern flats. Moose numbers in the western survey area may have stabilized in the last few years, and population density is now higher in this area than on the eastern flats. These trends may be related to differences in the level of harvest as well as other factors. Recent harvest surveys indicate that approximately 150–200 moose are harvested in Unit 25D East each year, while about 60 moose are taken in Unit 25D West. Assuming prehunt populations of at least 2500 moose in the east and 1700 in the west, this suggests harvest rates on the order of 6–8% in Unit 25D East and 3–4% in Unit 25D West.

Population Composition

Units 25A and 25B. Trend surveys conducted by FWS in Unit 25A in 1987, 1989, 1991, and 2000 showed high bull:cow ratios (63–91:100) and moderate calf and yearling survival (Table 1). Moderate to low harvests related to logistic limitations in this remote area suggest that hunting has so far had a minor effect on bull:cow ratios. Surveys have not been conducted in northern Unit 25B in recent years, but surveys in Yukon–Charley Rivers National Preserve indicate calf:cow ratios of 36:100 and bull:cow ratios of 51:100 (Burch 1999).

Unit 25D East. Population parameters in Unit 25D East were calculated based on both estimates (Table 3) and observations (Table 4). Fall calf survival was relatively high in 1999, 2000, and 2001, with estimated calf:cow ratios of 59:100, 49:100, and 43:100. The estimated proportion of calves during these years was 27%, 21%, and 18%. We observed 30 cows with single calves and 8 (21%) with twins in 1999, 25 with single calves and 3 (12%) with twins in 2000, and 24 with single calves and 1 (4%) with twins in 2001. The estimated proportion of calves has ranged from 7% in 1997 to 27% in 1999. Low calf survival in 1997 was most likely caused by flooding adjacent to the Black River following almost 6 inches of rainfall during 9–15 June. The estimated proportion of calves in the population is likely higher than the proportion observed because there is usually a higher calf:cow ratio in low density habitat, which includes a large area compared to high density areas. Calves composed an estimated 21% of the population in March 2004. One of 18 cows with calves was accompanied by twins in the 2004 survey.

Calf and yearling survival rates were fairly high during 1998, 1999, 2000, and 2001. However, the decline in total population size indicates the absolute number of young moose also declined. The number of bulls, cows, and total adults generally declined during 1996–2001. The decline in the total number of cows and calves was relatively great and accounts for a large part of the reduction in total numbers that appears to have occurred over the last several years (Table 3). The number of bulls in the population appears to have declined to a lesser degree, accounting in part for the increase in the bull:cow ratio over the last several years.

Composition data indicate a relatively high bull:cow ratio, with estimated ratios of 57:100 in 1999, 79:100 in 2000, and 95:100 in 2001. Small, medium, and large bulls were well represented in the population. We observed 24, 19, and 20 yearling bulls:100 cows in 1999, 2000, and 2001 (Table 3).

Unit 25D West. Surveys similar to those in Unit 25D East were completed in Unit 25D West (Tables 3 and 5; Bertram and Vivion 1999; 2000; 2001). Estimated bull:cow ratios in fall 1999, 2000, and 2001 surveys were 31:100, 71:100, and 52:100. We estimated 31 calves:100 cows in 1999, 22:100 in 2000, and 27:100 in 2001. Estimated calf:cow and bull:cow ratios, and the proportion of yearlings were lower in Unit 25D West than in Unit 25D East during 1999–2001 (Table 3). Late winter surveys were completed in March 1999, 2003, and 2004. The estimated percentage of calves in the population was 9% in 1999, 15% in 2003, and 15% in 2004.

Distribution and Movements

Moose are distributed throughout the area, but density varies. Large areas currently support densities of 0.1–0.3 moose/mi^2. Somewhat higher densities occur in localized areas in Unit 25D, particularly in late winter, when moose tend to concentrate in riparian habitat. Moose also concentrate in relatively small areas during early winter along the upper Sheenjek and Coleen Rivers in Unit 25A, but the extent of these concentrations was limited. Telemetry studies in Units 25D East and Unit 25D West indicate some moose are migratory, moving between higher elevation early winter range and low elevation late winter and summer ranges (Maclean and Golden 1991).

In March 1995, FWS initiated a telemetry study to determine moose seasonal movements and distribution, fidelity to winter range, and relationship between fall moose concentrations and harvest in eastern Unit 25A. Fifty-seven moose (44 females and 13 males) were radiocollared in the Sheenjek, Coleen, and Firth drainages and relocated approximately once each month. A strong pattern of annual movement was evident during the 3-year study, with over 40 moose migrating to the Old Crow Flats in the Yukon in spring and remaining there until late August, when they began moving back into Alaska (Mauer 1998).

MORTALITY

Harvest

<u>Seasons and Bag Limits</u>.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 25A		
RESIDENT HUNTERS: 1 bull.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 25B Porcupine River drainage upstream from the Coleen River drainage:		
RESIDENT HUNTERS: 1 bull.	10 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		10 Sep–25 Sep
Remainder of Unit 25B		
RESIDENT HUNTERS: 1 bull; or	5 Sep–25 Sep	
1 bull per community harvest report by community harvest permit in an established community harvest area.	1 Dec–15 Dec	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 25D West		
ALL HUNTERS: 1 bull by Tier II subsistence hunting permit only; up to 75 permits will be issued.	25 Aug–28 Feb	No open season
Unit 25D East remainder.		
RESIDENT HUNTERS: 1 bull; or	10 Sep–20 Sep	
1 bull per community harvest report by community harvest permit in an established community harvest area.	18 Feb–28 Feb	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		10 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. The Yukon Flats moose management planning process resulted in a number of regulatory proposals to the Alaska Board of Game. The board reviewed the draft Yukon Flats Moose Management Plan in March 2002 and addressed proposals relating to moose, wolf, and bear regulations forwarded by the planning team. The board established a 50-inch/4 brow-tine minimum antler size limit for nonresident moose hunters in Unit 25A; changed the moose season from 20 September–30 September to 10 September–25 September in northern Unit 25B; changed the brown bear season in Unit 25D to 1 March–30 November for residents, and 1 March–15 June and 1 September–30 November for nonresidents; designated Unit 25D as a community harvest hunt area with a community harvest permit hunt and season for black bear; added a 1 August–25 September fall baiting season for black bear; and increased the bag limit for wolf hunting from 5 to 10 wolves in Units 25A, 25B and 25D. The board also endorsed the draft management plan as a framework for managing the Yukon Flats moose population.

Hunter Harvest. The reported number of moose harvested was relatively stable in most of Unit 25 during RY96–RY00 (Tables 6, 7, 8). Reported harvest for Units 25A, 25B, and Unit 25D East was 84 moose in RY01 and 95 in RY02. The reported harvest in connection with the Tier II and federal permit hunts in Unit 25D West was small (Table 9), with 4–20 moose reported taken annually during RY98–RY02. The reporting rate in Unit 25D was generally low, but improved somewhat in Unit 25D West through the use of reminder letters and personal contacts. The actual number of moose harvested in Unit 25D West was not well documented, but reports by local governments and preliminary results of the Council of Athabascan Tribal Governments (CATG) harvest monitoring study indicate that about 40 bulls and up to 20 cows were harvested each year during RY99–RY02.

Unreported harvest, particularly by local residents, is common in the upper Yukon River valley. Household interviews conducted by the CATG in the communities of Arctic Village, Beaver, Birch Creek, Canyon Village, Circle, Chalkyitsik, Fort Yukon, Rampart, Stevens Village, and Venetie provided relatively complete information on local moose harvest during RY93 and RY94 (CATG, unpublished data). These harvests included 98 and 84 bulls, respectively. A comparison of these data with harvest tickets returned by local residents indicates only 25–35% of the bull moose harvested by local residents in Units 25A, 25B, and 25D East were reported on harvest tickets. Combining the harvest reported by nonlocal residents with the more accurate data for local harvests obtained in the CATG study indicates the total harvest of bull moose in Units 25A, 25B, and 25D East was at least 152 in RY93 and 149 in RY94. A large proportion of the moose harvest in this region occurred in Unit 25D, where the total harvest in recent years appears to have been about 150–200 annually.

Current information indicates that cow moose were taken at any time of year, especially near communities. While the harvest of cow moose seems to have declined somewhat in recent years, it continues to be a concern to many local residents. Two educational videos were produced in 1993 in a cooperative effort between FWS and ADF&G. The adverse effects of shooting cow moose are a central message in each. These videos have been distributed in local communities and other parts of Alaska and Yukon. The need to minimize the harvest of cow moose has also been a major topic of discussion during the development of a moose management plan.

Permit Hunts. Although local residents largely supported the Tier II moose permit hunt in Unit 25D West, there were a number of problems associated with this hunt (Table 9). These included confusion about differences in applicability of federal and state permits and boundaries of federal and private lands, which are subject to different seasons and/or different permit requirements. These difficulties led to efforts to revise the harvest quota and simplify regulations. The Chalkyitsik Village Council administered a Community Harvest Permit hunt during RY00, RY01, RY02 and RY03. From 12 to 31 people participated in the hunt, with reported harvests ranging from 3 to 12 moose annually (Tables 7 and 8).

Hunter Residency and Success. As in previous years, most hunters reporting from Units 25A, 25B, and 25D during RY01–RY02 were Alaska residents (Tables 10, 11, 12). The proportion of nonresidents was greatest in remote parts of Unit 25A, where guiding activity and float trips were more common. Local residents outnumbered other hunters by a wide margin in Unit 25D East. As described above, the number of local moose hunters was underrepresented because of a low reporting rate. Success among reporting hunters was 41–43% in Unit 25A, 31–33% in Unit 25B, and 16–20% in Unit 25D East.

Harvest Chronology. Most moose taken in Unit 25 were killed during the first 3 weeks of September, with a few reported killed before and after this period (Tables 13, 14, and 15). A number of moose were also taken in late August during the state Tier II and federal subsistence seasons in Unit 25D West. A few moose were reported taken in the 1–10 December open season, but hunting was almost exclusively by local residents during this period, and the number of moose killed was probably greater than reported. CATG harvest studies indicate that local residents harvested moose throughout the year, with the fewest being taken in spring and early summer and the most in late summer and fall (CATG, unpublished data).

Transport Methods. Aircraft were the most common transport mode in Unit 25A, being used by >70% of the successful hunters. Horses and boats were used in most of the remaining hunts (Table 16). Boats were used by at least 75% of successful hunters in Units 25B and 25D East, with airplanes used in about 10% of successful hunts (Tables 17 and 18). Snowmachines were used in taking a small percentage of the moose killed in Units 25B and 25D, but the use of snowmachines and boats was probably underrepresented because relatively few harvest reports were submitted by local hunters.

HABITAT

Assessment and Enhancement

Empirical observations and habitat surveys indicate that the upper Yukon River valley provides excellent moose habitat. Moose populations appear to be well below habitat carrying capacity. As in previous years, moose in Unit 25D appeared to be in excellent nutritional condition. Survey personnel often remark on the relatively large size and rounded contours of both adult and calf moose, noting that most calves were as large or larger than those observed in some other areas.

Habitat surveys indicate that moose browsing intensity is low in both riparian and upland sites and that a large amount of good to high quality forage is available. The occurrence of broomed browse plants is low compared to the Tanana Flats and other areas with high moose densities and/or more limited range (C.T. Seaton and C. Fleener, unpublished data). Feltleaf willow (*Salix alaxensis*) provides high quality food for moose, and is the most common shrub in riparian habitats. The limited occurrence of moose browsing is reflected in growth form, with extensive stands of 6–50 foot tall feltleaf willows that show little or no evidence of branching due to browsing. Plants only 6–8 feet tall exhibited a mature growth form, also indicating the low intensity of browsing. The mature growth form is rarely observed in young feltleaf willows along the Tanana and Koyukuk Rivers, where moose are more abundant (K. Kielland, personal communication).

Other common trees and shrubs, most of which are potential forage species for moose, include sandbar willow (*S. interior*), little tree willow (*S. arbusculoides*), pacific willow (*S. lasiandra*), blueberry willow (*S. nova-anglii/monticola*), diamond leaf willow (*S. pulchra*), fire willow (*S. scouleriana*), bebb willow (*S. bebbiana*), barren ground willow (*S. brachycarpa*), red osier dogwood (*Cornus stolonifera*), balsam poplar (*Populus balsamifera*), and aspen (*P. tremuloides*). The upper Yukon area has the shortest fire cycle in Alaska; extensive fires have created and maintained large areas of good habitat for moose. The low snow accumulation typical of the area is another factor making the Yukon Flats excellent habitat for moose.

CONCLUSIONS AND RECOMMENDATIONS

Recent population surveys indicate that moose numbers continue to be low and have declined in some parts of Unit 25D, although productivity and recruitment are higher than in some other areas in the Interior. Modest progress was made toward achieving management objectives in some areas, and the Yukon Flats Moose Management planning effort is resulting in some improvements in population and harvest management, specifically related to objectives 3 and 4. Objectives for Unit 25A were generally met, and the harvest of moose in the remainder of the unit was generally sufficient to satisfy local subsistence needs, as well as provide a moderate amount of hunting for other Alaskans and some nonresidents. Declining moose numbers may result in lower harvests in the future.

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TABLE 1 Units 25A and 25B moose observed during early winter aerial composition counts, 1987–2000 (data source: F. Mauer, Arctic NWR)

Area/ Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
Unit 25A								
1987[a]	63	9	33		17	124	149	
1989[b]	75	18	29	52	14	315	367	1.01
1991[c]	55		26	8	16	41	49	
1991[b]	91	13	31	44	14	270	314	0.87
1992[d]				8	15	44	52	
2000[b]	81	21	32	25	14	139	180	
Unit 25B[e]								
1987	119	6	10	6	5	105	111	

[a] Upper Sheenjek River only.
[b] Includes upper Sheenjek and Coleen Rivers.
[c] Observed during moose stratification flights in lower Sheenjek, Coleen, and East Fork Chandalar Rivers.
[d] March 1993 survey in East Fork of Chandalar River drainage around Arctic Village.
[e] The only early winter composition count in this area during regulatory years 1986–2002.

TABLE 2 Summary of moose population estimates in Unit 25D East, 1995–2003, and 25D West, 1992–2004

Survey year and type	Survey area (mi²)	Strata size (mi²) L	Strata size (mi²) M	Strata size (mi²) H	Area searched (mi²) L	Area searched (mi²) M	Area searched (mi²) H	Total search area	No. of moose estimated by strata and total, and density (moose/mi²) L	M	H	Total estimate @ 90% CI	Average density moose/mi²	No. of sample units counted
Eastern 25D														
1995 Regression Analysis	1534	--	--	--	--	--	--	386	--	--	--	704±33%	0.46	28
1997 Regression Analysis	1534	--	--	--	--	--	--	346	--	--	--	625±36%	0.40	27
1999 GSPE[a]	2936	1828	--	1108	175	--	366	541	229/0.13	--	596/0.54	829±20%	0.28	102
2000 GSPE	2936	1639		1297	218		375	594	368/0.22		359/0.28	726±25%	0.25	112
2001 GSPE	2936	1612		1324	186		419	605	52/0.03		487/0.37	514±27%	0.18	115
March 2004 GSPE	2936	1649		1286	187		413	600	53/0.03		324/0.25	382±20%	0.13	113
1999 GSPE	1550	--	--	--	--	--	--	--	--	--	--	516±21%	0.33	
2000 GSPE	1550											385±26%	0.24	
2001 GSPE	1550											305±32%	0.20	
Western 25D														
1992 Stratified Random	4544	3682	515	348	266	379	343	988	77/0.02	220/0.43	228/0.66	619±21%	0.14	76
1992 Stratified Random[b]	1532	1040	308	184	46	247	184	476	92/0.09	143/0.47	154/0.84	455±33%	0.30	37
1996 Regression Analysis	1532	476	516	539	120	122	124	366	--	--	--	666±21%	0.44	27
March 1999 GSPE	2269	1714	--	554	253	--	264	517	318/0.19	--	422/0.76	735±17%	0.32	96
1999 GSPE	2269	1444	--	825	156	--	345	501	295/0.20	--	567/0.69	862±19%	0.38	93
2000 GSPE	2269	1281		987	124		371	495	124/0.10		553/0.56	670±24%	0.30	
2001 GSPE	2269	1374		865	205		334	539	161/0.12		506/0.56	668±24%	0.29	100
March 2003 GSPE	2269	1682		587	194		264	458	156/0.09		383/0.65	508±29%	0.22	85
March 2004 GSPE	2269	1720		548	216		274	490	310/0.19		319/0.57	632±20%	0.28	91
1999 GSPE	1774											707±19%	0.40	
2000 GSPE	1774											555±24%	0.31	
2001 GSPE	1774	1020		755	156		280	437	104/0.10		428/0.57	543±25%	0.31	

[a] 1999 surveys used smaller sample units, and 2 rather than 3 strata.
[b] Based on sample units counted in the 1992 survey and which later comprised the 1996 survey area.

TABLE 3 Estimated moose population composition based on 1995, 1997, 1999, 2000 and 2001 fall population surveys and a 2004 spring survey in Unit 25D East, and results of fall surveys in 1992, 1996, 1999, 2000 and 2001 and spring 2003 and 2004 surveys in Unit 25D West

Survey period and area (mi²)	Total bulls	Total cows	Total calves	Total adults	Total moose (90% CI)	Bulls: 100 Cows	Yrlg bulls: 100 Cows	Calves: 100 Cows	% Bulls	% Cows	% Calves	Moose per mi²
Eastern Unit 25D												
Fall 1995 (1534)	199	369	136	568	704±33%	54	8	37	28	52	19	0.46
Fall 1997 (1534)	208	372	45	580	625±36%	56	16	12	33	60	7	0.40
Fall 1999 (2936)	218	381	223	599	829±20%	57	24	59	26	46	27	0.28
Fall 2000 (2936)	252	319	156	571	726±25%	79	19	49	35	44	21	0.25
Fall 2001 (2936)	208	217	93	425	514±27%	95	17	43	40	42	18	0.18
March 2004 (2936)	--	--	66	316	382±20%	--	--	--	--	--	21	0.13
Fall 1999 (1550)	141	246	123	387	516±21%	57	24	50	28	48	24	0.33
Fall 2000 (1550)	135	169	81	304	385±26%	79	19	49	35	44	21	0.24
Fall 2001 (1550)	123	130	54	253	305±32%	95	20	42	40	43	18	0.20
Western Unit 25D												
Fall 1992 (4544)	224	317	78	541	619±21	71	12	25	36	51	13	0.14
Fall 1992 (1531)	134	252	69	386	455±33%	53	9	28	30	55	15	0.30
Fall 1996 (1531)	184	340	142	524	666±21%	54	10	42	28	51	21	0.44
March 1999 (2296)	--	--	64	671	735±17%	--	--	--	--		9	0.31
Fall 1999 (2269)	165	529	168	694	862±19%	31	6	31	19	61	20	0.38
Fall 2000 (2269)	247	346	75	593	670±24%	71	12	22	37	52	11	0.30
Fall 2001 (2269)	193	375	100	568	668±24%	52		27	29	56	15	0.29
March 2003 (2269)	--	--	78	430	508± 29%	--	--	--	--	--	15	0.22
March 2004 (2269)	--	--	94	538	632±20%	--	--	--	--	--	15	0.28

TABLE 4 Moose observed in Unit 25D East during early winter moose composition surveys, 1986–2004

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
1986	84	13	34	26	15	144	170	0.7
1987	81	18	27	29	13	196	225	0.9
1988[a]								
1989	63	9	41	59	20	235	294	1.0
1990[b]	64	5	32	7	16	36	43	0.7
1991[c]	66	9	26	25	13	168	193	0.7
1992[a]								
1993	38	8	40	37	22	128	165	1.0
1994	68	20	25	24	12	160	184	0.6
1995[d]	50	7	30	39	16	193	232	0.46
1996[e]	54	6	43	16	22	57	73	--
1997[d]	61	18	13	14	8	169	183	0.40
1998[a]								
1999[d]	65	24	45	47	21.5	172	219	0.28
2000[d]	77	19	45	31	20.3	122	153	0.25
2001	103	20	39	26	16	134	160	0.18
2002[a]								
2003[a]								
2004[f]				20		93	113	0.13

[a] No survey.
[b] Poor survey conditions, partial count.
[c] Part of the Graveyard trend area was not completed.
[d] Based on composition observed in population survey, except that estimated density is shown.
[e] Based on limited composition survey in Graveyard and Mardow trend count areas.
[f] March 2004 survey.

TABLE 5 Unit 25D West moose observed during early winter aerial moose composition counts, 1986–2004

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
1986	78	23	27	20	13	132	152	0.42
1987	71	8	25	13	13	87	100	0.57
1988	84	18	29	13	14	83	96	0.55
1989[a]								
1990[b]	44	12	29	4	15	23	27	
1991[c]	98	8	31	15	13	97	112	0.47
1991[d]	146	8	46	6	16	32	38	0.22
1991[e]	81	8	25	9	12	65	74	1.15
1992[f]	71	12	25	48	13	345	393	0.12
1992[g]	70	11	19	5	10	46	51	0.47
1993[h]	51	14	30	17	16	86	103	0.50
1994[i]	115	23	45	9	14	56	65	0.63
1995[a]								
1996[j]	54	11	42	57	17	273	330	0.44
1997[a]								
1998[k]				26	10		248	0.48
1999[j]	32	6	35	56	21	213	269	0.50
2000	64	7	24	28	13	192	220	0.44
2001	45	9	32	49	18	223	272	0.51
2002[k]								
2003[l]	--	--	--	33	16	168	201	0.37
2004[l]				34	14	209	243	0.42

[a] No survey.
[b] Poor survey conditions, only Meadow Creek area surveyed.
[c] Includes both low and high elevation surveys.
[d] Includes only low elevation count areas (Meadow Creek and Birch Creek).
[e] Mt Schwatka area only.
[f] Data from Unit 25D West census.
[g] Data from Meadow Creek and Mud Lakes trend areas within census area.
[h] Data from Meadow Creek and Mud Lakes trend areas. Mt Schwatka area not surveyed.
[i] Mud Lakes area not surveyed.
[j] Based on composition observed in early winter population survey.
[k] No survey.
[l] Composition observed in March population surveys.

TABLE 6 Unit 25A reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Reported[a] harvest			
	M	F	Unk	Total
1986–1987	47	0	0	47
1987–1988	41	0	0	41
1988–1989	39	0	0	39
1989–1990	25	0	0	25
1990–1991	56	0	0	56
1991–1992	47	0	0	47
1992–1993	17	0	0	17
1993–1994	27	0	0	27
1994–1995	24	0	0	24
1995–1996	37	0	0	37
1996–1997	39	0	0	39
1997–1998	31	0	0	31
1998–1999	47	0	0	47
1999–2000	25	0	0	25
2000–2001	31	0	0	31
2001–2002	41	0	0	41
2002–2003	49	0	0	49

[a] Source: moose harvest reports.

TABLE 7 Unit 25B reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Reported[a] harvest			
	M	F	Unk	Total
1986–1987	27	0	0	27
1987–1988	26	0	0	26
1988–1999	28	0	0	28
1989–1990	24	0	0	24
1990–1991	47	0	0	47
1991–1992	32	0	0	32
1992–1993	18	0	0	18
1993–1994	43	0	0	43
1994–1995	33	0	0	33
1995–1996	32	0	0	32
1996–1997	20	0	0	20
1997–1998	21	0	0	21
1998–1999	31	0	0	31
1999–2000	36	0	1	37
2000–2001[b]	40	0	0	40
2001–2002[c]	32	0	0	32
2002–2003[d]	34	0	0	34

[a] Source: moose harvest reports.
[b] No moose were reported taken in Unit 25B in Chalkyitsik Community Harvest Permit hunt.
[c] Includes 3 moose taken in Chalkyitsik Community Harvest Permit hunt.
[d] Includes 1 moose taken in Chalkyitsik Community Harvest Permit hunt.

TABLE 8 Unit 25D East reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory	Reported[a]			
year	M	F	Unk	Total
1986–1987	39	0	0	39
1987–1988	47	0	0	47
1988–1999	32	0	0	32
1989–1990	38	0	0	38
1990–1991	52	0	1	53
1991–1992	29	0	0	29
1992–1993	19	0	0	19
1993–1994	27	1	0	28
1994–1995	27	0	0	27
1995–1996	23	0	0	23
1996–1997	14	0	0	14
1997–1998	19	0	0	19
1998–1999	23	0	0	23
1999–2000	16	0	0	16
2000–2001[b]	21	0	0	21
2001–2002[c]	16	0	0	16
2002–2003[d]	24	0	0	24

[a] Source: moose harvest reports.
[b] Includes 3 moose taken in Chalkyitsik Community Harvest Permit hunt.
[c] Includes 2 moose taken in Chalkyitsik Community Harvest Permit hunt.
[d] Includes 11 moose taken in Chalkyitsik Community Harvest Permit hunt.

TABLE 9 Unit 25D West moose harvest for permit hunt TM940 and federal subsistence permits, regulatory years 1989–1990 through 2003–2004

Regulatory year	Permits issued	Did not hunt (%)	Did not report (%)	Unsuccessful hunters (%)	Successful hunters (%)	Bulls (%)	Cows (%)	Unk (%)	Tier II harvest	Federal permit harvest
1989–1990	50	1 (2)	34 (68)	8 (16)	7 (14)	7 (100)	0 (0)	0 (0)	7	
1990–1991	60	9 (15)	44 (73)	3 (5)	4 (7)	4 (100)	0 (0)	0 (0)	4	11
1991–1992	63	44 (77)	0 (0)	13 (23)	6 (11)	6 (100)	0 (0)	0 (0)	6	8
1992–1993	95	67 (71)	2 (2)	21 (22)	5 (5)	5 (100)	0 (0)	0 (0)	5	4
1993–1994	125	53 (42)	21 (17)	41 (33)	10 (8)	10 (100)	0 (0)	0 (0)	10	0
1994–1995	119	65 (55)	14 (12)	30 (25)	10 (8)	10 (100)	0 (0)	0 (0)	10	2
1995–1996	88	43 (49)	3 (3)	26 (30)	16 (18)	16 (100)	0 (0)	0 (0)	16	1
1996–1997	91	32 (35)	18 (20)	31 (34)	10 (11)	10 (100)	0 (0)	0 (0)	10	7
1997–1998	36	23 (64)	0 (0)	11 (31)	2 (18)	2 (100)	0 (0)	0 (0)	2	13
1998–1999	40	21 (53)	1 (3)	11 (28)	7 (18)	7 (100)	0 (0)	0 (0)	7	20
1999–2000	92	55 (59)	0 (0)	24 (26)	13 (14)	13 (100)	0 (0)	0 (0)	13	17
2000–2001	75	41 (55)	4 (5)	21 (28)	9 (12)	7 (78)	0 (0)	2 (22)	9	7
2001–2002	34	15 (44)	6 (18)	9 (26)	4 (12)	4 (100)	0 (0)	0 (0)	4	14
2002–2003	49	23 (47)	6 (12)	16 (33)	4 (8)	4 (100)	0 (0)	0 (0)	4	7[a]
2003–2004	51	30 (59)	7 (14)	10 (20)	4 (8)	4 (100)	0 (0)	0 (0)	4	–[a]

[a] No federal harvest reports have yet been received from Stevens Village for 2002–2003, and federal permit harvest data are not yet available for 2003–2004.

TABLE 10 Unit 25A moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Hunters
1986–1987	4	22	6	5	37 (60)	2	13	10	0	25 (40)	62
1987–1988	4	16	18	3	41 (61)	4	14	3	5	26 (39)	67
1988–1989	3	19	11	6	39 (57)	2	15	9	3	29 (43)	68
1989–1990	3	12	10	0	25 (52)	4	14	5	0	23 (48)	48
1990–1991	5	27	22	2	56 (72)	1	16	5	0	22 (28)	78
1991–1992	4	21	22	0	47 (57)	0	22	13	0	35 (43)	82
1992–1993	2	7	7	1	17 (35)	5	20	6	0	31 (65)	48
1993–1994	3	13	10	1	27 (51)	0	18	8	0	26 (49)	53
1994–1995	1	14	8	1	24 (55)	2	13	5	0	20 (46)	44
1995–1996	6	11	20	0	37 (62)	2	11	10	0	23 (38)	60
1996–1997	1	6	32	0	39 (58)	2	16	9	1	28 (42)	67
1997–1998	3	13	13	2	31 (61)	0	11	9	0	20 (39)	51
1998–1999	4	17	24	2	47 (64)	0	20	7	0	27 (36)	74
1999–2000	3	4	17	0	24 (45)	3	19	7	0	29 (55)	53
2000–2001	1	15	15	0	31 (37)	0	31	21	0	52 (63)	83
2001–2002	2	15	24	0	41 (41)	2	34	22	1	59 (59)	100
2002–2003	2	20	27	0	49 (43)	3	33	29	0	65 (57)	114

[a] Source: moose harvest reports.
[b] Resident of Unit 25.

TABLE 11 Unit 25B moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	9	10	3	5	27 (47)	6	18	2	5	31 (54)	58
1987–1988	9	10	1	6	26 (53)	5	9	6	3	23 (47)	49
1988–1989	9	9	8	2	28 (50)	2	20	6	0	28 (50)	56
1989–1990	7	16	1	0	24 (40)	9	24	1	2	36 (60)	60
1990–1991	9	31	5	2	47 (57)	9	25	2	0	36 (43)	83
1991–1992	9	17	4	2	32 (46)	12	22	4	0	38 (54)	70
1992–1993	6	9	2	1	18 (19)	7	61	4	3	75 (81)	93
1993–1994	13	24	6	0	43 (52)	4	29	5	1	39 (48)	82
1994–1995	6	19	5	3	33 (34)	5	39	14	6	64 (66)	97
1995–1996	6	24	2	0	32 (40)	2	37	9	1	49 (60)	81
1996–1997	6	10	3	1	20 (29)	5	36	7	1	49 (71)	69
1997–1998	7	11	3	0	21 (34)	4	29	8	0	41 (66)	62
1998–1999	10	18	3	0	31 (53)	3	20	2	2	27 (47)	58
1999–2000	7	29	1	0	37 (41)	8	40	5	0	53 (59)	90
2000–2001		25	4	0	34 (48)	1	34	2	0	37 (52)	71
2001–2002	3	21	5	0	29 (31)	5	54	5	0	64 (69)	93
2002–2003	1	29	3	0	33 (33)	4	60	2	0	66 (67)	99

[a] Source: moose harvest reports; does not include moose taken under the Chalkyitsik Community Harvest Permit during RY00–RY02.

[b] Resident of Unit 25.

TABLE 12 Unit 25D East moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	23	10	1	5	39 (42)	29	22	1	1	53 (58)	92
1987–1988	24	16	6	1	47 (53)	22	13	3	3	41 (47)	88
1988–1989	18	5	4	5	32 (47)	19	8	4	5	36 (53)	68
1989–1990	24	11	2	1	38 (44)	24	20	5	0	49 (56)	87
1990–1991	35	17	0	1	53 (46)	31	26	4	1	62 (54)	115
1991–1992	17	11	1	0	29 (32)	31	31	0	0	62 (68)	91
1992–1993	10	8	1	0	19 (23)	31	31	3	0	65 (77)	84
1993–1995	14	10	3	1	28 (36)	22	24	0	3	49 (64)	77
1994–1996	16	9	0	2	27 (30)	29	31	3	0	63 (70)	90
1995–1996	17	5	1	0	23 (29)	13	35	7	1	56 (71)	79
1996–1997	7	6	1	0	14 (23)	18	25	4	1	48 (77)	62
1997–1998	13	11	2	0	26 (27)	15	50	5	0	70 (73)	96
1998–1999	13	9	1	0	23 (31)	22	24	5	0	51 (69)	74
1999–2000	5	11	0	0	16 (24)	21	25	4	0	50 (76)	66
2000–2001	3	8	1	6	18 (25)	6	38	9	0	53 (75)	72
2001–2002	6	7	1	0	14 (20)	19	30	5	1	55 (80)	69
2002–2003	5	6	1	1	13 (16)	22	32	12	0	66 (84)	79

[a] Source: moose harvest reports; does not include moose taken under the Chalkyitsik Community Harvest Permit during RY00–RY02.
[b] Resident of Unit 25.

TABLE 13 Unit 25A reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory	Harvest chronology percent by month/day						
year	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5[b]	Unk	*n*
1986–1987	32	43	13	11		2	47
1987–1988	12	34	34	17		2	41
1988–1989	10	54	31	3		3	39
1989–1990	20	36	40	4		0	25
1990–1991	21	54	20	4		2	56
1991–1992	19	43	32	2		4	47
1992–1993	12	41	35	12			17
1993–1994	30	48	19	4		0	27
1994–1995	44	52	4	0		0	24
1995–1996	35	38	16	8		3	37
1996–1997	33	23	35	8		0	39
1997–1998	3	23	39	26		9	31
1998–1999	28	36	30	2		4	47
1999–2000	12	48	28	4		8	25
2000–2001	16	48	29	6		0	31
2001–2002	17	41	37	2	2[c]	0	41
2002–2003	16	47	31	4	0	2	49

[a] Source: moose harvest reports.
[b] No open season.
[c] Harvested out of season.

TABLE 14 Unit 25B reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory	Harvest chronology percent by month/day							
year	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Dec	Unk	*n*
1986–1987	7	22	52	7	–[b]		11	27
1987–1988	8	19	39	19	4[b]	8	4	26
1988–1989	4	41	44	4	–[b]	4	4	27
1989–1990	8	21	42	13	–[b]	17	0	24
1990–1991	11	28	34	13	2[0]	11	2	47
1991–1992	3	41	38	13	0	3	3	32
1992–1993	11	44	17	0	0	28	0	18
1993–1994	12	33	35	12	0	7	2	43
1994–1995	3	38	44	13	0	3	0	33
1995–1996	28	38	25	3	0	6	0	32
1996–1997	25	35	15	5	0	10	10	20
1997–1998	5	5	29	29	19	10	5	21
1998–1999	10	32	39	10	0	6	3	31
1999–2000	8	32	27	11	0	0	22	37
2000–2001	27	11	35	16	0	8	3	37
2001–2002	10	28	38	24	0	0	0	29
2002–2003	6	36	36	15	0	0	0	33

[a] Source: moose harvest reports.
[b] No open season.

TABLE 15 Unit 25D East reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest chronology percent by month/day							
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Dec	Unk	*n*
1986–1987	0	56	31	3	–[b]		3	39
1987–1988	0	20	53	13	–[b]	7	7	45
1988–1989	0	47	31	3	3	13	3	32
1989–1990	0	45	24	11	3	13	3	38
1990–1991	8	37	40	2	2[8]	6	6	52
1991–1992	17	55	24	3	0	0	0	29
1992–1993	0	42	53	5	0	0	0	19
1993–1994	18	32	29	0	4	11	7	28
1994–1995	8	54	27	8	0	0	0	27
1995–1996	13	43	35	0	0	4	4	23
1996–1997	7	50	29	0	0	0	14	14
1997–1998	0	5	47	37	11	0	0	19
1998–1999	17	57	22	4	0	0	0	23
1999–2000	6	50	31	13	0	0	0	16
2000–2001	5	56	33	0	0	0	5	18
2001–2002[c]	0	43	43	7	0	0	0	14
2002–2003	0	31	46	15	0	0	8	13

[a] Source: moose harvest reports.
[b] No open season.
[c] Seven percent of the moose were harvested in August.

TABLE 16 Unit 25A moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	72	17	8	0	0	0	0	2	47
1987–1988	61	12	17	0	0	0	2	7	41
1988–1989	61	17	20	0	0	0	5	5	41
1989–1990	56	16	24	0	0	0	4	0	25
1990–1991	61	11	27	0	0	0	0	2	56
1991–1992	77	15	9	0	0	0	0	0	47
1992–1993	76	6	12	0	0	0	0	6	17
1993–1994	56	26	15	0	0	0	4	0	27
1994–1995	75	4	13	0	0	0	9	0	24
1995–1996	62	16	16	0	0	0	3	3	37
1996–1997	69	28	2	0	0	0	0	0	39
1997–1998	65	6	26	0	0	0	3	0	31
1998–1999	68	15	17	0	0	0	0	0	47
1999–2000	64	20	16	0	0	0	0	0	25
2000–2001	77	6	16	0	0	0	0	0	31
2001–2002	80	5	10	0	0	2	2	0	41
2002–2003	71	10	18	0	0	0	0	0	49

[a] Source: moose harvest reports.

TABLE 17 Unit 25B moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	30	0	63	0	0	0	0	7	27
1987–1988	27	0	65	0	4	0	0	4	26
1988–1989	29	0	61	0	4	0	0	7	28
1989–1990	21	0	75	0	0	0	0	4	24
1990–1991	23	0	68	0	6	2	0	0	47
1991–1992	9	0	78	0	0	0	0	12	32
1992–1993	22	6	61	0	11	0	0	0	18
1993–1994	12	2	77	2	2	2	0	2	43
1994–1995	22	0	73	0	0	0	0	6	33
1995–1996	9	3	75	3	3	0	0	6	32
1996–1997	15	5	75	0	0	0	0	5	20
1997–1998	14	5	71	0	0	0	10	0	21
1998–1999	13	3	81	3	0	0	0	0	31
1999–2000	8	3	73	5	3	0	3	5	37
2000–2001	11	3	81	0	3	0	0	3	37
2001–2002	3	0	93	0	0	3	0	0	29
2002–2003	12	0	82	6	0	0	0	0	33

[a] Source: moose harvest reports.

TABLE 18 Unit 25D East moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	13	0	67	0	5	0	3	13	39
1987–1988	17	0	66	0	6	0	2	8	47
1988–1989	28	0	47	0	16	0	0	9	32
1989–1990	26	0	51	0	13	0	3	8	39
1990–1991	26	0	64	2	2	0	0	6	53
1991–1992	21	0	72	0	0	7	0	0	29
1992–1993	42	0	53	0	0	5	0	0	19
1993–1994	14	0	75	0	4	0	0	7	28
1994–1995	8	0	78	4	0	0	0	11	27
1995–1996	26	0	61	0	0	0	4	9	23
1996–1997	21	0	71	0	0	0	0	7	14
1997–1998	11	0	84	5	0	0	0	0	19
1998–1999	13	0	74	4	0	4	4	0	23
1999–2000	25	0	63	0	0	6	6	0	16
2000–2001	17	0	78	0	5	0	0	0	18
2001–2002	7	0	79	14	0	0	0	0	14
2002–2003	15	0	77	0	0	0	8	0	13

[a] Source: moose harvest reports.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT : 26A (56,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Western North Slope

BACKGROUND

Archaeological evidence indicates moose have been present on the North Slope either sporadically or at low densities for many years. Since about 1940, moose populations have increased in size and have become well established in Unit 26A. Nearly all moose are confined to riparian habitat along river corridors during winter. During summer, many moose move into small tributaries and hills surrounding riparian habitat, and some disperse as far as the foothills of the Brooks Range and across the coastal plain. The largest winter concentrations of moose are found in the inland portions of the Colville River drainage.

Since 1970, late-winter surveys have been conducted annually to assess population status and short yearling recruitment. Complete surveys of all major drainages in Unit 26A were completed in 1970, 1977, 1984, 1991, and 1995. The population increased steadily from a count of 1219 moose in 1970 to 1535 in 1991, then declined to 757 in 1995 (Trent, 1989; Carroll, 1998). Trend counts indicated that the population continued to decline until 1996 to about 25% of the 1991 population; then, numbers increased from 1997 through 2001 (Carroll 2002).

Census and trend counts indicated that the population declined by 75% between 1992 and 1996. Adult mortality was high and fall surveys indicated poor calf survival during 1993 (4% calves), 1994 (2% calves), and 1995 (0%). The decline appeared to be a combination of malnourishment, disease, mineral deficiency, predation, weather factors, and competition with snowshoe hares (Carroll, 1998). Samples were collected from hunter-killed moose and those that were found dead in 1995 and 1996. In addition, we captured, examined, sampled, and radiocollared 45 female and 5 male moose in 1996 and 1997. Analysis indicated that nearly all of the moose tested to be marginally deficient in copper. Several cows captured in 1996 and 1997 tested positive for antibodies to the bacteria *Brucella suis Biovar 4* (8 of 43) and *Leptospira interrogans serovar pomona* (6 of 30). Both diseases cause abortions and weak calves. Relatively high moose populations in the 1980s and early 1990s may have led to overbrowsing. Snowshoe hares moved into the area in the early 1990s and irrupted, placing further stress on the

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

browse plants. Wolf and grizzly bear numbers were at relatively high levels during the time of the decline.

The population began to recover in 1996. Radiotracking surveys indicated that the adult and calf survival rates increased substantially. Short yearling counts indicated recruitment ranged from 17% to 26% between 1997 and 2001. The trend area count increased from 152 moose in 1996 to at least 333 moose in 2001 (Carroll, 2002) .

Hunters have used aircraft to hunt moose since the early 1970s (Trent 1989). Most local hunters travel by boat along the Colville River to hunt moose. The mean reported harvest from 1985 to 1993 was 59 moose per year, with a high of 67 in 1991. The harvest decreased to 40 during 1994–1995 and 14 in 1995–96 as the moose population declined and regulations became more restrictive. Hunters harvested from 0 to 5 moose per year between 1996 and 2001 (Carroll, 2002).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Allow for the recovery of the Unit 26A moose population and maintain a population of over 1000 moose, with a bull: cow ratio of over 30:100.

- Maintain a moose population capable of satisfying subsistence and general hunt needs.

MANAGEMENT OBJECTIVES:

- Conduct a unitwide spring census every 5 years and yearly spring trend area counts to assess population trend and recruitment on subsequent years.

- Conduct a yearly fall aerial sex and age composition survey of the Colville River population.

- Conduct radiotelemetry surveys to examine calf production and survival, distribution, and mortality rates each summer, fall, and spring.

- Monitor predator populations and other mortality factors through field observations and public contacts.

- Examine dead moose to look for causes of death, disease, mineral deficiencies, and contaminants.

- Develop updated population objectives in cooperation with the public and other agencies.

METHODS

We used a Cessna 185, a Bellanca Scout, and a Piper PA–18 aircraft to conduct census, trend area, and fall composition counts. During the census we attempted to survey all available moose habitat in Unit 26A. The trend count area included the Colville River valley from the mouth of the Killik River to the mouth of the Anaktuvuk River; the Chandler River below Sivugak Bluff; and the Anaktuvuk River below Table Top Mountain. During fall composition counts, we surveyed the trend count area, plus other selected areas, such as the lower Colville River and the Killik River. For all surveys we flew over suitable riparian habitat and attempted to locate all the moose in the survey areas. We determined short yearling recruitment and total number of moose during spring surveys and determined sex and age composition and estimated the antler size of bulls during the fall surveys.

Surveys to locate and observe radiocollared moose were flown in conjunction with the above-mentioned fall and spring surveys. In addition, we conducted calving success surveys each year during the first week of June. We obtained global positioning system locations for all moose observed during radiotracking surveys and noted whether females had 0, 1, or 2 calves.

We compiled harvest data from harvest reports submitted by hunters, from subsistence harvest surveys, and from talking to hunters.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Census results of 1219, 1258, 1447, and 1535 moose in 1970, 1977, 1984, and 1991, respectively, indicate the population was stable and slowly increasing for at least 20 years. A 1995 census indicated a 51% decline in the population between 1991 and 1995 (Carroll 2002). Censuses were conducted in 1999 when 326 moose were counted and 2002 when 576 were counted (Table 1). It was felt that we might have undercounted in 1999 due to early spring conditions and moose dispersing away from the river bottoms.

Trend area counts indicated that the population declined until 1996 to about 25% of the 1991 population and has steadily increased since then. Trend area count numbers increased from 152 in 1996 to 333 in 2001 (Carroll 2002). The trend area counts continued to increase in 2002 to 307 moose and in 2003 to 413 moose (Table 2). This would indicate an increase of about 15% per year between 1996 and 2003. The number of moose counted in the trend count area is increasing faster than in the upper part of the drainages.

The increase in population after 1996 resulted from low adult mortality and high calf survival, probably due to some combination of the following factors: recovery of vegetation after overbrowsing, reduction of bacterial diseases prevalent in the population, reduced predation, weather factors, and reduced hunting pressure.

We used radiocollared moose to determine how many moose were missed by observers during the spring count in 1999. We found that we had failed to see between 12% and 18% of the collared moose in the original count (Carroll, 2000). The number missed probably varies from year to year, depending on conditions.

Population Composition

The percentage of short yearlings counted in spring surveys was very low between 1994 and 1996 (3%, 2%, and <1%). However, it increased dramatically in 1997 when 23% were observed, and continued high from 1998 through 2001 when between 17% and 26% short yearlings were counted. During the reporting period 13% were observed in 2002 and 25% in 2003 (Table 2).

During fall 2001 composition surveys we observed 304 moose within the trend count area, including 105 bulls (69 bulls:100 cows), 153 cows, and 46 calves (30 calves:100 cows). During fall 2002 we observed 334 moose within the trend count area, including 87 bulls (52 bulls:100 cows), 166 cows, and 81 calves (49 calves:100 cows). In 2003 (after the reporting period) we observed 288 moose in the trend count area, including 93 bulls (75 bulls: 100 cows), 124 cows, and 71 calves (57 calves:100 cows). Fall bull:cow ratios can be quite variable because weather conditions influence how many bulls are in the survey area during fall counts. These counts continued the trend of increasing summer calf survival since 1996 compared to 1993–1995 (Table 3).

With improved calf survival, the percentage of bulls in the younger age groups gradually increased, and there is now good representation in all bull antler size groups as shown here:

Estimated bull antler widths in inches

Inches	<30	30–39	40–49	50–59	60+
1996	0%	0%	38%	45%	17%
1997	4%	8%	16%	48%	24%
1998	13%	22%	14%	31%	20%
1999	18%	16%	12%	28%	26%
2001	13%	18%	17%	32%	20%
2002	15%	12%	16%	25%	32%
2003	10%	18%	17%	29%	26%

Distribution and Movements

By late winter most moose can be found in the riparian corridors, primarily on the Colville River drainage. During late April, when snow cover begins to disappear in the foothills, moose begin to move away from the riparian corridors. During late May and early June most parturient cows move away from the river bottoms to calve. Bull moose disperse widely during the summer months, ranging from the northern foothills of the Brooks Range to the Arctic coast. Most cow moose move out of the river bottoms, but stay near riparian habitat during summer months, while some range onto the coastal plain. During the fall, as snow cover accumulates, moose move back into the riparian corridors of the large river systems.

During 1996 and 1997 we radiotracked the collared moose several times and obtained the following distribution information:

- <u>13 June 1996</u>. 25 of 35 collared moose had moved away from the river bottoms into small tributaries or hills surrounding the major rivers. Eighteen of 20 cows seen with calves had moved away from the major rivers before calving. Most pregnant cows stayed on the major rivers until a few days before parturition and then moved away from the river bottoms to give birth. Three cows moved from the Anaktuvuk River to the Tuluga River to give birth. The mean distance that moose had moved away from the river bottoms was 8 miles and ranged from less than a mile to 18 miles. Three of 5 bulls moved away from the river bottoms, with 12 miles being the maximum distance traveled.

- 28 July 1996. 16 of the collared cows were in the riparian corridors, and 18 had dispersed away from the river bottoms. Most of the cows were within 8 miles of the rivers, but one cow and calf were 107 miles north and another cow/calf pair was 36 miles north of the Colville River. One bull was located 2 miles from the riparian corridor and 2 were found in the foothills of the Brooks Range. Two bulls were not found, and we assumed they moved out of the survey area.

- 5–8 November 1996. 20 collared cow moose were sighted on the river bottoms and 14 were found on tributaries and hills around the rivers. Three bulls were found in the riparian corridor, 1 was adjacent to the corridor, and 1 was not found in the survey area.

- 1–2 April 1997. 28 cow moose were in the riparian habitat of the river bottoms and 4 moose in the areas adjacent to the rivers. Two bulls were dead, 2 were in the riparian corridor, and 1 was not found.

MORTALITY

Harvest

Season and Bag Limit.

2001–2002 Units and Bag Limits	Required Ticket or Permit Type	Open Season
Unit 26A: that portion in the Colville River drainage downstream from the Anaktuvuk River		
Residents: One bull**	Harvest	1 Aug–31 Aug
Nonresidents		No open season
Remainder of Unit 26A		
All hunters		No open season

**Hunters may not hunt moose during August using aircraft for transportation or for carrying meat.

Season and Bag Limit.

2002–2003 Units and Bag Limits	Required Ticket or Permit Type	Open Season
Unit 26A: that portion in the Colville River drainage downstream from and including the Chandler River		

2002–2003 Units and Bag Limits	Required Ticket or Permit Type	Open Season
Residents: One bull**	Harvest	1 Aug–14 Sep
Nonresidents:		No open season
Remainder of Unit 26A:		
Residents: One bull**	Harvest	1 Sep–14 Sep
Nonresidents:		No open season

**Hunters may not hunt moose during August or 1–14 September using aircraft for transportation or for carrying meat.

Board of Game Actions and Emergency Orders. During its November 2001 meeting the Board of Game increased the hunt area and length of the season. The hunt area was increased during August so that it included the Colville River drainage downstream from and including the Chandler River. In addition, the hunt area and season were increased so that all of Unit 26A was opened 1–14 September. The bag limit continued to be one bull moose. The board also modified the time period of the Unit 26A Controlled Use Area so that aircraft cannot be used for moose hunting, including transportation of hunters, their gear, and/or parts of moose during the open season from 1 August to 14 September.

Hunter Harvest. Hunter harvest reports indicate 4 bull moose were harvested during fall of 2001, and 10 in 2002 (Table 4). The increase in 2002 was a result of the season and hunt area being increased. Antler sizes in 2002 were: 1 from 30–39 inches, 5 from 40–49 inches, 3 from 50–59 inches, and 1 unknown (Table 5).

Permit Hunts. There were no permit hunts for moose in Unit 26A during the reporting period.

Hunter Residency and Success. During 2001 all successful hunters and most unsuccessful hunters were local residents. During 2002, 8 of 10 successful hunters were local residents and 11 of 19 total hunters were local residents. Hunters had a 53% success rate in 2002 (Table 6).

Harvest Chronology. During 2001 all reported hunting took place during August. During 2002 20% of reported moose were harvested in August and 80% in September (Table 7).

Transport Methods. All hunters used boats for transportation during 2001 and 2002 (Table 8).

Other Mortality

The Unit 26A moose population declined by approximately 75% between 1991 and 1996. A variety of factors contributed to the decline including: overpopulation, competition with snowshoe hares, copper deficiency, the bacterial diseases brucellosis and leptospirosis, weather, insect harassment, and predation from bears and wolves.

The mortality rate has been low for both adults and calves since 1996. Among the radiocollared moose the mortality rate was 5.7% for 1996–1997, 2.1% for 1997–1998, 0% for 1998–1999, 11.9% for 1999–2000, 7.25% for 2001–2002, and 13% for 2002–2003 for an average of about 6.7% mortality per year. Because no moose have been collared since 1997, the mortality rate of these collared moose is considered to be only a rough indicator for the entire population. Calf mortality has also decreased substantially since 1996. The percentage of short yearlings counted during spring surveys increased from an average of 2% from 1994 through 1996 to 22% from 1997 through 2003 (Table 2).

Mortality due to predation has probably decreased substantially during recent years. We conducted wolf surveys in the study area and found that wolf density declined from 4.1 wolves/1000 km^2 in 1994 to 1.6 wolves per 1000 km^2 in 1998. There is no indication that bear numbers have decreased, but is possible that some “specialist” bears that preyed on moose calves during the summer may have died or left the area.

The facts that we have not observed moose that appear to have died of starvation, and that most of the moose now appear to be in very good condition, indicate that the vegetation has recovered from the overbrowsing that probably took place when the population was at peak numbers during the late 1980s and early 1990s.

The mortality caused by brucellosis and leptospirosis may be greatly reduced due to the diseases having run their course. The moose that were exposed and were susceptible to the diseases died or did not produce calves that survived. The moose that were resistant to the diseases have survived and are reproducing.

CONCLUSIONS AND RECOMMENDATIONS

After several years of declining population numbers, the Unit 26A moose population began to increase in 1997. As a result of low adult mortality and high calf survival, the number counted in the trend count area has increased from 152 in the spring of 1996 to 413 in 2003, an increase of 15% per year. The recruitment rate for short yearlings has averaged 22%, and the adult mortality rate among moose that were collared in 1996 and 1997 has averaged about 6.7% for the last 7 years.

The population increase has been due to a combination of factors. Vegetation has recovered from being overbrowsed by moose when the population was at high numbers in the 1980s and early 1990s, allowing for better survival of adults and calves. The presence of bacterial diseases that were prevalent in the population is reduced. Some “specialist” bears that preyed on moose calves during the summer may have died or left the area. Wolf density in the area is much lower than it was during the decline, so there is less wolf predation. Weather factors have been more favorable during recent years. In addition, some moose may have migrated into Unit 26A from areas to the south or east.

In response to the severe population decline, we changed the management goal in 1996 from maintaining the population to rebuilding the population. The Board of Game passed regulations that eliminated hunting pressure for most of the area in 1996. While hunting was not the major cause of the decline, it was a contributing factor and one that could be changed to help rebuild the population. After the population increased consistently for 5 years, the board increased the hunt area and season for a bulls-only hunt in 2001 and continued restrictions on the use of aircraft for moose hunting. This regulation has provided more hunting opportunity but allows for the continuing recovery of the population. If the population continues to grow, hunting restrictions may be further liberalized in the future.

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Table 1 Number of adult and calf moose from Unit 26A censuses, 1970–2002

Year	Adults	Calves	Total	% Calves
1970	911	308	1219	25
1977	991	267	1258	21
1984	1145	302	1447	21
1991	1231	304	1535	20
1995	746	11	757	1
1999	274	52	326	16
2002	496	74	576	13

Table 2 Unit 26A moose trend counts: Anaktuvuk River from the mouth to Sivugak Bluff, Chandler River from the mouth to Table Top Mountain, and Colville River between the mouths of Anaktuvuk and Killik Rivers, 1970, 1974–1981, and 1983–2003

Year	Total moose	Adults	Short Yearlings	Short Yearling (%)
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
1988	684	602	82	12
1989	699	630	69	11
1990	618	543	74	12
1991	647	516	176	21
1992	510	416	133	18
1993	504	424	85	15
1994	407	396	11	3
1995	307	302	5	2
1996	152	151	1	<1
1997	188	145	43	23
1998	206	153	53	26
1999	210	174	36	17
2000	325	245	80	25
2001	333	251	82	25
2002	307	267	40	13
2003	413	309	104	25

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

Table 3 Unit 26A fall aerial moose composition trend area counts 1983–2003

Year	Bulls:100 Cows	Calves:100 Cows	Calves (%)	Adults	Total moose
1983	54	38	20	150	188
1986	47	18	11	302	339
1987	39	21	13	101	104
1990	33	45	25	277	371
1991	40	39	22	254	325
1992	36	41	23	190	248
1993	36	6	4	381	397
1994	35	3	2	287	293
1995[a]	70	0	0	34	34
1996	60	44	22	126	161
1997	46	40	22	80	102
1998	64	35	18	131	159
1999	49	52	26	155	209
2001	69	30	15	258	304
2002	52	49	24	253	334
2003	75	57	25	217	288

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

Table 4 Unit 26A moose harvest, 1985–2002

Regulatory year	Reported hunter harvest		
	Male	Female	Total
1985–1986	50	15	65
1986–1987	46	6	52
1987–1988	49	13	62
1988–1989	51	6	57
1989–1990	41	3	44
1990–1991	60	4	64
1991–1992	59	8	67
1992–1993	52	8	60
1993–1994	53	8	61
1994–1995	36	4	40
1995–1996	14	0	14
1996–1997	0	0	0
1997–1998	2	0	2
1998–1999	5	0	5
1999–2000	2	0	2
2000–2001	0	0	0
2001–2002	4	0	4
2002-2003	10	0	10

Table 5 Percent antler width categories (inches) among moose harvested in Unit 26A, 1983–2002

Regulatory year	Unknown	<20	20–29	30–39	40–49	50–59	60+	*N*
1983–1984	0	0	4	35	15	35	12	26
1984–1985	0	3	5	18	33	30	13	40
1985–1986	0	0	7	11	18	47	19	45
1986–1987	0	0	7	18	29	42	4	45
1987–1988	0	0	0	20	24	47	9	45
1988–1989	0	2	2	0	27	55	14	49
1989–1990	0	0	3	14	14	51	18	39
1990–1991	0	0	4	15	10	59	12	57
1991–1992	16	0	3	3	13	49	16	56
1992–1993	13	0	2	5	7	48	25	52
1993–1994	15	3	2	5	11	49	15	53
1994–1995	10	1	2	8	9	62	8	40
1995–1996	7	0	7	14	7	50	15	14
1996–1997	0	0	0	0	0	0	0	0
1997–1998	0	1	0	0	1	0	0	2
1998–1999	0	1	1	1	1	0	1	5
1999–2000	0	1	0	1	0	0	0	2
2000–2001	0	0	0	0	0	0	0	0
2001–2002	3	1	0	0	0	0	0	4
2002-2003	1	0	0	1	5	3	0	10

Table 6 Moose hunter residency and success, Unit 26A, 1987–2002

Regulatory year	Successful hunters: Local res[a]	Nonlocal res[b]	Nonres[c]	Unk[d]	Total	(%)	Total hunters: Local res[a]	Nonlocal res[b]	Nonres[c]	Unk[d]	Total
1985–1986	–	–	–	–	65	66	29	45	24	0	98
1986–1987	–	–	–	–	52	65	29	33	18	0	80
1987–1988	–	–	–	–	62	61	40	20	39	0	99
1988–1989	–	–	–	–	57	69	12	30	37	5	84
1989–1990	9	13	21	1	44	66	10	23	33	2	68
1990–1991	8	19	35	2	64	65	13	40	43	3	99
1991–1992	9	37	29	1	67	66	13	51	37	1	102
1992–1993	12	16	29	3	60	57	25	35	41	4	105
1993–1994	7	22	29	3	61	79	11	30	32	4	77
1994–1995	8	7	24	1	40	74	11	14	29	0	54
1995–1996	4	3	6	1	14	33	13	12	15	3	43
1996–1997	0	0	0	0	0	0	4	2	0	0	6
1997–1998	2	0	0	0	2	10	20	0	0	0	20
1998–1999	5	0	0	0	5	25	18	2	0	0	20
1999–2000	2	0	0	0	2	14	12	2	0	0	14
2000–2001	0	0	0	0	0	0	UN[e]	UN	UN	UN	UN
2001–2002	4	0	0	0	4	UN	UN	UN	UN	UN	UN
2002-2003	8	2	0	0	10	53	11	8	0	0	19

[a] Local resident hunters are residents of the North Slope Borough.
[b] Nonlocal resident hunters are residents of the State of Alaska, but not residing in the North Slope Borough.
[c] Nonresident hunters.
[d] Unknown residency.
[e] Unknown harvest.

Table 7 Percent chronology of moose harvest, Unit 26A, 1987–2002

Regulatory year	Harvest periods						
	Aug	1–7 Sep	8–14 Sep	15–21 Sep	22–31 Sep	Oct–Dec	*N*
1987–1988	9	36	35	6	4	10	62
1988–1989	9	45	34	6	3	0	57
1989–1990	17	48	18	16	0	2	44
1990–1991	4	44	39	6	5	2	64
1991–1992	10	55	22	10	0	3	67
1992–1993	9	58	20	3	8	2	60
1993–1994	7	62	23	3	3	2	61
1994–1995	3	50	19	18	5	5	40
1995–1996	29	7	50	7	0	7	14
1996–1997*	–	–	–	–	–	–	0
1997–1998*	100	–	–	–	–	–	2
1998–1999*	100	–	–	–	–	–	5
1999–2000*	100	–	–	–	–	–	2
2000–2001*	–	–	–	–	–	–	–
2001–2002*	100	–	–	–	–	–	–
2002–2003	20	80					

*Season only open in August

Table 8 Percent transport methods for moose harvest in Unit 26A, 1987–2002

	Percent method of transportation					
Regulatory year	Airplane	Boat	3 or 4 wheeler	Snowmachine	ORV	*N*
1987–1988	80	15	2	1	2	59
1988–1989	81	18	1	–	–	53
1989–1990	84	14	2	–	–	40
1990–1991	62	28	3	2	3	61
1991–1992	85	7	3	3	2	67
1992–1993	85	13	0	2	0	60
1993–1994	83	17	0	0	0	61
1994–1995	78	18	0	2	2	40
1995–1996	50	43	7	0	0	14
1996–1997	–	–	–	–	–	0
1997–1998	–	100	–	–	–	2
1998–1999	–	100	–	–	–	5
1999–2000	–	100	–	–	–	2
2000–2001	–	–	–	–	–	–
2001–2002	–	100	–	–	–	–
2002–2003		100				

WILDLIFE
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: Units 26B and 26C (26,000 mi^2)

GEOGRAPHIC DESCRIPTION: North Slope of the Brooks Range and Arctic Coastal Plain east of the Itkillik River

BACKGROUND

Moose were scarce in Arctic Alaska prior to the early 1950s, when populations expanded and reached high densities in the limited riparian habitat of major drainages (LeResche et al. 1974). Predation, as well as hunting, probably contributed to the historical scarcity of moose. The reduction in wolf numbers by federal control programs during the late 1940s and early 1950s was probably important in allowing moose populations to increase and become established in most of the riparian shrub habitat on the North Slope. Aerial wolf hunting during the decade following statehood also limited wolf populations.

This area represents the northern limit of moose range in North America. Thus, habitat severely limits the potential size of moose populations, and the concentrated nature of moose distribution and open habitat creates the potential for excessive harvests in accessible areas. During the early 1990s concentration of hunting pressure along these drainages caused concern among guides, outfitters, hunters, and Alaska Department of Fish and Game (ADF&G) and Arctic National Wildlife Refuge (ANWR) staff. Moose hunting regulations became increasingly restrictive during the past decade and a precipitous decline in numbers of moose led to a season closure in 1996.

The following is a review of previous regulations and regulatory changes. The regulatory year (RY) begins 1 July and ends 30 June (e.g., RY00 = 1 Jul 2000 through 30 Jun 2001). During RY90–RY94 the season for Units 26B and 26C was 5–15 September for both residents and nonresidents, with a bag limit of 1 bull. A 50-inch minimum antler size requirement was in effect for nonresidents and also for anyone hunting within the Dalton Highway Corridor Management Area (DHCMA; see below). During RY90–RY92 the definition of a 50-inch moose was an antler width ≥ 50" or 3 or more brow tines on 1 side. In RY93 the definition was changed for moose north of the Alaska Range to a bull with antlers at least 50 inches or 4

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

or more brow tines on 1 side. There was also a winter season of 1 November–31 December, with a bag limit of 1 bull with antlers at least 50 inches or 4 or more brow tines on 1 side, open to residents during RY90–RY94. In RY95 the season remained the same for Unit 26B and the Canning River drainage, part of which is in Unit 26C. The season for residents and nonresidents in Unit 26C east of the Canning River drainage was 5–15 September with a bag limit of 1 bull. The previous antler restriction for nonresidents was inadvertently eliminated due to an error in a proposal that was submitted to the Board of Game in 1994. The winter season for residents was changed to 1–31 December.

State regulations governed moose hunting along the Dalton Highway in Unit 26B through RY95. The DHCMA extends 5 miles from each side of the Dalton Highway from the Yukon River to the Prudhoe Bay Closed Area. The DHCMA was closed to hunting with firearms. However, big game, small game, and fur animals could be taken by bow and arrow. Hunters had to possess a valid International Bow Hunter Education card. In addition, no motorized vehicles, except aircraft, boats and licensed highway vehicles could be used to transport game or hunters.

Kaktovik and Nuiqsut are the only subsistence communities in the area, and residents took 2–6 moose annually prior to the season closure in 1996. Subsistence harvest was small because moose are scarce near Kaktovik and because most hunting by Nuiqsut residents occurred in the Colville River drainage in adjacent Unit 26A.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain viable populations of moose in their historic range throughout the region.
- Provide a sustained opportunity to harvest moose.
- Provide opportunity for viewing and photographing moose.

MANAGEMENT OBJECTIVES

- In Unit 26B East allow the moose population to increase to at least 200 moose, with at least 15% calves in spring surveys, before reopening the hunting season.
- In Unit 26B West allow the moose population to increase to at least 75 moose, with at least 15% calves in spring surveys, before reopening the hunting season.
- Once a hunting season has been reopened, maintain a posthunting sex ratio in Units 26B and 26C of 35 bulls:100 cows.

METHODS

The limited and relatively open nature of winter moose habitat on the North Slope makes a total count in trend count areas, rather than random sampling, the most effective population survey method. Moose are limited almost entirely to riparian shrub habitat during winter.

Historically surveys were conducted in Unit 26B East (east of the east bank of the Sagavanirktok, including the Canning River) and in Unit 26C along the Kongakut and Firth Rivers and Mancha Creek. The west bank of the Canning River is the boundary between Units 26B and 26C. However, Unit 26B East (east of the Sagavanirktok River) survey data includes moose counted in the Canning River portion of Unit 26C. Surveys in Unit 26B West (west of the east bank of the Sagavanirktok River) have also been conducted since 1970. Standard surveys began in 1996 and historical data were reanalyzed to allow a comparison with recent data. Moose inhabit different terrain in Unit 26B East and Unit 26B West. In Unit 26B East, moose are found primarily in the northern foothills of the Brooks Range, while in Unit 26B West moose are found along major drainages on the coastal plain.

The U.S. Fish and Wildlife Service conducted moose composition surveys of riparian willow habitat in Unit 26B East (Martin and Garner 1984; Weiler and Liedberg 1987; Mauer and Akaran 1994; Mauer 1995, 1997). Surveys were done during the end of October, early November, April, or May using Piper PA-18 aircraft flown at 70–90 mph, and/or a Cessna 185 flown at 95–120 mph, at altitudes of 300–600 feet above ground level. The following drainages were surveyed as weather permitted: Accomplishment Creek, Lupine River, Saviukviayak River, Flood Creek, Ivishak River, Gilead Creek, Echooka River, Shaviovik River, Juniper/Fin Creek, Kavik River, and Canning River. Aerial observers circled each moose and, during fall surveys, classified moose as calves, cows, yearling bulls, medium bulls (≤50 inch antlers), or large bulls (>50 inch antlers). Medium and large bulls were combined in this report. Spring surveys were completed in 1999, 2000, and 2001 because low snowfall and poor weather precluded fall surveys. The Alaska Department of Fish and Game conducted the surveys in spring 2002, 2003, and 2004, and moose were classified as short yearlings (11-month-old calves) and adult bulls and cows. Because the 2002 survey was conducted in early May, we were able to obtain a minimum estimate of bull:cow and calf:cow ratios.

We conducted spring moose surveys in Unit 26B West in April 1997 and during 1999–2004, using the methods described previously. Surveys were conducted along riparian willow habitat on the Sagavanirktok River from Happy Valley to Sagwon Bluffs and on the Toolik and Kuparuk Rivers starting at approximately 68°52'W latitude to the White Hills. In addition, parts of the Itkillik River have been surveyed periodically since 1981, but because of incomplete surveys during 1996–2004, these data are treated separately.

We conducted habitat reconnaissance in Unit 26B East during the last week of April 1994 in cooperation with the U.S. Fish and Wildlife Service and the University of Alaska. Availability, condition, and species composition of moose browse were evaluated along parts of Accomplishment Creek, Section Creek, and the upper Lupine River.

The hunting season has been closed since fall 1996. Prior to the closure, harvest and hunting pressure were monitored using harvest reports submitted by hunters. Reminder letters were sent to hunters who did not report after the fall season. Population surveys, total harvest, residency and success, chronology, and transportation data were summarized by regulatory year. Informal visits and interviews with hunters and guides also provided insight into population status and moose management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

A complete moose population survey has not been conducted in Units 26B and 26C, but the nature of terrain and sparse, low vegetation makes it possible for trend surveys to account for a large percentage of the moose in areas supporting major concentrations.

In Unit 26B East, the highest numbers of moose observed were 629 in fall 1988 and 600 in fall 1989 (Table 1). Beginning in fall 1990, the number of moose observed declined markedly to 381 moose and continued to decline to 141 moose by fall 1996. The lowest number of 97 moose observed in fall 1997 should be viewed as an underestimate because 25% of the Canning River was not surveyed. Since 1997, surveys have been conducted in the spring, and the population appears to have increased slowly to 224 moose in 2003 and 234 in 2004 (Table 1). During recent surveys the highest concentrations of moose were found along the Echooka, Ivishak, Kavik, and Canning Rivers. When moose numbers were higher, concentrations also were found along Juniper, Fin, and Gilead Creeks.

In Unit 26B West, excluding the Itkillik River drainage, it appears that moose numbers increased from approximately 100 moose to 165 moose during 1977–1984. The surveys conducted in 1984 and 1989 are comparable to standard surveys that began in spring 1996 (Table 2). Moose numbers appeared to be relatively stable during the mid to late 1980s at approximately 150 moose (Table 2). Information from harvest data, hunting guides, and bush pilots indicated that the moose population in this area declined during the early 1990s, just as it did in Units 26A and 26C. A survey was not conducted until spring 1996 when 53 moose were observed. Surveys conducted during 1999–2000 indicated a stable population of 50 moose, with an increase to about 70 moose in 2001 and 2002 (Table 2). This followed the same trend observed in Unit 26B East, where the population appeared relatively stable during 1996–2002. However, during spring 2003 we observed a substantial increase to 159 moose in Unit 26B West, excluding the Itkillik River drainage. In spring 2004 we observed 117 moose. ADF&G staff also reported an increase in the number of moose observed in Unit 26A, just west of Unit 26B West, in 2003 and 2004 (Carroll, ADF&G, personal communication). Obviously some migration into these drainages occurred, as it was not biologically possible for the current population to produce an additional 100 moose. However, it is difficult to determine where these moose originated, as we have little data on moose movements on the North Slope. Current radiotelemetry data on Colville River moose suggest those moose remain along the Colville River. There was probably some increase in the population that has been residing in the Kuparuk and Toolik Rivers as well. The most likely scenario was that most of the increase in moose numbers came from moose that migrated from Unit 26A, and perhaps a few from Unit 26B East. Some moose may have moved down from the headwaters of the Itkillik River. Most of the moose observed in Unit 26B West were found in the Kuparuk drainage.

Spring surveys conducted along the Itkillik River from the mid 1980s to the mid 1990s indicated moose numbers were stable at about 45 moose (ADF&G files). Although moose did not appear to decline in the early 1990s, as observed elsewhere, beginning in 1999 we observed only 27 moose and 9, 11, and 27 moose in 2002, 2003, and 2004. Either no surveys or incomplete surveys were conducted in 1996, 1997, 1998, 2000, and 2001.

The decline in moose numbers in the early 1990s appeared to be widespread on the eastern North Slope, as well as in Unit 26A (Carroll 1998). Calf survival was very low during 1993–1996 (Tables 1 and 2; Carroll 1998), and in summer 1995 carcasses of adult moose were found along the Colville River and its tributaries in Unit 26A (Carroll, ADF&G, personal communication). Necropsies revealed that wolves and bears had not killed these moose. Disease may have been involved, because in 1996 and 1997 the bacterial diseases brucellosis and leptospirosis were found in 8 of 43 and 6 of 43 (respectively) live moose that were captured and radiocollared. In addition, a marginal copper deficiency was reported in many of the live and dead moose sampled. Thus, it is possible that disease increased vulnerability to poor environmental conditions during the early 1990s. Winters were long in 1993–1994 and 1994–1995, subjecting moose to shorter growing seasons. Also, in summer 1995 there were numerous reports of intense harassment of moose by mosquitoes. (However, there is no documentation that moose are negatively impacted by mosquitoes). Disease may have also increased vulnerability to predation. Wolves and grizzly bears were common in the region, particularly in the mountains and northern foothills of the Brooks Range, and incidental observations by biologists, hunters, and pilots suggested that wolf numbers increased during the early 1990s. There was some postulation that range deterioration may have been involved. During the late 1980s moose were at the highest densities observed on the North Slope. At the same time the moose were declining, a population explosion of snowshoe hares occurred in some drainages in eastern Unit 26A (Carroll, ADF&G, personal communication). This may have created some competition by affecting the quality of browse. However, habitat reconnaissance east of the Dalton Highway in Unit 26B in April 1994 indicated forage was not in critically short supply even though browsing intensity on favored vegetation was relatively heavy. Species composition consisted mostly of *Salix alaxensis* and *S. pulchra*, with the former predominating. Some current annual growth remained; therefore, some moose browse was still available. Quality of browse was not determined, but *Salix alaxensis* is among the highest quality browse species and the one often favored by moose in Alaska. We assume disease, predation, weather, insect harassment, and range deterioration may all have been involved.

In eastern Unit 26C, sizable concentrations of moose were surveyed in fall 1990 and 1992 in the Kongakut and Firth Rivers and Mancha Creek. However, no surveys have been completed recently, and the status of these moose populations is unknown. A large proportion of the moose in these areas are migratory, moving south and east to the Old Crow Flats in Canada during spring and summer (Mauer 1998). In April 2003 staff from ANWR completed a moose survey in Unit 26C and observed 50 moose.

Population Composition

In Unit 26B East, survival of calves to fall was relatively good (12–14%) from 1988–1991, except in 1989 (5%). No surveys were conducted during RY92 and RY93 and by fall 1994, when the number of moose observed had declined dramatically, survival of calves to fall was very low (4%, Table 1). Low calf survival also occurred in 1995 (5%). A similar pattern was observed during spring surveys in 1994 in Unit 26A, where numbers of observed moose and survival of short yearlings declined sharply (Carroll, ADF&G, personal communication). Survival of calves to fall improved in 1996 and 1997 in Unit 26B East (11% and 14%, Table 1). Fall surveys have not been conducted since 1997.

During spring surveys in 1999 and 2000, 13% and 8% short yearling moose were observed (Table 1). Short yearlings were not classified in 2001, but we observed 13% short yearlings in 2002 (Table 1). The lowest value of 8% for short yearlings in spring 2000 may have been partly a result of problems with survey methods. Some short yearlings may have been misidentified as adults because observers did not circle and closely examine each moose. In 2003 we observed 18% short yearlings, a considerable increase compared with previous years. This coincided with a higher proportion of short yearlings observed in Units 26B West and 26A. However, survival of calves to 11 months in winter 2003–2004 was poor and only 6% short yearlings were observed in 2004 (Table 1). This did not occur in Unit 26B West (see below) or Unit 26A (~22%; Carroll, ADF&G, personal communication). It is possible that predation by wolves and/or grizzly bears may be higher on the east side because the more mountainous terrain is better habitat for bears and wolves.

In Unit 26B East, bull:cow ratios were below the management objective of 50:100 in fall 1994, but ranged from 61 to 69 during fall 1995–1997 (Table 1). Although bull:cow ratios were high during this time, the population was declining. This suggested that adult cow mortality was higher than adult bull mortality, at least during RY95. However, the season was closed to hunting in fall 1996 and high bull:cow ratios in fall 1996 and 1997 probably resulted from the closed season. We observed a high bull:cow ratio of 72:100 during the 2002 spring survey. This is likely somewhat conservative because we probably misclassified young bulls that lacked early antler development as cows.

In Unit 26B West (excluding the Itkillik drainage), the percentage of short yearlings in the population was very low in spring 1996 (2%). It increased to 23% in 2000, was again low in 2001 (7%), and was relatively high in 2002 (16%; Table 2). In 2003, we observed an increase to 25% short yearlings. This coincided with a substantial increase in the number of moose observed and with moderate–high percent short yearlings observed in Unit 26B East (18%) and Unit 26A (25%). The proportion of short yearlings remained relatively high in 2004 at 18%; but as mentioned above, Unit 26B East experienced a substantial decrease in the proportion of short yearlings observed.

During the 2002 spring survey we observed a bull:cow ratio of 34:100 in Unit 26B West. As was suggested for Unit 26B East, it is possible the bull:cow ratio was higher because we probably misclassified some young bulls as cows. However, the bull:cow ratio was substantially lower than that observed in Unit 26B East. Although we have no data on movements, it is likely that some bulls leave Unit 26B West after the rut and winter in the foothills in Unit 26B East. Data from the 1984 spring survey indicated a bull:cow ratio of 30:100 (ADF&G files), similar to that observed in 2002, although harvest would have influenced the composition observed in 1984.

Distribution and Movements

Moose were generally associated with narrow strips of shrub communities along drainages, except in summer when some dispersal occurred. Historically, the greatest concentrations occurred along the Canning, Kavik, Ivishak, Toolik, Kuparuk, Itkillik, and Kongakut Rivers and Juniper and Fin Creeks. Few moose have been observed on the Itkillik River and no surveys have been conducted on the Kongakut River in recent years. Moose movements have not been intensively studied, but recent surveys indicate there may be extensive movements within or between North Slope drainages. Telemetry studies show that some moose winter in the upper Kongakut River and migrate south and east to summer on the Old Crow Flats in Canada (Mauer 1998).

MORTALITY

Harvest

Season and Bag Limit. There was no open season for moose in Units 26B and 26C during RY96–RY03.

Alaska Board of Game Actions and Emergency Orders. In RY96 the season was closed because of a decline in moose numbers and has remained closed through RY03. During its March 2000 meeting the Board of Game determined that a harvest of 60–80 moose was necessary to satisfy subsistence needs in Unit 26.

Hunter Harvest. The reported moose harvest in Unit 26B was relatively stable during the early 1990s, ranging from 24–37, except in RY92, when harvest was 45 (Table 3). In RY95 harvest declined to 16 animals. The number of hunters increased markedly from 49 in RY91 to 90 in RY92. The number of moose hunters remained high during the following 3 years (63–85), but harvest declined (range = 16–37) to previous levels, probably reflecting the declining moose population.

In Unit 26C the harvest was 3–6 and the number of hunters was 5–12 during RY90–RY95 (Table 4). Compared with Unit 26B, fewer hunters reported hunting in Unit 26C, probably because of a lack of airstrips near moose habitat in Unit 26C and the small number of moose in the area during fall. Most of the hunting in Unit 26C occurred in the Canning River drainage.

Hunter Residency and Success. During RY86–RY96, Alaska residents living outside the area represented all but a few of the resident hunters in Units 26B and 26C (Table 5). Hunter success declined to below 50% beginning in RY93, probably due to the declining moose population. Nonresidents reported a higher success rate than Alaska residents, probably because many nonresidents benefited from guide-outfitter services.

Harvest Chronology. During RY86–RY96 most moose harvested in Units 26B and 26C were taken during the first 2 weeks of September (Table 6). The concentration of hunting activity in early autumn was likely due to early onset of winter in the region.

Transport Methods. During RY86–RY96, aircraft was used by more than 70% of the successful moose hunters (Table 7).

Natural Mortality

No intensive studies of moose mortality have been done in the eastern Arctic. The decline in the early 1990s was probably due to a combination of natural mortality factors, including the bacterial diseases brucellosis and leptospirosis, copper deficiency, weather, insect harassment, competition with snowshoe hares, and predation from bears and wolves.

There is some evidence that recent mortality rates for adult female moose have been low. In Unit 26A along the Colville River the mortality rate for radiocollared moose was 5.7% during RY96, 2.1% during RY97, 0% during RY98, and 11.9% during RY99 (Carroll, ADF&G, personal communication).

CONCLUSIONS AND RECOMMENDATIONS

The moose population in Units 26B and 26C declined dramatically during the early 1990s, probably due to a combination of factors including disease, weather, habitat limitations, insect harassment, and increased predation by wolves and grizzly bears. In Unit 26B, the population was relatively stable at low numbers with slight increases during 1996–2002 (Tables 1 and 2). In 2003 we observed a substantial increase in the number of moose in Unit 26B West, suggesting that moose had possibly migrated into the area. We have little data concerning movement of moose on the North Slope. A radiotelemetry study on Colville River moose concluded that radiocollared moose are residents of the Colville drainage. We hypothesize that some of the increase in moose numbers observed in Unit 26B may have come from Unit 26A; yet during 2003, ADF&G staff also reported increased numbers of moose in Unit 26A (although some of the increase was related to a few good years of calf recruitment). In addition, in 2003 calf survival to 11 months was good in all of Unit 26B (21%). In 2004 Unit 26B West still experienced high numbers of moose (but less than 2003) with good calf survival to 11 months (18%). However, Unit 26B East had poor calf survival at 6% and a slight increase in the number of moose observed. Predation by wolves and grizzly bears may have been higher in Unit 26B East.

We met our first goal of maintaining viable populations of moose in their historic range throughout the region, in part by continuing to keep the hunting season closed until the moose population recovers and our management objectives are met. We did not meet our second goal of providing an opportunity to harvest moose because moose numbers were too low. Moose were available for viewing and photographing, our third goal.

We met our first and second population objectives of at least 200 moose in Unit 26B East and 75 moose in Unit 26B West with ≥ 15% 11-month-old calves in the 2003 survey. In 2004 we were above both population objectives in Unit 26B West with 140 moose observed and 18% short yearlings. However, in Unit 26B East calf survival was poor and we observed only 6% short yearlings; yet the population remained stable at 238 moose. Our third population objective was to maintain a posthunting sex ratio of 35 bulls:100 cows for Units 26B and 26C. Spring 2002 surveys indicated that bull:cow ratios were higher than our objective. Because of the uncertain role the migrated moose will have on the population and poor calf survival in Unit 26B East, we recommend monitoring the population for an additional year before proposing to open a season.

Currently we estimate 700–800 moose in Unit 26A (Carroll, ADF&G, personal communication), 400–500 moose in Unit 26B, and 50 moose in Unit 26C for a total of 1150–1350 moose in Unit 26. There is a customary and traditional use finding for all of Unit 26 for a harvest of 60–80 moose. At a 5% harvest rate, the harvestable surplus is 57–67 moose for Unit 26. We will work with ADF&G/Division of Subsistence when we determine that the population can withstand harvest.

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TABLE 1 Unit 26B East (east of the Sagavarnirktok, including Canning River) aerial moose composition counts, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Season	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed
1986–1987[b]	Fall	57	NA	29	87	15	477	564
1987–1988[c]								
1988–1989	Fall	59	30	21	75	12	554	629
1989–1990	Fall	54	13	9	32	5	568	600
1990–1991[d]	Fall	59	7	26	63	14	383	446
1991–1992[d]	Fall	47	9	21	66	15	452	518
1992–1993[c]								
1993–1994[c]								
1994–1995	Fall	39	8	5	14	4	367	381
1995–1996	Fall	66	11	8	7	5	138	145
1996–1997	Fall	61	5	22	16	11	125	141
1997–1998	Fall	69	4	30	14	14	83	97
1998–1999	Spring	--	--	--	20	13	129	149
1999–2000[e]	Spring	--	--	--	14	8	151	165
2000–2001	Spring	--	--	--	--	--	--	146
2001–2002[f]	Spring	72	-	28	22	13	148	170
2002–2003[f]	Spring	--	--	--	41	18	183	224
2003–2004[f]	Spring	--	--	--	15	6	219	234

[a] Data source for 1988–1989 through 2000–2001: F Mauer, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks.
[b] Modified from Weiler and Leidberg 1987.
[c] No survey.
[d] Incomplete survey. Approximately 27% and 19% of total area was not surveyed in fall 1990 and fall 1991, respectively.
[e] Moose were not circled and examined closely, so some calves may have been identified as cows.
[f] Data collected by ADF&G.

TABLE 2 Unit 26B West, excluding the Itkillik River drainage, spring aerial moose surveys, regulatory years 1983–1984 through 2003–2004

Regulatory year	Short yearlings	Percent short yearlings	Adults	Moose observed
1983–1984	32	19	133	165
1984–1985 to 1987–1988[a]				
1988–1989[a]	18	12	131	149
1989–1990 to 1994–1995[a]				
1995–1996	1	2	52	53
1996–1997 to 1997–1998[a]				
1998–1999	6	11	50	56
1999–2000	10	23	34	44
2000–2001	5	7	65	70
2001–2002[b]	11	16	56	67
2002–2003	40	25	119	159
2003–2004	21	18	96	117

[a] No survey.
[b] The Sagavanirktok River was not surveyed.

TABLE 3 Unit 26B reported moose harvest and accidental death, regulatory years 1988–1989 through 2003–2004

Regulatory	Reported harvest				
year	M (%)	F (%)	Unk	Total	Hunters
1988–1989	33 (100)	0 (0)	0	33	49
1989–1990	24 (100)	0 (0)	1	25	47
1990–1991	24 (100)	0 (0)	0	24	45
1991–1992	28 (100)	0 (0)	0	28	49
1992–1993	45 (100)	0 (0)	0	45	90
1993–1994	30 (100)	0 (0)	0	30	84
1994–1995	37 (100)	0 (0)	0	37	85
1995–1996	16 (100)	0 (0)	0	16	63
1996–1997 through 2003–2004[a]					

[a] No open season.

TABLE 4 Unit 26C reported moose harvest and accidental death, regulatory years 1988–1989 through 2003–2004

Regulatory	Reported harvest				
year	M (%)	F (%)	Unk	Total	Hunters
1988–1989	10 (100)	0 (0)	0	10	18
1989–1990	1 (100)	0 (0)	0	1	11
1990–1991	3 (100)	0 (0)	0	3	8
1991–1992	6 (100)	0 (0)	0	6	11
1992–1993	4 (100)	0 (0)	0	4	5
1993–1994	4 (100)	0 (0)	0	4	7
1994–1995	6 (100)	0 (0)	0	6	12
1995–1996	4 (100)	0 (0)	0	4	8
1996–1997 through 2003–2004[a]					

[a] No open season.

TABLE 5 Units 26B and 26C moose hunter residency and success, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1988–1989	0	13	26	4	43 (64)	0	14	6	4	24 (36)	67
1989–1990	0	11	15	0	26 (45)	0	24	7	1	32 (55)	58
1990–1991	0	7	18	2	27 (51)	0	21	5	0	26 (49)	53
1991–1992	1	11	19	3	34 (57)	1	13	10	2	26 (43)	60
1992–1993	0	23	25	1	49 (52)	0	43	2	1	46 (48)	95
1993–1994	2	23	8	1	34 (37)	1	44	11	1	57 (63)	91
1994–1995	0	24	19	0	43 (44)	2	34	15	3	54 (56)	97
1995–1996	0	3	17	0	20 (28)	2	32	17	0	51 (72)	71
1996–1997 through 2003–2004[c]											

[a] Source: moose harvest reports.
[b] Residents of Units 26B or 26C.
[c] No open season.

TABLE 6 Units 26B and 26C moose harvest chronology percent by time periods, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Harvest chronology percent by time periods								*n*
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Oct	Nov	Dec	
1988–1989	42	25	22	11					36
1989–1990	27	31	31	4	4				26
1990–1991	37	52	4					2	27
1991–1992	53	41						6	34
1992–1993	63	37							49
1993–1994	50	44	3					3	34
1994–1995	54	44	3					2	41
1995–1996	37	53	10						19
1996–1997 through 2003–2004[b]									

[a] Source: moose harvest reports.
[b] No open season.

TABLE 7 Units 26B and 26C moose harvest percent by transport method, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1988–1989	83	2	5	0	2	0	7		41
1989–1990	96	0	4	0	0	0	0		26
1990–1991	75	4	21	0	0	0	0		24
1991–1992	76	0	15	0	6	0	0	3	34
1992–1993	84	0	8	0	0	0	8	0	49
1993–1994	71	0	21	0	3	0	6	0	34
1994–1995	74	0	19	0	2	0	5	2	43
1995–1996	90	0	0	0	0	0	10	0	20
1996–1997 through 2003–2004[b]									

[a] Source: moose harvest reports.
[b] No open season.

SPORT FISH & WILDLIFE RESTORATION

The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge and attitudes for responsible hunting.

Photo by Randy Rogers, ADF&G