Moose
Management Report
of survey-inventory activities
1 July 2003–30 June 2005

Patricia Harper, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation

ADF&G

Funded through
Federal Aid in Wildlife Restoration
Grants W-33-2 and W-33-3, Project 1.0

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

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If this report is used in its entirety, please reference as: Alaska Department of Fish and Game. 2006. Moose management report of survey-inventory activities 1 July 2003–30 June 2005. P Harper, editor. Juneau, Alaska.

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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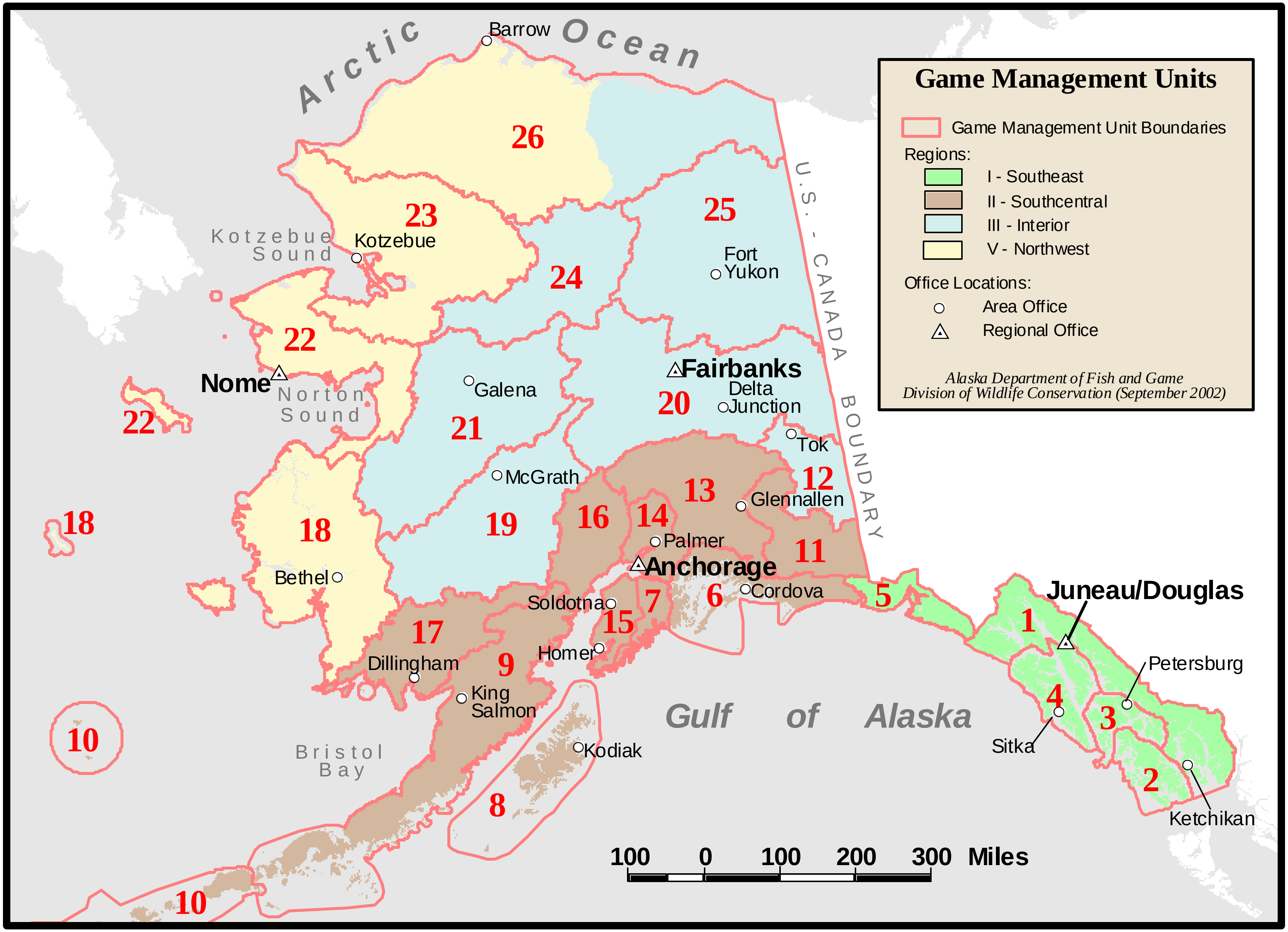
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Kotzebue
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WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNITS: 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. Consequently, population estimates are based on a combination of aerial survey counts and track distribution after a recent snowfall. 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. Moose are occasionally reported from other parts of Unit 1A including the lower mainland, Revillagigedo Island, Cleveland Peninsula, and on Prince of Wales Island. Moose are occasionally observed in Unit 2, but currently there is no open moose hunting season in this unit. Moose apparently have no problem swimming more than 6 miles across Clarence Strait to reach the Prince of Wales Archipelago.

MANAGEMENT DIRECTION

Management Objectives

- Maintain a post-hunting population of 50 moose, and an annual harvest of at least 3 bulls.
- Provide maximum opportunity to participate in hunting moose.
- Provide opportunities for nonconsumptive uses.

METHODS

Moose surveys are flown each winter (December–February) when weather and snow conditions become favorable. A registration hunt provides all the important information regarding hunter effort, timing, mode of transport, and success.

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, Unit 1A moose populations appear to be stable at a low density and carrying capacity is estimated to be low. Healthy brown bear, black bear, and wolf populations probably account for substantial mortality in this area, particularly on young calves. We expect this moose herd will decline in the near future as Federal Subsistence regulations allow hunters to remove many of the available bulls along the Unuk River drainage well in advance of the breeding season.

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, but numbers are estimated to be extremely low.

Population Composition

Current population estimates for the Unuk River within the Alaska portion of the drainage are between 35–50 moose. Efforts are made each year to complete aerial survey counts after fresh snowfall with calm wind conditions. However, thick timber canopy cover along most of the river and frequent inclement weather make accurate counts during aerial surveys difficult.

Distribution and Movements

Moose are not restricted from moving between Canada and the U.S. 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 drainage. Some of the best habitat along the river occurs at the upper reaches of the river on the U.S. side and in Canada, and likely supports a significant number of moose outside of Unit 1A. It is also likely those moose move back and forth across the border.

MORTALITY

HARVEST

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

Board of Game Actions and Emergency Orders. No regulatory changes were made by the Alaska Board of Game during this report period. Starting fall 2003 Federal Subsistence regulations allow qualified subsistence hunters to hunt moose in Unit 1A 6 September –15 October with a one bull bag limit.

Hunter Harvest. The Unit 1A 12-year mean harvest is 3 bulls. During the past 3 years, 2, 2, and 3 moose were harvested respectively under state regulations (Table 1). Using federal registration permits 3 bulls were taken during 2003 and 2 additional bulls were harvested during 2004. Hunters who receive Federal registration permits do not report to us. Nearly half of the hunters who regularly hunt this moose population qualify for Federal Subsistence and consequently we have lost a large portion of our management information. Combined with the State harvest during 2003 and 2004 hunters harvested a combined total of 5 bulls both years well above the long-term average of 3.

Permit Hunts. During fall 2002, 21 individuals obtained Unit 1A moose registration permits, all of which hunted. During 2003, only 10 hunters registered and all of them hunted. This was the lowest number of registered hunters during the past 12 years ($\bar{x}$ = 44, range 10–81). During 2004, 24 hunters registered and all of them hunted (Table 1). During these same 3 years, hunters reported 106, 57, and 67 days hunting moose in Unit 1A. Under Federal permits hunters reported an additional 62 and 61 days during the 2003 and 2004 seasons. During 2003 under federal regulations eight hunters registered and 6 went hunting. During 2004, ten hunters registered under federal regulations and 9 went hunting.

Hunter Residency and Success. Unit 1A moose hunters continue to be primarily from Ketchikan, Metlakatla, more recently Prince of Wales island. Ninety six percent of the successful hunters during the past 3 years were residents of Ketchikan. On average 10% of the hunters who spend time afield are successful (Table 2).

Harvest Chronology. Most Unit 1A moose are harvested during the early part (45%) and late (29%) portion of the season (Table 3).

Transport Methods. Most hunters use boats to access the Unuk River (88%) followed by airplanes (12%)(Table 4). Currently there are no roads in this hunt area and no suitable places to use off road vehicles.

OTHER MORTALITY

The extent of wolf, black bear, and brown bear mortality on adult and calf moose in Unit 1A is unknown, but likely plays a key role in limiting this moose population. Deep and persistent snow in this area is also likely a limiting factor in distribution and expansion of this small moose herd.

CONCLUSIONS AND RECOMMENDATIONS

Access to this hunt area is difficult and consequently attracts only a few hunters. Historically most moose hunters are from Ketchikan. Most of these local residents either own cabins along the mouth of the Unuk River or have access to one of them. Most moose harvested are young bulls with relatively small antlers, which have historically averaged about 30 inches in width. Winter weather, snow conditions, and abundant predators are likely limiting the moose population, and consequently we do not expect moose numbers to exceed current levels.

The Unit 1A registration permit provides accurate hunt-based data although the Federal season is making it difficult to account for all the hunting activity and harvest. We will continue to gather information about this moose population and continue to document Unit 2 moose sightings. We recommend Unit 2 remain closed to moose hunting. We do not recommend any changes to Alaska hunting regulations at this time.

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Management Coordinator

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

PORTER, B. 2005. Unit 1A moose management report. Pages 1–8 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 1A moose harvest data by permit hunt for regulatory years 1993 through 2004

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	25	0	22	3	3	(100)	0	(0)	0	(0)	3
	2002	21	0	19	2	2	(100)	0	(0)	0	(0)	2
	2003	10	0	8	2[c]	2	(100)	0	(0)	0	(0)	2
	2004	24	0	21	3[d]	3	(100)	0	(0)	0	(0)	3
	Average	60	25	32	3	3	(100)	0	(0)	0	(0)	3

[a] One permit not returned
[b] Illegal cow kill
[c] Three additional bulls were harvested under Federal Regulations
[d] Two additional bulls were harvested under Federal Regulations

TABLE 2 Unit 1A moose hunter residency and success for regulatory years 1993 through 2004

Year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	
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	4	(4)	36	6	1	43	(96)	47
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	(10)	19	0	0	19	(90)	21
2003	2	0	0	2	(20)	8	0	0	8	(80)	10
2004	2	1	0	3	(12)	21	0	0	21	(88)	24
Average	3	<1	0	3	(10)	25	2	0	27	(90)	30

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

TABLE 3 Unit 1A moose harvest chronology for regulatory years 1993 through 2004

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
2003	0	(0)	1	(50)	1	(50)	0	(0)	2
2004	1	(33)	0	(0)	1	(33)	1	(33)	3
Average	1	(45)	0	(10)	1	(18)	1	(27)	3

TABLE 4 Unit 1A moose harvest percent by transport method for regulatory years 1993 through 2004

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
2003	0	(0)	2	(100)	0	(0)	0	(0)	0	(0)	2
2004	0	(0)	3	(100)	0	(0)	0	(0)	0	(0)	3
Average	<1	(12)	2	(88)	0	(0)	0	(0)	0	(0)	3

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 regeneration 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 U.S. 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 three or more brow tines on at least one antler.

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 1-15 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 three or more brow tines on at least one antler. 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 three brow tines on at least one 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, during the 1960s was 8, during the 1970s was 10, during the 1980s was 18, and during the 1990s 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 subunit are taken either from 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	2003	2004
Post-hunt numbers	300	N/A	N/A
Annual hunter kill	30	18	27
Number of hunters	250	152	166
Hunter-days of effort	1,750	1,461	1,309
Hunter success	12%	12%	16%

Thomas Bay

	Plan Objective	2003	2004
Post-hunt numbers	200	N/A	N/A
Annual hunter kill	20	11	15
Number of hunters	160	121	108
Hunter-days of effort	675	798	767
Hunter success	12%	9%	14%

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 subunit. In 2003 a total of 207 hunters reported observing a total of 1813 moose in Unit 1B, including 571 bulls, 854 cows, and 388 calves, for a bull-to-cow ratio of 67:100, and a calf-to-cow ratio of 45:100. In 2004, 227 hunters reported observing a total of 2018 moose, including 764 bulls, 855 cows, and 462 calves, for a bull-to-cow ratio of 89:100, and a calf-to-cow ratio of 54:100.

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. Speculation has long existed that the current antler restrictions, which were developed for the *gigas* subspecies of moose found elsewhere in Alaska, are overly restrictive when applied to the smaller a*ndersonii* subspecies inhabiting the Central Panhandle. In fall 2004 the BOG adopted a department sponsored proposal to implement drawing permit hunts allowing the taking of a limited number of “any-bull” moose in Unit 1B. The current registration moose hunt (RM038) is managed under a selective harvest strategy that allows the taking of only those bulls that meet the spike-fork-3-brow tine or 50” antler criteria. Data collected from bulls harvested during the recently authorized any-bull drawing permit hunts will be used to evaluate the age structure and antler characteristics of that segment of the bull population currently protected under the existing antler restrictions. Such information will prove useful for evaluating the effectiveness of the current antler restrictions, and may provide information necessary to make informed changes to the existing antler regulations. The newly authorized any-bull drawing permit hunts will be implemented and reported upon during the next report period.

No emergency orders were issued regarding Unit 1B moose during the report period.

Hunter Harvest. In 2003 the unit-wide harvest was 29 moose, including 2 illegal. In 2004 the unit-wide harvest was 42 moose, including 7 illegal. In 2003, 152 hunters harvested 18 moose on the Stikine portion of Unit 1B. In 2004, 166 hunters harvested 27 moose in the Stikine River drainage (Table 2). In 2003, 121 hunters harvested 11 moose in the general vicinity of Thomas Bay, including 2 from Farragut Bay (Table 3). In 2004, 108 hunters harvested 15 moose at Thomas Bay, including 2 from Farragut Bay.

Hunter Residency and Success. The majority of Unit 1B moose hunters are local residents and participation by nonlocal residents and nonresidents is typically low. In 2003, local residents of Wrangell and Petersburg represented 83% of successful hunters on the Stikine River, with nonlocal hunters representing 17%. In 2004, local residents of Wrangell and Petersburg represented 93% of successful hunters on the Stikine River, with nonlocal and nonresident hunters each represented 4% (Table 4). The overall success rate for Stikine River moose hunters was 12% in 2003 and 16% in 2004.

Petersburg residents continued to dominate the Thomas Bay and Farragut Bay moose hunts (Table 5). During this report period, 100% of those who hunted moose successfully in the vicinity of Thomas Bay and Farragut Bay were Petersburg residents. The overall success rate for Thomas Bay and Farragut Bay moose hunters was 11 and 15%, respectively, in 2003 and 2004.

Harvest Chronology. Harvest chronology for Unit 1B moose varies from year to year. In general, most bulls are killed during the first half of the season and the success rate typically declines as the season progresses (Table 6). In 2003, the largest percentage of the annual harvest in both the Thomas Bay Area and on the Stikine River occurred during the third and fourth weeks of the season, respectively.

Harvest in particular Wildlife Analysis Areas (WAAs). During the report period, moose harvest was reported in 5 Unit 1B WAAs. In both 2003 and 2004 the highest percentage of the annual harvest occurred in WAA # 1708 on the Stikine River and in WAA # 1605 at Thomas Bay, respectively.

In 2004 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 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 moose hunts are currently offered in the subunit.

Transport Methods. With the exception of one hunter who reported using an airplane, and another who reported walking to access a hunt area at Thomas Bay in 2004, 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. In the Thomas Bay area, however, motorized land vehicles may be used for other moose hunt related activities such as establishing camps, checking boats, and retrieving harvested moose, which results in this regulation being difficult to enforce and frequently abused.

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 wolves and bears are responsible for low calf survival on the Stikine River. At Thomas Bay, wolves are thought to be responsible for the majority of moose predation.

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 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 or above 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. Anecdotal reports from hunters and observations by staff indicate that moose have recently increased utilization of these thinned second-growth units as browse production increases and residual thinning slash begins to settle and decompose.

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 additional habitat manipulation procedures.

For genetic or environmental reasons moose in this subunit 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 subunit rarely achieve 50-inch antler spreads, and in Thomas Bay, in particular, the population appears to contain a surplus of sub-legal bulls in excess of that needed to ensure timely breeding of cows. The any-bull drawing permit hunts recently authorized by the BOG should facilitate the removal of surplus bulls and provide information on the age structure and antler characteristics of that segment of the bull population protected under the existing antler restrictions. Such information may prove useful for evaluating the effectiveness of the current antler restrictions, and provide information necessary for modifying the current selective harvest strategy.

CONCLUSIONS AND RECOMMENDATIONS

During this report period, only the Stikine management objectives for hunter success were met. The success rate equaled the management objective of 12%, in 2003, and at 16% in 2004 exceeded the management objective. Although the total number of hunters was similar to the previous report period, actual days of effort decreased. The harvest of 18 moose in 2003 and 27 moose in 2004 was below the management objective of 30 moose. We believe the Stikine moose population was stable at low levels during the late 1990s and early 2000's, but now appears to be increasing rapidly.

During this report period, the Thomas Bay moose harvest was below the management objectives for both number of hunters and annual harvest. The number of hunters increased slightly in 2003, but decreased below both 2001 and 2002 levels in 2004. Hunter-days of effort increased slightly in 2003 and then decreased in 2004. Hunter success was below and slightly above the management objective in 2003 and 2004, respectively. The Thomas Bay moose population currently appears stable at a high level and is thought to be at or above carrying capacity.

The Thomas Bay moose harvest began to decline in 2000 and has remained stable at relatively low levels. Hunters continue to report seeing plenty of bulls in the area; however, few of those qualify as legal under the current antler restrictions. The majority of bulls historically harvested in the area have been younger bulls with spike or forked antlers. It may be that post-logging habitat changes have reduced carrying capacity, and/or wolf predation on calves has resulted in low survival and recruitment. As the success rate continues to decline, many traditional Thomas Bay hunters appear to be seeking out other more productive areas in Unit's 1B and 3 to hunt moose.

After a sharp decline which began in 1989, and culminated in the 1994 emergency closure of the Stikine moose hunting season, the moose population and harvest appears to be rebounding. The harvest of 27 bulls in 2004 is only slightly below the long-term average annual harvest of 29 moose during the period 1952 to 1990. An aerial moose survey in February 2005 documented 134 moose on the U.S.-side of the international boundary, which is the forth highest count going back as far as 1960. The relatively sudden appearance of moose in high numbers on the U.S.-side of the international boundary implies that there is considerable transboundary movement of moose between the U.S. and Canada.

We recommend that Units 1B and 3, and the extreme southern portion of Unit 1C, continue to be managed by a common registration permit hunt, and that the season dates remain from 15 September through 15 October 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 may be justified in the future. We, therefore, support implementation of any-bull drawing permit hunts allowing a limited harvest of surplus bulls. Data collected during the recently authorized any-bull drawing permit hunts will be used evaluate the age structure and antler characteristics of the currently protected segment of the bull population. Such information should prove useful for evaluating the effectiveness of the current antler restrictions, and may provide the information necessary to make informed changes to the existing antler restrictions.

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

LOWELL R. E. 2006. Unit 1B moose management report. Pages 9–23 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 1B Stikine area aerial moose surveys, regulatory years 1993 through 2004

Yr month/day	Adults	Calves	(%)	Unidentified	Total moose	Moose/hour
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 [a]	9	2	(18)	0	11	8
6/11	11	7	(39)	0	18	9
2001						
2/7 [a]	3	2	(40)[g]	3	8	8
2002						
3/14 [a, f]	71	5	(7)	0	76	31
6/16 [a]	21	8	(38)	0	29	19
2003						
3/31 [a, f]	33	6	(15)	0	39	13
2004						
2/15 [a, f]	103	31	(23)	0	134	46

[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
[g] Percent of moose identified as adults or calves

TABLE 2 Unit 1B (Stikine) moose harvest, regulatory years 1993 through 2004

Year	Hunter harvest reported					
	M	(%)	F	(%)	Unk.	Total
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	11	(100)	0	(0)	0	11
2003	18	(100)	0	(0)	0	18
2004[c]	27	(100)	0	(0)	0	27

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

[b] Includes 1 Defense of Life or Property (DLP) and 2 illegal kills.

[c] Includes 3 illegal kills.

TABLE 3 Unit 1B (Thomas and Farragut bays) moose harvest, regulatory years 1993–2004

Year	Hunter harvest reported						
	M	(%)	F	(%)	Illegal	Unk.	Total
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	23	(100)	0	(0)	1	0	24
1999	18	(100)	0	(0)	2	0	20
2000	6	(100)	0	(0)	0	0	6
2001	14	(100)	0	(0)	1	0	15
2002	14	(100)	0	(0)	1	0	15
2003[c]	9	(100)	0	(0)	2	0	11
2004	11	(100)	0	(0)	4	0	15

[a] Includes one moose harvested in Port Houghton.

[b] Includes DLP.

[c] Includes 1 DLP & 1 illegal.

TABLE 4 Unit 1B (Stikine) moose hunter residency and success, regulatory years 1993 through 2004

	Successful						Unsuccessful						
Year	Local[a] resident	Nonlocal resident	Non-resident	Unk.	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Unk.	Total	(%)	Total hunters
1993	14	0	0	0	14	(10)	121	6	0	0	127	(90)	141
1994[b]	State season closed by emergency order				3								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
2003	15	3	0	0	18	(12)	128	6	0	0	134	(88)	152
2004	25	1	1	0	27	(16)	124	15	0	0	139	(84)	166

[a] Residents of Petersburg and Wrangell.

[b] Three moose taken under federal permits.

TABLE 5 Unit 1B (Thomas and Farragut bays) moose hunter residency and success, regulatory years 1993 through 2004

Year	Successful					Unsuccessful					
	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Total hunters
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
2003	11	0	0	11	(9)	106	3	1	110	(91)	121
2004	15	0	0	15	(14)	81	11	1	93	(86)	108

[a] Residents of Petersburg and Wrangell.

[b] Includes illegal kill.

[c] Includes 2 illegal kills.

TABLE 6 Unit 1B moose harvest chronology, regulatory years 1995–2004

Area	Year	15–21 Sept.	22–28 Sept.	29 Sept.–5 Oct.	6–15 Oct.
Thomas Bay	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
	2003	2	3	7	6
	2004	7	1	7	0
Stikine	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
	2003	2	3	7	6
	2004	10	5	2	10

TABLE 7 Unit 1B successful moose hunter transport methods by area, regulatory years 1995–2004

Area	Year	Airplane	Boat	Highway vehicle	3- or 4-wheeler	Horse	Other	Total
Thomas Bay	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	15	0	0	0	0	15
	2003	0	11	0	0	0	0	11
	2004	1	13	0	0	0	1	15
Stikine	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	11	0	0	0	0	11
	2003	0	18	0	0	0	0	18
	2004	0	27	0	0	0	0	27

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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. Based on communications with Canadian biologists who occasionally 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.

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 did not occur naturally, however, it is one of the most popular herds to hunt in the Juneau area. 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 to manage this moose herd, 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 to 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. During the past few years, the southern end of the Chilkat Range near Homeshore and Pt. Couverdon has seen a spike in harvest, likely a reflection of an increase in moose numbers along with the adoption of ATV hunting practices on the logging road system in that area. Because of thick timber stands throughout this area, it is difficult to gather reliable aerial survey data, so 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 1958. It is likely moose migrated to this area via the Excursion River drainage. Thirty years passed before the first moose was harvested at Gustavus in 1988, indicating that the populating of this area by moose was a gradual process. During the 1990s this population experienced a pattern of eruptive growth, and soon became the largest moose population in the subunit (1C), accounting for a higher annual harvest than the rest of the moose populations in the subunit combined. As the moose population at Gustavus grew, concerns by ADF&G biologists about habitat over-utilization began to mount. Habitat studies were initiated by ADF&G in 1999. In 2000, ADF&G submitted a proposal to the Board of Game (BOG) to initiate an antlerless moose hunt at Gustavus to curb the population growth. Further studies included additional habitat evaluation, and radiocollaring and monitoring of female moose. Data from these studies and the examination of harvested female moose are directing the management efforts at Gustavus.

MANAGEMENT DIRECTION

For management purposes, we have separated the moose in Unit 1C into four distinct populations, with separate management objectives for each. In addition, a management goal was added and the management objectives were changed to reflect the difficult nature of acquiring reliable population composition and size data.

MANAGEMENT GOALS

- For all Unit 1C moose populations: use management strategies that allow for long-term sustainability of the populations.

MANAGEMENT OBJECTIVES

- Taku drainage: Annually compare hunter effort and success as well as age data from harvested moose to gain insight into the status of this moose population. Maintain an annual harvest of at least 10 bull moose, and continue to correspond with Canadian biologists on aerial survey data they are able to gather on the Canadian side of the Taku River drainage.
- Berners Bay: Maintain a post-hunting survey count of 80-90 moose, and a bull: cow ratio of at least 25:100.
- Chilkat Range: Annually compare hunter effort and success as well as age data from harvested moose to gain insight into the status of this moose population.
- Gustavus Forelands: Continue to gather research and management data associated with pregnancy, twinning, rump fat, and body condition to guide our management strategy at Gustavus. Maintain a bull: cow ratio of at least 25:100.

METHODS

Aerial surveys were conducted during both years of the report period at Berners Bay and the Gustavus Forelands, but surveys were not conducted along the Chilkat Mountains or in the Taku River drainage. One registration permit hunt (RM046) and 2 drawing permit hunts (DM041 and DM043) were used to manage moose hunting effort in Unit 1C. Berners Bay moose were managed under a bull-only drawing 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. Additional data was collected from the cow moose carcasses from the DM043 hunt. These data included: rump fat measurements, kidneys and associated fat, a liver sample, and the reproductive tract. 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 River: We have very little information regarding the number of moose in the Taku River drainage. We did not conduct any aerial surveys of this drainage during this report period, and the last survey conducted in the Taku River was in winter 2000, when 37 moose were counted (Table 1). Although this number seems extremely low, it is comparable to historical surveys of the Alaska portion of the Taku River. Correspondence with Canadian biologists suggests that most Taku River moose migrate up the Taku River drainage during early winter, and overwinter in Canada. Harvest records of hunter effort and take and anecdotal information from hunters indicate that the number of moose in the Taku River drainage appears to be stable.

Berners Bay: Aerial surveys conducted in Berners Bay in 2003 and 2004 enumerated 81 and 86 moose, respectively. These numbers fall within our management objective of 80-90 moose counted posthunt. The Berners Bay moose population appears to be near the estimated carrying capacity of between 120 and 150 animals. This number is being maintained with selective harvests, which also help to provide for a healthy bull to cow ratio (Table 1).

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. However, we have seen a large increase in moose harvested at the southern end of the Chilkat Range, suggesting moose are doing well in that area. Based on harvest records and anecdotal information from hunters, the number of moose in the Chilkat Range appears to be stable in the Endicott River and St. James Bay areas, and increasing near Homeshore and Pt. Couverdon.

Gustavus Forelands: Based on winter aerial surveys during 2003 and 2004, our harvest strategy at Gustavus appears to have finally decreased the moose population there (Table 1). We counted 404 moose during winter 2003, and after harvesting 43 bulls during the bull hunt and 53 antlerless moose during the cow hunt in fall 2004, we counted 298 moose during winter 2004. We used radiocollared moose to estimate a sightability of 70% during the 2004 survey, giving us a rough estimate of 425 moose. Both the total number of moose and the number of calves in the herd declined during the report period as a result of our antlerless moose harvest strategy.

Population Composition

Due to marginal snow conditions, we were only able to conduct a composition survey of the Berners Bay moose population during this report period (Table 1). This is typical for most of Southeast Alaska where good survey conditions generally do not exist until January, at which time antler drop has commenced and differentiating male and female moose is not possible. We collected lower jaws from each harvested moose from successful hunters, providing us with the age structure of the harvest (Tables 2 & 3).

Taku River: We did not conduct any aerial surveys of the Taku River during this report period and therefore were unable to collect composition data. However, we can get some insight into the population structure of the harvested bull moose using age at harvest. The mean age of harvested moose was 2.7 years during the report period, with 42% yearlings. This continued harvest of young bulls indicates a healthy population with good recruitment.

Berners Bay: A November 2003 aerial survey allowed us to gather reliable composition data. We calculated a bull to cow ratio of 36:100, and a calf to cow ratio of 24:100. Both of these ratios indicate a healthy moose population, and are comparable to what we had in the early 1990’s, when this moose population was considered to be doing very well

Mean age at harvest of bull moose in Berners Bay was 2.6 years, almost a full year younger than the previous report period. Five (36%) of the 14 bull moose taken during 2003-2004 were yearlings, similar to the previous report period.

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

The mean age of harvested moose during this report period was 3.9 years, similar to the previous report period, but higher than that for any other Unit 1C moose population.

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 2003 and 2004 (32% and 20% respectively).

The mean age at harvest was 2.1 years compared to 2.4 during the previous report period. The harvest of young bulls further reflects 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 100 permits may be issued	15 Nov–30 Nov (General hunt only)
Remainder of Unit 1(C) 1 bull by registration permit only	15 Sep–15 Oct (General hunt only)

Game Board Actions and Emergency Orders. At the spring 2004 Board of Game meeting, the board reauthorized the antlerless hunt at Gustavus and increased the allowable number of permits at Gustavus from 35 to 100. During the spring 2005 Board of Game meeting, the board adopted a proposal to change the antlerless moose hunt dates at Gustavus from 15-30 November to 10 November-10 December. This proposal had been deferred from the fall 2004 Board of Game meeting for Region I. Emergency orders (EOs) were issued to close the season early in the Gustavus area during both years of the report period. In 2003 the season was closed after only seven days of hunting, and in 2004 the season lasted just three days.

Hunter Harvest.

Taku River: The annual harvest of moose during this report period averaged 13 moose, with 11 being taken in 2003 and 15 in 2004. This is similar to the mean annual harvest of 15 moose during 1995–2002 (Table 3).

Berners Bay: During this report period permits were limited to bulls only, with 8 permits issued in 2003 and 2004. The resulting hunter success and harvest was 8 bulls (100% success) in 2003 and 6 bulls (75% success) in 2004 (Table 5).

Chilkat Range: The mean annual harvest during this report period was 20 moose, the highest ever recorded. Twenty-two moose were taken in 2003, and 18 in 2004. This compares with an annual average take of 17 during 1995–2002 (Table 5).

Gustavus: During this report period, the bull moose hunt at Gustavus was being managed under a guideline harvest of 40-45 moose, while the antlerless moose drawing permit allowance ranged from 35 to 60 drawing permits during 2003 and 2004, respectively. In 2003, the bull-moose harvest reached 51 animals in seven days, exceeding the guideline harvest level. In 2004 the harvest reached 43 bulls in only 3 days. During both 2003 and 2004 we used emergency orders to close the bull-moose season early to prevent overharvest. The antlerless hunts went the entire season lengths due to the limiting effect of the drawing permit management of the hunt. In 2003 32 moose were taken, consisting of 28 cows and 4 calves. In 2004, 53 moose were taken, consisting of 51 cows and 2 calves (Table 3).

Permit Hunts. In subunit 1C, moose hunts are managed under two types of permits; drawing and registration. The drawing permits are used to manage both bull moose (DM041) and antlerless moose (DM042) in Berners Bay. However during the report period we did not issue any DM042 permits. At Gustavus a draw permit (DM043) is used to manage the antlerless moose hunt. A registration permit (RM046) is used to manage the bull moose hunt at Gustavus as well as well as the remainder of Unit 1C excepting the Berners Bay drainages.

The Berners Bay bull moose drawing hunt (DM041) attracted 773 and 738 applications during 2003 and 2004 respectively. Although there were only 8 permits issued during each of these two years, the proximity of Berners Bay to Juneau and the high hunter success rate explain the popularity of this hunt. The relatively new drawing permit hunt for antlerless moose at Gustavus (DM043) attracted 785 applications (35 permits) and 830 applications (60 permits) during 2003 and 2004 respectively. With the limited options in Southeast Alaska for hunting moose, these draw hunts will always be popular.

Under the subunit 1C bull moose registration permit (RM046) a total of 516 permits were issued in 2003, followed by 474 in 2004. Although we can not determine the destination within Unit 1C of the permittees at the time they acquire their permit, the resulting reporting data (Table 4) tells us that during both years of the report period, approximately 50% of those permittees who hunted did so at Gustavus. As in most hunts, not all the permittees actually participated in a hunt. In both years of the report period, approximately 70% of the permittees hunted.

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 221 of 262 harvested moose, other Alaska residents took 39, and nonresidents took 2. 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. However, the recent adoption of the antlerless drawing moose hunt at Gustavus has led to hunters throughout Southeast Alaska participating in this particular hunt. The reason being of course, that with a drawing permit in hand, a moose is practically guaranteed. Nonresidents eager to take moose focus on areas with larger moose populations and a better chance of getting a trophy animal. Thirty-one percent of all Unit 1C hunters were successful in 2003, and in 2004 the success rate increased slightly to 34%. Hunters at Gustavus continued to experience higher success rates during this report period, averaging 29% for bull moose, and 96% for the antlerless draw hunt. Taku River hunters on the other hand averaged only 17%, and Chilkat Range hunters 21%.

Harvest Chronology. Similar to recent years, the 2003 and 2004 bull-moose harvest was heavily weighted toward the early part of the season (mid to late September). This is partly because nearly all hunters participate on opening day, and hunt less as the season goes on. Also, the guideline harvest for the Gustavus hunt has been reached after only seven and three days of hunting during 2003 and 2004 respectively. The pace of the hunts in the Chilkat Range and the Taku River are much slower than Gustavus, but even those areas experience the majority of their respective harvests within the first two weeks of the season.

The chronology of the antlerless harvest differs substantially from the bull harvest in that the antlerless season at Gustavus doesn't begin until mid November. Even then, a majority of the animals are killed during the first 2 or 3 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 100% 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 based out of 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. During 2003–2004, airplanes and boats were used by 33% and 43% of the hunters, respectively (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. Off-road-vehicle (ORV) use in the Couverdon area is gaining in popularity due to the increase in moose numbers and the recent discovery that ORV hunting is effective on the logging roads throughout that area.

Gustavus Forelands: Successful Gustavus Forelands hunters use a variety of access methods. During the report period an average of 47% used highway vehicles, 6% walked, 10% used boats, 6% used all-terrain vehicles, and 7% 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. Hunters who listed 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 years of the report period so moose survival was probably pretty high. There are both bears and wolves in the area though, and there certainly is some mortality associated with these predators.

<u>Habitat</u>. We initiated a moose browse monitoring project in 1999 that is 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 is being used to guide management of the Gustavus moose population.

CONCLUSIONS AND RECOMMENDATIONS

Taku: Without being able to conduct functional aerial surveys in the Taku River, it is hard for us to get a sense of the status of this moose population. However, in the absence of survey data, the age of harvested animals, the annual harvest, and the catch per unit effort by hunters all suggest that this population of moose is at least stable. The continued harvest of nearly 50% yearling bulls indicates that this population is relatively healthy when compared to previous years. Attempts need to be made in future years to acquire survey data in the upper Taku River by working with Canadian biologists.

Berners Bay: The moose population in Berners Bay appears to be responding to the bull-only hunts of the past two years, based on increasing aerial survey counts. In addition, our composition survey revealed a bull:cow ratio of 36:100, which is well above the management objective of 25:100. We will likely hold off on an antlerless hunt at least another year, and reassess the possibility of re-implementing the antlerless hunt after another year of population survey data. In Berners Bay, one of the real concerns with taking only bull moose is that the bull:100 cow ratio can quickly become skewed toward too few bulls. This is something we will watch closely during the next report period.

Chilkat Range: As with the Taku River moose population, the Chilkat Range moose numbers and composition are not attainable for us through aerial surveys. Therefore we again have to look at the hunter harvest and effort data as a gauge of how this population is doing. The harvest during this report period was the highest ever recorded while the number of hunters, and the effort expended were similar to previous years. In the absence of population survey data, these data give us a pretty good indication that this moose population is at least stable.

Gustavus Forelands: The recent initiation of a moose research study at Gustavus should provide us with valuable information on moose body condition as well as pregnancy and twinning rates. This along with the carcass evaluation from the antlerless hunts will be used to guide our management at Gustavus. Our concern that the numbers of moose on the Gustavus Forelands is beyond the long term carrying capacity of the habitat continues, but the past three years of aerial surveys indicates our strategy of harvesting bull and antlerless moose appears to be lowering the moose numbers. At present our greatest need is a composition survey of this population to assess the bull:100 cow and calf:100 cow ratios. Continued implementation of a cow hunt during the next report period to lower the productivity of this herd is advised.

Acquiring additional browse utilization information as well as herd composition data is a priority.

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 if cursorily, to estimate the status of moose populations in relation to carrying capacity. Efforts being conducted at Gustavus will hopefully serve as a template for investigations in other areas and with other populations.

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

BARTEN, N. L. 2006. Unit 1C moose management report. Pages 24–46 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project. 1.0. Juneau, Alaska.

TABLE 1 Unit 1C aerial moose survey data, regulatory years 1995 through 2004

Year	Bulls	Cows	Calves	Unknown	Total Moose	Count time (hrs)	Bulls per 100F	Calves per 100F	Calves % in herd	Moose per hour
					Berners Bay 1995–2004					
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	33`
2002	---	4	4	50	58	2.2	---	---	7	26
2003	18	11	13	39	81	2.6	---	---	16	31
2004	7	12	12	55	86	3.3	---	---	14	26
					Chilkat Range 1995–2004					
1995					No survey					
1996	---	---	---	20	20	---	---	---	---	
1997					No survey					
1998	6	15	16	35	72	1.1	---	---	22	65
1999					No survey					
2000	---	6	6	113	125	1.7	---	---	---	74
2001-2004					No survey					
					Taku River 1995–2004					
1995–1997					No survey					
1998	---	1	1	3	5	---	---	---	---	---
1999					No survey					
2000	---	5	7	25	37	2.1	---	---	19	18
2001-2004					No survey					
					Gustavus Forelands 1998–2002					
1998	---	48	54	83	185	1.9	---	---	29	97
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
2003	37	214	130	23	404	3.3	---	---	32	122
2004	23	41	45	121	230	3.8	---	---	20	60

TABLE 2 Unit 1C moose age at harvest, Berners Bay, regulatory years 1995 through 2004

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										
1995	0	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	7	100	2.2
1996	0	5	1	0	0	1	0	0	0	0	0	0	0	0	0	0	7	100	2.2
1997	0	2	1	5	0	0	0	0	0	0	0	0	0	0	0	0	8	100	2.8
1998	0	2	3	0	0	0	0	0	2	0	0	0	0	0	0	0	8	88	3.9
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
2003	0	5	2	0	1	0	0	0	0	0	0	0	0	0	0	0	8	100	2.1
2004	0	0	3	2	1	0	0	0	0	0	0	0	0	0	0	0	6	100	3.2
									Females										
1995	0	1	1	1	2	0	0	1	0	0	0	0	0	0	0	0	6	100	4.0
1996	0	0	1	0	2	0	0	0	1	0	1	0	0	1	0	0	7	100	7.3
1997	0	1	0	3	2	0	0	0	0	0	1	0	0	0	0	0	7	100	4.5
1998	0	2	3	1	0	0	0	0	0	0	0	0	0	1	0	0	7	100	3.9
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
2003	No cow hunt																		
2004	No cow hunt																		

TABLE 3 Unit 1C moose age at harvest, excluding Berners Bay, regulatory years 1995 through 2004[1]

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
Chilkat Range																			
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	100	4.6
1997	0	5	0	3	1	1	0	1	0	1	0	0	0	0	0	0	13	92	3.8
1998	0	10	2	7	1	0	2	2	1	0	0	0	0	0	0	0	28	89	3.4
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	3.9
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
2003	0	6	7	2	0	1	2	0	0	1	0	0	0	2	0	0	22	95	4.2
2004	0	5	3	3	1	0	3	0	1	0	0	0	0	0	0	0	18	89	3.6
Gustavus Forelands																			
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	87	2.5
1998	2	24	10	5	3	0	0	0	0	0	0	0	0	0	0	0	48	92	2.1
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	2.5
2001	2	18	9	6	4	0	0	1	1	0	0	0	0	0	0	0	46[2]	89	2.6
2002	1	22	13	6	2	0	0	0	1	0	0	0	0	0	0	0	49	92	2.3
2003	3	27	14	4	2	0	0	0	0	0	0	0	0	0	0	0	51	98	2.0
2004	0	23	10	7	0	1	1	0	0	0	0	0	0	0	0	0	43	98	2.3

[1] Does not include 3 cow moose taken illegally in Gustavus in 2000.
[2] Includes 1 cow moose shot inadvertently.

TABLE 3 continued

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
								Taku River											
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
2003	0	3	3	1	2	1	0	0	0	0	0	0	0	0	0	0	11	91	3.0
2004	0	7	3	3	0	0	1	0	0	0	0	0	0	0	0	0	15	93	2.5

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
								Gustavus Forelands (Antlerless Harvest)											
2002	0	1	1	2	1	3	1	0	0	0	0	0	0	0	0	1	10	100	5.4
2003	2	2	6	9	1	2	1	0	1	0	0	0	0	0	1	1	32	88	4.0
2004	2	14	2	8	5	4	4	1	6	1	2	2	0	0	1	0	53	98	4.8

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					
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	2.1	3	15	5.0	17	45	2.6
2002	15	9	26	2.9	5	28	5.6	14	54	3.9
2003	9	8	24	3.0	0	0	0	8	24	3.0
2004	8	6	9	1.5	2	9	4.5	8	18	2.3
					Chilkat Range					
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	4.0	105	412	3.9
1998	441	28	85	2.9	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
2003	516	22	61	2.8	75	244	3.3	97	305	3.1
2004	474	18	49	2.7	80	282	3.5	98	331	3.4
					Gustavus Forelands					
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	3.8	104	404	3.9
1998	---	48	139	2.9	71	255	3.6	119	394	3.4
1999	---	42	173	4.1	103	528	5.1	145	701	4.8
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
2003	---	52	107	2.1	127	437	3.4	179	544	3.0
2004	---	45	68	1.5	119	292	2.5	164	360	2.2

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

TABLE 4 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
Taku River										
1995	---	14	48	3.4	71	254	3.6	85	302	3.6
1996	---	15	57	3.8	85	320	3.8	100	377	3.8
1997	---	6	25	4.2	85	365	4.3	91	390	4.3
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	3.9	84	315	3.8
2003	---	11	28	2.5	73	283	3.9	84	311	3.7
2004	---	15	33	2.2	58	221	3.8	73	254	3.5
Gustavus Forelands (Antlerless Harvest)										
2002	10	10	14	1.4	0	0	0	10	14	1.4
2003	35	32	47	1.5	0	0	0	32	47	1.5
2004	60	53	95	1.8	4	18	4.5	57	113	2.0

[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.

TABLE 5 Unit 1C moose historical harvests, number of hunters, and percent success, regulatory years 1995 through 2004

Year	NR males	NR females	NR unknown	Total kill	NR hunters	% success
			Berners Bay			
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
2003	8	0	0	8	8	100
2004	6	0	0	6	8	75
			Chilkat Range			
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
2003	22	0	0	22	97	23
2004	18	0	0	18	98	18

TABLE 5 continued

Year	NR males	NR females	NR unknown	Total kill	NR hunters	% success
			Gustavus Forelands			
1995	21	0	0	21	90	23
1996	30	0	0	30	95	31
1997	30	1[1]	0	31	104	29
1998	47	1[1]	0	48	118	40
1999	41	1[1]	0	42	146	28
2000	46	3[1]	0	49	132	37
2001	45	1[1]	0	46	206	22
2002	49	0	0	49	179	27
2003	51	1[1]	0	52	179	29
2004	43	2[1]	0	45	164	26
			Taku River			
1995	14	0	0	14	85	16
1996	15	0	0	15	97	15
1997	6	0	0	6	91	7
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
2003	11	0	0	11	84	13
2004	15	0	0	15	73	21
			Gustavus Forelands (Antlerless Harvest)			
2002	0	10	0	10	10	100
2003	1	31	0	32	32	100
2004	1	52	0	53	57	93

[1] Illegal take.

TABLE 6 Unit 1C annual moose kill by community of residence, regulatory years 1995–2004

Year	Total kill	Gustavus	Juneau	Sitka	Wrangell	Petersburg	Haines	Other Alaska	Non-resident
				Berners Bay					
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
2003	8	0	7	0	0	0	0	1	0
2004	6	0	6	0	0	0	0	0	0
				Chilkat Range					
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	8	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
2003	22	0	15	0	0	0	0	7	0
2004	18	1	13	0	0	0	0	3	1
				Gustavus Forelands					
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
2003	52[1]	25	20	4	0	0	1	2	0
2004	45[2]	18	20	4	0	0	0	2	1

1 One of these moose was an illegal kill.

2 Two of these moose were illegal kills.

TABLE 6 continued

Year	Total kill	Gustavus	Juneau	Sitka	Wrangell	Petersburg	Haines	Other Alaska	Non-resident
				Taku River					
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	23	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
2003	11	0	10	1	0	0	0	0	0
2004	15	0	13	1	0	0	1	0	0
				Gustavus Forelands (Cow Harvest)					
2002	10	0	10	0	0	0	0	0	0
2003	32	5	23	1	0	1	1	1	0
2004	53	6	39	3	0	2	1	2	0

TABLE 7 Unit 1C successful moose hunters transport methods, regulatory years 1995–2004

	Airplane		Boat		3 or 4 wheeler		Hwy vehicle		Foot	
Year	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
					Berners Bay					
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	---
2003	0	---	8	(100)	0	---	0	---	0	---
2004	0	---	6	(100)	0	---	0	---	0	---
					Chilkat Range					
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	---
2003	6	(27)	10	(45)	6	(27)	0	---	0	---
2004	7	(39)	7	(39)	3	(17)	0	---	1	(5)
					Gustavus Forelands					
1995	3	(25)	7	(58)	0	---	2	(17)	0	---
1996	1	(4)	7	(26)	3	(11)	4	(15)	12	(44)
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)
2003	3	(6)	7	(13)	3	(6)	29	(57)	9	(18)
2004	1	(2)	6	(14)	4	(9)	30	(68)	3	(7)

TABLE 7 continued

Year	Airplane Total	(%)	Boat Total	(%)	3 or 4 wheeler Total	(%)	Hwy vehicle Total	(%)	Foot Total	(%)
					Taku River					
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	9	21	(91)	0	---	0	---	0	---
2001	1	(5)	18	(95)	0	---	0	---	0	---
2002	0	---	14	(100)	0	---	0	---	0	---
2003	0	---	11	(100)	0	---	0	---	0	---
2004	0	---	15	(100)	0	---	0	---	0	---
					Gustavus Forelands (Cow Harvest)					
2002	2	(20)	1	(10)	0	---	7	(70)	0	---
2003	5	(16)	3	(9)	2	(6)	22	(69)	0	---
2004	2	(4)	2	(4)	2	(4)	47	(88)	0	---

TABLE 8 Unit 1C moose hunters commercial services use, regulatory years 1995 through 2004

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											
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
2003	7	0	1	0	0	0	8	0	0	0	0
2004	8	0	0	0	0	0	8	0	0	0	0
Chilkat Range											
1995	72	2	29	0	0	0	101	2	2	0	0
1996	56	5	13	0	0	0	69	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
2003	74	0	19	1	3	0	96	1	1	0	0
2004	75	4	12	2	4	1	91	7	7	0	0
Gustavus Forelands											
1995	80	0	10	0	0	0	90	0	0	0	0
1996	78	3	12	1	0	1	90	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
2003	152	2	21	0	2	0	175	2	2	0	0
2004	134	4	17	0	7	1	158	5	4	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						
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	60	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
2003	76	0	6	0	1	0	83	0	0	0	0
2004	64	1	6	0	0	0	70	1	0	1	0
					Gustavus Forelands (Cow Harvest) [1]						
2002	7	3	0	0	0	0	7	3	2	0	1
2003	5	0	24	3	0	0	29	3	2	0	1
2004	6	0	44	7	0	0	50	7	4	0	3

[1]Unit Resident refers to Gustavus residents only for the Gustavus cow hunt

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, and this has been substantiated by aerial survey efforts conducted by Canadian biologists. . 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.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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. 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.

METHODS

Chilkat River Valley aerial surveys were conducted in both 2003 and 2004 (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 both years of the report period we maintained a moose check station in Haines and required hunters to check in their harvested moose within 3 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 aerial surveys in fall 2003 and winter 2004. In 2003, 158 moose were counted and in 2004, 239 moose were counted. The variability in observed moose between surveys was due to survey conditions. In 2003 the survey was conducted in late fall with marginal snow cover that effected sightability and count numbers, but did provide us with reliable herd composition. In 2004 our priority for the survey switched from composition to overall numbers, so we had the luxury of waiting until snow conditions were ideal for a survey. Consequently, our count numbers were much higher than the previous year. The number of moose counted during surveys for this report period is 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 2003 count were fair to poor, but due to the timing (November) we were able to classify all animals (158 total) seen as bulls, cows or calves. We classified 16.5 % of the moose seen on this survey as calves, a slight increase from 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 25:100. Survey conditions in 2004 were improved over 2003 but due to timing (January) we were unable to collect reliable herd composition data. We were however, able to differentiate calves from adults, and determined that 22% of the herd were calves, which is the highest calf percentage since 1983 and well above the past report period (Table 1).

Mean age at harvest was 4.3 years during this report period, similar to the last three report periods (1997–2002) (Table 2).

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 220 permits may be issued	15 Sep–30 Sep (Subsistence hunt only)	No open season

Game Board Actions and Emergency Orders: No Board of Game action or Emergency Order implementation occurred during this reporting period. However, a BOG decision in fall 2002 to increase the number of Tier II permits from 200 to 250 went into effect during this report period.

Hunter Harvest: During this report period, the mean annual harvest was 20 moose, which is similar to the last two report periods.

Permit Hunts: All moose hunting in Unit 1D is administered under a Tier II subsistence permit system. Two hundred and fifty permits were available during each year of the report period (Table 3), but only 222 and 202 were issued in 2003 and 2004 respectively.

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 36 of the 40 moose harvested in 2003–2004. Hunter success was 13% during this report period, which is similar to the previous four years (Table 3). Successful hunters took an average of 4.2 days per kill during the report period (Table 3), similar to the period of 1998–2002. Total hunter days were 975 in 2003 and 1,115 in 2004 (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: During each year of the report period, the Unit 1D moose season remained open for the entire two weeks of the season. Hunters took 50% of the total harvest in the first four days of the season in each year. This is partly due to the higher level of participation during the early part of the season, but also reflects the quick harvest of those bulls that have legal antler formations.

Transport Methods: Most Unit 1D moose hunters use boats or highway vehicles (Table 6). During the 2003 and 2004 hunting seasons, 62% and 58% of successful hunters used boats, respectively. Nearly all of the remaining successful hunters used highway vehicles (Table 6).

Commercial Services: Five hunters reported the use of commercial services during the report period (Table 7), 4 in 2003 and 1 in 2004. This apparent increase in commercial service use may simply be a reflection of incorrect reporting (e.g., commercial airline to Haines listed as a transporter). 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, although bears certainly do eat some of the moose calves. Although we have no data on early calf survival, we do have aerial survey data with calf counts on almost an annual basis (Table 1). Based on this data, the percentage of calves in the herd during 2004 (22%), was the highest level seen since 1982. 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. When possible, these moose are salvaged for local charities.

Unreported kills that do not meet the legal antler formation seem to be reported at the rate of one every other year or so. It doesn't appear to be a big problem, but is something that seems to be inherent with populations managed under the spike-fork, 3 brow-tine or 50-inch hunts.

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). Based on existing aerial survey data and the lack of correction or sightability data, we believe it is practical to use a minimum population level of 200 moose, post hunt, as a management objective. The harvest objective of 20–25 bulls was met in 2003 but not in 2004. We met the objective of a 12% hunter success rate; that rate was 13% in 2003 and 12% in 2004.

The number of moose harvested in Unit 1D has ranged from 27 in 1995 to 17 in 1997 and 2001. Based on management objectives to harvest 10% of surveyed moose, an additional 0-7 moose may be available for harvest. We are reviewing the current hunting season regulations and may prepare a Board of Game proposal to lengthen the season to approximately October 15th in order to provide for additional hunting opportunity and hopefully additional harvest of bull moose to hunt participants.

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 17 years. The present regulatory structure supports a moose population consistent 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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Please cite any information taken from this section, and reference as:

HESSING, P. 2006. Unit 1D moose management report. Pages 47–58 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 1D moose aerial survey data, regulatory years 1995 through 2004[1]

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
1995					No survey					
1996	48	121	31	7	207	3.8	40	26	15	54
1997	10	37	36	115	198	4.1	---	---	18	48
1998	20	23	25	103	171	5.2	---	---	15	33
1999	---	4	4	67	75	4.9	---	---	---	15
2000	28	30	35	129	222	5.5	18	22	15.7	40
2001	38	153	30	---	221	5.2	25	20	13.6	42
2002					No survey					
2003	29	103	26	---	158	4.4	28	25	16.5	36
2004	23	45	52	119	239	4.4	---	---	22	54

[1] Missing survey data is due to conditions that did not allow for herd composition data collection.

TABLE 2 Unit 1D age structure of harvested moose, regulatory years 1995 through 2004

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
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	22	96	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
2003	0	3	1	3	3	8	0	2	0	0	0	0	0	0	0	0	21	95	4.5
2004	0	4	2	4	3	3	0	3	0	0	0	0	0	0	0	0	19[1]	100	4.1

[1] Does not include 1 unsalvaged illegal harvest.

TABLE 3 Unit 1D moose hunter effort and success, regulatory years 1995 through 2004

		Successful hunters			Unsuccessful hunters			Total hunters		
Year	Permits issued	# hunters	Total # days	Avg. # days	# hunters	Total # days	Avg. # days	# hunters	Total # days	Avg. # days
1995	200	27	58	2.1	130	401	3.1	157	459	2.9
1996	181	22	70	3.2	121	735	6.1	143	805	5.6
1997	200	17	50	2.9	130	891	6.9	147	941	6.4
1998	200	19	79	4.2	146	976	6.7	165	1055	6.4
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
2003	222	21	80	3.8	140	895	6.4	161	975	6.1
2004	202	19	86	4.5	142	1029	7.2	161	1115	6.9

TABLE 4 Unit 1D annual moose kill by community of residence, regulatory years 1995– 2004

Regulatory year	Total kill	Haines	Skagway	Juneau	Sitka	Other Alaska	Non-resident
1995	27[1]	26	0	1	0	0	0
1996	23	22	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[2]	16	0	0	1	0	0
2002	22	21	1	0	0	0	0
2003	21	18	0	3	0	0	0
2004	19	18	1	0	0	0	0

[1]Includes 1 illegally harvested bull, 1 unrecovered bull, and 2 illegally harvested cows.
[2]Includes 1 illegally harvested bull.

TABLE 5 Unit 1D historical moose harvests, number of hunters, and percent success, regulatory years 1995 through 2004

Regulatory year	NR males	NR females	NR unknown	Total kill	NR hunters	Percent success
1995	27[1]	0	0	27	157	17
1996	23	0	0	23	145	16
1997	17	0	0	17	145	12
1998	19	0	0	19	164	12
1999	21	0	0	21	163	13
2000	18	0	0	18	160	11
2001	17	0	0	17	154	11
2002	22	0	0	22	157	14
2003	21	0	0	21	161	13
2004	19[2]	0	0	19	161	12

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

[2] Does not include 1 unsalvaged illegal harvest.

TABLE 6 Unit 1D transport methods used by successful moose hunters, regulatory years 1995–2004

	Airplane		Boat		ORV		Highway vehicle		Other	
Year	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
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	(12)	3	(17)	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	(10)	12	(57)	2	(10)	5	(23)	0	---
2003	1	(5)	13	(62)	1	(5)	3	(14)	3	(14)
2004	0	(0)	11	(58)	1	(5)	6	(32)	1	(5)

TABLE 7 Unit 1D commercial services used by moose hunters, regulatory years 1995–2004[1]

	Unit residents		Other AK residents		Total use		Other
Year	No	Yes	No	Yes	No	Yes	services
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
2003[5]	136	3	6	1	142	4	0
2004[5]	135	1	10	0	145	1	0

[1]Commercial service use may not be accurate due to reporting errors

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 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 1–15 October, with a one-bull bag limit, a spike-fork or 50-inch antler restriction, and a harvest ticket requirement. In 1991 the season reopened on Mitkof Island from 1-15 October with a one-bull bag limit, a spike-fork or 50-inch antler restriction, and a harvest ticket requirement. In 1993 the remainder of Unit 3 was opened from 1–15 October with a one-bull bag limit; a spike-fork, 3-brow tine or 50-inch 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 (BOG) 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 open 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. Most hunters are in the field early in the season and 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 of 10 and 17 bulls were harvested, respectively. Since 1993, 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 (Alaska Department of Fish and Game 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 established the draft goals below for Unit 3 moose based on a crude estimate of the population size, limited knowledge of habitat utilization and moose movements, and anecdotal information from people in the field.

The Alaska Department of Fish and Game (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	2003	2004
Post hunt numbers	400	N/A	N/A
Annual hunter kill	40	41	41
Number of hunters	470	512	500
Hunter-days of effort	2300	3124	3263
Hunter success	10%	8%	8%

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 2003 a total of 272 hunters reported observing 1552 moose, including 558 bulls, 622 cows, and 372 calves, for a bull-to-cow ratio of 90:100 and a calf-to-cow ratio of 60:100. In 2004, 330 hunters reported observing 2186 moose, including 704 bulls, 905 cows, and 577 calves, for a bull-to-cow ratio of 78:100 and a calf-to-cow ratio of 64:100.

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

Season and Bag Limit	Nonresident and resident hunters
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	

Game Board Actions and Emergency Orders. Speculation has long existed that the current antler restrictions, which were developed for the *gigas* subspecies of moose found elsewhere in Alaska, are overly restrictive when applied to the smaller a*ndersonii* subspecies inhabiting the Central Panhandle. In fall 2004 the BOG adopted a department proposal to implement drawing permit hunts allowing the take of a limited number of “any-bull” moose in Unit 3. The current registration moose hunt (RM038) is managed under a selective harvest strategy that allows the harvest of only those bulls that meet the spike-fork-3-brow tine or 50” antler criteria. Data collected from bulls harvested during the recently authorized any-bull drawing permit hunts will be used to evaluate the age structure and antler characteristics of that segment of the bull population currently protected under the existing antler restrictions. Such information will prove useful for evaluating the effectiveness of the current antler restrictions, and may provide information necessary to make informed changes to the existing antler regulations. The newly authorized any-bull drawing permit hunts will be implemented and reported upon during the next report period.

No emergency orders were issued regarding Unit 3 moose during the report period.

<u>Hunter Harvest.</u> In 2003, 512 hunters harvested 41 moose in Unit 3 (Table 1). In 2004, 500 permittees harvested 41 moose.

<u>Hunter Residency and Success.</u> The overwhelming majority of those who participate in the Unit 3 moose hunt are local residents of Petersburg, Kake, and Wrangell (Table 2). The overall success rate for a residency groups combined was 8% in both 2003 and 2004. Just 3 and 2 moose harvested in 2003 and 2004, respectively, were taken by nonlocal residents. Although 2 nonresident hunters participated in the Unit 3 moose hunt in 2003, neither was successful.

<u>Harvest Chronology</u>. Harvest chronology for Unit 3 moose varies from year to year. In general, most bulls are killed during the first half of the season and the success rate typically declines as the season progresses. In both 2003 and 2004 the largest percentage of the annual harvest occurred during the last week and first week of the season, respectively (Table 3).

<u>Harvest in particular WAA's</u>. During the report period hunters reported harvesting moose in 14 Unit 3 WAA's. In both 2003 and 2004 the largest percentage of the annual harvest occurred in WAA # 2007 on Mitkof Island and in WAA # 5132 on northwest Kupreanof Island, respectively.

<u>Guided hunter harvest</u>. No guided moose hunts are currently offered in the unit.

<u>Transport Methods.</u> During the report period, the majority of successful Unit 3 moose hunters used highway vehicles and boats to access their hunting areas (Table 4).

Other Mortality

Wolves are common throughout Unit 3 and predation by wolves on adult and calf moose has been well documented. Substantial predation of moose calves by black bears has been documented in other areas and probably occurs in Unit 3 as well. Poaching of moose undoubtedly occurs in Unit 3, however, the extent to which this occurs remains unknown.

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 the long-term. 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, pre-commercial 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 sub-legal bulls than are needed to ensure timely breeding of cows. The any-bull drawing permit hunts recently authorized by the BOG should facilitate the removal of surplus bulls and provide information on the age structure and antler characteristics of that segment of the bull population protected under the existing antler restrictions. Such information may prove useful for evaluating the effectiveness of the current antler restrictions, and may provide information necessary for modifying the current selective harvest strategy.

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 2003 and 2004 the Unit 3 moose hunt exceeded all management objectives with the exception of success rate. The success rate of 8% for both 2003 and 2004 was up from the previous report period, but still slightly below the management objective of 10%. Although moose density varies from island to island, the Unit 3 moose population appears to be expanding.

We recommend that Units 1B and 3, and the extreme southern portion of Unit 1C continue to be managed by a common registration permit hunt, and that the season dates remain from 15 September through 15 October 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 may be justified. Therefore, we support implementation of any-bull drawing permit hunts allowing a limited harvest of surplus bulls. Data collected during the recently authorized any-bull drawing permit hunts will be used evaluate the age structure and antler characteristics of the currently protected segment of the bull population. Such information should prove useful for evaluating the effectiveness of the current antler restrictions, and may provide the information necessary to make informed changes to the existing antler restrictions.

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

LOWELL, R. E. 2006. Unit 3 moose management report. Pages 59–69 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 3 moose harvest, regulatory years 1995 through 2004

Year	Hunter harvest reported							
	M	(%)	F	(%)	Unk.	Total	Illegal	Total
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
2003	39	(100)	0	(0)	0	39	2	41
2004	40	(100)	0	(0)	0	40	1	41

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

Table 2 Unit 3 moose hunter residency and success, regulatory years 1995–2004

Year	Successful					Unsuccessful					
	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Local[a] resident	Nonlocal resident	Non-resident	Total	(%)	Total hunters
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)	430	34	2	466	(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)	398	31	0	429	(94)	455
2003	38	3	0	41	(8)	421	48	2	471	(92)	512
2004	39	2	0	41	(8)	431	28	0	459	(92)	500

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

TABLE 3 Unit 3 moose harvest chronology in, regulatory years 1995–2004

Year	15–21 Sep	22–28 Sep	29 Sep–5 Oct	6–15 Oct	Total
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
2003	13	6	7	15	41
2004	10	12	6	13	41

TABLE 4 Unit 3 successful moose hunter transport methods, regulatory years 1995–2004

Year	Airplane	Boat	Highway vehicle	3/4 wheeler	Horse	Unknown	Total
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
2003	0	11	29	1	0	0	41
2004	0	11	30	0	0	0	41

Alaska Department of Fish and Game
Division of Wildlife Conservation
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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 non-federally qualified subsistence users can legally hunt during the first week of the state season that begins 15 October. Just prior to the 2004 hunting season, ADF&G worked with the USFS to draft a joint state and federal permit that will serve as the only permit needed to hunt the Yakutat Forelands. This joint permit will take away a lot of the problems associated with tracking hunter effort.

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		
Post-hunt 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		
Post-hunt 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		
Post-hunt 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 first year of the report period only (Table 1). All surveys were flown with a Cessna 185 or 206 aircraft because better-suited survey aircraft are not available in Yakutat.

Three state and one federal registration permit hunts were used to manage moose hunting effort in Unit 5 since 1996, and during the first year of this report period: RM062, RM059, and RM061 (state permits) and RM059 (federal permit). However, because of problems the dual state and federal permits created in tracking hunter effort, we created a joint state/federal permit (RM061) prior to the 2004 hunting season. Although the USFS helps issue these permits, the department oversees and manages the joint permit process and data. Successful hunters must provide the lower jaw from the animal taken and completed hunt report to the department no later than 15 days after the hunt closes.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In the Yakutat and the Malaspina forelands there are heavy coniferous forests that make it difficult to impossible to detect moose. With much of this heavy timber being immediately adjacent to riparian areas, we have generally assumed a moose sightability across the forelands of about 50% (Smith and Franzman 1979).However a product of an ADF&G and USFS moose study conducted on the Yakutat Forelands during 2000–2004 will be a moose sightability model to be used to interpret aerial survey data. This model should be developed and usable by fall 2006. 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 and population density is the number of moose observed per hour of survey time (Table 1). 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 correspond to lower sighting rates; this is probably due to a larger survey area including areas away from moose concentrations. Because of inconsistent early snowfall year to year, the timing of aerial surveys often occurs after antler drop resulting in unreliable composition data. Therefore, in the tables accompanying this report, the composition data is often absent. The total number of moose is annotated on survey reports and generally calves can be enumerated.

Unit 5(A) Yakutat Forelands: Aerial surveys suggest that the moose population size on the Yakutat forelands has remained relatively stable over the past 10 years (Table 1). During this report period we were only able to conduct a partial moose survey during regulatory year (RY) 2003. This survey enumerated 367 animals, with a sighting rate of 36 moose per hour which is comparable to other years. No surveys were completed in RY 2004 due to poor snow conditions.

Unit 5(A) Nunatak Bench: An aerial survey of the Nunatak Bench area was completed in RY2003, and 25 moose were counted. Herd composition data was not collected due to survey timing. No survey of the area was done in 2004. 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, it appears the moose population hasn't suffered from this more recent event, based on aerial survey counts (Table 1).

Unit 5(B) Malaspina Forelands: The Unit 5B moose population appears to be relatively stable based on the most recent aerial survey conducted during RY 2003 (Table 1). This survey enumerated 153 moose with a sighting rate of 37 moose per hour of survey time. Although the sighting rate isn't as high as that recorded in some years, the count of 153 moose is the most animals recorded in the past 20 years. We estimate the moose population in 5B to be at least 175–200 animals.

Population Composition

During this report period, the 2003 aerial survey provided us with incomplete composition data. The timing of the survey was after antlers began dropping, so detecting bull moose was not possible in many cases. Therefore, our survey data consisted of cows, calves, bulls, and adult moose of unknown sex (Table 1). Several of the bull moose we counted had only one antler remaining, and likely there were others that had lost both antlers. Therefore, estimating bulls and calves per 100 cows isn't possible.

Without composition survey data, we try to gain insight into population through the age structure of the harvested bull moose. Since 1995 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 decreased from 4.2 during the previous report period to a mean of 3.2 years during 2003-04. This age at harvest is comparable to the previous 8-year mean of 3.3 (Table 2). The only significant change in ages of harvested moose is that of 2.5 year old bulls, which is returning to historical levels of the early to mid 1990s.

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 since1995. The mean age of 5.3 during RY 2003 is one of the highest recorded (Table 2). This erratic age structure is probably related more to sample size than any real population differences. However, the older age class moose are probably more prevalent in Unit 5B because of the limited access and lower hunting pressure this area receives in comparison to the Yakutat Forelands.

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	

Season and bag limits	Resident and nonresident hunters
Unit 5B	15 Sep–15 Dec
1 bull by registration permit only; up to 25 bulls may be taken	

Game Board Actions and Emergency Orders. There were no Board of Game actions concerning Unit 5 moose hunting during the report period. However an emergency order (EO) was issued on November 10, 2004 to close the moose hunting season in that portion of Unit 5A west of the Dangerous River when Guideline Harvest Levels (GHL) were reached..

Hunter Harvest. The annual harvest of moose in Unit 5A (Yakutat Forelands) ranged from 37 to 61 during 1995–2002, with a mean of 49. However, the mean annual harvest over the past 3 report periods has been substantially lower than that recorded during the 1995-96 and 1997-98 report periods (Table 3). The mean annual harvest of 35 during this report period is the lowest recorded in the past 20 years. The reasons for this decline in harvest are puzzling, especially in light of aerial survey data that indicates the Unit 5A moose population has been relatively stable since the early 1980s. Changes in hunter effort could be responsible for the decline in harvest, but missing federal permit information doesn't allow us to rely on this data. Another component that could be responsible for the lower harvest is a scarcity of bull moose. This is not an easy question to address though as we seldom get an opportunity to get herd composition data. The little data we do have suggests that the bull moose sector of the population hasn't changed much between 1996 and 2002, the last two times reliable composition surveys were conducted (Table 1).

The harvest in Unit 5B also declined precipitously during this report period. The mean annual harvest remained at 6 moose, but only 2 were taken in 2004. A glance at hunter effort in Table 5 indicates a lack of effort was not the reason for the low harvest; rather, it appears to be a lack of moose. Over the two years of the report period, 35 unsuccessful hunters spent an average of 5.2 days afield in search of a moose. Given that any bull is legal in this area, this suggests that few bulls were seen. Reasons for this low harvest could be partly attributed to two reasons. First, most hunters targeting Unit 5B hunt out of the same place, that being a government cabin near Esker Stream. There could be habitat or predator changes occurring that make that area less desirable for moose. This is somewhat substantiated by hunters reporting that they are seeing very few moose, and lots of brown bears. Second, the number of guided hunters was only a portion of what it had been in previous years (Table 7), and they harvested only 1 moose compared to the 3–5 animals taken by guided hunters in previous years (Table 4).

The harvest of 7 moose at Nunatak Bench was the highest of the last three report periods. Three animals were taken in 2003 and 4 were taken in 2004 (Table 3). All of the moose harvested at Nunatak Bench for this report period were taken by Yakutat residents. Good weather and the availability of moose along the waterfront of Nunatak Fiord led to this increased harvest.

Permit Hunts. The total number of permits (both state and federal) issued for the Yakutat Forelands hunt (RM061) in 2003 was 171. In 2004 we issued 211 joint state/federal permits. This joint permit will allow us to reliably track hunter effort, as we did prior to the adoption of the separate federal permit. As is, from 1996 through 2003, there is considerable confusion over the tabulation of hunting effort due to missing hunt information from the federal permits. The hunting effort at Nunatak Bench hunt (RM059) increased during this report period. A total of 13 permit holders (Table 5) hunted compared to five hunters in the previous report period. In light of increased effort, it is understandable that the harvest rose over the last report period (Table 3).

The Unit 5B hunt (RM062) received slightly less hunting pressure during this report period (46 hunters) compared to the previous two years (50 hunters). Despite decreased effort, the harvest was only reduced by one moose (11 moose vs. 12) over the previous report period.

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 adoption of the joint state/federal permit during RY 2004 should make it easier for ADF&G to keep track of the reporting process.

Hunter Residency and Success. 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 50 (71%) of the bulls harvested in 5A during the report period. The majority of moose taken by local hunters were taken during the first two 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 (33%) in 2003 and 8 (20%) in 2004. Most nonlocal Alaska hunters are from Juneau. Nonresidents did not take any moose in Unit 5A during the 2003 season and took 2 in 2004 (Table 4).

Since 1986 the overall success of Unit 5A hunters has ranged from 19 to 35 percent (Table 3). In 2003 hunter success was 22%, then 23% in 2004. Considerable time has been spent to incorporate federal data; these data suggest 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 slightly higher than the previous report period (17 hunter days for 13 hunters during 2003-2004 compared to 11 days for 5 hunters during 2001-2002). Hunter success during this report period was 59%, nearly the same as 60% for the previous report period. Local hunters harvested all 7 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 4 of 11 moose (36%) harvested during the report period, compared to 25% during the previous 2 years. Nonlocal state residents killed 1 moose during the report period, while nonresidents took the largest proportion, 6 animals (55%). The nonresident harvest increased by only one moose.. All nonresident hunters were guided.

Harvest Chronology. Moose harvest from Unit 5 early in the state season is relatively low, partly because during the period of 1 September through 7 October only Unit 5B is open for moose hunting (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 open. Most of the harvest on the Yakutat Forelands took place during the first part of the state season. Moose are harvested throughout the latter part of the season but only in small numbers.

All of the moose taken at Nunatak Bench during the report period were harvested in January and February. Most moose harvested in this area are taken later in the season, 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 continued to change during the current report period (Table 6). The use of aircraft dropped from 27 to 19% for successful hunters. The use of boats (31%) surpassed both highway vehicles (21%) and 3- and 4-wheelers (21%). Three and 4-wheelers 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, all-terrain vehicles (ATVs), 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 14% 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 (63%) than Unit 5A hunters. 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.

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

BARTEN, N. L. 2006. Unit 5 moose management report. Pages 70–84 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 5 aerial survey data, regulatory years 1995 through 2004[1]

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					
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	26	32	33	183	274	6.7	NA	NA	12	41
2002	28	146	21	0	195	NA	19	14	11	NA
2003	11	46	48	262	367	10.3	---	---	13	36
2004						No survey				
					5A Nunatak Bench					
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	4	3	20	35	0.5	23	9	13	66
2002						No survey				
2003	1	1	1	22	25	0.4	---	---	---	58
2004						No survey				
					5B Malaspina Forelands					
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	22	8	9	52	91	2.0	24	15	10	46
2002						No survey				
2003	20	19	20	94	153	4.2	---	---	---	37
2004						No survey				

[1]Due to survey timing, weather and ground conditions, and aircraft availability, herd composition data is not available. In a few circumstatnces, herd data was collected for small portions of the survey area.

TABLE 2 Unit 5 age structure of harvested moose, regulatory years 1995 through 2004

Year	Age Class 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
Yakutat Forelands																			
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	100	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
2003	0	11	4	7	2	1	1	0	0	0	0	0	1	0	0	0	30	90	3.2
2004	1	12	12	6	3	2	0	3	1	0	0	0	0	0	0	0	40	100	3.1
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	---
2003	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	3	100	6.5
2004	0	0	0	1	0	0	0	1	2	0	0	0	0	0	0	0	4	100	7.0
5B Malaspina Forelands																			
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
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
2003	0	0	1	0	3	2	0	2	0	0	0	0	0	0	0	0	9	89	5.3
2004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	---

TABLE 3 Unit 5 historical harvests, hunters, and success, regulatory years 1995–2004

Year	Nr MM	Nr FF	Nr unk.	Total kill	Nr hunters	Percent success
			5A Yakutat Forelands			
1995	48[1]	2	0	50	185	25
1996	60	1	0	61	190	32
1997	59	1	1	61	194	31
1998	54	1	0	55	195	28
1999	41	1	0	42	114	37
2000	37	0	0	37	146	25
2001	37	1	0	38	152	25
2002	43	1	1	45	187	24
2003	30	0	0	30	137	22
2004	40	0	0	40	172	23
			5A Nunatak Bench			
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
2003	2	1	0	3	8	38
2004	2	2	0	4	5	80
			5B Malaspina Forelands			
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
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
2003	9	0	0	9	28	32
2004	2	0	0	2	18	11

Includes moose harvested under federal ceremonial permit

TABLE 4 Unit 5 annual moose kill by community of residence, regulatory years 1995 through 2004

Year	Total kill	Yakutat	Juneau	Ketchikan	Sitka	Pelican	Hoonah	Petersburg	Haines	Wrangell	Other AK	Non-resident
						5A Yakutat Forelands						
1995	50[1]	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
2003	30	20	7	0	2	0	0	0	0	0	1	0
2004	40	30	5	0	2	0	0	0	0	0	1	2
						5A Nunatak Bench						
1995–1996							(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
2003	3	3	0	0	0	0	0	0	0	0	0	0
2004	4	4	0	0	0	0	0	0	0	0	0	0
						5B Malaspina Forelands						
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
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
2003	9	3	1	0	0	0	0	0	0	0	0	5
2004	2	1	0	0	0	0	0	0	0	0	0	1

[1] Includes moose harvested under federal ceremonial permit.

TABLE 5 Unit 5 hunter effort and success, regulatory years 1995 through 2004[1]

Year	Permits issued	Successful hunters			Unsuccessful hunters			Total hunters		
		Nr hunters	Total days	Avg. days	Nr hunters	Total days	Avg. days	Nr hunters	Total days	Avg. days
5A Yakutat Forelands										
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
2003	171	30	78	2.6	107	586	5.5	137	664	4.8
2004	211	40	121	3.0	132	744	5.6	172	865	5.0
5A Nunatak Bench										
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
2003	14	3	3	1.0	5	6	1.2	8	9	1.1
2004	13	4	6	1.5	1	2	2.0	5	8	1.6
5B Malaspina Forelands										
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
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
2003	53	9	37	4.1	19	93	4.9	28	130	4.6
2004	44	2	20	10	16	87	5.4	18	107	5.9

[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 1995 through 2004[1]

Year	Airplane		Boat		3 or 4 wheeler		ORV		Highway vehicle		Foot	
	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)	Total	(%)
5A Yakutat Forelands												
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	8	(28)	10	(43)	3	9	1	3	6	(17)	0	---
2000	12	(34)	11	(31)	8	23	0	---	4	(12)	0	---
2001	11	(32)	14	(41)	1	(3)	0	---	8	(24)	0	---
2002	10	(23)	17	(39)	9	(20)	1	(2)	7	(16)	0	---
2003	6	(22)	7	(26)	7	(26)	1	(4)	6	(22)	0	---
2004	7	(18)	15	(38)	8	(20)	1	(2)	9	(22)	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	---
2003	0	---	3	(100)	0	---	0	---	0	---	0	---
2004	0	---	4	(100)	0	---	0	---	0	---	0	---
5B Malaspina Forelands												
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)
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	---
2003	1	(11)	5	(56)	3	(33)	0	---	0	---	0	---
2004	0	---	1	(50)	1	(50)	0	---	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 1995 through 2004[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						
1995	111	9	21	26	3	3	135	38	36	1	1
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	2
1999	59	2	16	11	3	7	78	20	15	2	3
2000[2]	90	3	10	15	3	3	103	23	18	2	3
2001	82	2	23	16	1	4	99	22	19	2	1
2002	130	3	33	12	2	1	165	16	15	1	0
2003	101	3	26	14	0	0	127	17	16	0	1
2004	117	2	26	21	2	5	143	28	25	1	2
					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
2003	6	0	2	0	0	0	8	0	0	0	0
2004	5	0	0	0	0	0	5	0	0	0	0
					5B Malaspina Forelands						
1995	6	9	1	5	3	4	10	18	15	2	1
1996	3	1	2	9	0	9	5	20	11	8	1
1997	8	1	0	4	2	8	10	13	5	8	0
1998	2	3	2	7	1	9	5	19	10	9	0
1999	3	1	0	0	0	5	3	6	1	5	0
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
2003	11	2	1	4	1	9	13	15	6	8	1
2004	2	0	1	7	1	7	4	14	9	5	0

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

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 the Matanuska-Susitna area (Burris and 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 1200 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 during 1965 and 6A during 1971. Moose in 6A were divided into 2 populations (east and west of Suckling Hills) during 1977 and have been managed separately since then. Hunters harvested more than 4300 moose during 1965–2004 in Subunits 6A, 6B and 6C. In contrast, total kill of the endemic moose population in 6D during the same period was approximately 55 moose. The harvest quota for cow moose in Subunit 6C was commandeered into federal subsistence during 2000–01, as was 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 aerial surveys to determine sex and age composition of moose populations in Units 6A–6C. We used Piper Super Cub (PA-18) and Bellanca Scout aircraft for searches of count areas.

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.

I summarized survey 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 completed field work on a cooperative study funded by the U.S. Forest Service (USFS), 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 vegetative characteristics, 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). Female moose were captured (half with calves) and collared during November and again in March. Rump fat thickness was measured using ultrasonography. Data analysis is in progress.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Stormy weather and lack of snow limit moose censuses in Unit 6. Poor conditions precluded moose censuses during the reporting period, but I conducted composition counts in Units 6A–6C (Table 1) during brief weather windows in early winter. Survey results indicated moose populations were stable in Units 6A and 6B, and increasing in Unit 6C.

Population Size

The posthunt moose population in Unit 6 during the reporting period was approximately 1250 moose, including 280 in 6A (East), 300 in 6A (West), 200 in 6B, 420 in 6C, and 50 in 6D. These estimates were somewhat dated because of the lack of recent censuses, but were also indicated by composition counts and population modeling.

Population Composition

High bull:cow ratios observed in Units 6B and 6C during 2003 prompted an increase in bull harvest during 2004 (Tables 1 and 2). The proportion of calves was adequate in Units 6A and 6C but poor in 6B (Table 1), a pattern that was similar to previous years.

MORTALITY

Harvest

<u>Season and Bag Limit</u>. In Subunit 6A East, the bag limit for all hunters was one moose. The bull moose season during this reporting period was 1 September–30 November. 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 September–30 November, 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 1 September–30 November 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 Alaska Department of Fish and Game identification number.

In Subunit 6C the state season was 1 September–31 October for resident hunters only, with a bag limit of 1 moose by drawing permit, and quotas of 5 bulls in RY 2003 and 9 bulls in RY 2004 (Table 3). Federal subsistence permits included 20 bulls in RY 2003, 33 bulls in RY 2004 and 5 antlerless moose each year. The subsistence hunt was administered by the USFS Cordova Ranger District.

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

Reported moose harvest for Unit 6 was 84 in 2003–04 and 116 in 2004–05 (Table 2), which was the highest harvest in 10 years. Composition of the harvest in Unit 6 was 89% males during 2003–04 and 94% in 2004–05.

Board of Game Actions and Emergency Orders. We issued emergency orders to close the registration permit hunts for bull moose in 6B (12 September 2003 and 14 September 2004). These were normal management actions. The Board of Game reauthorized antlerless moose hunts and increased season length by one month, to 30 November, in 6A–6C during the March 2003 meeting.

Permit Hunts. During this reporting period, Subunit 6A West had one registration and one drawing permit hunt, 6B had one registration hunt, and 6C had one state drawing hunt. Also in 6C there were one federal subsistence hunt (with a harvest of 5 cows each year and a harvest of 16 bulls in RY 2003 and 28 bulls in RY 2004) and one potlatch bull permit each year (Table 3).

Hunter Residency and Success. Approximately 73% of moose hunters in Unit 6 were local during the reporting period (Table 4). Federal subsistence seasons were restricted to Cordova residents only. Resident-only seasons and difficult access discouraged nonlocal hunters from participating. This has been the pattern for the last 5 years.

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 chasing and feeding on calves and adult moose in various parts of the unit (Carnes 2004; MacCracken et al. 1997; personal observation). Estimates of moose kill rates for wolves in Unit 6, which were comparatively low (Carnes 2004), indicated that approximately one-quarter of the Unit 6B moose population could be killed by wolves each year.

CONCLUSIONS AND RECOMMENDATIONS

Moose populations were below management objectives in Units 6A and 6B, primarily because of predation. High bull:cow ratios became evident in Subunits 6B and 6C during composition counts in early winter. More emphasis should be placed on obtaining these estimates in early winter rather than waiting for adequate census conditions during midwinter after bulls have cast their antlers. Adequate snow and flying conditions for censuses are becoming increasingly rare along the coast where most of the moose winter. The population objective in Unit 6C of 400 moose was probably surpassed, and an increase in cow harvest is recommended.

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

CROWLEY, D. 2006. Unit 6 moose management report. Pages 85–100 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Unit 6 moose estimated population composition and size, 1992–2004

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
	2000–01[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
	1999–00	-	13	348	412	181–643	382
	2001–02	-	13	260	297	236–358	253
	2003–04[a]	19	13	132	-	-	161
6B	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
	2003–04[a]	57	6	111	-	-	124
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
	2003–04[a]	63	6	114	-	-	146

[a] Composition count

TABLE 2 Unit 6 moose harvest and accidental death, 2000–2005

		Hunter harvest									
	Regulatory	Reported					Estimated			Accidental	
Unit	year	M	(%)	F	(%)	Total[a]	Unreported	Illegal	Total	death	Total
6A East	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
	2003–04	17	(100)	0	(0)	17	1	0	1	0	18
	2004–05	26	(100)	0	(0)	26	1	0	1	0	27
6A West	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
	2003–04	18	(86)	3	(14)	21	1	1	2	0	23
	2004–05	15	(88)	2	(12)	17	1	1	2	0	19
6A TOTAL	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
	2003–04	35	(92)	3	(8)	38	2	1	3	0	41
	2004–05	41	(95)	2	(5)	43	2	1	3	0	46
6B	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
	2003–04	16	(94)	1	(6)	17	0	1	1	0	18
	2004–05	30	(100)	0	(0)	30	0	1	1	0	31

TABLE 2 continued

		Hunter harvest									
	Regulatory	Reported					Estimated			Accidental	
Unit	year	M	(%)	F	(%)	Total[a]	Unreported	Illegal	Total	death	Total
6C	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
	2003–04	21	(81)	5	(19)	26	0	0	0	1	27
	2004–05	35	(88)	5	(13)	40	0	0	0	3	43
6D	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	2	(100)	0	(0)	2	0	1	1	0	3
	2003–04	3	(100)	0	(0)	3	0	1	1	0	4
	2004–05	3	(100)	0	(0)	3	0	1	1	0	4
Unit 6	2000–01	76	(85)	13	(15)	89	4	4	8	3	100
TOTAL	2001–02	75	(89)	9	(11)	84	2	2	4	0	88
	2002–03	65	(88)	9	(12)	74	2	2	4	0	78
	2003–04	75	(89)	9	(11)	84	2	3	5	1	90
	2004–05	109	(94)	7	(6)	116	2	3	5	3	124

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

TABLE 3 Unit 6 moose harvest data by permit hunt, 2000–2005

Unit/hunt nr	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6A/RM160[a]	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
	2003–04	Bull	68	51	55	45	15	(100)	0	(0)	15
	2004–05	Bull	62	69	47	53	10	(100)	0	(0)	10
6A/DM160[b]	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
	2003–04	Bull	5	0	40	60	3	(100)	0	(0)	3
	2004–05	Bull	5	0	40	100	5	(100)	0	(0)	5
6A/DM162	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
	2003–04	Antlerles	5	0	40	60	0	(0)	3	(100)	3
	2004–05	Antlerles	5	40	33	67	0	(0)	2	(100)	2
6B/RM164	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	15	15	(100)	0	(0)	15
	2003–04	Bull	154	36	85	17	16	(94)	1	(6)	17
	2004–05	Bull	166	28	75	25	30	(100)	0	(0)	30

TABLE 3 continued

Unit/hunt nr	Regulatory year	Legal moose	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	(%)	Cows	(%)	Total reported harvest
6C/DM167	2000–01	Bull	20	5	0	100	19	(100)	0	(0)	19
	2001–02	Bull	20	0	5	95	19	(100)	0	(0)	19
	2002–03	Bull	5	0	0	100	5	(100)	0	(0)	5
	2003–04	Bull	5	0	0	100	5	(100)	0	(0)	5
	2004–05	Bull	9	11	0	100	8	(100)	0	(0)	8
6C/	2000–01	Both sexes	6	0	0	100	1	(17)	5	(83)	6
Fed subst.[b]	2001–02	Both sexes	6	0	0	100	1	(17)	5	(83)	6
	2002–03	Both sexes	21	0	0	100	16	(76)	5	(24)	21
	2003–04	Both sexes	21	0	0	100	16	(76)	5	(24)	21
	2004–05	Both sexes	33	0	3	97	27	(84)	5	(16)	32

[a] RM prefix was a registration hunt, DM prefix a drawing hunt.
[b] Federal subsistence hunts, including bull, antlerless, and potlatch bull.

TABLE 4 Unit 6 moose hunter residency and success, 2000–2005

		Successful					Unsuccessful					
Unit	Regulator year	Local resident[a]	Nonlocal resident	Nonresident	Total	(%)[b]	Local resident	Nonlocal resident	Nonresident	Total	(%)	Total hunter
6A East	2000–01	1	6	12	19	(43)	3	7	15	25	(57)	44
	2001–02	1	3	8	12	(38)	4	5	11	20	(63)	32
	2002–03	0	0	13	13	(27)	6	6	22	35	(73)	48
	2003–04	1	2	13	17	(55)	3	3	8	14	(45)	31
	2004–05	1	3	22	26	(58)	0	4	15	19	(42)	45
6A West	2000–01	26	4	5	35	(54)	24	6	0	30	(46)	65
	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
	2003–04	13	5	3	21	(49)	13	7	2	22	(51)	43
	2004–05	12	0	5	17	(100)	0	0	0	0	(0)	17
6A TOTAL	2000–01	27	10	17	54	(50)	27	13	15	55	(50)	109
	2001–02	23	9	12	44	(52)	18	10	12	40	(48)	84
	2002–03	15	2	14	31	(39)	17	6	24	48	(61)	79
	2003–04	14	7	16	38	(51)	16	10	10	36	(49)	74
	2004–05	13	3	27	43	(69)	0	4	15	19	(31)	62
6B	2000–01	7	1	0	8	(8)	90	5	0	95	(92)	103
	2001–02	13	0	0	13	(12)	85	7	0	92	(88)	105
	2002–03	13	2	0	15	(17)	68	5	0	73	(83)	88
	2003–04	14	3	0	17	(17)	76	6	0	82	(83)	99
	2004–05	28	2	0	30	(25)	83	7	0	90	(75)	120

TABLE 4 continued

Unit	Regulatory year	Successful Local resident[a]	Nonlocal resident	Nonresident	Total	(%)	Unsuccessful Local resident	Nonlocal resident	Nonresident	Total	(%)	Total hunter
6C[c]	2000–01	16	9	--	25	(100)	0	0	--	0	(0)	25
	2001–02	18	7	--	25	(96)	0	1	--	1	(4)	26
	2002–03	26	0	--	26	(100)	0	0	--	0	(0)	26
	2003–04	25	1	--	26	(100)	0	0	--	0	(0)	26
	2004–05	39	1	--	40	(100)	0	0	--	0	(0)	40
6D	2000–01	0	2	0	2	(11)	11	5	0	16	(89)	18
	2001–02	2	0	0	2	(11)	13	3	0	16	(89)	18
	2002–03	1	0	0	2	(8)	21	2	1	24	(92)	26
	2003–04	3	0	0	3	(12)	17	4	1	22	(88)	25
	2004–05	3	0	0	3	(9)	22	7	2	31	(91)	34
Unit 6 TOTAL	2000–01	50	22	17	89	(35)	129	24	15	168	(65)	257
	2001–02	56	16	12	84	(36)	117	21	12	150	(64)	234
	2002–03	55	4	14	74	(34)	106	13	25	145	(66)	219
	2003–04	56	11	16	84	(38)	109	20	11	140	(63)	224
	2004–05	83	6	27	116	(45)	105	18	17	140	(55)	256

[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, 2000–2005

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
6A East	2000–01	0	32	26	21	21	0	0	19
	2001–02	0	25	17	17	33	8	0	12
	2002–03	0	31	8	31	31	0	0	13
	2003–04	0	41	24	29	6	0	0	17
	2004–05	0	38	27	23	12	0	0	26
6A West	2000–01	0	31	57	11	0	0	0	35
	2001–02	0	53	44	3	0	0	0	32
	2002–03	0	44	50	0	6	0	0	18
	2003–04	0	62	33	5	0	0	0	21
	2004–05	0	18	12	6	65	0	0	17
6A TOTAL	2000–01	0	31	46	15	7	0	0	54
	2001–02	0	45	36	7	9	2	0	44
	2002–03	0	39	32	13	16	0	0	31
	2003–04	0	53	29	16	3	0	0	38
	2004–05	0	30	21	16	33	0	0	43

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	2000–01	25	75	0	0	0	0	0	8
	2001–02	0	100	0	0	0	0	0	13
	2002–03	0	100	0	0	0	0	0	15
	2003–04	0	100	0	0	0	0	0	17
	2004–05	0	100	0	0	0	0	0	30
6C	2000–01	0	44	28	12	12	4	0	25
	2001–02	0	48	16	12	20	4	0	25
	2002–03	0	52	20	16	12	0	0	25
	2003–04	0	50	12	19	12	8	0	26
	2004–05	0	53	20	13	8	5	1	40
6D	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	2
	2003–04	0	0	100	0	0	0	0	3
	2004–05	0	0	100	0	0	0	0	3
Unit 6 TOTAL	2000–01	2	39	37	12	8	1	0	89
	2001–02	0	56	24	7	11	2	0	84
	2002–03	0	55	23	11	11	0	0	73
	2003–04	0	60	20	13	5	2	0	84
	2004–05	0	55	17	10	15	2	1	116

TABLE 6 Unit 6 moose harvest percent by transport method, 2000–2005

Unit	Regulatory year	Airplane	Boat	3- or 4-wheeler	ORV	Highway Vehicle	n
6A East	2000–01	53	11	21	0	16	19
	2001–02	67	0	25	0	8	12
	2002–03	100	0	0	0	0	13
	2003–04	88	6	0	0	6	17
	2004–05	85	8	4	4	0	26
6A West	2000–01	34	63	0	0	3	35
	2001–02	27	73	0	0	0	30
	2002–03	28	72	0	0	0	18
	2003–04	53	47	0	0	0	21
	2004–05	59	41	0	0	0	17
6A TOTAL	2000–01	41	44	7	0	7	54
	2001–02	38	52	7	0	2	42
	2002–03	58	42	0	0	0	31
	2003–04	71	26	0	0	3	38
	2004–05	74	21	2	2	0	43

TABLE 6 continued

Unit	Regulatory year	Airplane	Boat	3- or 4-wheeler	ORV	Highway Vehicle	n
6B	2000–01	0	63	0	0	38	8
	2001–02	17	58	0	8	25	13
	2002–03	20	73	0	0	7	15
	2003–04	0	45	0	0	55	17
	2004–05	8	67	8	0	17	30
6C	2000–01	4	44	0	0	52	25
	2001–02	8	25	4	4	58	25
	2002–03	0	39	4	4	52	26
	2003–04	0	32	16	0	52	26
	2004–05	0	39	0	0	61	40
6D	2000–01	50	0	0	0	50	2
	2001–02	0	50	0	0	50	2
	2002–03	0	0	0	0	0	2
	2003–04	0	33	33	0	33	3
	2004–05	0	0	0	0	100	3
Unit 6 TOTAL	2000–01	27	45	4	0	24	89
	2001–02	25	44	5	2	23	83
	2002–03	30	46	1	1	21	74
	2003–04	31	31	7	0	30	84
	2004–05	32	37	3	1	27	116

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNIT: 7 (3520 mi^2)

GEOGRAPHIC DESCRIPTION: Eastern Kenai Peninsula

BACKGROUND

In Unit 7, federal public lands compose approximately 78% of the unit; 50% is managed by the U.S. Forest Service–Chugach National Forest, 22% by the National Park Service–Kenai Fjords National Park, and 5% by the U.S. Fish and Wildlife Service–Kenai National Wildlife Refuge. The moose population in Unit 7 is at a low density relative to other units on the Kenai Peninsula. Winters with deep snow are normal for this region and probably contribute much to the mortality and/or low reproduction of this moose population. Less than 10% of the moose harvest on the Kenai Peninsula over the past 20 years has come from Unit 7. Very little moose monitoring or research has been done by the Alaska Department of Fish and Game (ADF&G) in this unit since the 1970s and early 1980s due to budget constraints. However, moose survey and research collaborations between ADF&G and the U.S. Forest Service (USFS) are slated in the unit for 2006–2008.

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.This report reflects updated data, so the information in the tables may differ slightly from past reports.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

A comprehensive moose survey has never been conducted in Unit 7. Limited 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 rigorously comparable between years, because survey intensity and conditions are inconsistent. We perform composition counts in order to get an adequate sample of moose to calculate ratios of bulls:cows and calves:cows. Composition counts conducted in 3 count areas in November–December of 2003 showed 24 bulls:100 cows and 27 calves:100 cows (Table 1). We conducted no composition counts in 2004.

MORTALITY

Harvest

Season and Bag Limit. The general season in Unit 7 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.

The average reported harvest from 2001 through 2004 in Unit 7 was 42 moose (Table 2). Results are reported by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY04 = 1 July 2004–30 June 2005).

Board of Game Action and Emergency Orders. During the March 2005 meeting, the board changed the season for the permit hunt DM522 from 20 October–20 November to 10 October–10 November.

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 portions of Units 7 and 15A, took 3 bulls in both 2003 and 2004 (Table 3).

Hunter Residency and Success. About half of the general season hunters were residents of Unit 7 (Table 4). The success rate averaged 13% over the past 4 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 depends on weather conditions and other factors unrelated to moose abundance.

Transport Methods. Highway vehicles are the main transportation method used by successful hunters in Unit 7 (Table 6).

Other Mortality

Highway vehicles killed an average of 21 moose per year during the past 4 years in Unit 7 (Table 2). The effect of wolf and bear predation on moose and the degree of illegal poaching is unknown. The level of mortality for moose during severe winters is probably high and a significant limiting factor.

HABITAT

Assessment/Enhancement

A small fire encompassing more than 3000 acres burned north of Kenai Lake in 2001. No other significant fires or other habitat alterations are known to have occurred in the unit during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The ADF&G and the USFS have started a collaborative moose project slated to start in 2006 and continue for at least 2 years. The project entails conducting fall composition counts through a large portion of the unit, which will provide the most comprehensive assessment of the bull:cow and calf:cow ratios in the unit since the early 1980s. The project also involves fitting 20–40 moose with GPS-telemetry collars to gain information on moose movements, habitat use, adult and calf survival, and reproduction limitations in the unit.

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MCDONOUGH, T. 2006. Unit 7 moose management report. Pages 101–106 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Unit 7 moose aerial composition counts and estimated population size, 2001–04

Regulatory Year	Bulls: 100 Cows	Calves: 100 Cows	% Calves	Adults	Total Moose Observed	Estimated Population Size
2001–02	30	13	9	141	203	700–1000
2002–03	No surveys conducted					700–1000
2003–04	24	27	18	249	304	700–1000
2004–05	No surveys conducted					700–1000

TABLE 2 Unit 7 reported general season moose harvest and accidental death, 2001–2004

Regulatory	Reported Hunter Harvest				Accidental death			Total
Year	Bull	Cow	Unk	Total	Road	Train	Total	Reported Mortality
2001–02	55	0	0	55	12	9	21	76
2002–03	50	0	1	51	16	0	16	67
2003–04	29	0	0	29	24	0	24	53
2004–05	32	0	0	32	30	0	30	62

TABLE 3 Unit 7 harvest for drawing permit hunts, 2001–2004

Hunt Nr	Regulatory Year	Permits issued	Permittees that hunted	Percent success	Harvest			
					Bulls	Cows	Unk.	Total
DM522[a]	2001–02	25	21	10	2	0	0	2
	2002–03	25	18	0	0	0	0	0
	2003–04	25	14	21	3	0	0	3
	2004–05	25	18	17	3	0	0	3

[a] Includes area within Units 15A and 7.

TABLE 4 Unit 7 residency and success of moose hunters for the general season, 2001–2004

Regulatory Year	Successful				Unsuccessful				Total Hunters
	Local[a] resident	Nonlocal resident	Non-resident	Total[b] (%)	Local[a] resident	Nonlocal resident	Non-resident	Total[b]	
2001–02	23	26	5	55 (17)	111	146	16	273	328
2002–03	23	22	6	51 (15)	132	137	12	281	332
2003–04	14	13	2	29 (9)	147	147	9	304	333
2004–05	13	14	4	32 (9)	157	126	21	310	342

[a] Local means residents of Unit 7.
[b] Includes unspecified residency.

TABLE 5 Unit 7 moose general season harvest chronology (percent of harvest), 2001–2004

Regulatory Year	Harvest Periods 8/20–8/25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unknown	Harvest
2001–02	22	2	7	16	25	25	2	55
2002–03	20	6	12	10	14	33	6	51
2003–04	28	3	7	7	14	38	3	29
2004–05	16	6	9	6	28	31	3	32

TABLE 6 Unit 7 general season transport methods for successful moose hunters (percent of harvest), 2001–2004

Regulatory Year	Percent of Harvest 3–4 wheel ATV	Airplane	Boat	Highway vehicle	Horse/ dog team	ORV	Unknown	Harvest
2001–02	7	16	16	42	15	4	0	55
2002–03	2	6	10	53	24	0	6	51
2003–04	0	14	14	59	10	0	3	29
2004–05	0	13	9	59	13	6	0	32

WILDLIFE MANAGEMENT REPORT	Alaska Department of Fish and Game Division of Wildlife Conservation (907) 465-4190 PO BOX 115526 JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNIT: 9 (33,638 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 Unit 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 later (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 Unit 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, and 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 Units 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 indicate populations in most of Unit 9 have been relatively stable over the past 25 years. A slight decline was detected in the portion of Unit 9C outside of Katmai National Park. Moose densities remained very low in Units 9A, 9D, and the southern portion of 9E, and unreliable snow conditions hindered surveys for monitoring trends in population size or composition.

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

Population Size

A 1983 census in the central portion of Unit 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 Unit 9E provided a rough estimate of 2500 moose. The area of Unit 9C outside of Katmai National Park had approximately 500–600 moose. There were approximately 2000 moose in Unit 9B. Units 9A and 9D probably contained about 300 and 600 moose, respectively.

Population Composition

Poor weather conditions and inadequate snow cover frequently limit moose surveys in Unit 9. This has led to most trend areas being surveyed infrequently. Moose movements are also thought to add variability to survey results. During this reporting period we conducted trend surveys during November of 2003. We also conducted surveys in November 2005, after this reporting period ended. Lack of snow cover during the winter of 2004 prevented the completion of surveys in all subunits.

Bull:cow ratios observed in Unit 9B trend areas are generally lower than the ratios reported during the 80s and 90s. This change probably stems from bag limit modifications that prevent cow harvest. The bull:cow ratio for Unit 9B was 14 in 2003 and 23 in 2005 (Table 1). While these ratios appear low, they are skewed by the Nakeen Trend Area, which has had an average of 20 bulls:100 cows during the past 25 years (range 8–32) and was the only trend area surveyed in 2003. Bull:cow ratios in Unit 9B averaged 34 bulls:100 cows when the Nakeen Trend Area was excluded. Calf ratios were above the 25-year average for this subunit in 2003 and slightly below average in 2005 (25-year average = 21.5 calves:100 cow, Table 1).

Bull:cow ratios in Unit 9C appear relatively stable in spite of the low ratio reported in 2003 (Table 2). The calf:cow ratios in Unit 9C were extremely low between 1999 and 2003, but showed improvement in 2005. This low recruitment provides a reasonable explanation for the reduced densities observed in this subunit.

Surveys in Unit 9E were conducted by the U.S. Fish and Wildlife Service (FWS) during this reporting period. Bull:cow ratios were generally above management objectives, but were abnormally low in 2005 (Table 3). The calf ratio observed in 2005 is among the highest reported in Unit 9E during the past 25 years. Taking sample size and historic variation into consideration, the population in Unit 9E appears stable. Harvests probably are not reducing bull:cow ratios.

While conducting line transect surveys for bears in Unit 9D during May and June of 2002, we observed 86 moose, of which 17 were calves. Because the data were 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. In Unit 9A resident and nonresident hunters could hunt 1–15 September, and the bag limit was 1 bull. In Unit 9B nonresidents could hunt 5–15 September with a bag limit of 1 bull with ≥50-inch antlers or ≥4 brow tines; and resident hunters could hunt 1–15 September and 15 December–15 January, with a bag limit of 1 bull. Effective in 1997, meat of moose taken in Unit 9B was required to remain on the bone until processed for human consumption. The federal subsistence season in Unit 9B is 20 August–15 September and 1 December–15 January.

The nonresident season dates in Unit 9C were the same as for Unit 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 Unit 9C were different in the Naknek River drainage and the remainder of 9C. Within the Naknek drainage any bull could be taken during the state hunting season of 1–31 December, while the remainder of 9C was open 15 December–15 January with the same bag limit. Within the southern portion of the Naknek drainage, the federal subsistence season was open 20 August–15 September 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.

The nonresident season in Unit 9E was 10–20 September, and the bag limit was 1 bull with an antler spread of ≥50 inches or ≥3 brow tines on at least 1 antler. The state season for resident hunters in Unit 9E was 10–20 September and 1 December–20 January. The bag limit in Unit 9E was 1 bull; however, moose taken 10–20 September must have a spike or fork or have an antler spread of ≥50 inches or have ≥3 brow tines on at least 1 antler. The federal subsistence seasons in Unit 9E were open 20 August–20 September and 1 December–20 January with a bag limit of 1 bull.

Unit 9D was only open to residents 15 December–20 January with a bag limit of any bull. Federal subsistence permits were issued with the same season dates and had a quota of 10 bulls from both the state and federal hunts.

Board of Game Actions and Emergency Orders. In 2003 the moose hunt in Unit 9D was changed from a drawing permit hunt to a general season hunt. During the same year the winter portion of the federal hunt in the remainder of Unit 9C was extended to include the first 15 days in January (1 December–15 January).

Hunter Harvest. The Unit 9 reported harvests during this period were below the 20-year average (20-year average = 215, SD = 8, Table 4). Household surveys of several communities and unconfirmed reports indicate a significant portion of the unreported harvest in some areas may be cow moose. These surveys also indicate that the amount of unreported harvest may be underestimated.

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 9C. A quota of 5 antlerless moose was set for RM232. During this reporting period 21 permits were issued for RM233, and 1 bull was harvested. Twenty-five permits were issued for RM232, and 3 cows were harvested.

Hunter Residency and Success. The number of moose hunters in Unit 9 peaked between 1981 and 1987 at 645 hunters. Participation in the moose hunt dropped to an average of 531 hunters during the 1990s and has continued to decline in recent years (Table 5). While there have been fluctuations in the proportion of hunters from 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 (average = 54% from 2000 to 2004, range = 52–57%) than either residents of Unit 9 (average = 28% from 2000 to 2004, range = 25–32%) or other Alaska residents (average = 29% from 2000 to 2004, range = 26–36%) because virtually all of them flew out to hunt, and many employed guides.

Harvest Chronology. Since 2000, approximately 89% of the moose harvest occurred in September (Table 6). Harvest levels during the winter season, which depend on weather and travel conditions, have remained low and ranged from 7 to 16% of the total harvest.

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

Moose calf production and condition appear to have improved since the 1960s and 1970s, but calf recruitment has remained low. Bear predation of neonatal moose appears to remain the primary cause. 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

Compared to other units statewide, harvests in Unit 9 have remained relatively stable for the past 20 years, despite major changes to moose regulations. Reduced harvests since 2000 reflect changes in the number of moose hunters in Unit 9 and coincided with reduced opportunity to hunt caribou in portions of Unit 9. Changes in the number of moose taken have resulted from decreased effort and do not indicate differences in the moose population.

The average annual harvest reported since 2000 (174 moose) was within sustainable levels. Largely unknown are the number of unreported moose taken and to what extent cow harvest has continued in spite of regulatory changes to deter this practice. In spite of these concerns, the moose population appears stable in most of Unit 9, based on harvest statistics and trend data. The detrimental effects of illegal harvest are limited by the lack of snow cover and poor winter travel conditions in Unit 9 during recent years.

The decrease in the moose density in Unit 9C was not surprising given the low calf recruitment observed between 1999 and 2003. Because bull:cow ratios were sufficient for reproduction, it is unlikely that changes in state regulation would improve moose numbers in this area. However, federal regulations still allow cow harvest and should be changed to reduce adult female mortality.

The low bull:cow ratio observed in Unit 9E during surveys in 2005 was a significant change from bull:cow ratios reported during prior years. Reported harvests have not been sufficient to alter bull:cow ratios. Additionally, antler restrictions apply to the majority of hunters, adding extra protection to the bull segment of the population. No other sources of mortality have been detected that would reduce bull survival and alter the bull:cow ratio in Unit 9E. Surveys should be conducted to determine whether the 2005 survey results accurately reflect a change in the bull:cow ratio or are an anomaly in the data.

Brown bear predation on neonatal moose was the major limiting factor preventing an increase in moose densities in Unit 9, followed by the harvest of cows in some areas. However, the 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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Please cite any information taken from this section, and reference as:

BUTLER, L. G. 2006. Unit 9 moose management report. Pages 107–115 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Moose composition counts in Unit 9B, 1998–2005

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	-	-	-	-	-	-	-
2003	14	3	26	19	74	91	30
2004	-	-	-	-	-	-	-
2005	23	5.5	19	13	158	182	20

TABLE 2 Moose composition counts in Unit 9C, 1998–2005

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	-	-	-	-	-	-	-
2003[a]	23	3	5	4	91	96	25
2004	-	-	-	-	-	-	-
2005	34	9	19	12	440	504	36

[a] Includes some surveys by FWS

TABLE 3 Moose composition counts in Unit 9E, 1998–2005

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
2003[a]	46	10	10	6	131	140	18
2004	-	-	-	-	-	-	-
2005[a]	25	5	22	15	81	95	19

[a] Includes some surveys by FWS

TABLE 4 Annual moose harvest in Unit 9, 1998–2004

	Reported			Estimated			
Year	Male	Female	Total[a]	Unreported	Illegal	Total	Total
1998	198	2	200	100		100	300
1999	238	8	253	100		100	353
2000	176	2	180	100		100	280
2001	167	8	175	100		100	275
2002	171	6	179	100		100	279
2003	177	0	177	100		100	277
2004	155	3	158	100		100	258

[a] Includes unknown sex.

TABLE 5 Moose hunter residency and success in Unit 9, 1998–2004

	Successful				Unsuccessful			
Year	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	179	73	109	84	276
2003	40	32	102	177	84	92	90	273
2004	32	29	93	158	86	80	80	248

[a] Includes unknown residency

TABLE 6 Moose harvest chronology (percent) in Unit 9, 1998–2004

Year	August 20–31	September 1–5	September 5–10	September 11–15	September 16–20	December 1–15	December 16–31	January 1–20
1998	1	11	22	43	15	6	3	-
1999	<1	9	25	39	10	7	5	4
2000	<1	9	22	43	18	0	3	3
2001	<1	7	26	41	14	3	7	1
2002	<1	8	22	40	15	13	3	0
2003	<1	7	26	42	15	5	4	2
2004	0	9	22	48	14	3	3	1

TABLE 7 Successful moose hunter transport methods (percent) in Unit 9, 1998–2004

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
2003	57	0	21	7	10	1	2	1
2004	61	0	24	5	3	3	2	3

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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. It increased during the 1950s and reached a peak 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 (range = 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 bring it into alignment with adjacent Unit 13. In 1993, the current 20 August–20 September state season and bag limit were established.

Most of Unit 11 was included in Wrangell–Saint Elias National Monument in December 1978. In 1980 monument status was changed to park/preserve status with passage of the Alaska National Interest Lands Conservation Act. State hunting regulations still apply to private and preserve lands within Unit 11, though “hard park” lands–those within park, rather than preserve, boundaries–are managed solely by the National Park Service (NPS).

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 is usually conducted every year during the late fall to determine sex and age composition and population trends in a count area along the western slopes of Mount Drum. Because of a lack of snow, fall counts were not completed in 2002 and 2005. The survey in 2004 was dropped due to budget constraints. 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. Weather conditions have been unfavorable for burning in recent years, and wildfires affected little or no habitat this reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The only fall moose count this reporting period was done in 2003. The number of moose observed in Count Area (CA) 11 (212 mi^2; the western slopes of Mount Drum) increased. Historically, the number of moose counted has fluctuated in this count area. Moose movements and survey conditions probably account for some of the yearly variation. By comparing the average number of moose observed and moose per hour counted over 3-year periods, some annual variation in survey results due to differences in snow conditions and sightability can be minimized. From 1994 to 1996, an average of 132 moose (0.46 moose/mi^2) at a rate of 29 per hour were observed. The 3-year average between 1999 and 2001 was 106 moose (0.37 moose/mi^2) at 24 per hour, down 20% from the previous period. The 2003 count of 138 moose, at a rate of 30 moose per hour, suggests moose numbers may have increased slightly.

Population Size

An accurate population estimate is not available for all of Unit 11 because a complete census has never been conducted. 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, NPS biologists conducted a Gasaway survey in portions of Unit 11. The density estimate within the survey area was 0.58 moose/mi^2, and the extrapolated Unit 11 population estimate from the survey was 3000 moose (Bill Route, NPS, personal communication).

Based on the 2 unitwide density estimates, it appeared the Unit 11 population increased by nearly 17% between 1986 and 1993, though the continuous count data from CA-11 suggested a different trend. Within CA-11, the density remained fairly stable between 1986 and 1990, averaging 0.7 moose/mi^2, and the observation rate averaged 49 moose per hour. Between 1990 and 1992 the density dropped considerably, down to 0.1 moose/mi^2, and the observation rate dropped to an average of 31 moose per hour. The density has remained fairly low since the early 1990s, fluctuating between 0.3 and 0.4 moose per mi^2. The most recent 2003 fall composition count in CA-11 resulted in a density estimate of 0.5 moose per mi^2.

Population Composition

The bull:cow ratio averaged 120:100 for the 5 years between 1997 and 2001, and dropped slightly to 115:100 in 2003 (Table 1). These bull:cow ratios have been among the highest ever observed in CA-11. The bull:cow ratio greatly exceeds the current management goal of maintaining no less than 30 total bulls:100 cows, 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 and have ranged from 9:100 to 25:100 since 1994. An increase in yearling bulls in CA-11 from 3:100 in 2000 to 7:100 in 2003 suggests there may have been an increase in calves and perhaps an increase in calf survival since 2000.

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 post rutting concentrations normally occur in upland habitats to elevations as high as 4000 feet. Migrations to lower elevations begin with snowfall, but usually are not complete 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 general 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.

Prior to 2000, all federally taken moose were reported through the state harvest ticket system, and state and federal hunt and harvest data were combined. Since 2000, a specialized federal moose permit has been available to qualified federal subsistence moose hunters, and most local residents that hunt moose in Unit 11 hold both state harvest tickets and federal subsistence permits. Unfortunately, there is some double reporting due to hunters filling in the state harvest ticket and federal permit with identical data, causing harvests and effort data to be inflated. Known cases of successful hunter double reporting are identified, and the data altered to reflect the harvest of only a single moose. The effort data, however, is still inflated. Double reports have not yet been identified for the 2003–04 and 2004–05 seasons; therefore, the data for these years may still reflect slightly inflated harvest numbers.

Hunting pressure in Unit 11, based on general harvest ticket data, has slowly dropped since the early 1980s. The number of hunters during the 1980s ranged from 151 to 221, and averaged 186. The number of hunters during the 1990s ranged from 100 to 187, and averaged 131. The combined number of state and federal hunters since 2000 has averaged 246, though due to double reporting, most local resident moose hunters are included twice. Between 1995 and 1999, the number of local residents hunting moose in Unit 11 averaged 72 hunters. Since 2000, the number of local residents hunting moose in Unit 11, in the general harvest ticket database, has averaged 50 hunters, indicating that a portion of federal subsistence hunters no longer get a state harvest ticket for moose.

Perhaps in response to reduced moose hunting success in the adjacent Unit 13, moose harvests have increased recently in Unit 11 after reaching a low of 28 in 1998. The combined state and federal harvest for moose in Unit 11 in 2004 was 56 moose (Table 2). 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 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 illegally taken off private or state land and reported as legal bulls taken on the federal registration permit. With 2 different bag limits applying to the same GMU, it is impossible to enforce the more restrictive state bag limit, which protects small bulls, because any bull is legal under the federal subsistence regulations on federal land.

Board of Game Actions and Emergency Orders. The Board of Game took no actions affecting Unit 11 moose hunting this reporting period.

Hunter Residency and Success. Table 3 gives residency breakdowns for successful and unsuccessful moose hunters in the state general hunt. Local rural residents accounted for 20% (n=6) of the total moose taken in Unit 11 during 2004, while nonresidents took 43% (n=13). The remainder (n=10) went to nonlocal Alaska residents. Though success rates appear to have fallen over the past decade for area residents in the state harvest ticket database, most of the moose harvested by area residents are now reported through the federal permit system established by the NPS in 2000. The liberal federal subsistence regulations, allowing local rural residents to take any bull on federal land, have been in place since the early 1990s. Since reporting methods changed in 2000, the effort data must be interpreted differently.

Nonlocal state hunters are restricted by the state general hunt and a bag limit of a spike/fork bull or 50-inch bull with 3 or more brow tines, and may only hunt on private or preserve lands. Harvests by nonresidents increased in 2003 and 2004, probably due to a couple of changes. With declining sheep populations in Unit 11, some commercial guides may have shifted their effort from sheep to moose. Additionally, nonresidents with a tradition of hunting in the region may have shifted to Unit 11 after moose hunting was closed to nonresidents in the adjacent Unit 13 in 2002.

The overall hunter success rate in 2004 was 28% for the state general hunt, similar to the 5-year average of 26% during RY 2000–2004. Success rates for federal subsistence hunters have been lower, averaging 15% (range = 8–20) between 2000 and 2004 (Table 4). Successful state hunters averaged 6.9 (range = 5–6.9) days in the field to kill a moose during this reporting period, while unsuccessful hunters also averaged 6.9 (range = 6.9–8.2) days in the field. No trend was evident in this effort data.

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 mostly use aircraft, 3-or 4-wheelers, or highway vehicles to reach hunting areas (Table 6). The only trend noted in the transportation data for this reporting period is the drop in the use of 3-or 4-wheelers in the state hunt. NPS regulations limit transportation methods in Unit 11, limiting hunting opportunities throughout the unit. Aircraft cannot be used for hunter transportation in portions of the unit designated as park. Except for federal subsistence hunting, all off-road vehicle use for hunting is restricted to existing trails by permit only. Federal subsistence hunters do not need a permit to use 3-or 4-wheelers or ORVs and are not limited to existing trails; thus, their use in the state hunt may be declining because more locals are hunting from these vehicles under the more liberal federal subsistence regulations.

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 and 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 suggest early calf mortality similar to that observed in areas with documented high brown bear predation on neonatal moose calves. The Unit 11 moose population will probably remain at low densities as long as predation continues to limit 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) began suppressing fires. The benefits 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, 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.

During the 1990s, limited commercial clearcut logging occurred in the lower Chitina River Valley on privately owned lands. The willow regrowth in some of these cuts has been substantial. However, much of it remains underused by moose, because predation remains the most limiting factor for moose within Unit 11.

Enhancement

Habitat manipulation to benefit moose is not currently an option in Unit 11 because most of the area 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. Should a fire ignite under the right conditions, substantial moose habitat could be regenerated.

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 between 2001 and 2003. A slight increase was observed in moose numbers during fall counts in Unit 13 as well. The increase was attributed to the mild winters in 2001 and 2002, as well as a slight reduction in wolf numbers. Unfortunately, budget limitations and poor snow conditions prevented counts in CA-11 in 2004 and 2005. Budget shortfalls will have to be addressed and moose count areas given higher priority before counts can be resumed in GMU 11.

Given the relatively high numbers of brown bears and wolves in Unit 11, the moose population will probably remain relatively stable at the current low density for an extended period of time. Annual fluctuations may occur when predation rates respond to changing winter severity.

Moose hunting patterns have not changed considerably in Unit 11 during this reporting period for the state general hunt. The number of hunters has increased since 2000 for all hunts combined, but much of this is due to the establishment of a separate NPS federal subsistence moose permit for the federal subsistence hunt that same year. Additionally, as new communities are added to the federally qualified list by the Federal Subsistence Board, more hunters are drawn to the unit in search of moose. Unfortunately, many local federal subsistence hunters report identical information on both federal permits and state harvest tickets; thus, the effort data is artificially inflated, and it is difficult to tell if effort truly has increased. The liberal bag limit of any bull in the federal subsistence hunt draws considerably more interest than the state general hunt, which has antler restrictions.

Another recent change in moose hunting trends relates to changes in the adjacent Unit 13, where since 2002, no nonresident moose hunting has been allowed. This has shifted pressure to Unit 11 by nonresidents, mostly on guided hunts. The 5-year annual average of 10 nonresidents hunting in Unit 11 prior to this reporting period jumped to 26 in 2003 and 24 in 2004.

Nonresident harvests have increased recently as well. The nonresident success rate has averaged 57% over the last decade. That, combined with the increase in nonresident hunters, has naturally increased the harvest by that user group. The nonresident take averaged 14 during this reporting period, up from the average of 8 for 2001 and 2002.

Whether the overall increase in effort will continue is unknown, because moose numbers are low and access extremely limited. As moose numbers rebound in the adjacent Unit 13, the nonresident season may be reinstated, and some pressure may revert to Unit 13. Much of the moose harvest in Unit 11 comes from the same area each year, where there is reasonable access. Harvest by federal subsistence hunters undoubtedly includes smaller bulls protected under the more restrictive state regulation. In the accessible areas that are heavily hunted the federal subsistence any-bull bag limit may result in too many bulls being harvested, which may eventually compromise hunt success. The currently low recruitment rate due to heavy predation may further compound this problem.

Unit 11 has the potential to support more moose. The population objective of maintaining moose at existing densities (0.3 to 0.5 moose/mi^2) should be reconsidered and perhaps increased. To do this, we need to explore options available to managers to enhance the moose population consistent with NPS regulations. I recommend reviewing the control and enforcement of the moose harvest in Unit 11. Dual management creates numerous enforcement and reporting problems, such as illegally taken moose on state or private land being reported as federal subsistence moose.

LITERATURE CITED

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TOBEY R. W. 2006. Unit 11 moose management report. Pages 116–125 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Unit 11 (CA-11) fall aerial moose composition counts, 2000–2005

Year	Bulls: 100 females	Yearling bulls: 100 females	Calves: 100 females	Calf %	Adults	Total moose	Moose /hour	Density moose/mi ^{2}
2000	157	3	24	9	95	104	23	0.4
2001	94	4	9	4	89	93	19	0.3
2002	No data	--	--	--	--	--	--	--
2003	115	7	15	7	129	138	30	0.5
2004	No data	--	--	--	--	--	--	--
2005	No data	--	--	--	--	--	--	--

TABLE 2 Unit 11 Moose harvest [a] and accidental death, 2000–2005

Regulatory	Reported			Estimated			
Year	M	F	Total [b]	Unreported	Illegal	Total	Total
2000–01	45	0	46	5	5	10	56
2001–02	41	1	43	5	5	10	53
2002–03	51	0	52	5	5	10	62
2003–04 [c]	39	0	39	5	5	10	49
2004–05 [c]	55	0	56	5	5	10	66

[a] Includes state harvest tickets and federal registration permit hunts and is corrected for double reporting.
[b] Includes unknown sex.
[c] Double reporting data not available, and harvest not corrected for double reporting.

TABLE 3 Unit 11 Moose hunter residency and success for general state harvest ticket hunt only, 2000–2005

Regulatory Year	Successful: Local resident	Nonlocal resident	Non Resident	Total [a]	Unsuccessful: Local resident	Nonlocal resident	Non-resident	Total [a]
2000–01	13	8	4	30	36	39	4	80
2001–02	8	12	8	31	49	34	3	88
2002–03	10	13	8	33	50	30	8	88
2003–04	8	7	14	29	34	45	12	95
2004–05	6	10	13	30	34	34	11	79

[a] Includes unspecified residency.

TABLE 4 Unit 11 Federal subsistence permit hunt, 2000–2005

Hunt	Regulatory year	Permits issued	Percent[a] did not hunt	Number (%) unsuccessful hunters	Number (%) successful hunters	Bulls	Cows	Unknown	Harvest
RM 714	2000–01	161	16	97 (80)	24 (20)	23	0	1	24
	2001–02	183	22	113 (88)	16 (12)	14	1	1	16
	2002–03	191	27	108 (84)	21 (16)	20	0	1	21
	2003–04	243	22	107 (92)	9 (8)	9	0	0	9
	2004–05	262	30	126 (83)	26 (17)	26	0	0	26

[a] Percent of all permittees returning reports.

TABLE 5 Unit 11 Moose harvest (%) chronology by seasonal weeks for general state harvest ticket hunt only, 2000–2005

Regulatory Year	Season Dates	*Week of Season* 1st	2nd	3rd	4th	5th
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
2003–04	20 Aug–20 Sep	11	11	18	36	25
2004–05	20 Aug–20 Sep	3	3	21	34	38

TABLE 6 Unit 11 Successful moose hunter transport methods (%) for general state harvest ticket hunt only, 2000–2005

Regulatory Year	Airplane	Horse	Boat	3- or 4-Wheeler	Snowmachine	ORV	Highway vehicle	Unknown
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
2003–04	60	3	3	17	0	10	7	0
2004–05	50	7	0	13	0	13	13	3

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 began 1 July and ended 30 June (e.g., RY82 = 1 July 1982–30 June 1983), attempts were made to reduce the grizzly bear population by liberalizing grizzly bear hunting regulations. Small-scale 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 traveling the area's highways. During the 1960s, needs of consumptive and nonconsumptive users were usually met. Since the moose population declined to a low level, the hunting season and bag limit have been 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

During 2000–2003, in cooperation with Tetlin National Wildlife Refuge staff, we estimated moose population size and composition using the GeoSpatial Population Estimator method (GSPE; Ver Hoef 2001; DeLong 2006; Kellie and DeLong 2006), 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, 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 originally did not employ a sightability correction factor, as research on sightability was not completed. We flew surveys at a search intensity of 4.0 min/mi^2, so it is appropriate to multiply observable moose by about 1.25 to estimate total moose in most of Unit 12 (R. Boertje, ADF&G, unpublished data). 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. No surveys were conducted during fall or winter 2004 due to poor snow conditions. We conducted a GSPE survey in 2005 on state and private lands in northern and western Unit 12.

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 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.

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 the future when conditions allow.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In RY03 we estimated the observable Unit 12 moose population at 2900–5100 moose (±22%, 90% CI), with a search intensity of 4.0 min/mi^2. Total moose numbers were 3600–6400 using a sightability correction factor of 1.25, with an average of 5000 moose and an estimated density of 0.6–1.1 moose/mi^2 of suitable moose habitat (6000 mi^2). These results were similar to the 2001 observable population estimate of 3450–4300 moose (±16%, 90% CI, 0.6–0.7 moose/mi^2), suggesting the population was stable during the report period.

Based on data collected during annual October–November aerial composition surveys and area-specific population estimation surveys during 1989, 1990, 1994, 1997, 1998, 2000, 2001, 2003, and 2005, the moose population in Unit 12 increased slowly from 1982 to 1989 and remained relatively stable from 1989 to 1993. The population grew slightly during 1994–1997, possibly due to increased calf survival. During population growth in 1994–1997, the most apparent increase occurred in the northwest portion of Unit 12 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. During 2000–2005 the population in northwestern Unit 12 appeared stable (Table 1).

Localized moose harvest likely 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. 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. A recent effort by village councils and local community leaders to heighten awareness appears to be creating a positive change.

In spring 2000 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 IM population objective was met during RY03–RY05, but calf survival is not high enough to achieve the IM harvest objective. Based on modeling the Unit 12 trends in moose population size, the reported moose harvest must be ≤130 bulls distributed throughout the unit to protect the bull segment of the population, especially in the more accessible areas of the unit. Significantly increasing 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 (0.2–1.1 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 with habitat enhancement, increased predator harvest, and/or predator control. Resulting moose population increases probably would be moderate and eventually would be limited by predation, but could potentially be sufficient to satisfy the minimum intensive harvest objective of 250 moose.

Population Composition

We conducted moose composition surveys in Unit 12 during fall 1988–2005 (Table 2). Composition data before 1994 are not directly comparable with more recent 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, 2000–2003 and 2005 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 ensure that we would not miss a catastrophic decline in the area's moose population during years when population estimation surveys were not flown. Benefits of conducting population estimation surveys included confidence limits around composition estimates. Also, with a larger survey area, it was less likely that weather or moose distribution would affect the count. We found calf:cow ratios were lower within the high strata compared to low strata, indicating that most calf and cow pairs select for habitats not normally surveyed during trend counts. Trend count areas were located within high-density areas to maximize the number of moose counted.

During 2003 and 2005, bull:cow ratios ranged from 22–25:100 in western and northern portions of Unit 12. In 2003, the bull:cow ratio was 89:100 in eastern and southern Unit 12, but no survey was conducted in this area during 2004 and 2005. Most harvest occurred in western and northern Unit 12 and evidently 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 from the low 30s:100 to the low 20s:100 during the mid to late 1990s but has remained relatively stable since 1999. The Unit 12 bull:cow ratio west of the Nabesna River remained above the minimum population objective of 20:100.

Annually approximately 50% of the 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 apparently was not adequate to compensate for harvest. For example, the bull:cow ratio declined in recent years in these areas.

Calf survival to 5 months remained constant during RY03–RY05 (Table 2; 30–33:100 cows). There apparently was little loss of moose between the ages of 5 months and 17 months.

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 south of the Alaska Range 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–RY05, 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 these resident moose. Also, some of these moose may spend more time in the 1990 Tok River burn. Use of the Tok River valley and Tetlin Hills by moose increased substantially since the burn. 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 resulted from improved habitat from the fire and the close proximity to Tok, which allowed for moderate harvest of predators.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits in Unit 12 are summarized in Table 3.

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 beginning in 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 of Unit 12 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. In spring 2000 the board established intensive management objectives for Unit 12.

Hunter Harvest. Reported harvest in Unit 12 was 134 bulls and 1 unknown sex in RY03, 137 bulls in RY04, and 136 bulls and 2 unknown sex in RY05 (Table 4). The average reported moose harvest during RY01–RY05 was 126. The number of hunters and number of bulls harvested increased beginning in RY95. Average annual harvest during RY90–RY94 was 92 compared to 125 (34% increase) during RY95–RY05.

Total harvest represented ≤4% of the estimated prehunt population in recent years and had little impact on population dynamics. During RY99–RY05 the annual out-of-season take was estimated at 25–60 moose, mostly cows. Most out-of-season harvest occurred near communities and along the road system.

Hunter Residency and Success. During RY03–RY05, local residents accounted for an average of 49% of moose hunters, nonlocal residents averaged 39% and nonresidents 12%. 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%, 36%, and 40% respectively of the reported harvested bulls during RY03–RY05, nonlocals took 33%, 39%, and 38%, and nonresidents 27%, 25%, and 22% (Table 5). The harvest of moose by nonlocal Alaska residents increased during RY99–RY05 compared to RY93–RY98 due to a 33% increase in the number of nonlocal Alaska residents who hunted in Unit 12.

During RY03–RY05, 567, 538, and 574 hunters reported hunting moose in Unit 12 (Table 5). The 5-year average was 546 hunters during RY01–RY05 compared to the average of 518 from RY96 through RY00, a 5% increase. Increased participation by nonlocal Alaska residents, mostly from Southcentral Alaska, accounts for a majority of the increase in hunters. During

RY03–RY05 the average success rate in Unit 12 was 24% compared to 21% during RY00–RY02, and 25% during RY97–RY99.

Harvest Chronology. During RY91–RY00, an average of 33 bulls were harvested during 1–6 September (Table 6) representing 30% of the fall harvest (range = 27–35%). In an attempt to reduce the fall harvest in Unit 12, beginning in RY01, the hunting season in most of the unit 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 contrast to an average of 11 bulls harvested during 24–28 August RY01–RY05. This represents a harvest reduction of 41% during the first 5 days of the season. This reduction in harvest was not regained during the 10-day September season, until RY03–RY05, when the number of hunters increased. For example, the average harvest during RY01–RY03 was 10% lower than the RY98–RY00 average, and the average harvest for RY03–RY05 was 1% lower than the RY98–RY00 average.

In southern Unit 12 during RY03–RY05, the number of hunters who hunted the 1–30 September season ($\bar{x}$ = 31.5) and the total harvest for this season remained similar to past years. Most were either guided nonresidents or Chisana residents.

Transport Methods. During RY03–RY05, the type of transportation used most by successful hunters, on average, was 4-wheelers (34%), followed by highway vehicles (17%), airplanes (13%), boats (15%), horses (11%), other ORVs (8%), and airboats (2%, Table 7). Compared to RY98–RY00, the percentage of harvest by hunters who used 4-wheelers increased from an average of 22% to an average of 34%, while the percentage of the harvest by hunters who used highway vehicles decreased from 23% to 17%. Use of all other transportation types by successful hunters remained relatively constant.

Other Mortality

Predation by wolves and grizzly bears has likely been the greatest source of mortality for moose in Unit 12 and has likely been the major factor keeping the population at a low density since the mid 1970s. In contrast to most other areas that contain sympatric moose, wolf, and grizzly bear populations, wolves, rather than bears, appeared to be 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, the moose population is likely to remain at low densities 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 (Gasaway et al. 1983, 1992).

HABITAT

Assessment

Excessive wildfire suppression for nearly 30 years allowed vast areas of potentially good moose habitat to become dominated by spruce forests lacking abundant 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 RY03–RY05, habitat was not limiting the moose population in Unit 12, but medium- to large-scale creation of early seral species could result in a higher moose population, as evidenced by moose population increases in 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 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.

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 10–15 years.

Local residents observed the increase in moose in the area burned by the 1990 Tok wildfire. As a result, local residents are 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.

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 should be implemented, especially in areas like Unit 12 where the moose densities are very low. 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 villages' needs.

CONCLUSIONS AND RECOMMENDATIONS

During RY03–RY05, 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 relatively stable from 1997 through 2005. Moose numbers, especially in the vicinity of the road system, were very low, which primarily affected subsistence hunters and nonconsumptive users. Every year 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 upper Little Tok River drainage, an antler restriction regulation was adopted in RY96 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 because of high harvest rates.

During RY01–RY05 the most significant change in harvest patterns was the increase in the portion of the harvest by hunters using 4-wheelers (33%) compared to RY98–RY00 (22%). 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.

During RY03–RY04 the Unit 12 moose management objective of maintaining a posthunting sex ratio of at least 40 bulls:100 cows east of the Nabesna River and 20 bulls:100 cows in the remainder of the unit was met. An average of 136 moose were reported harvested annually during RY03–RY04, which did not meet the IM harvest objective of 250–450 moose. Recruitment of young moose into the population was not high enough in accessible areas of Unit 12 to achieve the IM harvest objective. To meet this harvest objective, recruitment along the road and trail systems must be improved. Modeling data indicate IM harvest objectives could be met in these portions of the unit if intensive habitat management is coupled with elevated wolf and bear harvest.

Population trends were monitored. Additional habitat enhancement programs were planned and should be implemented during the next 2 years. Hunting seasons and bag limits allowed maximum hunting opportunity and met subsistence needs. We continue to work with local villages to manage moose harvest and reduce harvest of cows for potlatch ceremonies. Moose viewing opportunities were shared with visitors and local residents.

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

HOLLIS, A. L. 2006. Unit 12 moose. Pages 126–143 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

TABLE 1 Unit 12 Northwest population estimate using GeoSpatial Population Estimator, 2000–2005

Year	Area surveyed	Survey size (mi^2)	Number of sample units surveyed	Population estimate (±90% CI)	Population estimate with SCF[a]
2000	Northwest Unit 12	2846	60	2575 (±23%)	3219
2001	Northwest Unit 12	2865	79	2204 (±15%)	2755
2003	Northwest Unit 12	2845	69	3064 (±35%)	3830
2005	Northwest Unit 12	2845	48	2129 (±15%)	2661

[a] Sightability correction factor of 1.25 used in estimate.

TABLE 2 Unit 12 aerial moose composition counts, fall 1988–2005

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	16	
2005[g,h]	22	11	30	384	315	69	18	

[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 3 Unit 12 moose hunting seasons and bag limits, regulatory years 2003–2004 and 2004–2005

Regulatory year	Area	Season		Bag limit[a]
2003–2004	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:	1–30 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	1–30 Sep	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.
2004–2005	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:	1–30 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.
		Nonresident:	1–30 Sep	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.

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

TABLE 4 Unit 12 moose harvest and accidental death, regulatory years 1990–1991 through 2005–2006

Regulatory year	Harvest by hunters									Accidental death		Total
	Reported						Estimated					
	M	(%)	F	(%)	Unk	Total	Unreported	Illegal	Total	Road	Total	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
2004–2005	137	(100)	0	(0)	0	137	20–50	3–10	23–60	3–5	3–5	163–202
2005–2006	134	(99)	0	(0)	2	136	20–50	3–10	23–60	3–5	3–5	162–201

TABLE 5 Unit 12 moose hunter residency and success, regulatory years 1990–1991 through 2005–2006

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)	508
1997–1998	43	29	30	0	102 (21)	245	125	14	0	384 (79)	486
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
2004–2005	49	53	34	1	137 (25)	204	167	30	0	401 (75)	538
2005–2006	53	51	30	2	136 (24)	234	167	35	2	438 (76)	574

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

TABLE 6 Unit 12 moose harvest chronology by month/day, regulatory years 1990–1991 through 2005–2006

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		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	124
2003–2004	12	2	63	40	12	2	134
2004–2005	7	3	68	43	10	4	135
2005–2006	12	0	58	43	7	7	127

[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.

TABLE 7 Unit 12 moose harvest percent by transport method, regulatory years 1990–1991 through 2005–2006

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
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
2004–2005	15	11	15	36	0	7	15	1	137
2005–2006	13	10	13	36	0	7	19	1	136

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[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 bull harvest dropped to 557 in 1980, down 34% from the 1979 harvest of 848. From 1981 through 1988 the population increased, as did the harvest, which peaked in 1988 at 1259 moose. Since 1990, the harvest regulations have been through several changes in response to severe winters, increased predation, and low bull:cow ratios.

By the late 1990s, the wolf population in Unit 13 had grown so large that predation-caused mortality was exceeding annual recruitment each year. As a result, the moose population declined rapidly between 1997 and 2002. A wolf control implementation plan was adopted in 2000 to help stop the decline. Since then, wolves have been reduced substantially across central

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

Unit 13, the moose decline has stopped, and the population appears to be moving into the recovery stage.

MANAGEMENT DIRECTION

POPULATION OBJECTIVE

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

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

We conducted aerial surveys during the fall to learn sex and age composition and population trends in large count areas distributed throughout the unit. Additional surveys, using techniques developed by Gasaway (1986) and Ver Hoef (2001), have been conducted periodically in different portions of the unit to obtain detailed population estimates.

We flew surveys during calving season to determine percent twins at birth, and monitored harvests by requiring permit and harvest ticket reports from all hunters. Computer modeling of the moose population has been used to help explain past trends as well as predict future trends.

Moose habitat improvement planning included 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. The Alaska Department of Natural Resources (DNR) and the federal Bureau of Land Management (BLM) ignited a controlled burn in the Alphabet Hills in 2003; approximately 5000 acres burned. The fire was ignited again late during the summer of 2005, and total acreage burned increased to 41,000 acres. A donation from the Safari Club International allowed us to establish browse plots in the summer of 2005 within the burn to evaluate vegetation regrowth. An additional moose count area was also established during the fall of 2005 within the burn to help evaluate the response in moose numbers.

On a smaller scale, a 50-acre mechanical browse-crushing project was carried out during the spring of 2006 to improve overwinter survival in a critical area along the lower Chistochina River. The project was funded by the Alaska Soil and Water Conservation District, Alaska Department of Fish and Game (ADF&G), and Cheesh'na Tribal Council. Staff from ADF&G, along with BLM, will cooperatively monitor vegetation regrowth and the overall benefit to moose. The project will also be used as an educational tool within the Copper River valley to promote healthy moose habitat and additional projects to further benefit moose through habitat manipulation.

In addition to general habitat projects, staff evaluated and responded to several land-use proposals that could affect moose habitat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

We monitor long-term population trends for moose by observing changes in the number of moose counted in established trend count areas during the fall each year (Table 1). Sex and age composition data are also recorded during these counts. Many of these counts have been done consistently across Unit 13 since the early 1960s. Collectively, the data from the core count areas are referred to as the continuous count area data (Table 2).

Moose per hour of survey time is one aspect of this count area data that we use to estimate population trends. This index is thought to be a reliable indicator of long-term trends in moose numbers because it minimizes the effects of moose movements and survey conditions. The rate of moose observed per hour in the continuous count areas in Unit 13 declined more than 47% from 75 in 1988 to less than 40 between 2000 and 2002. We attribute this decline to increased overwinter loss during a series of severe winters in the early 1990s and again in 1999, along with increased wolf predation from the mid 1990s on. Moose per hour rates since 2002 have improved to 40–47 between 2003 and 2005 (Table 2). We attribute this increase in the moose per hour rate to increased survival during mild winters in 2001, 2002, and 2003 and to a decline in wolf predation since wolf control efforts started in 2000.

The ADF&G research staff has done several additional surveys since 1994 to further address population dynamics in the moose study area in western 13A. The staff conducted Gasaway moose surveys in this area in 1994 and 1998 and slightly modified Ver Hoef surveys (Geostatistical Population Estimator surveys [GSPE]) between 1999 and 2001, and again in 2004. The moose density reported in the 1994 survey was 2.09 moose/mi^2 (Ward Testa, ADF&G files). The 1998 survey resulted in a density estimate of 1.47 moose/mi^2. Though a decline was also documented in the count area index, it was less severe. Moose continued to decline from 1998 until 2001, according to both the survey data and the count area index. The density estimate from the Verhoef survey in 2001 was 0.93 moose/mi^2, an overall decline of 56% since 1994. Survey conditions were good in all years, and the results are thought to represent an actual decline in moose and not survey or weather-related variations. The most recent Ver Hoef survey in 2004 showed a density estimate of 1.0 moose/mi^2, and similar to the trend seen in the count area data, it shows that the decline in moose numbers has stopped.

Population Size

Unit 13 covers nearly 24,000 mi^2 over 5 subunits. Though it is not possible to survey the entire area, we fly up to 130 hours annually in established moose count areas that cover nearly 4800 mi^2. The continuous count areas alone cover nearly 3900mi^2. Density estimates from fall 2005 counts ranged from a low of 0.4 moose/mi^2 in subunit 13D to a high of 1.4 moose/mi^2 in count area 10 within subunit 13C. An average of 1.1 moose/mi^2 was observed within the continuous trend count areas during 2005 (Table 3), up 10% from the 1.0 moose/mi^2 estimate between 2000 and 2002, when moose numbers bottomed out. Similar to the trend seen in the moose per hour rate, moose densities observed between 2000 and 2002 were down 47% unitwide from the 1987 high of 1.9 moose/mi^2. The densities observed in count areas cannot be directly extrapolated unitwide to a population estimate because count areas are located in upland fall concentration areas; thus, densities are not representative of the habitat unitwide.

Population Composition

Population composition data collected during fall sex and age composition counts from 2000 through 2005 are presented in Tables 1 and 2. The bull:cow ratio in Unit 13 in continuous count areas increased from 20 bulls:100 cows in 2000 to 27 bulls:100 cows in 2005. An analysis of the bull:cow ratio by age class indicates an increase of 4 yearling bulls:100 cows from 2000 to 2005 (Table 2). The recent increase in yearling bulls has been due in part to improved calf production due to mild winters, as well as increased overwinter survival of calves due to a reduction in wolves. Although recruitment of yearling bulls appears to be down 46% from the 13 yearling bulls:100 cows observed in 1988, due to changes in harvest regulations, the yearling bull:100 cow ratios are no longer directly comparable to past ratios. Current harvest regulations allow a portion of the yearling bulls that have spike or fork antlers to be harvested prior to the composition surveys, so the yearling bull ratios are no longer a complete picture of recruitment.

Fall calf:cow ratios in the continuous count areas were 22:100 in 2004 and 18:100 in 2005 (Table 2). Between 1978 and 1988, when moose numbers increased in Unit 13, calf production and survival were high, represented by calf:cow ratios of 22 to 31:100 in the fall. The calf:cow ratio in 2000 was the lowest annual estimate ever observed in GMU 13, 11:100 cows. Calf:cow ratios the last 4 years have shown improvement, ranging from 18 to 24:100, and are the best observed since the early 1990s, when the population was coming off a peak. The recent improvement in calf ratios coincides with wolf reductions under the Unit 13 predator control program.

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 weather-related 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 40, down by 15%. The cow per hour rate continued to decline over the next few years. Since 2003, though, the rate has stabilized at 30 cows per hour, a 36% decline since the high in the late 1980s.

Productivity

Productivity estimates are only available for portions of Unit 13 and should not be directly extrapolated to the remainder of the unit. Research by Ballard et al. (1991) showed pregnancy rates of 72–88% between 1977 and 1985 across 13A and 13B. The lower rates were attributed to misdiagnosis and a disproportionate number of older cows in the sample population. During the early 1990s, because of relatively high moose numbers and harvest pressure in western 13A, along with direct competition from the Nelchina Caribou herd, moose research in this area focused specifically on productivity. The radiocollared moose in the study area were subjected to ultrasound pregnancy exams during November of 1994, 1995, and 1997. Results showed average pregnancy rates near 88%, which were maintained until spring in 2 of the 3 years (Testa 1997). These pregnancy rates approach those observed during earlier research by Ballard et al. (1991), when calf recruitment was higher.

The fall in utero twinning rate was 26% (n=43) for radiocollared cows in 13A tested by ultrasound in 1994 and 1995 (Testa and Adams 1998). The twinning rate at birth for collared cows in 13A, based on calf observations, has averaged 18% (range = 9–27) between 1994 and 2004. Twinning rates are obtained in other subunits by aerial surveys in early June, just past the peak of parturition. Twinning rates averaged 30% (range = 29–34) for portions of 13B, C and E between 1992 and 1997, then dropped to an average of 14% (range = 11–17) between 1998 and 2000. The number of twins observed starting in 2002 increased appreciably, peaking at 32% in 2004, and averaged 28% (range = 22–32) over these last 3 years. No twinning surveys were done in 2005 because of budget constraints. For Interior Alaska moose populations, twinning rates of ≥20% indicate average to above average productivity.

Distribution and Movements

Data from fall surveys are represented in Table 3. Moose were most abundant along the southern slopes of the Alaska Range in 13B and 13C and in the eastern Talkeetna Mountains in western 13A. Subunit 13D and the Lake Louise Flats (eastern 13A) had the lowest observed densities. Historically, moose numbers in western 13A, 13B, and 13C have fluctuated more than the lower density areas of eastern 13A and 13D.

Fall rutting and postrutting concentrations are in subalpine habitats. The distribution of wintering moose depends on snow depth. Moose move down to lower elevations as snow depth increases. Known wintering 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

Season and Bag Limit. Season dates were 1–20 September for the general moose hunt under state regulations. 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, and 150 Tier II permits were issued. Tier II moose permits are limited to 1 per household. The Tier II hunting season during this report period was 15–31 August. A federal subsistence hunt has been in place in Unit 13 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 reported harvest of 468 moose from all hunts is the lowest take in GMU 13 in 40 years (Table 4). The Unit 13 moose harvest declined 63% between 1993, when 1278 moose were taken, and 2001. Total harvest figures for 2004 and 2005 were 619 and 616 respectively, a 32% increase from 2001. Hunting pressure in Unit 13 peaked at 6110 hunters in 1996, though as the moose population declined, so did the hunting pressure. By 2002, only 3443 hunters reported hunting in Unit 13, a 43% decline. Though the number of hunters has increased slightly over the past few years, pressure remains low, with only 3594 reported hunters in 2004.

Board of Game Actions and Emergency Orders. In 1999 the board reduced the general moose season in Unit 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 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.

The Board of Game also passed a wolf control implementation plan during March 2000. During the fall 2003 meeting, the board authorized a land-and-shoot control program by permit for portions of subunits 13A, B and E as a component of the overall wolf control plan. During the March 2005 meeting, the board added subunit 13C to the plan.

General Hunt. Harvest tickets from 2004 showed 510 moose taken by 2923 hunters during the general state hunt (Table 5). Harvests in all units except 13B and 13C increased in 2004.

Permit Hunts. The current BLM 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 (<2% of Unit 13). Harvests under this permit hunt are presented in Table 6. This is a very popular hunt for Unit 13 residents, as well as residents of Delta, shown by the high number of hunters getting permits. Harvests are low, averaging 50 per year, and have been relatively stable with no trend evident. Because the amount of federal land open for this hunt is extremely limited, accounting for <2% of the moose habitat in GMU 13, the fact that the federal harvest accounts for up to 8–10% of the yearly unitwide moose harvest 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) for any bull was initiated in 1995, with 150 permits allocated under the Tier II permitting system. The harvest in 2004 was 55 bulls and 1 of unknown sex (Table 6). Between 2000 and 2004 the harvest increased 40%, and the hunter success rate increased from 32% to 49%. This hunt became more important to permit holders when moose numbers began to decline in the late 1990s. Of the total unit moose harvest, this subsistence harvest has gone from 3% in 1995 to 9% in 2004. 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 (36 inches vs. 52 inches in 2004). 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 season. The general hunt begins the day after the subsistence hunt closes.

Illegal Harvests. Unreported and illegal harvest estimates are presented in Table 4. The estimate for the illegal take is high, (and I believe could even 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 a number of 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. Some illegal bulls that are taken and transported home without detection are probably reported as legal kills. 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 (residents of Unit 13) accounted for 9–13% of the moose harvested under the general season, according to harvest ticket returns (Table 5). 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 17% in 2004, up from the 13% in 2001 and similar to the 16–17% observed between 1996 and 1999 (Table 5). Hunter success for the 10-year period before 1993 averaged 24%. The hunter success rate in 2004 for the Tier II subsistence permit hunt was 49%, and 9% for the federal subsistence hunt (Table 6). Effort has remained steady among successful moose hunters in the general hunt during this reporting period, averaging 7.4 and 7.1 days per hunter for 2003 and 2004 respectively. Unsuccessful hunters averaged only slightly more effort during the same 2 years, reporting an average of 7.7 and 7.5 days per hunter. The average hunt length has increased compared to 1989, when harvest ticket returns showed that 3556 hunters reported an average of 6.0 days hunting for a total of 21,240 days hunting moose in Unit 13. Hunting effort peaked in 1995 when 5483 general season hunters spent an average of 10.2 days hunting, for a total of 55,938 days afield. By 2004, reported hunting effort had declined 62%, to 21,259 days afield.

Harvest Chronology. Chronology data for the general hunt are presented in Table 7. The last 2 weeks of the season have accounted for more than 60% of the harvest in every year since 2001. 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, and their use is increasing (Table 8). It is obvious that Unit 13 is an important 4-wheeler and off-road vehicle (ORV) area for moose hunters. In 2004, those using either 4-wheelers or ORVs were the largest group of hunters and have accounted for 73% of the total moose harvest. For the past 10 years, the use of 4-wheelers has continuously increased, while all other transport methods have slowly declined.

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 for calves. Because bears kill so many calves, a substantial reduction in the bear population can result in increased calf survival that is carried over as spring recruitment (Ballard et al. 1987). The hunting regulations have continuously been liberalized for brown bears in Unit 13 over the past decade in an attempt to reduce the population substantially.

Wolf numbers in Unit 13 started increasing in 1990. The fall 1999 and 2000 unitwide estimates exceeded 500 wolves (>11.7 wolves/1000km^2) and were the highest in more than 25 years. Based on the continuous moose count area data and the unitwide wolf population estimate, the fall 2000 moose-to-wolf ratio was 31:1. Considering that wolves in Unit 13 continue to prey on moose even when caribou are present (Ballard et al. 1987), this extremely low ratio alone could explain the recent decline in moose. Wolf numbers started declining in 2002, after implementation of a wolf control program. The moose-to-wolf ratio has since improved to 46:1, and the fall wolf population estimate in 2004 was down to about 375 wolves (9.3 wolves/1000 km^2).

Winter mortality due to deep snow conditions is monitored by measuring snow depths at 17 established snow courses throughout the unit. A winter severity index is then developed. The historical winter severity index for Unit 13 includes data back to 1963. The winter severity index for the period covered by this report shows that the winter of 2004–05 was classified as severe and had the deepest snows in over 15 years, especially in 13E, which had record snow depths. The winter of 2000–01 was considered moderate while 2001–02, 2002–03, and 2003–04 were mild winters. 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 is about 30 inches deep. As the snowpack increases, yearlings, then adult bulls, and finally adult cows die, regardless of moose densities. Deep snow also influences survival of neonatal calves the following spring. If cows are in poor condition at parturition, neonatal survival declines, resulting in lower calf:cow ratios the following fall. In addition to killing moose, deep snows often make it easier for wolves to take moose, which increases predation mortality.

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 began. 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 limited application in Unit 13. The climate in Unit 13 typically prevents the use of prescribed fire, except in the driest years. 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 has been ongoing, and a prescribed fire was completed in 2004. The Alphabet Hills controlled burn was ignited in August 2004 and approximately 40,000 acres 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 and 2003, but in both instances the fires did not carry because moistures were too high and the weather changed abruptly. Plans call for another ignition attempt in 2006, 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 its use to small but important concentration areas near the road system where access for heavy equipment is available. One such small site near Paxson 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. A small 50-acre site just east of Chistochina in 13C was crushed during March of 2006. Vegetation regrowth will be monitored over the next several years.

CONCLUSIONS AND RECOMMENDATIONS

Survey data from 1994 and 1998–2001 indicated a 50% decline in the moose population in western 13A. Declines occurred in all sex and age classes. Declines were evident unitwide in moose trend count area data during the same time period. Declining moose-per-hour rates and moose densities were observed.

Moose count data between 2001 and 2005 suggest the decline in moose ended in 2002. The moose per hour rate has improved slightly, along with the overall density observed since 2002.

Two important factors contributed to the turnaround: increased calf survival and total overwinter moose survival. The winters of 2001–02, 2002–03, and 2003–04 were classified as mild, both in snowfall and temperature. During mild winters, there is little winter kill, and predation rates decline as wolves have a more difficult time killing moose. The wolf population also declined by nearly 30% following record-high wolf harvests under the wolf control implementation plan. The increase observed in the Unit 13 moose population might have been even larger if the winter of 2004–05 had not been the most severe one observed in more than 15 years. Subunit 13E had record snow depths, and not unexpectedly, count data from 13E reflected lower moose survival.

The calf:cow ratios observed during fall sex and age composition counts between 1998 and 2001 were the lowest ever seen in Unit 13, and 25–30% below levels observed in the 1980s, when moose were increasing. The calf:cow ratios observed in 2002 and 2004 were the highest in 6 years. Both increases occurred following high wolf harvests and mild winters. The poorest fall calf:cow ratios occurred in years with the highest wolf estimates. The calf:cow ratio declined only slightly in 2005 and was variable across the unit, with lower ratios observed in western 13A and 13E. Lower calf ratios in western Unit 13 could in part be attributed to the severe winter in 2004–05 weakening pregnant cows. Considering calf production has changed little over the past 26 years, based on pregnancy and birth rates for radiocollared cows, the low calf:cow ratio can most likely be attributed to poor calf survival. Overall, calf:cow ratios have improved but have not reached the levels observed during the 1980s, when wolf numbers were down and moose were increasing. The twinning rate, a typical indication of range quality for moose, has fluctuated between years and subunits, generally due to a combination of weather-related influences on productivity and predation on young calves. Regardless of annual fluctuations, the twinning rates in Unit 13 are typical of an Interior Alaska moose population on mature range with more than adequate productivity.

The bull:cow ratio has increased consistently since 1994. The 2004 and 2005 bull:cow ratios are at levels last observed in the late 1980s and meet the minimum bull:cow ratio objective of 25:100. Yearling bull:cow ratios have also increased during this period, suggesting that the increase in total bulls is due in part to increased overwinter calf survival and not just due to the more restrictive 4 brow tine regulation. The yearling bull ratio of 7:100 in 2005 falls well below the management objective of 10:100, though it has improved considerably from the 3:100 seen in 2000 and 2001. Reaching the objective of 10:100 may be difficult since more than 50% of the yearling bulls are thought to be spike/fork bulls, thus legal for harvest. Since 1996, the general season yearling take has ranged from 135 to 311, and has averaged 34% of the total harvest. Though these young bulls were removed from the population, as long as the overall bull:cow ratio remains near or above the objective, this yearling take will be sustainable.

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 was the top bull harvest unit in the state. Harvests and hunting pressure bottomed out in 2001, with only 468 moose reported by approximately 3500 hunters. This represents a decline of almost 50% in harvest and hunting pressure and closely parallels the estimated decline in overall moose numbers. Since 2001, harvests have increased by about 150 moose (30%), but hunting effort remains low.

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

TOBEY, R. W., AND R. A. KELLEYHOUSE. 2006. Unit 13 moose management report. Pages 144–158 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Unit 13 fall aerial moose composition counts, 2000–2005

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves %	Adults observed	Total moose observed	Moose /hour	Density moose/mi^2 (observed range)
2000 [a]	20	3	12	9	4238	4642	37	1.0 (0.4–4.4)
2001 [b]	22	3	15	11	4127	4642	34	1.0 (0.5–4.5)
2002 [c]	27	7	23	16	2098	2485	33	1.0 (0.5–1.9)
2003 [d]	24	8	18	13	3902	4457	49	1.3 (0.5–5.0)
2004 [e]	28	6	22	15	3355	3932	41	1.1 (0.4–3.6)
2005 [f]	27	7	18	13	3500	4009	45	1.1 (0.4–1.4)

[a] Areas counted in 2000 were 3, 5, 6, 7, 10, 13, 14, 15, 16, 17, 21, 22, and 23.
[b] Areas counted in 2001 were 3, 5, 6, 7, 10, 13, 14, 15, 16, 17, 21, 22, and 23.
[c] Areas counted in 2002 were 5, 10, 13, 14, 15, 16, 17.
[d] Areas counted in 2003 were 3, 5, 6, 10, 13, 14, 15, 16, and 17.
[e] Areas counted in 2004 were 3, 5, 6, 10, 13, 14, 15, 16, and 17.
[f] Areas counted in 2005 were 3, 5, 6, 10, 13, 14, 15, and 16.

TABLE 2 Unit 13 fall aerial moose composition counts in continuous count areas 3, 5, 6, 10, 13, 14, 15, and 16, 2000–2005

Year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves %	Adults observed	Total moose observed	Moose /hour	Density moose/mi^2 (observed range)
2000	20	3	11	8	3257	3549	39	1.0 (0.4–1.4)
2001	23	3	15	11	3086	3466	37	1.0 (0.6–1.4)
2002 [a]	27	7	24	16	2022	2398	32	1.0 (0.5–1.2)
2003	24	8	18	12	3707	4230	47	1.2 (0.5–1.7)
2004	28	6	22	15	3215	3768	40	1.1 (0.5–1.5)
2005	27	7	18	13	3500	4009	45	1.1 (0.4–1.4)

[a] Count areas 3 and 6 were not flown in 2002.

TABLE 3 Unit 13 fall 2005 aerial moose composition counts by subunit in continuous count areas 3, 5, 6, 10, 13, 14, 15, and 16

Unit	Bulls: 100 cows	Yearling bulls:100 cows	Calves: 100 cows	Calves %	Total moose observed	Moose /hour	Density moose mi^2
13A	26	8	14	10	1266	50	1.3
13B	27	7	23	15	1891	45	1.3
13C	21	7	18	13	329	42	1.1
13D	85	7	7	4	138	25	0.4
13E	21	6	16	12	385	48	0.9

TABLE 4 Unit 13 moose harvest [a] and accidental death, 2000–2005

Regulatory	Reported				Estimated			Accidental			Grand
year	M	F	U	Total[b]	Unreported	Illegal	Total	Road	Train[c]	Total	total
2000–01	550	3	9	562	25	25	50	50	26	76	688
2001–02	463	0	5	468	25	25	50	50	8	58	576
2002–03	571	0	3	574	25	25	50	50	5	55	679
2003–04	617	1	1	619	25	25	50	50	12	62	731
2004–05	609	0	7	616	25	25	50	50	43	93	759

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

TABLE 5 Unit 13 moose hunter residency and success for general harvest ticket hunt only, 2000–2005

	Successful				Unsuccessful				
Regulatory year	Local resident [a]	Nonlocal resident	Non-resident	Total [b]	Local resident [a]	Nonlocal resident	Non-resident	Total [b]	Total hunters
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
2003–04	64	425	1	496	337	1943	4	2305	2801
2004–05	48	458	1	510	317	2075	10	2413	2923

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

TABLE 6 Unit 13 moose harvest data for permit hunts, 2000–2005

Hunt Number	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	Cows	Unknown	Harvest
State Tier II	2000–01	150	9	68	32	40	0	--	40
TM300	2001–02	150	11	72	28	35	0	--	35
	2002–03	150	8	58	42	54	0	--	54
	2003–04	150	12	52	48	62	0	--	62
	2004–05	134	10	51	49	55	0	1	56
Federal	2000–01	800	30	91	9	45	0	0	45
Subsistence	2001–02	935	34	93	7	38	0	0	38
BLM	2002–03	1103	36	91	9	54	0	0	54
RM313/314	2003–04	1075	32	89	11	60	1	0	61
	2004–05	1062	38	91	9	49	0	1	50

TABLE 7 Unit 13 moose harvest chronology percent by week for general harvest ticket hunt, 2000–2005

Regulatory year	Season dates	Week of harvest [a] 1st	2nd	3rd	4th	*n*
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
2003–04	1 Sep–20 Sep	7	24	33	36	487
2004–05	1 Sep–20 Sep	6	24	40	29	493

[a] Weeks end 1 September, 8 September, 15 September, and 22 September.

TABLE 8 Unit 13 moose harvest percent by transport method for successful general harvest ticket hunters, 2000–2005

	Percent of Harvest								
Regulatory year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Airboat	Unknown	*n*
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
2003–04	8	1	7	47	0	20	14	1	2	496
2004–05	7	2	5	54	0	18	11	0	1	510

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

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

GEOGRAPHIC DESCRIPTION: Matanuska Valley

BACKGROUND

Moose were scarce in the Matanuska Valley when colonists arrived and settled during the 1930s, but probably grew to numbers approaching 7000 during the 1960s (Griese 1996). Moose numbers fluctuated with deep snow winters but stabilized at 5000–6000 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 (1960–71) ranged from 20 to 1300 (Griese 2000). The harvest was predominantly bulls, averaging 350 annually, but the harvest of antlerless moose was as high as 1131 in 1962–63 (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 total 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 general season harvest averaged 354 (range = 226–498) (Del Frate 2004).

The human population in the Matanuska–Susitna region 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 region. Since 2000, the average road kill has increased to 194. The number of moose killed by the Alaska Railroad seems to reflect snowfall and varies widely from year to year.

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 occurred 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 Alaska Department of Fish and Game (the department or ADF&G) have begun a 5–10 year habitat enhancement project in the Matanuska Valley Moose Range. After 5 years, 375 acres of aspen forest were clearcut to produce early successional growth to benefit grouse, moose, and other species.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

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

Ver Hoef Spatial Estimator Surveys were conducted 7–12 December 2003 (Ver Hoef 2001). This generated a population estimate and age and sex statistics, including bull to cow ratios, calf to cow ratios, and numbers of yearling bulls. During these surveys, bulls were categorized as yearlings (spike/fork) medium (<50 inch or 3 brow tines), or large (>50 inch or 3 brow tines).

The harvest was monitored through harvest and permit reports from Unit 14A hunters. 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 Alaska 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 decreased slightly in 2003 (6564 ± 748) (Table 1). No surveys were flown in 2004.

Population Composition

We observed 19 bulls:100 cows in the fall of 2001 (Table 1). 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 general open season was 10–17 August for archery-only hunters and 20 August–30 September for all 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 (SF50).

The department issued 50 drawing permits for antlerless moose for the 20 August–30 September period in 2001 and 400 permits for antlerless moose in 2002. In 2003 the season length was reduced to 20 August–25 September, and the number of permits was reduced to 390. The number of permits was further reduced to 280 in 2004.

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 previous population objective of 5500. The board increased the population objective (from 5000–5500 to 6000–6500) and extended 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 and 2005 meetings, the board considered proposals to modify moose hunting and the SF50 management strategy, but took no action.

Hunter Harvest. During the past 10 years the moose harvest has fluctuated from 320 to 851 moose depending on herd status and the number of permit hunts. The bull moose harvest for the past 5 years has remained relatively consistent, averaging 352 moose (range 314–415).

Permit Hunts. 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, DM409). The department increased the number of cow permits to 370 in 2002 (harvest of 202) in order to keep the moose population within objectives and subdivided the permit area into smaller, manageable units. The permits were reduced in 2003 to 390, resulting in 177 moose taken, and reduced again in 2004 to 280 permits, resulting in 137 moose taken.

Hunter Residency and Success. An average of 2864 people hunted in Unit 14A during the previous 5 years. Local residents of Unit 14 consistently make up the majority of the hunters, harvesting 96 to 98 percent of all moose taken in Unit 14A. Hunter success ranged from 11 to 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 2001–02 consequently 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 10-year period 1995–2005 averaged 172 (range 85–252) 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 multiyear project enhancing habitat in the Matanuska Valley Moose Range. To date, 375 acres of predominantly aspen forest have been cut.

CONCLUSIONS AND RECOMMENDATIONS

The new harvest objective has been met since it was increased in 2001(Table 3). The antlerless permits have helped achieve this objective. Harvest of antlerless moose is needed to maintain the population size at levels specified by the management objective.

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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PELTIER, T. C. 2006. Unit 14A moose management report. Pages 159–171*in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003 –30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 14A fall aerial moose composition surveys and censuses, 1995–2005

Regulatory year	Bulls: 100 Cows	Yearling Bulls: 100 Cows	Calves: 100 Cows	Calves(%)	Adults observed	Moose observed	Moose / mi^2	Estimated population size
1995–96 [a]	--	--	--	--	--	--	--	5000–5500
1996–97 [c]	23	6	42	25	1696	2290	n/a	5500–6500
1997–98 [d]	14	5	30	21	611	774	n/a	5000–6000
1998–99 [e]	17	7	33	22	1191	1509	3	4729±530[b]
1999–00 [e]	19	10	37	24	1021	1317	3.4	5348±721[b]
2000–01 [e]	18	7	37	19	1300	1693	3.5	5552±571[b]
2001–02 [e]	19	8	34	22	1781	2301	4.2	6679±453[b]
2002–03 [a]	--	--	--	--	--	--	--	--
2003–04 [f]	21	9	29	19	1498	1869	4.1	6564+748[b]
2004–05 [a]	--	--	--	--	--	--	--	--

[a] No surveys.
[b] 80% confidence interval.
[c] Combined results of Matanuska River drainage east of Moose Creek and composition surveys in CAs 1–7 and Pt. MacKenzie.
[d] Incomplete Becker survey due to antler drop.
[e] Modified Becker survey (nonrandom sampling but duplication of 1991 sampling units).
[f] Ver Hoef Spatial Estimator Survey method.

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

Regulatory year	Date	Count areas	Total moose	Calves[a]	Percent calves
1990–91	Mar 4–11	5,6 & 8	1348	167	12
1991–92	Feb 25	7	121	26	21
	Apr 10	3–6 & 8	546	76	14
1992–93	Mar 24	4–8	693	131	19
1993–94	Mar 5–9	4–8	981	175	18
1994–95	Apr 3–4	4–8 & Pt. McKenzie	518	75	14
1995–96	Mar 28	6 & Pt. McKenzie	471	85	18
1996–97	Apr 8–9	5, 6, 8 & Pt. MacKenzie	226	53	23
1997–98	no surveys				
1998–99	Mar 12–15	4–8 & Pt. MacKenzie	1178	201	17
1999–00	MAR 8–10	1, 2, 4–8 & PT. MACKENZIE	1291	222	17
2000–01	Mar 26–Apr 2	1–8 & Pt. MacKenzie	633	120	19
2001–02	Mar 28–29	1, 3, 5–8 & Pt. MacKenzie	899	148	16
2002–03	no surveys				
2003–04	Apr 14	6, 8	80	25	31

[a] Calves = short yearlings.

TABLE 3 Unit 14A moose harvest[a] and accidental death, 1995–2005

	Reported				Estimated			Accidental deaths[e]			Grand
Regulatory year	M	F	Unk	Total[b]	Unreported[c]	Illegal[d]	Total	Road	Train	Total	total
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	314	1	5	320	22	60	82	133	7	140	541
2001–02	345	31	7	383	24	60	84	252	15	267	734
2002–03	328	215	1	544	23	60	83	130	2	132	759
2003–04	415	177	2	594	29	60	89	247	21	268	951
2004–05	360	134	3	497	25	60	85	209	14	223	804

[a] Includes permit hunt harvest.
[b] Includes moose of unknown sex.
[c] Derived by taking 7% of the reported harvest of bulls.
[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, 2001–2005

Hunt	Regulatory year	Applicants	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	Cows	Unk	Total
DM400, 14A, Susitna River										
	2001–02	2479	60	7	37	57	4	30	0	34
	2002–03	2248	50	12	46	42	0	21	0	21
	2003–04	1931	40	15	53	33	0	13	0	13
	2004–05	1460	30	17	50	33	0	10	0	10
DM401, 14A, Susitna River, Figure Eight Lake										
	2004–05	477	10	0	10	90	1	8	0	9
DM402, 14A, Point Mackenzie										
	2001–02	3216	50	2	38	60	3	27	0	30
	2002–03	3126	50	10	16	74	0	37	0	37
	2003–04	2806	50	6	34	60	0	30	0	30
	2004–05	2985	51	6	25	69	2	33	0	35
DM403, 14A, Big Lake										
	2001–02	1498	20	5	25	70	0	14	0	14
	2002–03	1562	20	5	40	55	0	11	0	11
	2003–04	1563	20	10	25	65	0	13	0	13
	2004–05	1425	20	5	30	65	0	12	1	13
DM406, 14A, Bald Mountain Ridge										
	2001–02	2167	50	12	40	48	0	24	0	24
	2002–03	1970	50	10	46	44	0	22	0	22
	2003–04	1963	40	0	62.5	37.5	0	15	0	15
	2004–05	1925	40	5	37.5	57.5	0	23	0	23

TABLE 4 continued

Hunt	Regulatory year	Applicants	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls	Cows	Unk	Total
DM407, 14A, Matanuska River, North										
	2003–04	3430	60	8	33	58	1	34	0	35
	2004–05	2879	60	12	38	50	0	30	0	30
DM408, 14A, Matanuska River, South										
	2003–04	976	30	10	53	37	0	11	0	11
	2004–05	819	30	13	47	40	0	12	0	12
DM409, 14A, Matanuska River										
	2001–02	4803	50	8	32	60	0	30	0	30
	2002–03	4192	150	9	33	58	1	86	0	87
	2003–04	3656	100	7	31	62	2	60	0	62
DM410, 14A, Knik River										
	2001–02	3042	70	11	43	46	1	31	0	32
	2002–03	2290	50	6	46	48	0	24	0	24
	2003–04	2068	40	5	45	50	2	18	0	20
	2004–05	1992	40	8	20	73	0	29	0	29

TABLE 5 Unit 14A moose hunter residency and success[a], 1995–2005

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[b]	Nonlocal resident	Non-resident	Unk.	Total (%)	Local resident[b]	Nonlocal resident	Non-resident	Unk.	Total (%)	
1995–96	292	11	2	3	308 (9)	3009	84	22	13	3128 (91)	3436
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	331(12)	2440	62	21	28	2551 (88)	2882
2000–01	295	14	7	3	319 (11)	2424	51	38	16	2529 (89)	2848
2001–02	327	13	11	2	353 (13)	2256	46	30	12	2344 (87)	2768
2002–03	306	11	12	0	329(11)	2489	51	46	4	2590 (89)	2910
2003–04	385	16	14	0	415 (13)	2590	63	38	0	2691 (87)	3106
2004–05	329	9	14	0	352 (13)	2295	56	47	0	2398 (87)	2750

[a] Does not include drawing permit hunters.
[b] Unit 14 residents.

TABLE 6 Unit 14A moose harvest chronology[a] 1995–2005[b]

Regulator y year	August			September					November	December			
	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
1995–96[d]	3	67	20	45	31	45	--	--	41	8	26	22	308
1996–97[d]	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[d]	2	68	23	41	39	56	--	--	45	21	45	16	356
1999–00[e]	6	57	14	32	25	44	53	--	--	36	52	13	332
2000–01[e]	4	67	20	38	30	43	24	--	--	27	55	11	319
2001–02[f]	10	61	28	36	43	48	46	68	--	--	--	13	353
2002–03[f]	6	71	20	32	35	51	45	53	--	--	--	10	323
2003–04[f]	13	87	34	57	41	67	54	50	--	--	--	14	417
2004–05[f]	11	73	17	48	36	62	45	53	--	--	--	16	361

[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.
[d] Open season = 10–17 Aug (archery only), 20 Aug–20 Sep (general season SF50), 20 Nov–15 Dec (SF).
[e] Open season = 10–17 Aug (archery only), 20 Aug–25 Sep (general season SF50), 5 Dec–15 Dec (SF).
[f] Open season = 10–17 Aug (archery only), 20 Aug–30 Sep (general season SF50).

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

Regulatory year	Airplan e	Horse	Boat	3 or 4 wheeler	Snowmachine	ORV	Highway vehicle	Unk.	Airboat	Sample size
1995–96	2	3	10	29	1	6	41	7		308
1996–97	2	3	7	22	16	7	40	4		498
1997–98	3	3	6	28	18	4	35	3		472
1998–99	4	4	7	35	6	5	33	5	1	356
1999–00	3	2	12	29	7	6	36	3	1	332
2000–01	3	2	9	34	8	4	36	3	1	319
2001–02	5	1	10	37	0	7	36	3	1	353
2002–03	6	3	12	36	0	5	32	5	1	323
2003–04	4	2	11	39	0	6	35	3	0	417
2004–05	7	3	10	38	0	5	30	5	1	361

[a] Does not include drawing permit hunts.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[a]

LOCATION

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

GEOGRAPHIC DESCRIPTION: Western Talkeetna Mountains

BACKGROUND

The first comprehensive moose survey in Unit 14B, conducted in fall 1987, estimated moose numbers at 2814 $\pm$ 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 $\pm$ 527 (80% CI), but another severe winter in 1994–95 caused high mortality levels (Masteller 1998). The fall 1999 survey estimated the population at 1687 $\pm$ 244 (80% CI) indicating the Unit 14B population had not yet recovered.

The moose harvest has decreased since the 1970s and 1980s. Hunter harvest averaged 96 moose during the 1970s and 259 during the 1980s. 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 harvest during the 1990s dipped as low as 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 total 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 ratio $\geq$ 20 bulls:100 cows during the rut.
- Achieve an annual harvest of 100–200 moose.

[a] This unit report includes some information beyond the reporting period at the discretion of the biologist.

METHODS

We generated a population estimate in the fall of 1999 using the Gasaway et al. (1986) stratified random census technique. In fall 2005, just after the end of the reporting period, we conducted a Ver Hoef Geospatial Population Estimator (GSPE) survey (2001).

The harvest has been monitored with harvest reports and permits from Unit 14B hunters. However, the last permit hunt was in 2000. All harvest data have been 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 Alaska Department of Public Safety provided numbers of moose killed illegally, those killed by highway vehicles, and those killed in defense of life or property (DLP).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population size

The fall 1999 survey conditions were excellent. The resulting moose population estimate in Unit 14B was 1687 ± 244 (80%CI) (Table 1). However, in the winter of 1999–2000, deep snow contributed to the highest number of road and 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 Unit 16B, and the 14B survey was again postponed. We surveyed Unit 14B in the fall of 2005, after the end of the reporting period; the results of that survey are reported in Table 1 for informational purposes.

Population Composition

In our November 1998 survey, we observed 38 bulls:100 cows and 11 calves:100 cows with 8% of the sampled population being calves (Table 1). The fall 1999 survey estimated 40 bulls:100 cows 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

Season and Bag Limit. The fall general open season was 10–17 August for archery-only hunters and 20 August–30 September for all other 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 of at least 50 inches or 3 or more brow tines on at least 1 side (SF50).

Board of Game Actions and Emergency Orders. At the spring 2003 and 2005 meetings, the board considered several proposals to change moose hunting and the SF50 system, but no changes were approved.

Hunter Harvest. Reported harvest has decreased since hunters took 92 bulls during 1996–97 (Table 2). The reported harvest for the last 2 years has been about 10 bulls lower than the average for the last 10 years and is substantially lower than the historic highs reported in the 1980s.

Hunter Residency and Success. Residents of Unit 14 consistently make up the majority of the hunters (Table 3). The number of local hunters has been relatively consistent the past 5 years, ranging between 391 and 460 (Table 3). Hunting success rates during the past decade range between 9 and 16%.

Harvest Chronology. The highest proportion of moose were taken during the last 10 days of the season in 7 out of the last 10 years. Only 1 animal was harvested during the archery-only season in the past 5 years.

Transport Methods. The elimination of the winter hunt in 2001–02 ended the use of snowmachines as a transportation method (Table 5). Four-wheelers and highway vehicles have accounted for a majority of the transportation type 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 percent or less of the hunters have reported using airboats in Unit 14B.

Other Mortality

Automobile and train collisions killed 39 moose in 2003–04 and 107 in 2004–05 (Table 2). Increased traffic in Unit 14B has led to a steadily increasing number of moose killed over the last 10 years (Table 5).

CONCLUSIONS AND RECOMMENDATIONS

Even before the severe winter of 1999–2000, the moose population was below the objective level of 2500–2800. The average annual harvest by hunters for the last 5 years was 61, 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 Unit 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. SF50 ensures that some bulls remain in the breeding population in heavily accessed areas (i.e. along highways and near communities).

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

PELTIER, T. C. 2006. Unit 14B moose management report. Pages 172–180 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 14B fall aerial moose composition surveys, 1995–2005

Regulatory year	Bulls: 100 cows	Yearling bulls: 100 cows	Calves: 100 cows	Calves (%)	Adults observed	Moose observed	Observable moose/mi^2	Population estimate (±80% CI)
1995–96 [a]	--	--	--	--	--	--	--	--
1996–97 [a]	--	--	--	--	--	--	--	--
1997–98 [a]	--	--	--	--	--	--	--	--
1998–99 [b]	37.5	9.5	11.1	7.5	407	440	--	--
1999–00 [c]	40.2	12.3	21.3	13.2	616	699	1.6	1687 ± 244
2000–01 [a]	--	--	--	--	--	--	--	--
2002–03 [a]	--	--	--	--	--	--	--	--
2003–04 [a]	--	--	--	--	--	--	--	--
2004–05 [a]	--	--	--	--	--	--	--	--
2005–06 [d]	29.82	5.35	15.5	10.7	582	646	--	1413 ± 215

[a] No surveys conducted.

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

[c] Data from Gasaway surveys conducted in late October/early November. Sightability correction factor estimated at 1.20, 1.33, 1.15, and 1.03 for low, medium, high, and super high density strata, respectively.

[d] Data from Ver Hoef GSPE surveys conducted in November 2005.

TABLE 2 Unit 14B moose harvest[a] and accidental death, 1995–2005

Regulatory year	Reported				Estimated			Accidental deaths[d]			Grand
	M	F	Unk	Total	Unreported[b]	Illegal[c]	Total	Road	Train	Total	Total
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
1999–2000	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	15	46	140
2002–03	67	0	0	67	7	20	27	13	2	13	107
2003–04	56	0	0	56	6	20	26	29	10	39	121
2004–05	57	0	0	57	6	20	26	29	78	107	190

[a] All information in this table has been updated since the last management report.
[b] Derived by taking 10% of the total reported kill.
[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, 1995–2005

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Non-resident	Unk.	Total (%)	Local resident[a]	Nonlocal resident	Non-resident	Unk.	Total	
1995–96	36	1	2	3	42 (9)	413	12	5	11	441	483
1996–97	56	2	3	0	61 (11)	475	12	9	2	498	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	468
2003–04	54	1	1	0	56 (12)	375	12	17	0	404	460
2004–05	52	2	3	0	57 (13)	355	24	13	0	392	449

[a] Unit 14 residents.

TABLE 4 Unit 14B moose harvest chronology 1995–2005

Regulatory year	August			September					November	December			
1995–96[a]	10–17	20–26	27–31	1–7	8–14	15–20	21–25	26–30	20–30	1–7	8–15	Unk	Total
1996–97[a]	2	3	0	4	9	13	--	--	2	2	7	0	42
1997–98[a]	0	15	2	3	9	12	--	--	8	1	8	3	61
1998–99[a]	1	7	1	6	11	9	--	--	3	3	5	3	49
1999–00[b]	2	6	5	6	6	16	--	--	4	4	7	5	61
2000–01[b]	0	6	2	3	5	14	9	--	--	3	7	2	51
2001–02[c]	0	3	0	5	2	15	9	--	--	2	10	2	48
2002–03[b]	0	10	0	4	6	6	15	23	--	--	--	3	67
2003–04[c]	1	7	5	5	7	8	19	14	--	--	--	1	67
2004–05[c]	0	5	2	5	4	12	12	16	--	--	--	--	56
	0	8	1	6	7	12	9	13	--	--	--	1	57

[a] Open season = 10–17 Aug (archery-only), 20 Aug–20 Sep (general season SF50), 20 Nov–15 Dec (SF-only) (SF50 = "spike-fork/ 50 inch").
[b] Open season = 10–17 Aug (archery-only), 20 Aug–25 Sep (general season SF50), 5–15 Dec (SF-only).
[c] Open season = 10–17 Aug (archery-only), 20 Aug–30 Sep (general season SF50).

TABLE 5 Unit 14B percent transport methods of successful moose hunters, 1995–2005

Regulatory year	Airplane	Horse	Boat	3 or 4 wheeler	Snowmachine	ORV	Highway vehicle	Unk.	Airboat	Number moose harvested
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
2003–04	5	2	4	52	0	16	20	2	0	56
2004–05	2	0	2	58	0	11	21	7	0	57

Alaska Department of Fish and Game
Division of Wildlife Conservation
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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 3 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 3 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 93 moose (30% cows).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- 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 some 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. In addition, the Fort Richardson/Elmendorf/Upper Ship Creek aerial census was not conducted in 2004 because we were unable to obtain a flight clearance from the Fort Richardson Range Control on days when weather and snow conditions were conducive to an aerial survey, due to military training activities. 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 more severe winters, interspersed with a few milder 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 subunit’s moose population. Vehicle collisions and starvation caused most of the known moose mortality. Fall 1996 surveys found the moose population 25–30% below the fall 1994 estimate. With milder winters and a reduction in harvest, the subunit’s moose population recovered by fall 1998 to near or above the management objective of 2000 moose. Another severe winter in 1998–99 reduced the population to an estimated 1650 by fall 1999. The population rebounded to an estimated 2200 in fall 2003, which is the highest estimate on record. The 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 2003 population of 2200 moose in Subunit 14C, including the Placer and Portage River drainages (Table 1).

Population Composition

The bull:cow ratio ranged from 43:100 to 53:100. It has increased unitwide, with substantial increases in the Fort Richardson/Elmendorf/Upper 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 29:100 to 45:100, and the percentage of calves in the population ranged from 16 to 24%, which is also an increase from the previous reporting period.

The subunit had 15-22 yearling bulls per 100 cows, reflecting both the higher production and greater survival of calves in this reporting period.

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 2 September–15 November and 15 December–15 January in 2003–04, and 7 September–15 November and 15 December–15 January in 2004–05. 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 in 2003 and 100 archery permits and 25 muzzleloader permits in 2004. We issued an additional 20 drawing permits for both sexes for Elmendorf Air Force Base in 2003 and 2004. The bag limit was one moose; however, bull or antlerless moose were specified on permits, and the season was 2–30 September in 2003 and 7–30 September in 2004. There was no open season in the Anchorage Management Area. The open season in the Birchwood Management Area was 2–30 September in 2003 and 7–30 September in 2004. The bag limit was one moose by drawing permit; however, bull or antlerless moose were specified on permits. Fifteen permits were issued in 2003 and 2004. This hunt has been increasingly difficult to administer, because it is nearly all private or railroad property, where access is restricted, or municipal park, where discharge of firearms and bows is prohibited. Much of the private land is under development and the area is becoming less rural and more suburban. The open season in the Eklutna Lake Management Area was 2–30 September in 2003 and 7–30 September in 2004. 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 Subunit 14C was 2–30 September in 2003 and 7–30 September in 2004. 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 2003 and 60 permits in 2004). The open season for the Twentymile River area was 20 August–30 September in 2003 and 2004. The bag limit was 1 moose by drawing permit with 20 bull permits issued in 2003 and 2004 and 5 antlerless permits issued in 2004.

Board of Game Actions and Emergency Orders. The Board of Game 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 were issued because the Division of Parks and Outdoor Recreation continued to prohibit discharge of firearms in these drainages, and the antlerless portion of this hunt was not reauthorized by the Board beginning in 2001. The antlerless hunt was reinstituted by the Board in March 2005 and, in fall 2005 a moose hunt was conducted in the Anchorage Management Area for the first time in 2 decades.

Beginning in 1998, only Alaska residents could obtain an antlerless moose permit in the remainder of Subunit 14C. In March 2001 the Board of Game extended the general season moose hunt from 25 September to 30 September beginning in fall 2001. All antlerless moose hunts were reauthorized annually, except DM666, from 2001– 2004.

Moose hunting in the Eklutna Management Area is managed with a registration hunt (RM445) and is closed by emergency order when the quota of bulls is met. An emergency order closed the season effective 3 October 2000, when the quota of 4 moose was met. An emergency order closed the effective 21 September 2001, when the quota of 2 moose was met. The 2001 quota had been reduced because 5 moose were harvested and 1 mortally wounded during the 2000 season. An emergency order closed the season 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. An emergency order closed the season effective 2 October 2003, when the quota of 4 bulls was met. An emergency order closed the season effective 12 October 2004, when the quota of 4 bulls was met.

The Board of Game revised 5 AAC 92.230 (Feeding of game). Effective 1 July 2002, it is illegal to intentionally or negligently leave human food, pet food, or garbage in a manner that attracts moose. Initially the fine was $50, but it was increased to $100 in September 2002. During this report period a few moose were increasingly reported getting into dumpsters and other garbage containers. Alaska State Troopers stationed in Anchorage and the Anchorage area biologists issued several citations for feeding moose in 2004-05.

<u>Hunter Harvest</u>. During the 2003–04 and 2004–05 seasons, 116 and 83 moose were harvested, respectively, with a 2-year mean of 73 bulls and 26 cows (Table 2). Approximately 43% of the bulls were taken during the general season. The remaining moose were taken in permit hunts.

<u>Permit Hunts</u>. During the 2003–04 season, we issued 382 permits to hunt moose in Subunit 14C. Of these, 75 hunters (28%) were successful. In 2004–05, 463 permits were issued and 62 hunters (21%) were successful (Table 4).

Drawing permit hunts are very popular. In 2003, 5044 hunters applied for 215 drawing permits (1351 applications were for the 20 bull permits for the Placer/Twentymile hunts). In 2004, 4565 hunters applied for 240 drawing permits (1270 of the applications were for the 20 permits for the Placer/Twentymile hunts). Although the number of drawing permits increased substantially (e.g., up from 140 in 2003) during this reporting period, the number of applications dropped beginning in 2002 to about half of the number of applicants in 2003, 2004, and 2005. In large part, this is due to the new antlerless moose hunts in Subunit 14A, where 280-400 permits have been issued annually since 2002. In addition to those receiving drawing permits, 167 bowhunters in 2003 and 218 bowhunters in 2004 registered for a permit for the Eklutna Valley archery hunt. The high number of unsuccessful bowhunters in this hunt reduces the total success rate for permit hunts in Subunit 14C (Table 4).

<u>Hunter Residency and Success</u>. Residents of Unit 14 and 7 accounted for 89% and 87% of the moose harvested in Subunit 14C in 2003–04 and 2004–05, respectively (Table 3). Nonresidents accounted for 8% and 4% of the total harvest in Subunit 14C in 2003–04 and 2004–05, respectively.

Harvest Chronology. 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). In 2003 the day after Labor Day was September 2, and this was reflected in the harvest chronology; nearly one-third of successful hunters took a moose in the first week of September. In 2004 the day after Labor Day was September 7. Surprisingly, the harvest chronology was almost identical to the previous year, except two moose (10% of the harvest) were reported taken before the season opened.

The permit archery hunt is held on military land from mid December through mid January, after many moose summering in the Fort Richardson/Elmendorf/Upper Ship Creek area became accessible in lowland areas of Fort Richardson.

Transport Methods. Approximately three-fourths of all successful hunters reached their moose 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 60–63% 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 188 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. The number of moose killed by vehicles continues to increase as more roads and houses are built and more vehicles are used for commuting.

An additional 10–20 moose have died from unknown, but not natural, causes each year and most have been salvaged by trappers for use as bait in other units. In recent years, several of these moose have been biopsied. One died in winter from cyanide gas produced during the digestion of what appeared to be Mayday tree (*Prunus padus*) fruits (K. Beckmen, pers. commun.). Thousands of Mayday trees have been planted in Anchorage, and they have become an invasive species, replacing natural woody vegetation in riparian areas. Other moose in Anchorage have browsed ornamental evergreens, and were found dead hours or a few days later. Evergreens such as Japanese yew (*Taxus* spp.) are known to be highly toxic to herbivores; however, the number of potentially toxic ornamental plants available to moose in Anchorage is unknown. Moose have also been observed regurgitating excessive amounts of liquid after eating ornamental kale (*Brassica*), one of the first plants to become succulent in Anchorage in early spring.

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, and both black and brown bears kill moose calves in summer, particularly before the salmon spawn.

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, and the fall 2003 population was estimated at 2200 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. A decade ago, 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 probably cost Anchorage residents at least $2.7 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).

With so many moose in the city, public safety is a concern, especially for children. Area biologists devote considerable time advising schools and parents on moose safety. Area biologists also assist schools that are unable to chase moose from school grounds. In 2003, Region II education staff and Anchorage area biologists produced a moose-safety poster for children to color. The poster is used in elementary school classes, in conjunction with a teacher's guide. A moose-safety video was produced in 2003-04 by Mirror Lake Middle School students in cooperation with Anchorage area biologists, Region II education staff, the University of Alaska Anchorage, and the Anchorage School District. Copies were distributed to all Anchorage elementary schools. The target audience was all 3th-5th graders in the Anchorage School District; however, 2nd graders are also watching the video. Pre- and post-tests show a substantial increase in knowledge of how to avoid moose attacks or injuries in the event of an attack.

The Alaska Legislature enacted a "nuisance moose" law (AS 16.05.052) during its 2004 session. The new law allows private individuals and organizations to capture and translocate "nuisance" moose from urban to rural areas. The department opposed the bill because it would have little or no affect on moose populations held at low numbers by predation or poor habitat, and it could result in spreading disease from high-density urban populations to rural populations. The department also expressed concerns about unqualified people using lethal drugs in urban settings, holding moose calves without adequate facilities and veterinary supervision, and potential cost to the state. The primary source of "nuisance" moose is likely to be Subunit 14C. Since the bill has become law, the department's policy is to hold private parties to the same standards as department staff, and no individuals or organizations have been authorized to capture, hold, or translocate moose to date.

Anchorage area biologists are often involved in planning efforts that affect moose habitat and mortality, such as roads. From 2003 to 2005, staff have participated in planning for the Abbott Loop Extension, Seward Highway and Alaska Railroad upgrades, and the Knik Arm Crossing, to name a few. Without our input, the Abbott Loop Extension would have been a fenced barrier to moose movement in Bicentennial Park and adjacent areas. Area biologists were hampered by a lack of detailed information. We proposed a two-year study using GPS radio collars on 30 bull and 30 cow moose to determine when, where, and how moose crossed urban roads and methods to mitigate collisions and other adverse impacts. The Alaska Department of Transportation and Public Facilities did not fund this study; however, they did pay about $92,000 to a private consultant to conduct several inadequate track surveys, pellet-group counts, and aerial counts that added nothing to available anecdotal information.

Similarly, in 2003, the U.S. Army Alaska (USARAK) proposed building a 34-mile-long, eight-foot-high chain link fence along the border of Fort Richardson. This fence would have bisected the Anchorage lowlands from the North Fork of Campbell Creek to the coast north of Eagle River Flats, in effect blocking movement of hundreds of moose between calving, rutting, and winter ranges (Sinnott 2003). Based on our input and public concerns, USARAK subsequently agreed to build only a pipe rail fence with numerous gaps to facilitate wildlife passage, although the Glenn Highway fence was replaced and extended nearly to the Hiland weigh station. During the same period, Elmendorf Air Force Base built several miles of security fence that blocks wildlife movements, without soliciting or heeding the area office's advice. Cumulative losses of habitat and restrictions on movement are adversely affecting the moose population in Subunit 14C. Area biologists need to be involved early in planning of roads and long fences and must have information on moose distribution and movement corridors.

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

Sinnott, R. 2006. Unit 14C moose management report. Pages 181–198 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Subunit 14C fall aerial moose composition counts and estimated population size, 2000–2005

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	2000–01[b]	--	--	--	--	--	--	
Portage River	2001–02	--	--	--	--	--	--	180
Placer River	2002–03[b]	--	--	--	--	--	--	
	2003–04	26	12	62	35	185	43	229
	2004–05[c]	61	34	52	24	94	30	120
Hillside	2000–01[b]	--	--	--	--	--	--	
	2001–02	46	26	33	19	161	49	185
	2002–03[b]	--	--	--	--	--	--	
	2003–04	27	10	22	13	130	33	160
	2004–05	28	11	40	24	99[d]	30	120
Anchorage Bowl (except Hillside)	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	300[e]
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	300[e]
	2004–05	--	--	--	--	--	--	
Fort Richardson	2000–01[b]	--	--	--	--	--	--	
Elmendorf AFB	2001–02	63	20	33	17	482	29	555
Upper Ship Cr.	2002–03[b]	--	--	--	--	--	--	
	2003–04	58	18	40	20	527	39	649
	2004–05[f]	--	--	--	--	--	--	

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	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	145
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	170
	2004–05	--	--	--	--	--	--	
Peters Creek	2000–01[b]	--	--	--	--	--	--	
	2001–02	112	23	31	13	63	20	75
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	85
	2004–05	--	--	--	--	--	--	
Eklutna River	2000–01[b]	--	--	--	--	--	--	
Thunderbird Cr.	2001–02	42	8	11	7	55	12	65
	2002–03[b]	--	--	--	--	--	--	
	2003–04	36	11	14	9	46	--	57
	2004–05	--	--	--	--	--	--	
Bird Creek	2000–01[b]	--	--	--	--	--	--	
Indian River[g]	2001–02	--	--	--	--	--	--	140
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	160
	2004–05	--	--	--	--	--	--	

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	2000–01[b]	--	--	--	--	--	--	
Knik River	2001–02	23	4	21	15	163	44	190
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	220
	2004–05	--	--	--	--	--	--	
Lake George[h]	2000–01[b]	--	--	--	--	--	--	
	2001–02	--	--	--	--	--	--	165
	2002–03[b]	--	--	--	--	--	--	
	2003–04	--	--	--	--	--	--	170
	2004–05	--	--	--	--	--	--	
Subunit 14C	2000–01[b]	--	--	--	--	--	--	
Total	2001–02	53	17	29	16	924	29	2000
	2002–03[b]	--	--	--	--	--	--	
	2003–04	44	15	40	22	888	38	2200
	2004–05[f]	43	22	45	24	183	28	

[a] Estimates based on sightability correction factors (SCF) of 1.15 (2001) and 1.23 (2003), calculated with MOOSPOP for the Fort Richardson/Elmendorf/Upper Ship Creek census area, except estimates in unsurveyed drainages are extrapolated based on trends on the Fort Richardson/Elmendorf/Upper Ship Creek census area.
[b] Fall surveys not conducted due to lack of snow.
[c] Bear Valley not surveyed due to turbulence.
[d] Total includes 10 adult/yearling moose of unknown sex.

[e] No aerial surveys completed in past decade; therefore, estimate is best guess.
[f] No aerial survey of Fort Richardson/Elmendorf/Upper Ship Creek census area because of difficulty obtaining flight clearances from Range Control due to military training activities.
[g] Last surveyed in 1988.
[h] Last surveyed in 1997.

TABLE 2 Subunit 14C moose harvest and accidental death, 2000–2005

Regulatory year	Hunter harvest: Reported M (%)	Reported F (%)	Reported Total[a]	Estimated Unreported	Estimated Illegal	Estimated Total	Accidental death[b] Road	Accidental death Train	Accidental death Total	Total
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	15	244	350
2002–03	62 (66)	32 (34)	94	10	10	20	143	11	154	268
2003–04	84 (72)	32 (28)	116	10	10	20	188	14	202	338
2004–05	62 (75)	21 (25)	83	10	10	20	167	7	174	277

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

TABLE 3 Subunit 14C moose hunter residency and success, 2000–2005

	Successful				Unsuccessful				
Regulatory year	Local resident[a]	Nonlocal resident	Nonresident	Total (%)[b]	Local resident[a]	Nonlocal resident	Nonresident	Total (%)	Total hunters[b]
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
2003–04	103	4	9	116 (24)	340	10	12	362 (76)	478
2004–05	72	8	3	83 (18)	353	18	13	384 (82)	468

[a] Residents of Units 14 and 7 (majority from Subunit 14C).
[b] Includes hunters with unspecified residency.

TABLE 4 Subunit 14C moose harvest data by permit hunt, 2000–2005

Hunt no. /Area	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Total harvest[a]
DM210, 211	2000–01	10	40	83	17	100	0	1
Twentymile	2001–02	10	30	43	57	100	0	4
Portage	2002–03	10	40	67	33	100	0	2
Placer	2003–04	20	10	50	50	100	0	9
	2004–05	25	28	57	43	89	11	9
DM424,425,427	2000–01	95	16	50	50	73	27	40
Fort Richardson	2001–02	95	38	47	53	39	61	31
(archery only)	2002–03	95	14	61	39	41	59	32
	2003–04	95	16	53	48	49	51	38
	2004–05	100	13	67	33	55	45	29
DM422,423	2000–01	25	16	67	33	57	43	7
Fort Richardson	2001–02	25	76	67	33	100	0	2
(muzzleloader)	2002–03	25	8	57	43	80	20	10
	2003–04	25	8	74	26	50	50	6
	2004–05	25	12	73	27	83	17	6
RM445[b]	2000–01	229	54[c]	95	5	100	0	5
Eklutna	2001–02	102	59[d]	93	7	100	0	3
(archery only)	2002–03	114	43[e]	94	6	100	0	4
	2003–04	167	48[f]	94	6	100	0	5
	2004–05	218	58[g]	96	4	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	2000–01	10	0	70	30	0	100	3
Hunter	2001–02	10	20	75	25	0	100	2
Knik	2002–03	10	10	67	33	0	100	3
	2003–04	10	10	67	33	0	100	3
	2004–05	10	30	86	14	0	100	1
DM428,429,430	2000–01	15	7	50	50	57	43	7
Elmendorf AFB	2001–02	15	7	43	57	50	50	8
(archery only)	2002–03	15	13	31	69	56	44	9
	2003–04	20	5	47	53	60	40	10
	2004–05	20	10	50	50	67	33	9
DM442	2000–01	20	20	81	19	0	100	3
Ship	2001–02	20	35	92	8	0	100	1
	2002–03	20	15	65	35	0	100	6
	2003–04	20	30	86	14	0	100	2
	2004–05	40	30	93	7	0	100	2
DM443	2000–01	10	30	86	14	0	100	1
Peters and	2001–02	10	10	89	11	0	100	1
Little Peters	2002–03	10	20	62	38	0	100	3
	2003–04	10	50	80	20	0	100	1
	2004–05	10	20	100	0	0	0	0

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	2000–01	15	27	73	27	100	0	3
Birchwood[c]	2001–02	15	27	91	9	0	100	1
(archery only)	2002–03	15	27	82	18	50	50	2
	2003–04	15	13	92	8	100	0	1
	2004–05	15	20	83	17	100	0	2
Totals for all	2000–01	429	35	74	26	66	37	70
permit hunts	2001–02	302	44	68	32	46	54	54
	2002–03	314	25	70	30	55	45	71
	2003–04	382	30	72	28	57	43	75
	2004–05	463	36	79	21	66	34	62

[a] Includes moose with unspecified sex.
[b] Registration hunt.
[c] Includes 39 permittees who did not report..
[d] Includes 21 permittees who did not report.
[e] Includes 22 permittees who did not report.
[f] Includes 33 permittees who did not report.
[g] Includes 86 permittees who did not report.

TABLE 5 Subunit 14C moose harvest[a] chronology, 2000–2005

Regulatory year	Percent of harvest 8/26–9/1	9/2–9/8	9/9–9/15	9/16–9/22	9/23–9/29	9/30–10/6	n
2000–01[b]	0	19	31	19	25	6	16
2001–02[c]	3	9	19	34	31	3	32
2002–03[d]	0	9	13	43	35	0	23
2003–04[e]	2	29	22	22	22	2	41
2004–05[f]	10	19	24	24	24	0	21

[a] Excludes permit hunt harvests.
[b] Season 9/5–9/25
[c] Season 9/4–9/30
[d] Season 9/3–9/30
[e] Season 9/2–9/30
[f] Season 9/7–9/30

TABLE 6 Subunit 14C moose harvest percent by transport method, 2000–2005

Regulatory year	Percent of harvest Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Off-road vehicle	Highway vehicle	Unknown/ Other	n
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
2003–04	6	9	11	3	0	0	63	7	116
2004–05	2	4	11	6	0	0	76	1	83

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNIT: 15A (1314 mi^2), 15B (1121 mi^2), and 15C (2441 mi^2)

GEOGRAPHIC DESCRIPTION: Western Kenai Peninsula

BACKGROUND

Unit 15A. 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 Ver Hoef (ADF&G Fairbanks biometrician). Using Ver Hoef'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 occurred on the Kenai Peninsula between 1969 and 2004. 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 improvements have temporarily reversed this general trend in local areas.

Increased human presence and the 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 for 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 Alaska Department of Fish and Game 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.

Unit 15B. 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 (Kenai Peninsula Borough 2006). Since 2001, infestation rates are decreasing as the number of unaffected trees becomes scarce (U.S. Forest Service 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 in 15B East, which is designated as a "trophy" area.

Unit 15C. 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 infestations have also affected this region of the peninsula. Much of the affected forests outside of designated wilderness 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

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

Primary moose management objectives in the SLWMA are to:

- Provide opportunities 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.

Unit 15B-West

- Maintain a bull-to-cow ratio of 15:100.
- Allow for maximum opportunity to participate in hunting in 15B West.

Unit 15B-East

- Maintain a bull-to-cow ratio of 40:100.
- Provide opportunities to harvest large-antlered bulls under aesthetically pleasing conditions.

Unit 15C

- Maintain a healthy and productive population.
- Maintain a minimum sex ratio range of 15–20 bulls:100 cows.

METHODS

Unit 15A. 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 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 (2001) developed the techniques used for S-Plus Spatial Statistics.

Unit 15B. Composition surveys are flown in traditional count areas as funding allows. Harvest data is provided by hunter information taken from harvest tickets.

Unit 15C. 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.

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 and Composition in Unit 15A

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.

Composition surveys flown during November and December 2003 and 2004 indicated a relatively stable bull:cow ratio (23:100 and 24:100, respectively), but the total number of moose observed and percent calves in the population declined in 2004 (Table 1). Since these are trend counts, we did not apply statistical analyses to the data, but there is an obvious decline in total moose numbers and number of calves in the 15A population.

Population Size and Composition in Unit 15B

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. No survey flights have been conducted since this 2001 census.

Population Size and Composition in Unit 15C

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) (Table 1). A comparison between surveys showed a population increase of about 30%. Both censuses were conducted in late winter, precluding composition counts. There were probably additional moose in the mountainous portion of Subunit 15C, outside the census area, during both censuses.

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, 1 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 for Unit 15A and 15B is 10–17 August (archery only), and 20 August–20 September. Unit 15C shares the 20 August–20 September dates but does not have an archery-only season. 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 (SF50). Harvest statistics are shown in Tables 2 and 3.

From 2001 through 2004, the federal subsistence hunt issued an average of 43 permits each year in Units 15A, 15B, and 15C, with an average yearly harvest of 6 moose each year.

Board of Game Actions. The board has reauthorized the antlerless moose permits for the Homer area (DM549) each year since 1995 and for Skilak Loop (DM 524) since 1989. During the March 2005 meeting, the board took the following actions: changed the season for the permit hunt DM522 from 20 October–20 November to 10 October–10 November; changed season date of TM549 from 1–30 September to 20 August–20 September; and clarified the boundaries of the Lower Kenai Controlled Use Area by allowing use of motorized vehicles for moose hunting on specific roads in the area by local residents accessing personal residences and businesses.

Permit Hunts

Unit 15A. No permits were issued for the SLWMA during this report period. The last survey conducted in November 2003 counted 98 moose and 25 bulls:100 cows. 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 area can be issued.

Unit 15B. 15B East is managed as an area where hunters are able to view and harvest large-antlered bulls through a drawing permit system. We received 1799 applications in 2003 and 1604 in 2004 for all drawing hunts in 15B. Permittees reported harvesting 15 bulls in 2003 and 16 in 2004 (Table 3).

Unit 15C. Since 1987 there has been a Tier II subsistence hunt for any bull in a portion of Unit 15C southwest of a line from Point Pogibshi to the point of land between Rocky and Windy Bays. Three 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 2001. In 2002 through 2004, 50 permits were issued each year resulting in an average annual harvest of 25 cow moose (Table 3).

Hunter Residency and Success

Unit 15A. Hunter success ranged between 12 and 18% during the last 4 years (Table 4). During all years, local residents (people living in Unit 15) accounted for the vast majority (79–86%) of successful moose hunters.

Unit 15B-West. Hunter success ranged between 14 and 17% during the last 4 years (Table 4). During all years, local residents (people living in Unit 15) accounted for the vast majority (92–98%) of successful moose hunters.

Unit 15C. Hunter success ranged between 20 and 25 during the last 4 years (Table 4). During all years, local residents (people living in Unit 15) accounted for the vast majority (84–87%) of successful moose hunters.

Transport Methods. Most moose hunters use highway vehicles as their primary method of transportation to access hunting areas in Units 15A and 15B (Table 5). The most popular method used in Unit 15C was the all-terrain vehicle (ATV).

Harvest Chronology. The chronology of the harvest depends on weather conditions and other factors unrelated to moose abundance. The highest proportion of the harvest generally occurs at the start and the end of the season (Table 6).

Other Mortality

Unit 15A. Crippling loss by hunters and loss to predation was unknown. In 2003, vehicle–wildlife accidents killed 134 moose in 15A, compared to 83 in 2004 (Table 2). About 50% of moose killed by vehicles each year are calves. Between regulatory years 2001–02 and 2004–05, on average 98 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.

Unit 15B. An average of 51 moose per year have been killed by motor vehicles in Unit 15B during the past 4 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 probably high.

Unit 15C. Moose killed in Subunit 15C by motor vehicles averaged 86 annually over the last 4 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

15A

Assessment

The last significant burn (85,000 acres) in Unit 15A occurred in 1969. Generally, the duration for producing quality moose browse after a burn is 20–25 years, and I believe the area within the 1969 burn has lost its value for producing significant amounts of quality browse. I believe maturation of the habitat, predation, and collisions with automobiles are the leading causes for declines in the Unit 15A moose population.

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 (FWS) 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.

15B

No significant burns have occurred since 1890, when a wildfire burned most of the unit. The FWS enhanced approximately 3700 acres of predominantly winter habitat using a variety of mechanical tree removal techniques in 1968. The Glacier Creek fire (2004) encompassed approximately 5000 acres in the southeastern portion of Unit 15B, and this should provide a benefit for moose in that area, but have little impact on the overall Unit 15B moose population. The King County Creek fire (summer of 2005) encompassed approximately 10,000 acres near the southwestern portion of Skilak Lake in Unit 15B. Assessments of the potential effects on moose in that area will be provided during the next report period.

15C

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Postlogging site work 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 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.

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. This group continues to purchase land and help orchestrate conservation easements to benefit moose habitat on the lower Kenai Peninsula. The Tracey Road fire burned more than 5000 acres northeast of Homer in May of 2005. It is unknown if this fire was hot enough to burn the ground layer and greatly enhance moose habitat. The Fox Creek fire (summer 2005) south of Tustumena Lake encompassed approximately 35,000 acres. Assessments of the potential effects on moose in that area will be provided during the next report period.

CONCLUSIONS AND RECOMMENDATIONS

Unit 15A. Kris Hundertmark of ADF&G 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 (23:100 in 2003 and 24:100 in 2004).

With the increase in the number of bulls, the opportunity for viewing and photography has increased. Public perception of improved population health and public support for continuation of the SF50 program has also widened.

Unlike other game management units in Alaska, no emergency reduction in moose seasons or bag limit was necessary, even with a decreasing population. 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, predation, and deaths caused by collisions with motor vehicles. In the absence of significant events affecting habitat (such as burns encompassing more than 50,000 acres), I expect the downward trend in Unit 15A moose numbers to continue.

Unit 15B. 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 FWS should cooperate on selected habitat enhancement projects (mechanical manipulation and prescribed burns) to improve moose habitat in the unit. Similar to Unit 15A, the habitat in Unit 15B is maturing, and I expect moose numbers to be stable to decreasing during the next several years unless significant portions of the unit burn.

Unit 15C. 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. Snow depth appears to dictate movements to the Homer Bench, but we do not know 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 us make management decisions 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:

SELINGER, J. 2006. Unit 15 moose management report. Pages 199–214 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 15 moose aerial composition counts and estimated population size, 2001–05

Unit	Regulatory year	Bulls: 100 cows	Calves: 100 cows	% Calves	Adults	Total moose observed	Estimated population size
15A	2001–02	21	31	20	620	778	1500–2500
	2002–03	No surveys conducted					1500–2500
	2003–04	23	26	17	628	763	1000–2000
	2004–05	24	16	11	544	614	1000–2000
15B	2001–02	No surveys conducted					
	2002–03	No surveys conducted					700–1000
	2003–04	No surveys conducted					700–1000
	2004–05	No surveys conducted					700–1000
15C	2001–02	19	31	21	958	1207	2508–3454[b]
	2002–03	No surveys conducted					2500–3500
	2003–04[a]			15	895	1059	2500–3500
	2004–05	No surveys conducted					2500–3500

[a] Summary of late winter composition counts; sex of adults could not be distinguished.

[b] Estimates from geostatistical census method; estimated population size shown = 95% confidence interval.

TABLE 2 Unit 15 reported general season moose harvest and accidental death, 2001–2005

Unit	Regulatory year	Reported hunter harvest				Accidental death			Total reported mortality
		Bull	Cow	Unk.	Total	Road	Train	Total	
15A	2001–02	227	0	1	228	100	0	100	328
	2002–03	139	1	1	141	73	0	73	214
	2003–04	172	1	3	176	134	0	134	310
	2004–05	130	0	1	131	83	0	83	214
15B	2001–02	49	0	1	50	42	0	42	92
	2002–03	40	1	0	41	33	0	33	74
	2003–04	41	1	0	42	67	0	67	109
	2004–05	37	0	0	37	61	0	61	98
15C	2001–02	309	1	3	313	87	0	87	400
	2002–03	258	3	2	263	78	0	78	341
	2003–04	308	3	1	312	105	0	105	417
	2004–05	276	0	2	278	74	0	74	352

TABLE 3 Unit 15 reported harvest for drawing permit hunts, 2001–2005

Unit	Hunt Nr	Regulatory year	Permits issued	Permittees that hunted	Percent success	Harvest Bulls	Harvest Cows	Harvest Unk.	Harvest Total
15A	DM524	2001–02	0						
		2002–03	0						
		2003–04	0						
		2004–05	0						
	DM526	2001–02	0						
		2002–03	0						
		2003–04	0						
		2004–05	0						
15B	DM530–539 (combined totals)	2001–02	100	65	25	16	0	0	16
		2002–03	100	60	20	12	0	0	12
		2003–04	100	67	22	15	0	0	15
		2004–05	100	58	28	16	0	0	16
15C	DM549	2001–02	0						
		2002–03	50	41	59	0	24	0	24
		2003–04	50	49	55	0	27	0	27
		2004–05	50	41	56	1	22	0	23
	TM549	2001–02	4	3	0	0	0	0	0
		2002–03	4	3	0	0	0	0	0
		2003–04	4	4	50	2	0	0	2
		2004–05	4	3	33	1	0	0	1

TABLE 4 Unit 15 residency and success of moose hunters for the general season, 2001–2005

		Successful				Unsuccessful				
Unit	Regulatory year	Local[a] resident	Nonlocal resident	Non-resident	Total[b] (%)	Local[a] resident	Nonlocal resident	Non-resident	Total[b]	Total hunters
15A	2001–02	196	28	4	228 (18)	848	163	25	1036	1264
	2002–03	119	19	3	141 (12)	837	155	29	1023	1164
	2003–04	151	13	11	176 (14)	842	170	34	1052	1228
	2004–05	103	17	6	131 (13)	707	159	32	912	1043
15B	2001–02	49	1	0	50 (17)	223	26	3	252	302
	2002–03	38	1	2	41 (14)	221	19	5	245	286
	2003–04	40	2	0	42 (14)	203	37	10	251	293
	2004–05	34	0	2	37 (15)	184	18	10	216	253
15C	2001–02	259	38	13	313 (25)	786	131	36	960	1273
	2002–03	227	28	7	263 (20)	876	127	39	1040	1303
	2003–04	267	33	10	312 (23)	906	124	26	1066	1378
	2004–05	241	27	9	278 (22)	871	110	21	1010	1288

[a] Local = residents of Unit 15.

[b] Includes unspecified residency.

TABLE 5 Unit 15 general season transport methods for moose hunters (percent of harvest), 2001–2005

		Percent of Harvest							
Unit	Regulatory year	3/4 wheel-ATV	Airplane	Boat	Highway vehicle	Horse/ dogteam	ORV	Unknown	Harvest
15A	2001–02	11	3	7	72	1	3	3	228
	2002–03	9	4	6	74	1	1	5	141
	2003–04	15	6	6	61	2	5	5	176
	2004–05	15	5	9	62	2	4	3	131
15B	2001–02	18	0	2	66	4	2	8	50
	2002–03	7	0	0	66	15	2	10	41
	2003–04	14	5	12	52	2	5	10	42
	2004–05	8	3	3	76	3	0	8	37
15C	2001–02	43	2	3	33	9	5	4	313
	2002–03	41	0	4	38	6	6	4	263
	2003–04	45	2	2	33	6	8	4	312
	2004–05	52	2	3	25	7	6	5	278

TABLE 6 Unit 15 moose general season harvest chronology (percent of harvest), 2001–2005

		Harvest Periods[a]								
Unit	Regulatory Year	8/10–8/17[a]	8/20–8/25	8/26–8/31	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	Unknown	Harvest
15A	2001–02	21	21	8	4	10	17	16	4	228
	2002–03	24	23	9	4	4	14	18	4	141
	2003–04	15	22	5	4	8	21	18	7	176
	2004–05	17	19	5	8	9	18	21	4	131
15B	2001–02	16	20	8	0	10	8	24	14	50
	2002–03	24	15	10	15	7	7	12	10	41
	2003–04	14	31	10	10	5	14	17	0	42
	2004–05	19	24	8	8	11	14	14	3	37
15C	2001–02	-	27	12	13	16	12	15	5	313
	2002–03	-	38	10	8	9	12	16	6	263
	2003–04	-	33	11	13	10	12	17	4	312
	2004–05	-	27	10	13	12	16	21	3	278

[a] Archery-only season is 10–17 August in 15A and 15B only.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[a]

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 Unit 16A has fluctuated 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 in 1990–91, 1992–93, and 1994–95 and by increasing predator populations.

Unit 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 Oil Well Road. Boats, 4-wheelers, or snowmachines are used to access more remote portions of the unit. Since Unit 16A was separated from Unit 16B in 1973, historical annual hunter harvest has 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 309 (1984) to a low of 37 (1990) (Del Frate 2004). The annual harvest has averaged 151 bulls in the past 5 seasons (2000–2004).

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 total 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.

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[a] This report contains information gathered after the report period ended at the discretion of the reporting biologist.

- 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

No surveys were completed during this reporting period. Surveys were conducted using the Ver Hoef method (Ver Hoef 2001) 22–28 November 2005. The results are added to Table 1 for informational purposes. Previous surveys were conducted in 2000 and 1997 (Del Frate 2004).

We monitored the harvest with general season and drawing permit harvest reports from Unit 16A hunters. However, the last permit hunt was in 2000. 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 Alaska Department of Public Safety provided numbers of moose taken illegally, killed by highway vehicles, or shot 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). We attempted no surveys in 2002 because of poor weather and lack of snow. In 2003 and 2004 management priority focused on Unit 16B, and a 16A survey was not attempted. We completed a survey in the fall of 2005, and further information on the results will be available in future reports.

Population Composition

The composition assessed in 2000 included 28 bulls:100 cows and 22 calves:100 cows, which is down from 33 bulls:100 cows and 35 calves:100 cows found in 1997 (Table 1). Recent surveys show that the bull:cow ratios are probably lower due to the season extension, but above the minimum objective of 20 per 100 cows.

MORTALITY

Harvest

Season and Bag Limit. The fall general open season was 10–17 August for archery-only hunters and 20 August–30 September for all resident and nonresident hunters for both years. During this period an SF50 bag limit was in place.

Board of Game Actions and Emergency Orders. At the spring meetings in 2003 and 2005, the board considered, but did not approve, several proposals to change moose hunting and the SF50 system.

Hunter Harvest. The annual harvest has been relatively stable for the past 5 years, averaging 151 moose, but still below the harvest objective minimum (190–360) (Table 2). The lower harvest is probably due to lower moose densities and the removal of the permit hunts.

Hunter Residency and Success. The number of moose hunters in Unit 16A averaged 904 during 2003–2005 (Table 3). The majority of hunters are not residents of Unit 16 (Table 3). Hunter success during the reporting period was 17%. This is slightly higher than the 10-year average of 16%.

Harvest Chronology. No moose were taken in the 10–17 August archery season during the reporting period. Hunters generally waited until the end of the season to hunt in Unit 16A, harvesting more than 50% of the general season moose during the last 2 weeks (Table 4).

Transport Methods. The elimination of the winter hunt in 2001–02 ended the use of snowmachines as a transportation method (Table 5). The majority of successful hunters in the past 10 seasons reported using 4-wheelers or boats. 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 Unit 16A.

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, ADF&G, 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 continues to develop, the potential for moose habitat improvement may increase. The Alaska Department of Natural Resources has a number of large timber sales that could open up habitat for moose if they are allowed to proceed.

The National Park Service has begun planning efforts to build a new visitor center in Denali State Park. This facility will be located in Unit 13E adjacent to the northeast corner of Unit 16A. Construction of the visitor center and access road may affect moose habitat and movement. More importantly, 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 approximately 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 in 2001, 2002, and 2003 due to an extension of the general season in 16A and the general moose season closure in Unit 16B. The latter probably resulted in a limited shift in local hunting pressure from Unit 16B to 16A (Table 3). Hunter effort will probably continue to increase in Unit 16A due to improved access within the unit. It is unlikely that the moose population will reach the objective levels until the predator population decreases and habitat quality improves. Also, continued mild winters with moderate snow depths will be necessary to stabilize recovery in the moose population.

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

PELTIER, T. C. 2006. Unit 16A moose management report. Pages 215–224 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Grants W-27-3 and 4, Project 1.0. Juneau, Alaska.

TABLE 1 Unit 16A fall aerial moose composition surveys and censuses, 1995–2005

Regulatory year	Bulls: 100 Cows	Yearling Bulls: 100 Cows	Calves: 100 Cows	Calves(%)	Adults Observed	Moose Observed	Moose / mi^2	Population Size
1995–96 [a]	--	--	--	--	--	--	--	--
1996–97 [a]	--	--	--	--	--	--	--	--
1997–98 [c]	33	12	35	21	974	1234	2.1	3636 ± 614[b]
1998–99 [a]	--	--	--	--	--	--	--	--
1999–00 [a]	--	--	--	--	--	--	--	--
2000–01 [c]	28	6	22	15	661	787	1.4	2420 ± 528
2001–02 [a]	--	--	--	--	--	--	--	--
2002–03 [a]	--	--	--	--	--	--	--	--
2003–04 [a]	--	--	--	--	--	--	--	--
2004–05 [a]	--	--	--	--	--	--	--	--
2005–06 [d]	22	3	19	14	510	590	1.1	1619 ± 197

[a] No surveys conducted
[b] 80% CI
[c] Becker and Reed (1990) survey methodology
[d] Ver Hoef (2001) survey methodology

TABLE 2 Unit 16A moose harvest and accidental death, 1995–2005

Regulatory year	Reported				Estimated			Accidental deaths[c]			Grand total
	M	F	Unk	Total	Unreported[a]	Illegal[b]	Total	Road	Other	Total	
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
1999–00	168	0	3	171	12	25	37	14	0	14	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	155	0	0	155	11	25	35	12	0	12	202
2003–04	168	0	0	168	12	25	37	17	0	17	222
2004–05	139	0	0	139	10	25	35	15	0	15	189

[a] Derived by taking 5–10% of the reported kill, 7% from 1996 to present
[b] Includes moose taken in defense of life or property
[c] Roadkill is minimum number and does not reflect moose hit and lost or unsalvageable.

TABLE 3 Unit 16A moose hunter residency and success, 1995–2005

Regulatory year	Successful: Local resident[a]	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk.	Successful: Total (%)	Unsuccessful: Local resident[a]	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk.	Unsuccessful: Total	Total hunters
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
1999–00	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	134	14	0	155 (16)	43	730	29	0	802	957
2003–04	12	144	11	1	168 (18)	48	696	38	0	782	950
2004–05	7	119	10	3	139 (16)	33	646	40	0	719	858

[a] Unit 16 residents

TABLE 4 Unit 16A moose harvest chronology[a] 1995–2005

Regulatory	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
1995–96[b]	8	1	11	12	34	--	--	5	1	4	2	78
1996–97[b]	5	4	19	26	41	--	--	18	6	10	10	139
1997–98[b]	20	7	11	29	36	--	--	17	4	8	9	141
1998–99[b]	9	5	13	21	40	--	--	11	4	13	4	120
1999–00[c]	11	7	15	21	38	32	--	--	2	16	4	146
2000–01[c]	6	3	5	16	37	29	--	--	7	11	4	118
2001–02[d]	8	3	7	10	34	37	52	--	--	--	2	153
2002–03[d]	17	2	9	11	33	34	44	--	--	--	4	154
2003–04[d]	13	6	10	15	34	34	47	--	--	--	9	168
2004–05[d]	8	4	9	20	35	37	21	--	--	--	5	139

[a] Does not include harvest from drawing permit hunts
[b] Open season = 20 Aug–20 Sep (SF50), 20 Nov–15 Dec (SF-only)
[c] Open season = 20 Aug–25 Sep (SF50), 1–15 Dec (SF-only)
[d] Open season = 10–17 Aug (archery-only), 20 Aug–30 Sep (SF50)

TABLE 5 Unit 16A percent transport methods of successful moose hunters[a], 1995–2005

Regulatory year	Airplane	Horse	Boat	3 or 4 wheeler	Snowmachine	ORV	Highway vehicle	Unk.	Airboat	Total
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
2003–04	11	0	21	40	0	8	14	1	5	168
2004–05	9	1	15	52	0	6	15	1	0	139

[a] Does not include harvest from drawing permit hunts.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 Unit 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 predation (Griese 2000). Faro (1989) implied that predation on neonatal moose calves by bears influenced recruitment and caused the current declining trend. Alaska Department of Fish and Game (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 fall 1998 (Masteller 2000). More recently, ADF&G biologist Tony Kavalok (unpublished data) indicated a fall 2004 population of 175–180 wolves.

Since 1972, when Unit 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 Unit 16B were liberal (20 August–30 September and 1–30 November seasons 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 total width of 50 inches. This selective harvest strategy is referred to as "spike-fork-50-inch" (SF50) (Schwartz et al. 1992).

The general season was closed in both 2001 and 2002. Four hundred Tier II permits were issued each year for the 20 August–30 September (SF50) and the 15 November–28 February (any bull) periods. These Tier II hunt areas were divided into 3 units (TM565, TM567, TM569) (Del Frate 2004).

The Kalgin Island moose population resulted from a translocation of calves during 1957–59. Numbers grew to a density of 7 moose/mi^2 during 1981 (Taylor 1983) but were down 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-moose registration hunt for 20 August–30 September. The board later shortened the season to 20 August–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 the unit's size, mainland 16B is divided 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. Kalgin Island has historically been surveyed separately, and is not included in most population estimates. We have conducted various surveys (Gasaway et al. 1986; Becker and Reed 1990; Ver Hoef 2001) of each of these units as funding and priority allow (Table 1).

Aerial surveys were conducted in 16B north and on Kalgin Island in 2003, and trend counts were conducted in 16B south in 2003 and 2004.

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 898 ± 163 (80% C.I.) in fall 2003 (Table 1). The 16B middle population was 1836 ± 267 (80% C.I.) in fall 2001 (Table 1). Trend counts were completed in 16B south in 2003 and 2004. As a result of the 2004 trend count survey, the population of 16B south was revised upward to 960 animals. The Unit 16B fall population in 2005 was likely between 3264 and 4124 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 2003 was 35 bulls:100 cows and 17 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 23 bulls and 23 calves:100 cows in 2004 (Table 1). Kalgin Island in 2003 had 38 bulls and 89 calves:100 cows.

MORTALITY

Harvest

Season and Bag Limit. The general hunting season of 1–20 September was restored for residents only in 2003 and 2004 (SF50). Tier II permits were reduced to 261 and season length was changed to 15 November–28 February (any bull). Kalgin Island was open to registration hunting 20 August–20 September (any moose).

Board of Game Actions and Emergency Orders. The Board of Game approved a predator management plan to reduce the number of wolves in 16B and subsequently increase the moose population. Permitted pilots took 91 wolves in the winter of 2004–05. The effects of this 5-year plan on the moose population will not be known for some time. The board made no changes to 16B moose hunting during the reporting period.

Hunter Harvest. The harvest increased dramatically in 2003 due to the opening of the general season (Table 2). The Tier II harvest decreased due to the reduction in the allotment of permits issued in 2003 and 2004 (Table 3). The harvest on Kalgin Island (DM571/RM572) was 54 moose for both years in the reporting period (Table 3).

Hunter Residency and Success. The general season was reopened to residents only during this reporting period (Table 4).

Harvest Chronology. About 50% of the moose taken in the general hunt in 16B were taken during the last 5 days of the season (Table 5).

Transport Methods. The lack of road accessibility to the unit is reflected by the dominance of aircraft and boats as transportation used by successful hunters (Table 6).

Other Mortality

The severe winter of 1999–2000 negatively affected the moose population. In midwinter, moose were observed floundering in snow depths exceeding 5 feet (Griese 2000). As the winter progressed, rain fell giving the surface an ice crust that eased wolf travel and complicated moose movement. Recent survey results reflect the population has yet to recover from the 1999–2000 winter. We suspect wolf and bear predation on mainland 16B is responsible for 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). Recent control efforts have reduced the wolf population in the area. An ongoing study in 16B shows that black and brown bear predation may have as much or more influence on calf recruitment as wolf predation.

Due to the continued decline in moose numbers throughout Unit 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 3264–4124 moose is below the minimum objective of 6500 and below what we believe the habitat could support. Current seasons and bag limits will allow bull:cow ratios to remain above minimum objective levels. If the moose density remains low, we should be careful 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 Unit 16B. We should direct future efforts 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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Please cite any information taken from this section, and reference as:

PELTIER, T. C. 2006 Unit 16B moose management report. Pages 225–238 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 16B fall aerial moose composition counts and estimated subpopulation sizes, 1995–2004

Regulatory 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
1995–96	Northern [a]	2/27–28	--	--	--	7	298	321	--	--
	Middle [a]	2/27–28	--	--	--	12	855	969	--	--
	Southern [a]	2/29–3/3	--	--	--	6	505	537	0.8	1081±145 [b]
	Kalgin Is. [c]	2/09	--	--	--	28	26	36	1.5	60–90
1996–97	Northern [d]	11/1–2	38	7	23	14	422	484	1.2	1912±325
	Southern [a]	11/8–9	32	7	14	10	305	338	--	--
	Kalgin Is. [c]	11/8	67	27	60	26	25	35	1.5	80–110
1997–98	Southern [a]	11/25, 12/3	37	8	13	9	544	591	--	--
	Kalgin Is. [c]	2/27	--	--	--	23	17	22	0.9	100–130
1998–99	Southern [a]	11/22	35	7	8	6	337	357	--	--
	Kalgin Is. [e]	12/7	27	9	36	29	82	116	5.0	130–150
1999–00	Middle [d]	11/22–27	28	2	9	7	587	631	1.3	3314±489 [b]
	Southern [a]	11/15–22	38	4	8	6	432	458	--	--
	Kalgin Is. [e]	01/5	--	--	--	24	38	50	2.2	60–80
2000–01	Northern [f]	11/20–22	39	5	7	5	253	268	0.6	909±184
	Southern [a]	12/16	--	--	--	--	85	98	--	--
	Kalgin Is. [e]	12/12	--	--	--	30	35	50	2.2	80–100
2001–02	Northern [f]	11/5–7	40	7	14	9	393	438	0.8	1187±182
	Middle [f]	11/8–11	32	4	10	7	494	537	0.7	1836±267
	Southern [a]	10/30–11/4	31	3	13	9	539	594	--	700–850
	Kalgin Is. [e]	10/22	--	--	--	33	64	96	4.2	110–140
2002–03 [g]	--	--	--	--	--	--	--	--	--	--

TABLE 1 continued

2003–04	Northern [h]	11/24–12/6	35	7	17	9	292	326	--	898±163
	Southern [a]	12/1	46	17	23	14	133	154	--	700–850
	Kalgin Is.[e]	11/25	38	25	89	39	76	125	--	179
2004–05	Southern [a]	12/5–9	23	10	23	16	509	604	--	960

[a] Trend area composition survey (2–4 min/mi2)
[b] 80% confidence intervals
[c] Sex and age composition survey (4–6 min/mi2)
[d] Gasaway et al. (1986) random stratified survey
[e] Sex and age composition survey (6–8 min/mi2)
[f] Becker survey (Becker and Reed 1990)
[g] No survey this year
[h] J. Ver Hoef’s regression sampling method (Ver Hoef 2001) for 1/3 of area (612 ± 151 [80% CI]), plus 350–550 estimated for remainder of area

TABLE 2 Unit 16B moose harvest[a] and accidental death, 1995–2004

Regulatory year	Reported				Estimated			Accidental deaths			Grand total
	M	F	Unk	Total[a]	Unreported[b]	Illegal	Total	Road	Other	Total	
1995–96	186	10	3	199	10	25	35	0	0	0	234
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	377
1998–99	289	7	1	297	20	30	50	0	0	0	347
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	10	25	35	0	0	0	189
2002–03	91	16	2	109	10	25	35	0	0	0	144
2003–04	191	25	1	217	15	25	40	0	0	0	257
2004–05	184	34	0	218	15	25	40	0	0	0	258

[a] Includes all reported harvest including federal subsistence.
[b] Includes moose taken in defense of life or property.

TABLE 3 Unit 16B moose harvest data by permit hunt, 1995–2004

Hunt number [a]	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest Bulls	Cows	Unk	Total
TM565	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
	2002–03	141	25	51	24	33	0	0	33
	2003–04	141	27	42	32	43	1	0	44
	2004–05	100	11	45	44	43	1	0	44
TM567	1995–96	60	30	58	7	4	0	0	4
	1996–97	60	18	30	49	30	0	0	30
	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	37	54	9	14	0	0	13
	2003–04	60	22	40	38	23	0	0	23
	2004–05	60	8	49	43	26	0	0	26

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	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
	2002–03	100	26	51	23	21	0	0	21
	2003–04	60	28	50	22	13	0	0	13
	2004–05	60	13	72	15	9	0	0	9
DM571/	1997–98	60			20	1	11	0	12
RM572	1998–99	40			18	0	7	0	7
	1999–00	437	37	42	18	30	50	0	80
	2000–01	355	32	50	18	22	42	0	64
	2001–02	142	30	48	22	10	21	0	31
	2002–03	130	27	43	30	21	16	1	38
	2003–04	202	29	44	27	30	24	0	54
	2004–05	255	28	50	22	22	32	0	54

[a]TM = Tier II permit, RM = registration permit, DM= drawing permit.

TABLE 4 Unit 16B moose hunter[a] residency and success 1995–2004

	Successful					Unsuccessful					
Regulatory year	Local resident[b]	Nonlocal resident	Non-resident	Unk.	Total (%)	Local resident[b]	Nonlocal resident	Non-resident	Unk.	Total	Total hunters
1995–96	5	114	38	3	160 (25)	33	407	44	5	489	649
1996–97	12	145	39	3	199 (30)	24	412	31	0	467	666
1997–98	14	163	48	4	229 (32)	25	416	36	2	479	708
1998–99	7	153	37	1	198 (25)	25	497	53	4	579	777
1999–00	7	115	40	6	168 (22)	27	489	62	18	596	764
2000–01	10	129	30	2	171 (22)	20	534	60	4	618	789
2001–02[c]	--	--	--		--	--	--	--	--	--	--
2002–03[c]	--	--	--		--	--	--	--	--	--	--
2003–04	4	92	1	1	98 (24)	15	286	3	5	309	407
2004–05[d]	7	75	0	3	85 (20)	29	300	6	5	340	425

[a] Does not include individuals participating in permit hunts
[b] Unit 16 residents
[c] No general open season
[d] No general nonresident open season

TABLE 5 Unit 16B moose harvest chronology[a] by months of season, 1990–2004

Regulatory year	August		September						
	20–26	27–31	1–7	8–14	15–20	21–25	26–30	Unknown	Total
1995–96[b]	15	5	15	28	38	23	33	3	160
1996–97[b]	9	16	18	30	45	28	48	5	199
1997–98[b]	11	12	22	27	63	35	49	9	228
1998–99[b]	14	8	18	30	33	38	50	7	198
1999–00[c]	5	1	10	28	35	37	45	7	168
2000–01[c]	3	5	14	19	55	34	37	4	171
2001–02[d]	--	--	--	--	--	--	--	--	--
2002–03[d]	--	--	--	--	--	--	--	--	--
2003–04[e]	--	--	14	28	47	1	2	6	98
2004–05[e]	1	--	12	22	47	1	1	1	85

[a] Does not include harvest from permit hunts
[b] Open season = 20 Aug–30 Sep (SF50); Kalgin Island = 20 Aug–20 Sep (any bull)
[c] Open season = 20 Aug–30 Sep (SF50)
[d] No general open season
[e] Open season = 1–20 Sep (SF50)

TABLE 6 Unit 16B percent transport methods of successful moose hunters[a], 1990–2004

Regulatory year	Airplane	Horse	Boat	3 or 4 wheeler	Snowmachine	ORV	Highway vehicle	Unk.	Airboat	Sample size
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[b]	--	--	--	--	--	--	--	--	--	--
2002–03[b]	--	--	--	--	--	--	--	--	--	--
2003–04	56	1	16	14	1	1	5	4	1	98
2004–05	64	0	15	12	0	1	5	4	0	85

[a] Does not include harvest from permit hunts
[b] No general open season

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 Alaska Department of Fish and Game (ADF&G) 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 two 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 resulted in part from a positive response by unit residents to department education efforts, and from the 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·

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 radio-collared 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 were 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 November–15 December, when moose were thought to be 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 1992–1993 to investigate population trends, but have not been conducted since 1998.

Moose population estimation surveys have been conducted seven 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 and most of 17A, were surveyed. In March 1999 a population estimation survey for 17C was completed using a spatial statistics stratification (SSS) model. In March 2001 a population estimation survey for the western portion of 17B (upper Nushagak River drainage) was completed using an SSS model. In March 2002 a population estimation survey for the eastern porting of Unit 17B (Mulchatna drainage) was completed using an SSS model. In March 2004 a population estimation survey for 17C was completed using an SSS 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 the 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. Each year during late winter, department staff and TNWR staff attempt to survey 17A, east of and including the Matogak River drainage and north of the Nushagak Peninsula. A survey conducted in March 2004 indicated a minimum population of 777 moose in 17A (Aderman and Woolington 2005). The present population size in 17A probably exceeds 900 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 a minimum of 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, a moose population estimation survey was completed in the western portion of 17B, yielding an extrapolated estimate of 1202 (± 141 at 90% CI) moose, including 61 (± 9 at 90% CI) calves (5.1% of moose) (Woolington 2002). In March 2002, a moose population estimation survey was completed in the eastern portion of 17B, yielding an extrapolated estimate of 1953 (± 254 at 90% CI), including 76 (± 12 at 90% CI) calves (3.9% of total moose) (Woolington 2004). These estimates indicate the 17B moose population was 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, a moose population estimation survey was completed for 17C north of the Igushik River, yielding an extrapolated estimate of 2955 (± 488 at 90% CI) moose, including 435 (± 76 at 90% CI) calves (14.7% of moose) (Woolington 2002). In March 2004 a moose population estimation survey was completed for 17C north of the Igushik River, yielding an extrapolated estimate of 3670 (± 542 at 90% CI) moose, including 410 (± 96 at 90% CI) calves (11.2% of moose). This estimate indicates the 17C moose population is above minimum management objective.

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. The 2004 survey indicated a minimum calf percentage of 11.2% in Unit 17C.

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 and TNWR radiotelemetry study indicated most moose radiocollared in western 17C stayed in that area, but there was some movement into 17A. One collared 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 collared moose remained in the same range during winter and summer, while others used different ranges during those seasons. Since then, moose collared 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 (Aderman and Woolington 2005).

MORTALITY

HARVEST

Season and Bag Limit. The fall resident-only registration hunt in Subunit 17A was open 25 August–20 September. The winter resident-only two-week registration hunt in 17A (RM575) for regulatory year 2003–04 was open 22 December–4 January. The winter resident-only two-week registration hunt in 17A (RM575) for regulatory year 2004–05 was open 3–16 January. Registration permit holders could take one bull in a regulatory year. There was no general hunt, or nonresident hunting season for moose in Subunit 17A.

The general moose hunt in Subunits 17B and 17C was open for resident hunters 1-15 September. The bag limit for residents was one bull with spike/fork or 50-inch or greater antler spread or with three or more brow tines on at least one side. The general moose hunt in 17B for nonresident hunters was open 5–15 September. The bag limit for nonresident hunters was one bull with 50-inch or greater antler spread or with four or more brow tines on at least one 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 1 bull in a regulatory year.

The winter resident-only registration hunt in 17B and 17C (RM585) was open 1–31 December. Registration permit holders could take 1 bull in a regulatory year. 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 RM573 and RM 575 permits were valid only in 17A and were available to any Alaska resident who applied in person at Togiak (RM573: 5 August–25 September; RM575:

throughout the open season). 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 July–31 August; RM585: 25 October–31 December).

Board of Game Actions and Emergency Orders. During this reporting period the Board of Game expanded the area included in the winter Subunit 17A moose hunt to include the western portion of Subunit 17C, that area west of Killian Creek, Snake Lake, and Snake River. Another proposal passed by the Alaska Board of Game established a corridor two miles wide on each side of portions of the major rivers in Subunit 17B, in which nonresidents could hunt moose only by registration permit (RM587). Each of these new regulations went into effect beginning with regulatory year 2005–06.

Hunter Harvest. As a result of the more than four-fold increase in hunters afield since 1983 (1983/84=293; 2004/05=1204), reported moose harvests in Unit 17 have more than tripled (1983/84=127; 2003/04=426). The reported harvest in the past five years in 17B has ranged from 163 to 226, with an annual average harvest of 185 moose. In Unit 17C the 5-year mean annual harvest was 202, with a range of 136 to 251 moose (Table 1).

Hunters continued to harvest moose with large antlers throughout this reporting period. During each of the last five seasons, more than 46% of the reported harvest has consisted of moose with antler spreads of 50 inches or greater. The largest antlers reported for each of these seasons have exceeded 69 inches (Table 2).

General Hunt. The general moose hunt in 17B and 17C is shorter and has 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 five years for the general moose season in 17B has ranged from 96 to 165, with a mean annual harvest of 125 moose (Table 4). In 17C, the 5-year mean annual harvest for the general hunt was 22 moose, with a range of 18 to 26 (Table 5).

Permit Hunts. Longer seasons and more liberal bag limits have enticed many resident hunters to participate in the registration hunts (RM573, RM575, RM583, and RM585). In fall and winter of 2003, 957 permits were issued for Unit 17 registration moose hunts, and 774 hunters reported they hunted, killing 285 moose. In the fall and winter of 2004, 975 permits were issued for Unit 17 registration moose hunts, and 792 hunters reported hunting, killing 254 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 regulatory year 2003–04 in 17A, 61 hunters reported killing 11 moose; during regulatory year 2004–05, 77 hunters reported killing 20 moose (Table 6). In 2003–04, 880 registration hunt permits were issued for Subunits 17B and 17C, with 713 hunters reporting that they hunted and killed 274 moose. In 2004/05, 878 registration hunt permits were issued for 17B and 17C, with 715 hunters reporting that they hunted and killed 234 moose (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 five years was 503, an increase from the previous reporting period (Woolington 2004). Participation by resident hunters in the general hunt has declined because of increased interest in the registration hunt. Unitwide success during the general hunt ranged from 25% to 36% during the past five years, with a mean annual success rate of 31%. In regulatory years 2000–01 though 2004–05, nonresidents accounted for 64% of reporting hunters in the general hunt, residents of Unit 17 accounted for 6%, and other residents of Alaska made up 29% of the total number of hunters (Table 3).

The mean number of moose hunters participating in registration moose hunts in Unit 17 during the past five years was 703, a 14% increase from the previous reporting period (Woolington 2004). Success during the registration hunts in Unit 17 ranged from 32% to 42% during the past five years, with a mean annual hunter success rate of 36%. Residents of Unit 17 composed 81%, and other residents of Alaska made up 19% of hunters in the registration hunts from regulatory years 2000/01 through 2004/05 (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 = 69%, Table 12). Most participants in the registration hunt used boats for access (5-yr mean = 77%, 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 have been 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.

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. Attitudes are changing following considerable efforts by state and federal management agencies, working with local communities, to help hunters see the benefits of reducing illegal moose kills. 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 winter.

HABITAT

ASSESSMENT

Aderman (1999) established seven 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 probably are 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 has been 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.

NONREGULATORY 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 as the caribou herd declines (Woolington 2005).

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. Population estimation surveys during the previous reporting period indicated the moose population in 17B was below management objectives. No further information for 17B was available for this reporting period.

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 have been 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.

The moose population in 17A 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 continuing efforts to inform the local public of the advantages of reducing illegal harvest of moose in the unit.

The Board of Game 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 two ungulate populations and attempt to monitor predator populations.

Recommended management actions for the next few years include the following:

- Conduct a population estimation survey of subunits each winter on a rotating basis.
- Continue to develop the moose management plan for Subunit 17A in cooperation with Togiak National Wildlife Refuge, local advisory committees, and local citizen groups.
- Continue to seek cost-effective and accurate methods to obtain bull:cow ratios within the unit.

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

WOOLINGTON, J.D. 2006. Unit 17 moose management report. Pages 239–261 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Reported moose harvest data for all hunts in Unit 17, 1964–65 through 2004–05

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	7
1984–85	158	344	46%	0	86	70	2
1985–86	148	401	37%	0	94	52	2
1986–87	202	486	42%	0	122	73	7
1987–88	207	499	41%	0	152	42	13
1988–89	187	457	41%	0	157	28	2
1989–90	175	438	40%	0	122	48	5
1990–91	225	489	46%	0	178	44	3
1991–92	268	590	45%	0	172	85	11
1992–93	263	705	37%	0	160	90	13
1993–94	249	705	35%	1	150	78	20
1994–95	297	800	37%	0	168	94	35
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
1999–00	425	1116[b]	38%	10	170	192	53
2000-01	373	1112[b]	34%	10	226	136	1
2001-02	419	1175[b]	36%	7	186	222	4
2002-03	404	1147[b]	35%	8	183	210	3
2003-04	426	1168[b]	36%	11	163	251	1
2004-05	383	1204[b]	32%	20	168	193	2

[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 through 2004–05

	Antler size			
Regulatory Year	<30"	30–50"	>50"	Largest antlers
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”
1999–00	7	37	56	71”
2000–01	8	27	65	80”
2001–02	19	28	53	72”
2002–03	20	35	46	69”
2003-04	13	33	54	78”
2004-05	15	33	52	72”

TABLE 3 Unit 17 moose hunter[a] residency and success, 1992/93–20004/05

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
1999–00	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	304 (64)[k]	473
2002–03	12	25	77	120 (25)[l]	19	115	217	351 (75)	471
2003-04	6	38	97	141 (36)	27	96	127	253 (64)[m]	394
2004-05	4	26	97	129 (31)[n]	20	92	169	283 (69)[o]	412

[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.
[m] Includes 3 successful hunters of unknown residency.
[n] Includes 2 successful hunters of unknown residency.
[o] Includes 2 successful hunters of unknown residency.

TABLE 4 Unit 17B reported moose harvest[a] and accidental death, 1992–93 through 2004–05

Regulatory	Hunter Harvest								
	Reported				Estimated[b]				Grand
Year	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	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
1999–00	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
2003-04	114 (100)	0	0	114	0	0	0	0	114
2004-05	107 (100)	0	0	107	0	0	0	0	107

[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 through 2004–05

Regulatory Year	Hunter Harvest								
	Reported				Estimated[b]				Grand
	M (%)	F (%)	Unk.	Total	Unreported	Illegal	Total	Accidental death	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	0	1[e]	29
1995–96	32 (100)	0	0	32[f]	0	0	0	0	32
1996–97	23 (100)	0	0	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	1	28
1999–00	23 (100)	0	0	23[k]	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
2003-04	26 (100)	0	0	26[o]	0	0	0	0	26
2004-05	21 (100)	0	0	21[p]	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.
[o] Does not include 1 bulls from an unspecified portion of Unit 17.
[p] Does not include 1 bull from an unspecified portion of Unit 17.

TABLE 6 Unit 17A reported moose harvest data by permit hunt, 1997–98 through 2004–05

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
	1999–00	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	15	7 (100)	0	0	7
	2002–03	40	10	78	22	8 (100)	0	0	8
573/575[c]	2003-04	77	21	82	18	11 (100)	0	0	11
	2004-05	97	20	74	26	20 (100)	0	0	20

[a] Registration permits were valid for only Unit 17A.
[b] Includes only those permittees reporting that they hunted.
[c] Registration hunt RM575 established beginning winter 2003-04

TABLE 7 Unit 17B reported moose harvest data by permit hunt, 1992–93 through 2004–05

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
	1999–00	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
	2003-04	880	20	69	31	47 (100)	0	0	47
	2004-05	878	20	75	25	60 (100)	0	0	60

[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 through 2004–05

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
	1999–00	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
	2003-04	880	20	56	44	227 (100)	0	0	227
	2004-05	878	20	65	35	173 (100)	0	0	173

[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, 1992/93–2004/05

Regulatory Year	Successful				Unsuccessful				Total hunters
	Local[b] Resident	Nonlocal resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total(%)	
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
1999–00	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
2003-04	214	71	0	285 (37)	407	82	0	489 (63)	774
2004-05	204	50	0	254 (32)	446	92	0	538 (68)	792

[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 through 2004–05

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
1999–00	0	3	51	42	0	2	0	1	1	146
2000–01	0	0	55	41	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
2003-04	0	0	57	39	0	0	0	0	4	141
2004-05	0	0	50	46	0	0	0	0	4	129

[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 through 2004–05

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	Other/ 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
1999–00	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
2003-04	14	44	20	13	0	1	2	4	2	285
2004-05	8	33	16	22	0	5	5	5	5	254

[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, 1992/93–2004/05

Regulatory Year	Percent of harvest: Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unknown	Total moose
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
1999–00	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
2003-04	70	0	29	1	0	0	0	0	141
2004-05	75	0	23	1	0	0	0	1	129

[a] Excludes permit hunt harvest.

TABLE 13 Unit 17 reported moose harvest by permit hunt, percent by transport method, 1992/93–2004/05

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
1999–00	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
2003-04	11	0	79	1	7	1	1	1	285
2004-05	6	0	72	3	16	0	0	2	254

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNIT: 18 (42,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Moose are thought to have begun immigrating 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 2,500–3,500 moose. Allow the lower Kuskokwim River moose population to increase above its estimated size of 75–250 moose to at least 2,000 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 2004 we operated a hunter check station approximately 20 miles downstream of Russian Mission. Whenever possible, we collect incisors and take antler measurements. Hunter participation is voluntary.

In February 2004 and March 2005, 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 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. As a result of these efforts, the LKAC wrote a proposal to the BOG to close moose hunting in the Lower Kuskokwim for 5 years starting with the fall of 2004.

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 Dept. 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 February 2004 we conducted moose population censuses in the Lower Kuskokwim survey area, and in March 2005 we conducted a moose population census on the Lowest Yukon survey area (Table 1). In general, the Lower 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 1341 ± 21.0% in 2005. 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.

In 2000, 2002 and 2004 we estimated the number of moose at 86 ± 26.4%, 117 ± 18.3% and 69.6 ± 32.4% respectively in the Lower Kuskokwim Area, using spatial techniques. The midpoint of the density estimate remained low with a high of 0.13 moose/mi^2 in 2002 and a low of 0.08 moose/mi^2 but the difference was not significant.

Population Composition

During the winter moose censuses in February 2004 and March 2005, 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.

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.

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 support 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 this drainage in 2001 to 2005. The latest report included 35 moose.

We have some radiotelemetry data, which show that moose are entering Unit 18 from adjacent Unit 17. These moose appear to be colonizing the southern drainages of Unit 18 including the Goodnews and Kanektok river drainages, where Togiak NWR staff observed 22 moose in March 2005. We also have reports from local residents of increasing numbers of moose in this area. (A. Aderman, personal communication, 2005).

During the summer, moose are found in low numbers throughout the Unit. Moose have been reported along the Manokinak and Izaviknek rivers, near Chevak, on Nelson Island 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 below. 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 State of Alaska seasons with two exceptions. The federal season within the Kuskokwim River drainage was from 25 August–25 September. Also, there is no federal season in Unit 18 south of and including the Kanektok River drainages.

2003–2004 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	5 Sep – 25 Sep	5 Sep – 25 Sep

2003–2004 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, south of the south banks of Kwikluak Pass and the Yukon River, and north and west of a line from Cape Romanzof to Kuzilvak Mountain and then to Mountain Village:		
1 bull	5 Sep– 25 Sep	No open season
Unit 18, All Yukon River drainages north of the south bank of the Yukon River, including sloughs, upstream of Mountain Village:		
1 bull	1 Sep–30 Sep	1 Sep–30 Sep
or 1 bull	27 Dec–5 Jan	No open season
Remainder of Unit 18		
1 bull	1 Sep–30 Sep	No open season

2004–2005 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, Lower Kuskokwim Closed area; easterly of a line from the mouth of the Ishkowik River to the closest point of Dall Lake then to the easternmost point of Takslesluk Lake then along the Kuskokwim drainage boundary to the Unit 18 border and north of and including the Eek River drainage, and that portion south of and including the Goodnews River drainage	No open season	No open season

2004–2005 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, that portion south of the Eek River drainage and north of the Goodnews River		
1 bull	1 Sep 1–30 Sep	No open season
Or 1 bull, a 10-day season may be announced 1 Dec– 28 Feb		
Unit 18, Remainder		
1 bull	1 Sep–30 Sep	1 Sep–30 Sep
Or 1 bull	27 Dec–5 Jan	No Open season

<u>Board of Game Actions and Emergency Orders.</u> A 10-day winter resident season during the period from 1 Dec–28 Feb upriver from Mt. 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 Dec–5 Jan in 1996–1997, 1997–1998, 1998–1999, 1999–2000, 2001–2002, 2003–2004 and 2004–2005. 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.

The winter moose season was not opened within, and south and east of the Kuskokwim River drainage in 2003–2004. This was the fourth year the winter season remained closed in this portion of Unit 18 and follows a request by the LKAC to leave it closed for at least 5 years.

The Board of Game closed moose hunting on the Kuskokwim River drainage during their fall 2003 meeting in response to a request by ADF&G and the LKAC for a 5–year moratorium on moose hunting. This closure was agreed upon with the hopes that it would have similar results to the Lower Yukon River moratorium in the late 1980s and early 1990s.

<u>Human Harvest</u>. During the 2003–2004 open season, 653 hunters reported a harvest of 233 moose**.** For the 2004–2005 season, 528 hunters reported a harvest of 226 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. Until recently, harvest exceeded annual recruitment on the Kuskokwim River and moose survived there only due to continual immigration from adjacent areas. We believe unreported harvest has drastically declined due to education efforts undertaken from 2001 through 2004, and the moratorium on moose hunting that started in fall 2004.

The reported harvest of moose in Unit 18 does not reflect the actual harvest; it shows only the harvest by people who operate within the regulatory system. In recent years we have seen an increase in reporting, and 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 greater acceptance among hunters of the requirements for harvest tickets and reports, the willingness of most hunters to harvest only bulls, the successful cooperative effort that resulted in a huntable moose population below Mt. 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 5) accounting for approximately 89% (208 moose) of the reported harvest in 2003–2004 and 96 % (218 moose) in 2004–2005.

In Unit 18 there is growing use of Alaska 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 statute 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.

<u>Permit Hunts</u>. There were no permit hunts for moose in Unit 18 during the reporting period.

<u>Hunter Residency and Success</u>. 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 653 hunters who reported hunting during the 2003–2004 season, 0 were nonresidents. Of 589 hunters who reported hunting during the 2004–2005 season, 3 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.

Based on reported harvest, the moose hunter success rates based on harvest reports were 36% for 2003–2004 and 42% for 2004–2005 seasons. Successful hunters spent an average of 6.7 days hunting in 2003–2004 and 7.4 days in 2003–2004. Unsuccessful hunters spent an average of 9.3 days hunting in 2003–2004 and 10.2 days in 2004–2005.

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, though the number of hunters making these upriver trips is declining.

<u>Harvest Chronology</u>. 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 4).

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 workweek 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.

<u>Transport Methods</u>. 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 since caribou have become more available, moose numbers have increased, and trapping pressure has declined. We estimate that 250–300 wolves in 25–30 packs reside 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 item 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 provides some escape cover for moose. Downstream of Akiachak toward the mouth of the Kuskokwim, the riparian corridor narrows and escape cover is lacking. Moose are rarely found in the riparian corridor along the Kanektok, Goodnews, and Arolik Rivers, 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.

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 on 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. During this reporting period compliance is improved, but other community factors still affect moose management. 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. Over 20,000 rural residents live in 42 communities throughout Unit 18. We need continued effort to curb illegal harvest of moose. Another factor is the declining number of Mulchatna caribou and its affect on the ability of local hunters to gather meat.

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.

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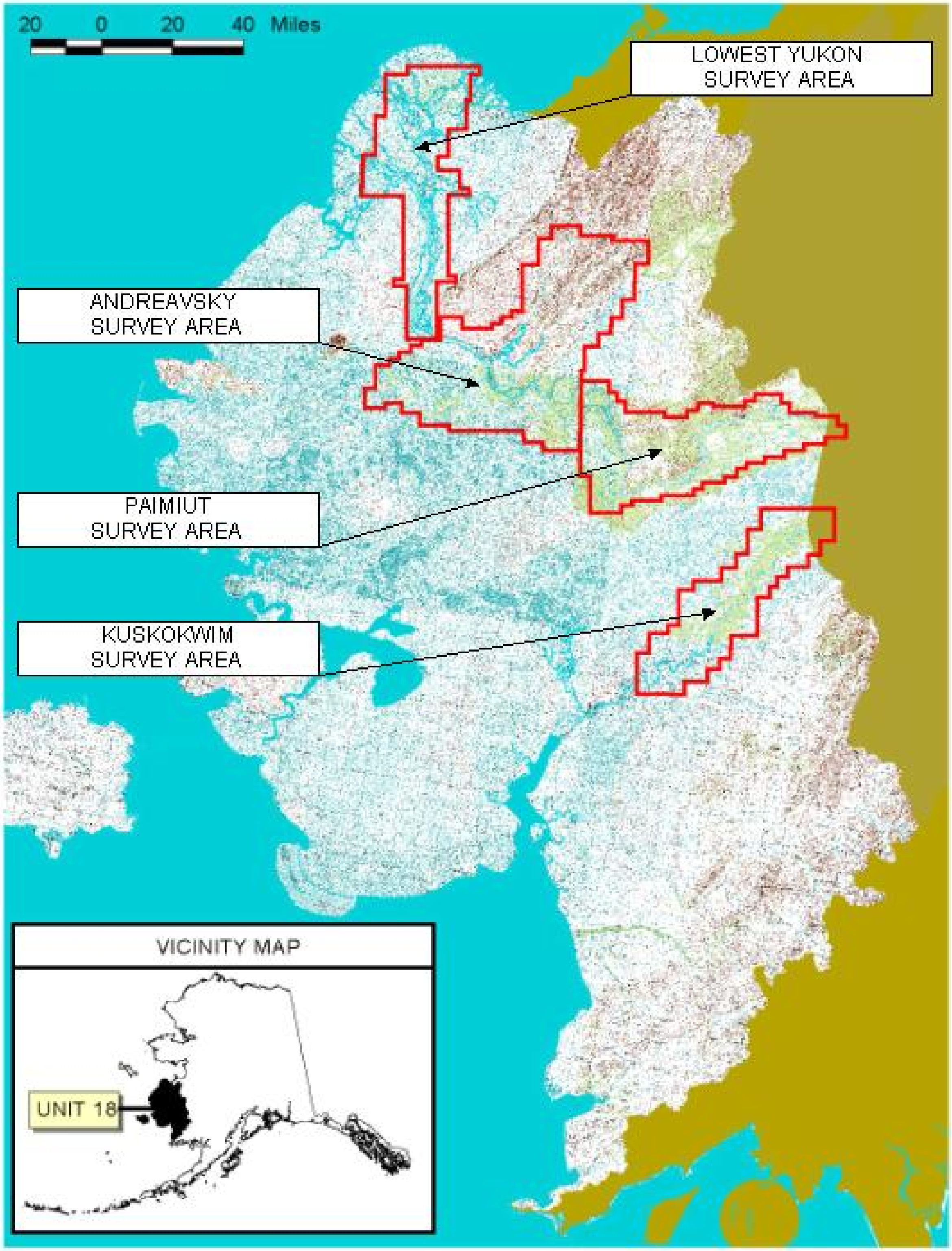

FIGURE 1 Unit 18 showing geostatistical population survey areas (Ver Hoef style survey areas). The larger area is shown for survey areas where boundaries were adjusted.

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
	2005	1193	1341±21.0%	1.12	Spatial
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
Lower Kuskokwim Unit 18 Only	2004	869	69.6 ±32.4%	0.08	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 February 2004 Lower Kuskokwim and March 2005 Lowest Yukon estimates of calves:100 adults within Unit 18 survey areas

Survey Area	*Calves:100 Adults*
Lowest Yukon	64.2
Lower Kuskokwim	70.0

TABLE 4 Fall and winter moose harvests for Unit 18, 1978–2005

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	1	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
2003-2004	220	94	13	6	0	0	233
2004-2005	189	84	36	16	1	0	226

TABLE 5 Reported moose harvest in the Yukon River, Kuskokwim River and Johnson River drainages, Unit 18, 1981–2005 Does not include harvest south of the Kuskokwim River drainage

	%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	76	23	1
1994–1995	86	14	0
1995–1996	85	15	0
1996–1997	72	28	0
1997–1998	75	24	1
1998–1999	78	16	6
1999–2000	80	18	2
2000–2001	82	14	3
2001–2002	80	18	2
2002–2003	84	14	2
2003-2004	89	11	0
2004-2005	100	0	0

TABLE 6 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
2003-2004	633	233
2004-2005	528	226

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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Division of Wildlife Conservation
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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNITS: 19A, 19B, 19C, and 19D (36,486 mi^2)

GEOGRAPHIC DESCRIPTION: All of the drainages into the Kuskokwim River upstream from Lower Kalskag

BACKGROUND

Moose are a relatively recent faunal addition to western Interior Alaska. According to oral history, their initial discovery was sometime after the turn of the 20th century. As recently as the 1970s, populations were at record highs. Currently, moose are found throughout this area, with the exception of the rugged peaks of the Alaska Range. Predation by wolves, black bears, and grizzly bears is the major factor influencing moose abundance in Unit 19 with weather, habitat, and hunting playing important roles.

Unit 19 can be conveniently divided into 2 regions that have distinct differences in moose habitat, user access, and hunting practices. Units 19A and 19D are generally lower elevation areas accessible by boat. Hunters in these units are generally local residents who hunt primarily for food and who live in Unit 19 or nearby in Unit 18. Units 19B and 19C are generally higher elevation areas where access is largely accomplished using aircraft. Few people live in these areas, and those who travel there to hunt often seek large bulls for their trophy quality, although meat is an important consideration.

Aerial composition surveys were the primary means of assessing population status and trend in this large area for several decades (Tables 1a–1c). Unfortunately, these older data were kept as hard copies and information related to these surveys (i.e., snow conditions, weather and light conditions, survey dates, observers, etc.) that help to interpret these data were lost during a fire that consumed the McGrath office in December 2006.

Regulations, including controlled use areas (CUA) and management areas (MA), and other requirements to manage moose hunting and reduce conflicts between user groups, have existed

[1] At the discretion of the reporting biologist, this unit report may include data collected outside the reporting period.

in the area for many years. A sample of these include the Holitna–Hoholitna CUA which imposes a boat motor horsepower restriction; the upper Holitna–Hoholitna MA where hunters must stop at a checkstation if one is established, and where hunters entering the area by aircraft must exit the area by the same means; meat on bone requirements and meat care education requirements in various areas; aircraft restrictions in the upper Kuskokwim CUA in Unit 19D and; moose hunting by Tier II permit only within the Lime Village MA.

As moose populations declined, conflicts between users intensified and moose hunting regulations increased and became more cumbersome. A working group of multiple users was formed and developed the Central Kuskokwim Moose Management Plan (CKMMP), which was finalized in June 2004. This plan guides moose management in Units 19A and 19B. Similar public input has been accomplished in Unit 19D since 1995 through the McGrath Advisory Committee.

Wolf and bear predation plays a significant role in the population dynamics of moose (Gasaway et al. 1992). In Unit 19D, wolves, black bears, and grizzly bears were all identified as significant predators (Keech et al. 2002). This understanding refocused our management toward efforts to reduce predation. In 1995 the Alaska Board of Game adopted a Wolf Control Implementation Plan for Unit 19D East (8513 mi^2, encompassing Unit 19D upriver of, but not including, the Black and Selatna River drainages; Fig. 1) and reauthorized the same plan with updates in January 2000, March 2001, and March 2003. (Reauthorizations occurred again in January 2006, and May 2006). In 2001 the Experimental Micro Management Area (EMMA; Fig. 1), a 528-mi^2 area located within a 20-mi radius of McGrath, was established. This area encompasses the highest density of moose in Unit 19D East and was established as a treatment area where predator population manipulations and other management actions could be tested.

Predation control programs in Units 19A and 19D are critical for compliance with intensive management mandates. As moose numbers declined, public planning efforts increased; predator control plans were implemented; research efforts undertaken; and despite universal local support for predator control, legal challenges to these programs remain. These efforts to increase the moose populations in Unit 19 characterize the most important management responsibilities in the McGrath office.

MANAGEMENT DIRECTION

During this reporting period the objectives were defined as follows:

In Units 19A, 19B, 19C and 19D:

- 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.

Units 19A and 19B additional objectives, as recommended in the CKMMP:

- Minimum fall posthunt bull:cow ratio of 25–30 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.

Units 19A and 19B activities, as recommended in the CKMMP:

- 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.

However, the goals, objectives, and activities listed above for RY03–RY04 were not the ones actually used during the report period. While similar to the objectives and activities listed above for RY03–RY04, the goals, objectives, and activities listed below are consistent with the CKMMP and the intensive management law, were presented to the Alaska Board of Game during the report period, and more closely reflect management direction during RY03–RY04. Therefore, the following goals, objectives, and activities for RY03–RY04 replaced those listed above.

MANAGEMENT GOALS

- Achieve the intensive management moose population and harvest objectives for Units 19A and 19B.

- Achieve the intensive management moose population and harvest objectives for Unit 19D.

- Maintain or increase moose numbers and harvest levels in Unit 19C.

- In Unit 19A and Unit 19D East: reduce predation on moose through predator control activities.

MANAGEMENT OBJECTIVES

In Units 19A and 19B intensive management population and harvest objectives, as listed regulation 5 AAC 92.108, were:

- Achieve a moose population of 13,500–16,500 moose (7,600–9,300 in Unit 19A) with a harvest of 750–950 moose.

In Units 19A and 19B objectives, which were recommended in the CKMMP were:

- Maintain a minimum fall posthunt bull:cow ratio of 20–30 bulls:100 cows.

- Maintain a minimum fall posthunt calf:cow ratio of 30–40 calves:100 cows.

- Maintain no fewer than 20% calves in late winter surveys. These were described as short yearlings in the CKMMP and are approximately 10-month-old calves.

In Unit 19C:

- Maintain an annual average antler spread measurement of at least 48 inches in Unit 19C.

In Unit 19D, the intensive management population and harvest objectives were:

- Achieve a moose population of 6,000–8,000 moose with a harvest of 400–600 moose in Unit 19D East and a moose population of 4,000–6,000 with a harvest of 250–600 in the remainder of Unit 19D.

ACTIVITIES

Throughout Unit 19:

- Assess population composition and trend through composition/trend surveys, particularly in portions of the unit where harvest levels make significant impacts on moose populations.

- Assess population size through population density estimation surveys.

- Assess moose movements through regular radiotelemetry surveys.

- Assess moose habitat directly through browse surveys, and indirectly through population parameter measures such as twinning rates and through body parameter measures such as weights and fat depth, when possible.

- Encourage landowners and land managers to reduce fire suppression on wildfires that do not threaten human life, property, or valuable resources, allowing fire to maintain young, productive, and diverse habitats.

- Monitor harvest through Tier II permits, registration permits, and general hunt harvest reports; analyze harvest data; and assess the accuracy of this data in selected areas when possible.

- Monitor natural mortality and analyze mortality data.

- Provide moose management information to state and federal regulatory bodies.

In Units 19A and 19B additional activities, as recommended in the CKMMP:

- Assemble moose biology and management educational curricula and distribute through newsletters, school materials, posters, and other mechanisms to a variety of audiences, including students, teachers, hunters, and others.

- Fit moose with radio collars in Unit 19A and in Unit 19B and conduct flights to track the locations of these radiocollared moose.

METHODS

During 16 and 17 November 2004, moose composition surveys were conducted in Unit 19A using a modified geospatial population estimator (GSPE; Ver Hoef 2001; Kellie and DeLong 2006) to estimate early winter moose population composition in Unit 19A within the drainages of the Holitna and Stony Rivers. The Aniak River drainage was not included in this survey due to lack of snow cover. This was the first use of this technique for estimating population composition without an accompanying density estimate.

We stratified the area south of the Kuskokwim River into 2 strata; pseudo-randomly selected 23 low and 67 high-density sample units (2×5 minute GSPE units of approximately 6.3 mi^2 each) for a total of 90 units; surveyed each unit for an average of 7.3 minutes per block; “high-graded” the area by concentrating on the most likely areas to find moose; and recorded number of animals and classified them as bulls, cows, or calves.

During November 2005, aerial trend and composition surveys were conducted in central Units 19A and 19B in the Holitna River drainage, and in western Unit 19A in the Aniak River drainage, including the Kuskokwim River from Lower Kalskag to Napaimiut. Super Cubs were flown along randomly selected east–west transects defined by lines of latitude, and pilots used a GPS to maintain the aircraft on the transects.

During February 2005, aerial GSPE density estimation surveys were conducted south of and along the Kuskokwim River in approximately 7156 mi^2 of Unit 19A. During March 2006 a similar survey was conducted in the western portion of this area using the same methods. No sightability correction factors were applied to density estimates from these surveys.

An aerial trend/composition survey was conducted in the Farewell trend count area during November 2006. A transect grid was established using lines of longitude and latitude and followed using a GPS in the area south of Farewell along the South Fork Kuskokwim River and to the west within the area known as the Farewell Burn. We recorded the number of moose and classified them as small, medium, or large bulls; cows; or calves.

We monitored harvest through moose hunt reports from harvest tickets, and registration and Tier II permits. We collected incisors for aging from moose harvested in fall 2001, but those data were lost in the McGrath office fire. Population and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY04 = 1 July 2004–30 June 2005).

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). Radio collars were deployed on moose distributed 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 radiotrack the locations of these radiocollared moose were conducted on a regular basis through 2006.

We used these radiocollared moose to assist our collection of calving data and to determine whether the Unit 19A and 19B moose populations were distinct from each other.

Keech (2006) conducted additional moose population research in Unit 19D East that included: conducting moose density and composition surveys using GSPE techniques; radiocollaring moose calves and using aerial radiotelemetry surveys and ground observations to determine primary causes of their mortality; radiotracking yearling and adult moose to determine reproductive and condition indices, movements, and mortality rates; and obtaining snow depth and density data within the EMMA from the National Oceanic and Atmospheric Administration. Browse surveys were also conducted in March 2003 via helicopter and snowmobile throughout the EMMA.

We contributed educational moose management articles to local newspapers as possible. Our intent was to make regular contributions, but other priorities prevented more than a few articles.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Units 19A and 19B. During February 2005, we measured a moose population density of 0.27 observable moose/mi^2 (90 % CI ±16%), in Unit 19A along and south of the Kuskokwim River. During March 2006 we measured a moose population density of 0.39 moose/mi^2 (90% CI ±15%) in the western half of the area surveyed in 2005 (Table 1d). These population estimates are well below our objective of 13,500–16,500 moose (7600–9300 in Unit 19A).

Unit 19C. Moose numbers probably declined in Unit 19C since the late 1980s and early 1990s. Although no density estimation surveys were conducted in Unit 19C, trend count data revealed an average of 150 moose per hour between 1987 and 1997 (range 100–194 moose per hour). More recent trend count data during 1999–2006 revealed an average of 91 moose per hour (range 81–110 moose per hour; Table 1b).

Unit 19D. In fall 2001 we estimated 3959 observable moose in Unit 19D East (0.46 moose/mi^2), based on extrapolation of a survey conducted in a 5204-mi^2 portion of the unit. Using similar techniques in 2004, we estimated 4374 observable moose in Unit 19D East (0.5 moose/mi^2). These population estimates are well below our objective of 6000–8000. However, a sightability correction factor of 1.39 is sufficient to achieve the lower end of this objective. Sightability correction factors varied from 1.17 to 1.33, suggesting that we are not as far below this objective as the estimate of observable moose indicates. Additional survey results are summarized in Tables 1e and 1f.

Population Composition

Units 19A and 19B. During the November 2004 GSPE composition survey in Units 19A and 19B, we observed 226 moose and estimated 32 calves:100 cows (90% CI ±38%) and 19 bulls:100 cows (90% CI ±53%). The wide confidence intervals were due to high variance within each stratum.

During the November 2005 composition survey in Holitna and Aniak River drainages, we observed 307 moose; 24 calves:100 cows; and 8 bulls:100 cows (5 yearling bulls:100 cows) within the Holitna River drainage, and most of these bulls were classified as yearlings (12 of 19). In western Unit 19A within the Aniak River drainage, we observed 410 moose, 23 calves:100 cows, and 20 bulls:100 cows.

In Unit 19B, during the November 2005 upper Holitna–Hoholitna survey, we observed 146 moose (13 yearling bulls, 13 medium bulls [31–50" antlers], 23 large bull [>50" antlers], 75 cows, and 22 calves). The observed bull:cow ratio was 66:100 and the yearling bull:cow ratio was 17:100. The calf:cow ratio was 29:100.

During the February 2005 GSPE population density estimation survey in Unit 19A, 17% of the observed moose were calves.

Unit 19C. Moose composition surveys conducted in November 2006 provided the following population composition information (Table 1b):

279 total moose (84.6 moose/hr)
26 yearling bulls (9%)
8 sets of twins (13%)
40.9 calves:100 cows
46.3 bulls:100 cows

Additional data obtained during this survey were lost in the December 2006 fire.

Unit 19D. Within the EMMA, the calf:cow ratio varied from a low of 34 calves:100 cows in 2001 to a high of 63 calves:100 cows in 2004 while the bull:cow ratio varied from a low of 13 bulls:100 cows in 2004 to a high of 25 bulls:100 cows in 2006. Yearling bull:cow ratios ranged from a low of 5 yearling bulls:100 cows in 2003 to a high of 14 yearling bulls:100 cows in 2006 (Table 1e). Moose population composition for the moose survey area (MSA) and that portion of Unit 19D East MSA excluding the EMMA is summarized in Table 1f.

Table 1g shows reproduction and condition indices for moose in Unit 19D East during 2001–2006. Parturition for cows older than 2 years ranged from 73% to 97% and twinning rates ranged from 24% to 59%.

Moose Movements

Movements of moose in Units 19A and 19B are characterized in Figures 2 and 3. Data were collected to better understand seasonal movement of moose in Units 19A and 19B, and to determine whether moose present during surveys were available to hunters during the fall hunting season. Generally, moose did not move far from their capture locations in Units 19A and 19B. Moose that did move considerable distances wintered to the south in Unit 17. Data from bull moose radiocollared in the Unit 19B portion of the Aniak River drainage were lost during the December 2006 fire that destroyed the McGrath office, but indicated that these bulls remained in Unit 19B during late August and October.

MORTALITY

Harvest

Seasons and Bag Limits.

Seasons and bag limits 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

Regulatory year 2002–2003

Unit and Bag Limits		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 one 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–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 one 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 one 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 one side.		1 Sep–20 Sep

Regulatory year 2002–2003 Unit and Bag Limits		Open Season
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 one 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

Seasons and bag limits for 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 and Bag Limits		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		
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 one 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 one 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

Regulatory year 2003–2004

Unit and Bag Limits		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 one 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 one 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 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 one 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

Seasons and bag limits for RY04 were:

Regulatory year 2004–2005 Unit and Bag Limits		Open Seasons
Unit 19A, Lime Village Management Area, that portion drained by the Stony River from the mouth of the Stink River, including the Stink River drainage upstream to, but not including the Can Creek drainage.		
RESIDENT HUNTERS: 2 antlered bulls by Tier II permit TM684		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
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 one 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 one side.		1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 one 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 one 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
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
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
NONRESIDENT HUNTERS:		No open season

Seasons and bag limits for RY05 were:

Regulatory year 2005–2006 Unit and Bag Limits		Open Seasons
Unit 19A, Lime Village Management Area, that portion drained by the Stony River from the mouth of the Stink River, including the Stink River drainage upstream to, but not including the Can Creek drainage.		
RESIDENT HUNTERS: 2 antlered bulls by Tier II permit TM684		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

Regulatory year 2005–2006

Unit and Bag Limits	Open Seasons
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 one 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 one side.	1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 one 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 one 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	
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

Regulatory year 2005–2006 Unit and Bag Limits	Open Seasons
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 one side.	1 Sep–20 Sep
Remainder of Unit 19D	
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season

Alaska Board of Game Actions and Emergency Orders. The board shortened the nonresident season in Unit 19C by moving the ending date from 25 September to 20 September effective during the RY02 season. The previous management report, in 2004, incorrectly stated that this change occurred with the RY03 season.

Alaska Board of Game changes effective during the RY04 season were:

- Unit 19A: bag limit in the Lime Village Management Area was changed from 2 moose to 2 antlered bulls.
- Unit 19A remainder: resident general harvest seasons were replaced by a resident registration permit hunt (RM640) from 1 September to 20 September with a bag limit of 1 antlered bull, and the nonresident season was eliminated.
- Unit 19B within nonresident closed area: resident general harvest season was changed from 1 bull to 1 bull with spike fork or 50 inch antlers or 4 brow times on one side. Additionally the season was shortened from 1 September–25 September to 1 September–20 September. Additionally, the registration permit necessary to hunt in Unit 19A (RM640) could also be used by residents to take any bull in Unit 19B.
- Unit 19B within nonresident closed area: a resident registration hunt for 1 antlered bull was implemented from 1 September to 20 September.
- Unit 19B remainder: the resident general harvest season was changed from 1 bull to 1 bull with spike fork or 50 inch antlers or 4 brow times on one side. Additionally the season was shortened from 1 September–25 September to 1 September–20 September.
- Unit 19B remainder: the nonresident hunt was shortened from 1 September–25 September to 5 September–20 September.

- Unit 19C: the general harvest season was changed from 1 bull to 1 bull with spike fork or 50 inch antlers or 4 brow times on one side.
- Unit 19C: the resident winter registration hunt was changed from 15 January–15 February to 1 February–28 February.
- 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 from 1 September–20 September to 1 September–25 September and the season date for RM650 in the Takotna River drainage upstream from Takotna was shortened to 1 September–20 September by deleting the August portion of the season.
- Unit 19D: the December resident moose season was eliminated.

Hunter Harvest. Hunter harvest in each unit for RY00–RY05 is reported in Tables 2a–2e by sex and hunt type and in Table 2f by percent bulls. While it appears that the moose harvest increased toward the end of this period, that is probably an artifact of the better harvest reporting rates achieved through the use of registration permits. Nearly all moose reported taken were bulls, consistent with bulls-only bag limits. Some cows were taken illegally, but the number is difficult to estimate.

Because nonlocal hunters tend to report at higher rates, annual reported harvests in Units 19B and 19C were probably closer to actual harvest than those reported in Unit 19A prior to RY04 when the registration permit was implemented. The decline in Units 19B and 19C harvests probably reflects declines in the moose populations.

In Unit 19D, compliance with reporting requirements also increased with the institution of the registration permit hunt RM650 in RY01. The average reported harvest for this hunt was roughly 75 bulls during RY01–RY05.

Table 2e shows the number of moose taken in areas where the reported harvest location was either missing, ambiguous, illegible, or otherwise indecipherable. Occasionally, reports from permits or general harvest tickets were received for areas where they were not valid and all of the harvest report tables include such reports.

Permit Hunts. Table 3 summarizes permit hunt statistics in Unit 19. The number of moose reported taken using TM684 and RM655 was typically low.

Participation and harvest in the RM640 hunt was high, harvestable surplus was lower than the amounts needed for subsistence. This hunt will be replaced in RY06 with a Tier II permit hunt (TM680) for a portion of the hunt area.

On average, approximately 250 hunters took about 75 bulls annually using the RM650 permit in Unit 19D during RY01–RY05.

Antler Size. One of our objectives was to maintain an annual average antler spread measurement of at least 48 inches in the Unit 19C harvest. During RY03, RY04, and RY05, the average annual antler spread measurement in inches was 51, 59, and 57, respectively. The regulations changed in RY04 to allow only ≥50-inch antlers or 4 brow tines on at least one side, assuring a high likelihood of achieving our objective.

Hunter Residency and Success. Tables 4a–4e summarize hunter residency and success, and include a breakdown of local and nonlocal resident hunters and nonresident hunters.

In Unit 19A, regulations prohibited nonresidents from hunting beginning in RY04, but nonresident hunters reported hunting, probably due to confusion. Also, the number of reports escalated from fewer than 300 to over 1000 after the institution of the registration permit requirement in RY04. Success rates appear to have declined as well, but this is likely an artifact of better harvest reporting, particularly by unsuccessful hunters who are typically less likely to report.

In Units 19B and 19C, the total number of resident and nonresident hunters declined from 665 in RY00 to 247 in RY05, but success rates did not change considerably in Unit 19B where one-third of all hunters reported taking a moose. In Unit 19C however, success rates fell from roughly 50% to 33%. This was coincident with declining moose numbers as well as declining numbers of other big game species in these areas.

In Unit 19D, residency restrictions in much of the area decreased the number of nonresident hunters from 27 to 35 during the mid 1990s, to an average of 16 during RY00–RY05. Similar to Unit 19A, the registration permit requirement in Unit 19D improved reporting. Success rates prior to the permit requirement in RY01 were probably inflated (e.g., RY00; Table 4e).

Transport Methods. In Units 19B and 19C, hunters using aircraft took the most moose, while in Units 19A and 19D, boat-borne hunters were most common, particularly after the institution of the registration permit hunt requirements (Tables 5a–5e).

Other Mortality

Under 5 AAC 92.019, hunters were permitted to take moose for customary and traditional Alaska Native funerary or mortuary religious ceremonies. Harvest reporting for these types of hunts appears to have improved, but the number actually harvested probably did not change from 4–8 per year. For example, 4–8 moose were reported during RY06 and up to 4–8 moose were likely taken each year during RY03–RY04, but these data were lost during the December 2006 fire.

Keech (2006) found that the primary cause of moose calf mortality was predation by black bears, grizzly bears, and wolves (Fig. 4). Deep snow contributed to nonpredation calf mortality during winter 2004 (Fig. 4). This natural mortality was additive. Yearling moose survival was higher than 90% in recent years (Fig. 5), when wolf control and bear removal was conducted, indicating that removing wolves and bears allowed recovery of the moose population.

HABITAT

Assessment

Browse surveys were conducted in March 2003 via helicopter and snowmobile throughout the EMMA. Thirty-nine locations and 235 plants were sampled within the area. Browse biomass removal in the EMMA was 20%, a moderate to low removal rate (Boertje et al. 2007). Birch, poplar, and willow species were all present in the survey area, although willow species tended to be the most preferred winter browse species in the EMMA. This is similar to most areas in Interior Alaska.

Enhancement

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. Regular wildland fires occurred over large acreages of diverse vegetation types in Unit 19. Wildfires were particularly active in summer 2002.

Historically, ice scouring events regularly reset succession along rivers in Unit 19. However, major flooding events have not occurred since the 1980s and only one large event occurred recently, in 2002. This event produced substantial ice-scouring that helped to rejuvenate willow stands but the quality and availability of the moose habitat along the rivers is not as high as it was during the previous decade. What is available is still underutilized.

CONCLUSIONS AND RECOMMENDATIONS

We did not achieve the Unit 19A or 19B moose population and harvest objectives. The intensive management population objectives would require a moose density of approximately 0.75–0.93 moose/mi^2. The most recent moose density estimate of 0.39 observable moose/mi^2 measured in the western part of Unit 19A during March 2006 fell far below the objective. Even with a sightability correction factor of 1.3, there were only about 0.5 moose/mi^2. Densities measured during February 2005 were lower. Harvest figures for Units 19A and 19B of 67 and 53 in RY03–RY04 (Tables 2a and 2b) show that we are well below the Board of Game’s harvest objective of 750–950.

Our most recent composition surveys in Unit 19A revealed 19 bulls:100 cows in November 2004. During November 2005 we measured 8 bulls:100 cows in the Holitna River drainage and 20 bulls:100 cows in the Aniak River drainage. Only in the Aniak River drainage were we able to meet our composition objective of 20–30 bulls:100 cows.

During November 2004 we reached our composition objective for calves of 30–40 calves:100 cows with 32 calves:100 cows in Unit 19A, but fell below this objective by November 2005 when we measured only 24 calves:100 cows in the Holitna River drainage and 23 calves:100 cows in the Aniak River drainage.

The wide confidence intervals obtained during the November 2004 composition survey in Unit 19A (calves:100 cows, 90% CI ± 38%; bulls:100 cows, 90% CI ± 38%) were due to high variance within each stratum. While there is an advantage to obtaining moose composition data with confidence intervals, the wide confidence intervals do not justify the cost of such surveys; particularly since other methods of obtaining composition give results within these confidence intervals and are sufficiently accurate for management purposes. I recommend discontinuing composition surveys using the GSPE method in Unit 19A where logistics and weather are not conducive to efficient GSPE surveys.

In Unit 19B, during November 2005, we found 66 bulls:100 cows, and 29 calves:100 cows. Thus, we achieved our bull:cow objective, but narrowly missed our calf:cow objective.

During the February 2005 population density estimation survey in Unit 19A, 17% of the moose surveyed were calves. This was less than our objective of 20% recommended in the CKMMP.

Radiotelemetry data indicated that moose populations in Units 19A and 19B were distinct from each other. Moose radiocollared in Unit 19A did not move far from their capture locations. Also, bull moose from Unit 19B did not move into Unit 19A and consequently, were not available to Unit 19A hunters.

In Unit 19C, during RY03, RY04 and RY05, the average annual antler spread measurement in inches was 51, 59, and 57 respectively, and we exceeded our objective of an average antler spread at least 48". However, among the reported data are antler spreads of 1" that were obviously incorrect and were discarded. If those discarded 1" antler spreads were from instances where hunters actually reported the number of points and these represented spike bulls, then we may not have achieved this objective.

In fall 2001 we estimated 3959 observable moose in Unit 19D East (0.46 observable moose/mi^2), based on extrapolation of a survey conducted in a 5204-mi^2 portion of the unit. Using similar techniques in 2004, we estimated 4374 observable moose in Unit 19D East (0.5 moose/mi^2). Even with a liberal sightability correction factor of 1.3, these population estimates are below our objective of 6000–8000.

The primary cause of moose calf mortality was determined to be predation by black bears, grizzly bears, and wolves (Fig. 4). Deep snow contributed to nonpredation mortality during winter 2004. Wolves caused most of the short-yearling and yearling moose mortality.

The proportional forage removal and high twinning rates (Table 1g) for this area indicate favorable nutritional status compared to other regions of higher moose density in Interior Alaska (Boertje et al. 2007). Nutrition status was adequate to support an increasing moose population (Boertje et al. 2007).

The current population, harvest, and composition objectives are likely appropriate for Unit 19, but should be reviewed at the earliest opportunity.

Habitat is not limiting; reproduction, condition indices, and twinning rates are high; and we have documented causes of high mortality. These data indicate that by controlling predation, we can expect moose populations to recover. Thus, predation control programs taking place in Units 19A and 19D East are defensible given the Board of Game objectives for moose.

Our harvest report data includes reports where the permit or harvest ticket used was not valid for that area. Hunters who report are trying to comply with our regulations but are frustrated by their complexity. This is exacerbated by not having vendors or accessible Internet access in most villages so access to the hunting regulations is limited. Also, many of the hunters from these villages and nearby Unit 18 use Yup'ik as their primary language. We should strive to improve access to these regulations and reduce their complexity whenever we can.

The number of hunt reports in Unit 19A and 19B escalated from fewer than 300 to over 1000 after institution of the registration permit requirement in RY04, even after nonresident participation was eliminated. When we relied on license vendors in the villages to provide hunting licenses and harvest tickets, and when there was no enforcement action against those who failed to report, we did not get good harvest reporting or participation. When we instituted more restrictive registration permit regulations, dedicated department resources to make them available, and increased enforcement of this permit, we achieved better harvest reporting. This was accomplished with significant costs in terms of personnel and time, but it shows that when materials are available, hunters in the villages along the Kuskokwim are willing participants. We recommend support for reporting programs through village visits to cultivate relationships and to recruit and support vendors.

We contributed educational moose management articles to local newspapers as possible. These were particularly well received by local residents; provided considerable dividends in public understanding; and increased reception for our programs. Despite our intent to make regular contributions, other priorities prevented more than a few articles. We recommend striving toward regular contributions as resources and time allow.

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

SEAVOY, R. J. 2006. Unit 19 moose. Pages 281–321 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

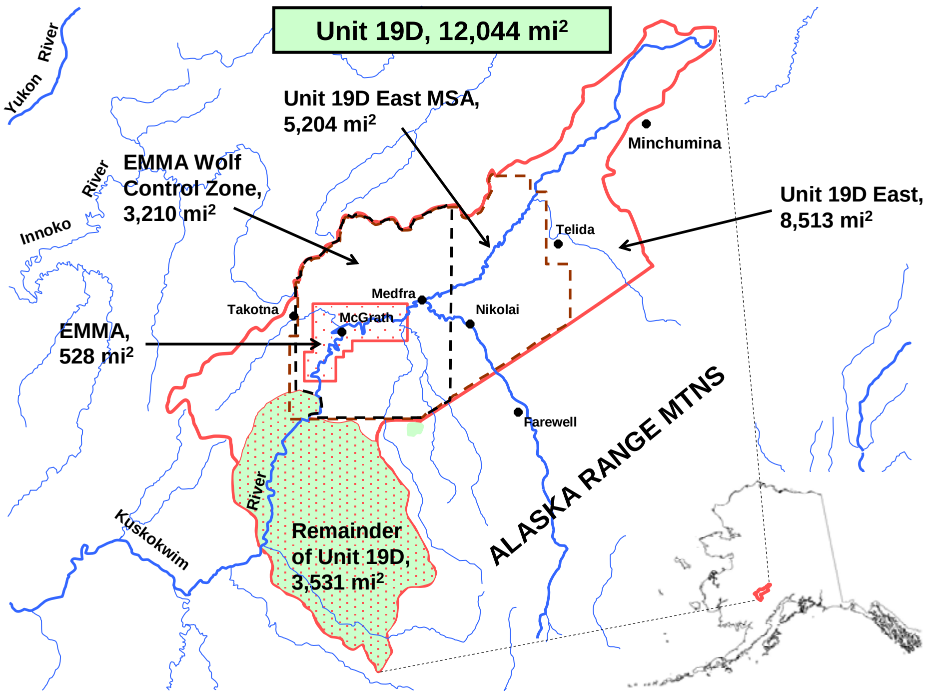


FIGURE 1 Unit 19D showing management activity areas

Note: EMMA = Experimental Micro Management Area; MSA = moose survey area.

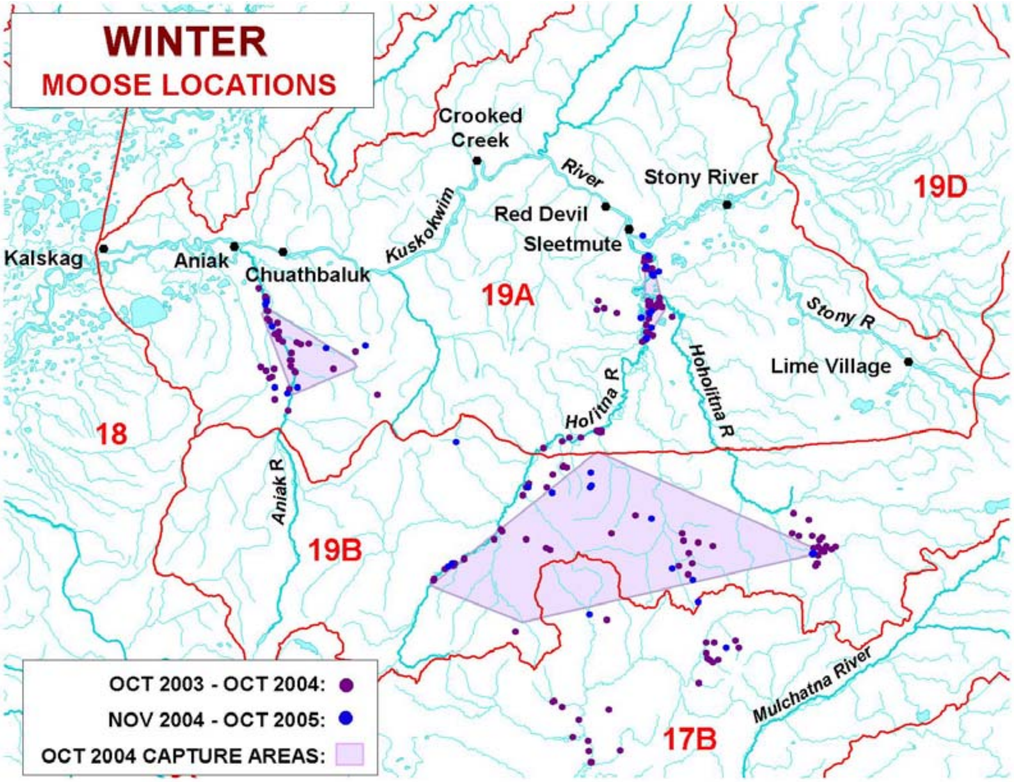


FIGURE 2 Winter moose locations in Units 19A and 19B

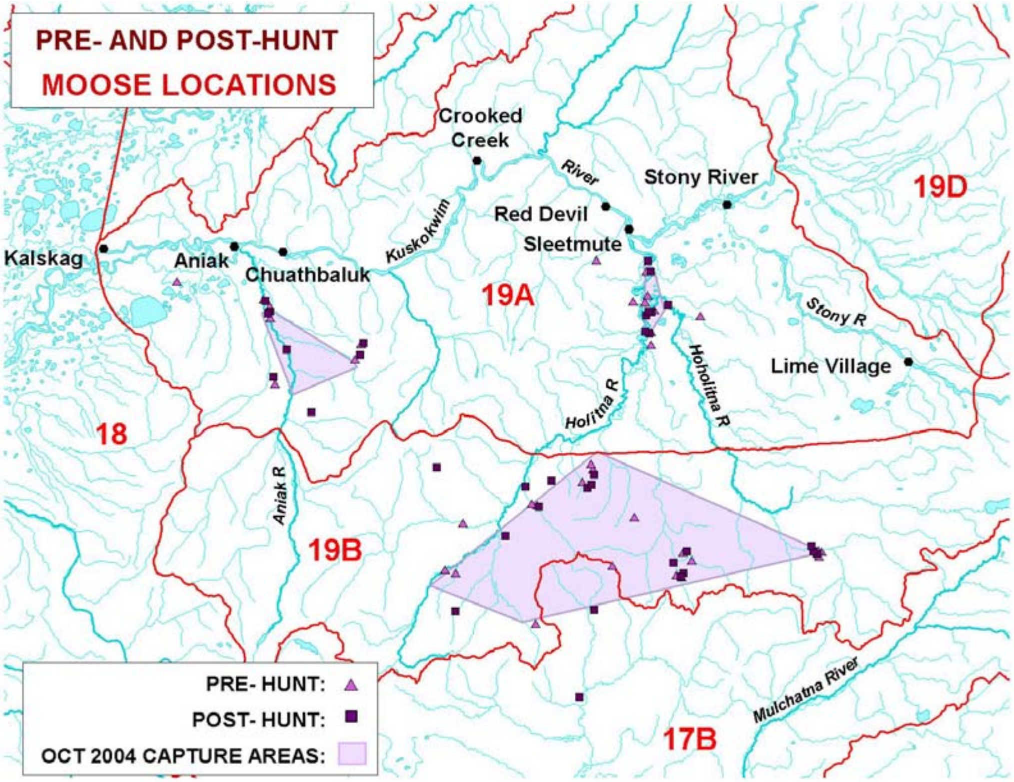


FIGURE 3 Pre- and post-hunt moose locations in Units 19A and 19B

Cohort (May-May)	Black Bear	Grizzly Bear	Wolf	Non-predation	Illegal take	Unknown cause	# of calves monitored
	Number deaths from birth to September/Total number deaths 1st yr-of-life						
2001 cohort	18/**18**	5/**5**	4/**9**	1/**1**	0/**0**	1/**1**	51
2002 cohort	21/**21**	12/**12**	19/**28**	1/**2**	0/**0**	0/**0**	85
2003 cohort*	8/**8**	4/**4**	4/**9**	3/**3**	0/**0**	0/**1**	53
2004 cohort*	3/**3**	0/**0**	4/**8**	3/**19**	0/**1**	0/**0**	52
2005 cohort[a]*	12/**12**	3/**3**	2/**3**	5/**8**	0/**0**	0/**1**	50

***Bears removed during 2003 and 2004, public wolf control during the winters of 2003, 2004, and 2005.**
[a]Data collected thru February 2006 only.

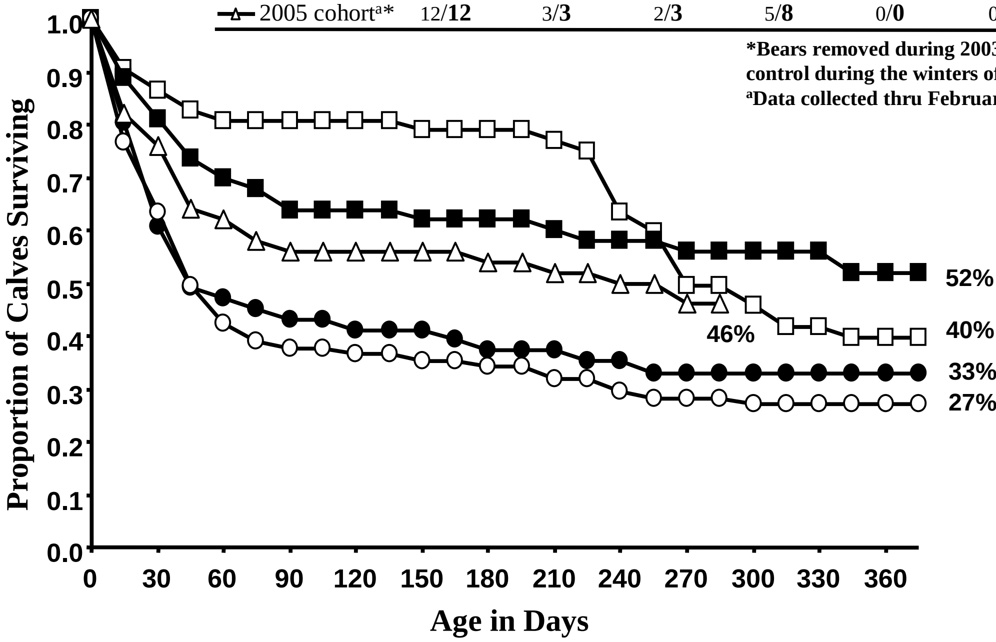
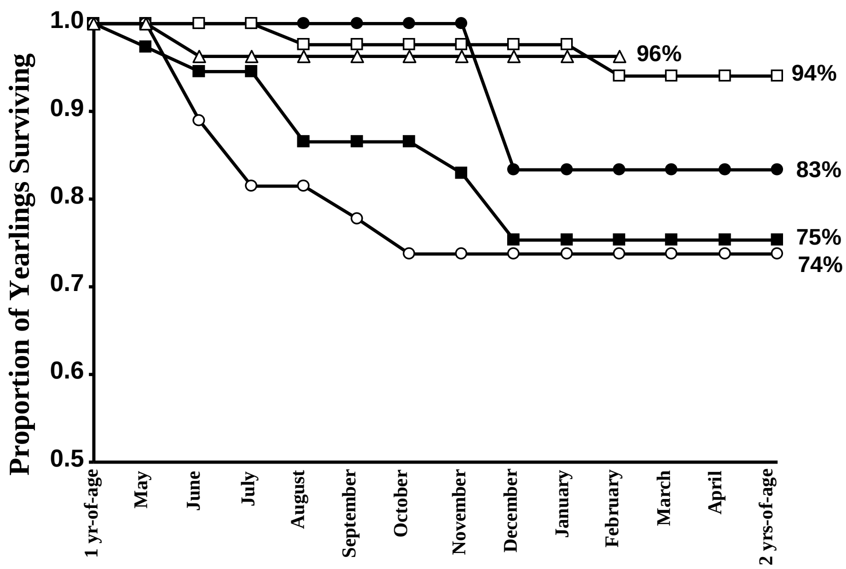


FIGURE 4 Primary causes of moose calf mortality in Unit 19D East and survival curves. Winter snow depths during 2004 were deeper than normal and contributed to nonpredation mortality during that year.

Year (May-May)	Number of Yearlings Killed: Wolf	Black Bear	Grizzly Bear	Non-predation	Hunter	Illegal take	Unknown	# of yearlings monitored
2001/02	2	0	0	0	0	0	0	12
2002/03	6	0	0	0	2	0	1	27
2003/04*	5	1	0	2	2	0	0	37
2004/05*	1	0	0	0	0	1	0	41
2005/06*[a]	1	0	0	0	0	0	0	27



*Bears removed during 2003 and 2004, public wolf control during the winters of 2003, 2004, and 2005.
[a]Data collected thru February 2005 only.

FIGURE 5 Primary causes of yearling moose mortality in Unit 19D East and survival curves

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/ Hr
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 2006–2007

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose	Moose/ Hr
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	9	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
2004–2005[a]								
2005–2006[a]								
2006–2007[c]	46		41				279	85

[a] No survey.
[b] Fall 1999 – only 77.5% of the survey area flown.
[c] Additional data lost in McGrath office fire December 2006.

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	20	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	21	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 Moose population density estimates for Unit 19A. During February 2005, the entire area south of the Kuskokwim was surveyed and in March 2006, the western portion of the area surveyed in 2005 was surveyed.

Survey date	Density moose/mi^2	90% CI	Area surveyed	Total moose
Feb 2005	0.27	±16%	7156	1623–2241
Mar 2006	0.39	±15%	3444	1141–1545

TABLE 1E Results of 2001–2006 moose surveys in the EMMA. Included are the actual number of moose observed, SCFs (sightability correction factor — based upon observations of radiocollared moose during the survey) calculated for each year, and the estimated number of moose in the area based upon the multiplication of observed moose and the SCF. Ratios are based only on observable moose.

Year	Area	Number of moose observed[a]	SCF	Estimate with SCF applied	Calves: 100 Cows	Bulls:100 Cows	Yearling bulls:100 cows
2001	EMMA	440	1.19 (32/38)	524	34	18	8
2003	EMMA	237	1.33 (21/28)	580[b]	55	18	5
2004	EMMA	531	1.25[c]	664	63	13	6
2005	EMMA	479	1.29 (38/49)	618	51	18	9
2006	EMMA	591	1.17 (42/49)	691	58	25	14

[a] All 87 units within the EMMA were counted in 2001, 2004, 2005, and 2006, in effect a population census. Only 52% (45) of the 87 EMMA units were counted during the 2003 survey.
[b] In 2003 only 52% of the SUs within the EMMA were counted, and the estimate with SCF applied is based upon 1.33 × the geospatial population estimate for the EMMA of 393 moose.
[c] Sightability of radiocollared moose was not recorded in 2004, therefore, the SCF for 2004 is a combination of the 2001, 2003, 2005, and 2006 SCFs.

TABLE 1F Results of 2001–2004 moose surveys in the remainder of Unit 19D East moose survey area (MSA; that portion of the Unit 19D East MSA excluding the EMMA) and combined results for the EMMA and the remainder of Unit 19D East MSA (Unit 19D East MSA). No surveys were conducted in the remainder of Unit 19D East in 2005 or 2006.

Year	Area (mi^2)	Population estimate[a,b]	Calves:100 Cows	Bulls:100 Cows	Yearling bulls:100 cows
2001	Remainder Unit 19D East MSA (4676)	1135, 2005, 2912	10, 24, 45	20, 47, 88	1, 7, 15
2003	Remainder Unit 19D East MSA (4676)[c]	692, 1084, 1528	21, 53, 99	5, 29, 60	0, 2, 4
2004	Remainder Unit 19D East MSA (4676)	1652, 2190, 2728	43, 55, 67	24,35, 45	8, 14, 21
2001	Unit 19D East MSA (5204)	1652, 2536, 3469	14, 25, 42	19, 39, 66	3, 7, 13
2003	Unit 19D East MSA (5204)	1219, 1664, 2195	30, 53, 84	13, 23, 37	0, 3, 13
2004	Unit 19D East MSA (5204)	2287, 2825, 3464	47, 56, 66	22, 30, 37	7, 12, 17

[a] The 3 values given are the lower 90% confidence interval, the estimate, and the upper 90% confidence interval.
[b] Based upon radiocollared moose sightings during surveys, sightability correction factors of 1.19 and 1.33 were applied to population estimates in 2001 and 2003, respectively. Because radiocollared moose were not radiolocated during the 2004 survey, a sightability correction factor of 1.25 (a combination of the 2001 thru 2006 sightability data) was used to estimate population size in 2004.
[c] Because of poor weather conditions, only 7% (52) of the sample units in the remainder of the Unit 19D East MSA were surveyed, therefore, caution needs to be used when interpreting the 2003 survey results for the Unit 19D East MSA.

TABLE 1G Reproduction and condition indices for moose in Unit 19D East, 2001–2006

Year	Observed rate of parturition for radiocollared cows >2 yr-of-age (no. of cows monitored)	Observed rate of parturition for radiocollared cows 3 yr-of-age (no. of cows monitored)	Observed rate of twinning for radiocollared cows > 2-yr of age (*n*)	Observed rate of twinning for uncollared cows (*n*)	Average maximum adult rumpfat depth in cm (*n*)	Median maximum adult rumpfat depth in cm (*n*)
2001	73%[a] (22)	100% (3)	25% (16)	--	0.71 (25)	0.55 (25)
2002	88%[b] (25)	0% (1)	59% (22)	39% (46)	1.51 (15)	1.58 (15)
2003	84%[c] (31)	56% (9)	24% (25)	36% (39)	--	--
2004	80%[d] (40)	70% (10)	32% (31)	39% (31)	--	--
2005	92%[e] (51)	100% (11)	44% (45)	50% (40)	--	--
2006	97%[f] (62)	100% (13)	40% (60)	35% (29)	--	--

[a] Includes 1 fetal calf found during necropsy of cow in late May, and 2 births observed during June.
[b] Includes 3 births observed during June.
[c] Includes 1 cow considered to have given birth because placenta was observed but no calf was seen, and 1 birth observed during July.
[d] Includes 2 births observed during July.
[e] Includes 5 births observed during June.
[f] Includes 1 birth observed during June.

TABLE 2A Unit 19A moose harvest, regulatory years 2000–2001 through 2005–2006

Regulatory	Moose harvest				Hunt type		
year	M	F	Unk	Total	General	TM684	RM640
2000–2001	106	0	0	106	104	2	NA
2001–2002	93	1	3	97	92	5	NA
2002–2003	67	0	0	67	66	1	NA
2003–2004	67	0	0	67	67	0	NA
2004–2005	107	0	0	107	10	0	97
2005–2006	174	2	0	176	15	3	158

TABLE 2B Unit 19B moose harvest, regulatory years 2000–2001 through 2005–2006

Regulatory	Moose harvest				Hunt type	
year	M	F	Unk	Total	General	RM640
2000–2001	152	0	1	153	153	n/a
2001–2002	112	0	0	112	112	n/a
2002–2003	81	0	1	82	82	n/a
2003–2004	53	0	0	53	53	n/a
2004–2005	47	0	0	47	40	7
2005–2006	42	0	0	42	31	11

TABLE 2C Unit 19C moose harvest, regulatory years 2000–2001 through 2005–2006

Regulatory	Moose harvest				Hunt type		
year	M	F	Unk	Total	General	RM655	RM640[a]
2000–2001	122	0	1	123	119	4	
2001–2002	111	0	0	111	105	6	
2002–2003	84	0	1	85	79	6	
2003–2004	71	0	0	71	62	9	
2004–2005	38	0	1	39	35	3	1
2005–2006	38	0	0	38	36	2	

[a] Incorrect permit for this hunt area.

TABLE 2D Unit 19D moose harvest, regulatory years 2000–2001 through 2005–2006

Regulatory	Moose harvest				Hunt type	
year	M	F	Unk	Total	General	RM650
2000–2001	84	0	0	84	84	n/a
2001–2002	94	0	0	94	21	73
2002–2003	115	0	0	115	16	99
2003–2004	91	0	0	91	16	75
2004–2005	70	0	0	70	15	55
2005–2006	93	1	0	94	23	71

TABLE 2E Moose harvest from Unit 19 where specific harvest location was not reported, regulatory years 2000–2001 through 2005–2006

Regulatory	Moose harvest				Hunt type		
year	M	F	Unk	Total	General	RM640	RM650
2000–2001	14	0	0	14	14		
2001–2002	10	0	0	10	10		
2002–2003	8	0	0	8	8		
2003–2004	4	0	0	4	4		
2004–2005	19	0	0	19	5	14	
2005–2006	8	0	0	8	4	2	2

TABLE 2F Unit 19 reported moose harvest, regulatory years 2000–2001 through 2005–2006

Regulatory	Reported harvest					
year	M	(%)	F	(%)	Unk	Total
2000–2001	478	(>99)	0	(0)	2	480
2001–2002	420	(99)	1	(1)	3	424
2002–2003	355	(99)	0	(0)	2	357
2003–2004	286	(100)	0	(0)	0	286
2004–2005	281	(>99)	0	(0)	1	282
2005–2006	355	(99)	3	(<1)	1	359

TABLE 3 Permit hunt results from Lime Village Tier II (TM684) and Unit 19C (RM655) and Unit 19D (RM650), regulatory years 1992–1993 through 2005–2006

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
	2003–2004	0	5	8	13
	2004–2005	0	5	7	12
	2005–2006	3	8	13	24
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
	2003–2004	9	7	13	29
	2004–2005	3	5	2	10
	2005–2006	2	0	5	7
19AB/RM640	2004–2005	121	634	191	946
	2005–2006	173	688	162	1023
19D/RM650	2001–2002	73	137	67	277
	2002–2003	98	127	40	265
	2003–2004	75	115	53	243
	2004–2005	60	109	70	239
	2005–2006	72	114	51	237

TABLE 4A Unit 19 moose hunter residency and success, regulatory years 2000–2001 through 2005–2006

	Successful					Unsuccessful					
Regulatory year	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters[a]
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
2003–2004	99	102	78	7	286 (31)	178	300	141	8	627 (69)	913
2004–2005	103	116	59	4	282 (21)	417	570	93	9	1089 (79)	1371
2005–2006	135	158	59	7	359 (23)	454	656	93	7	1210 (77)	1569

[a] Total hunters for Unit 19 may not equal sum of hunters from all subunits due to hunters not reporting locations or unidentifiable reported locations.

TABLE 4B Unit 19A moose hunter residency and success, regulatory years 2000–2001 through 2005–2006

	Successful					Unsuccessful					
Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Total hunters
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
2003–2004	14	35	16	2	67 (26)	44	125	18	4	191 (74)	258
2004–2005	48	55	4	0	107 (15)	242	350	5	1	598 (85)	705
2005–2006	65	106	5	0	176 (17)	325	517	4	2	848 (83)	1024

[a] Local residents reside in Unit 19A.

TABLE 4C Unit 19B moose hunter residency and success, regulatory years 2000–2001 through 2005–2006

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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
2003–2004	3	14	34	3	54 (30)	2	50	71	1	124 (70)	178
2004–2005	2	11	33	1	47 (31)	5	48	51	0	104 (69)	151
2005–2006	2	12	28	0	42 (31)	2	49	43	0	94 (69)	136

[a] Local residents reside in Units 19A or 19B.

TABLE 4D Unit 19C moose hunter residency and success, regulatory years 2000–2001 through 2005–2006

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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
2003–2004	9	37	23	2	71 (36)	7	87	32	1	127 (64)	198
2004–2005	3	18	17	1	39 (35)	3	45	22	1	71 (65)	110
2005–2006	3	18	15	2	38 (34)	1	38	31	3	73 (66)	111

[a] Local residents reside in Units 19C or 19D.

TABLE 4E Unit 19D moose hunter residency and success, regulatory years 2000–2001 through 2005–2006

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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
2003–2004	73	15	3	0	91 (36)	114	34	12	1	161 (64)	252
2004–2005	46	19	3	2	70 (29)	98	63	8	3	172 (71)	242
2005–2006	59	22	9	5	95 (37)	108	41	11	2	162 (63)	257

[a] Local residents reside in Unit 19D.

TABLE 5A Unit 19[a] moose harvest percent by transport method, regulatory years 2000–2001 through 2005–2006

Regulatory year	Harvest percent by transport method[b]								
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat
2000–2001	54	1	37	6	1	0	0	<1	<1
2001–2002	46	1	41	8	2	<1	<1	1	0
2002–2003	44	<1	44	8	2	<1	0	1	0
2003–2004	39	<1	50	7	3	<1	<1	0	0
2004–2005	26	0	67	6	1	0	0	<1	0
2005–2006	21	<1	74	4	<1	0	0	0	0

[a] Total for Unit 19 may not equal sum of hunters from all subunits due to hunters not reporting methods, locations, or unidentifiable reported locations.
[b] Successful hunters only.

TABLE 5B Unit 19A moose harvest percent by transport method, regulatory years 2000–2001 through 2005–2006

Regulatory year	Harvest percent by transport method[a]								
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat
2000–2001	27	0	70	1	1	0	0	0	1
2001–2002	14	1	81	3	1	0	0	0	0
2002–2003	28	0	61	6	0	0	0	4	0
2003–2004	25	0	72	1	0	0	1	0	0
2004–2005	5	0	89	6	0	0	0	<1	0
2005–2006	5	0	93	2	0	0	0	0	0

[a] Successful hunters only.

TABLE 5C Unit 19B moose harvest percent by transport method, regulatory years 2000–2001 through 2005–2006

Regulatory year	Harvest percent by transport method[a]								
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat
2000–2001	87	0	12	0	0	0	0	1	0
2001–2002	85	0	12	1	0	0	2	0	0
2002–2003	84	0	14	2	0	0	0	0	0
2003–2004	79	0	17	4	0	0	0	0	0
2004–2005	74	0	24	2	0	0	0	0	0
2005–2006	71	0	29	0	0	0	0	0	0

[a] Successful hunters only.

TABLE 5D Unit 19C moose harvest percent by transport method, regulatory years 2000–2001 through 2005–2006

Regulatory year	Harvest percent by transport method[a]								
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat
2000–2001	71	3	1	21	4	0	0	0	0
2001–2002	64	5	0	24	5	1	0	1	0
2002–2003	65	2	0	23	7	1	0	2	0
2003–2004	62	1	0	23	13	1	0	0	0
2004–2005	62	0	3	27	8	0	0	0	0
2005–2006	66	5	0	24	5	0	0	0	0

[a] Successful hunters only.

TABLE 5E Unit 19D moose harvest percent by transport method, regulatory years 2000–2001 through 2005–2006

Regulatory year	Harvest percent by transport method[a]								
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat
2000–2001	5	0	92	2	0	0	0	1	0
2001–2002	14	0	80	3	0	0	0	3	0
2002–2003	9	0	88	2	1	0	0	0	0
2003–2004	5	0	92	1	0	1	0	0	0
2004–2005	7	0	93	0	0	0	0	0	0
2005–2006	11	0	88	1	0	0	0	0	0

[a] Successful hunters only.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 1994. More recent publications that discuss important management implications include those by Young et al. (2006) and Boertje et al. (in press).

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 Alaska Department of Fish and Game, (ADF&G) 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 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. Fish and Game 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 bull harvests to sustainable levels. Evidence of an increasing, high-density, nutritionally stressed moose population led to liberal antlerless hunts by registration permit across the entire unit (Young et al. 2006; Boertje et al., in press).

Regulations 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) and the Yanert Controlled Use Area (YCUA; no motorized access except aircraft, antler restrictions since 1988), a November muzzleloader hunt for bull moose in the eastern portion of the WRCUA, and antlerless moose hunts from September through early December.

Approximately one-third of Unit 20A is military land, including 1003 mi^2 used by Fort Wainwright Army, 893 mi^2 by Fort Greely Army, and 17 mi^2 by Clear Air Force Station. 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 harvest of 1400–1600 moose annually.
- 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

2003 Population Estimation Survey

We surveyed 112 (65 high-density and 47 low-density; 649 mi^2) of 987 sample units (SUs)

(5747 mi^2) during 21 November–11 December. We used the GeoSpatial 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.

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 1.16 to 1.25 is appropriate for most of Unit 20A GSPE surveys. We applied a SCF of 1.2 to GSPE estimates in Unit 20A.

Search time per SU averaged 45 minutes (7.8 min/mi^2). Adjusted search intensity (search time/estimated percentage of moose habitat in the 5.8 mi^2 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%).

2004 Population Estimation Survey

We surveyed 129 (81 high density and 48 low density; 751 mi^2) of 987 SUs (5747 mi^2) during 3 November–30 November using the methods described above.

Search time per SU averaged 39.2 minutes (6.8 min/mi^2). Adjusted search intensity averaged 8.9 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 (69%), with the remainder reported as excellent (19%) and fair (12%).

Twinning Surveys

Twinning rates in 2004 and 2005 were estimated from surveys conducted in traditional survey 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 23 May 2004 (6.7 hr) and 2005 (8.4 hr) during or within a few days after the median calving date (Boertje et al., in press). 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.

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. One reminder letter was sent to each nonreporting general season hunter, 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., RY03 = 1 July 2003–30 June 2004).

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

Moose densities remained high at an estimated 3.3–3.5 moose/mi^2 during this reporting period (Table 1). These are the highest reported moose densities in Alaska for any comparable-sized area.

The moose population increased between 1999 and 2003 (Table 1). Comparing the 1999 estimate (SCF = 1.0) of 7213 cows with the 2003 estimate of 9106 cows reveals an average annual finite growth rate of 1.066 during that period. The population appears to have peaked in 2003 at 15,000–20,000 total moose (SCF = 1.2). Slightly lower population estimates in both 2004 and 2005 suggest the population possibly experienced a slight decrease in numbers beginning posthunt 2004. This decrease was likely the result of poor productivity, particularly in 2001 and 2003 (R. Boertje, ADF&G files) and liberal antlerless harvests initiated in RY04. Several more years of data will be needed to determine if this apparent decrease in moose numbers is the beginning of a declining trend.

Population Composition

Sex ratios steadily increased between 2000 and 2005 and likely surpassed the unitwide management objective of ≥30 bulls:100 cows in 2003 (Table 1). An increase from an estimated 26 bulls:100 cows in 2001 to 38 bulls:100 cows in 2005 supports the contention that unitwide antler restrictions (beginning RY02) were effective in improving the bull:cow ratio.

We also met our objective of ≥20 bulls:cows in the Tanana Flats, Western Foothills, and Eastern Foothills portions of Unit 20A. Unlike 2001 when bull:cow ratios were higher in the Eastern Foothills (40:100) than the Tanana Flats (26:100) and Western Foothills (22:100), bull:cow ratios were similar across the unit in 2003 (Tanana Flats 32:100, Western Foothills 31:100, and Eastern Foothills 34:100) and 2004 (Tanana Flats 35:100, Western Foothills 34:100, and Eastern Foothills 37:100). This is likely because of higher harvests due to increased access and hunting pressure in the Eastern Foothills, but lower harvests in the Tanana Flats and Western Foothills because of antler restrictions. In addition, higher antlerless harvests in the Tanana Flats and Western Foothills increased bull:cow ratios somewhat.

Sex ratios continued to improve in the southwestern portion of Unit 20A, where numerous trails provide motorized access, and bull:cow ratios have been chronically low in some areas. For example, 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; 2004: FTMA = 30:100; Western Tanana Flats = 36:100).

Yearling recruitment (i.e., yearlings:100 cows) was relatively strong 2003–2005, averaging 20:100 (range = 18–22:100; Table 1). Bishop and Rausch (1974) suggested that the proportion of yearlings seldom exceeds 15% (i.e., 17–18 yearlings:100 cows) in relatively “stable” moose populations. Therefore, we surmise that the Unit 20A moose population was robust during this period. Yearling:cow ratios likely would have been even higher had it not been for recently initiated (RY02) spike, forked, or 50-inch antler restrictions, which typically result in high harvests of yearling bulls. The possibility exists that some 29-month-old bulls are being classified as 17-month-old bulls because nutritional status is poor, which adversely affects antler size. The extent of this possible misclassification will be examined with known-age radiocollared moose in autumn 2006.

Twinning Rates

Twinning rates remained poor at 5% to 9% in 2004 and 2005, but similar to the mean of 7% (range 3–10%) observed during 1998–2003 (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., in press) because of high moose densities and, presumably, declining habitat condition.

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 March to May many bull and cow moose migrate from the surrounding foothills (Alaska Range and Chena and Salcha River drainages) to summer range 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

<u>Seasons and Bag Limits</u>. Seasons and bag limits in Unit 20A during RY03 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 one 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; 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 one 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 one side; or		1 Sep–20 Sep
1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side; by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued		1 Nov–30 Nov

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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 one 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 of a registration 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)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 one 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)	

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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 one side.		1 Sep–20 Sep

Seasons and Bag Limits. Seasons and bag limits in Unit 20A during RY04 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 one side; or	1 Sep–25 Sep (General hunt only)	
1 antlerless moose by registration permit only; or	1 Sep–10 Dec (General hunt only)	
1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on one 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		1 Sep–25 Sep

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
tines on one side; or		
1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side; by drawing permit only; by muzzleloading firearms only; up to 75 permits may be issued.		1 Nov–30 Nov
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 one side; or	1 Sep–25 Sep (General hunt only)	
1 antlerless moose by registration permit only;	1 Sep–10 Dec (General hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side.		1 Sep–25 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 one 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 SF50/4. 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 remained 1 bull moose with SF50/4. Resident and nonresident antler restrictions remained unchanged through RY05.

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 authorized an antlerless hunt by registration permit, 1–25 September, for the Unit 20A portion of the Nenana Controlled Use Area (NCUA; i.e., the Western Tanana Flats), a calf hunt by drawing permit (up to 300 permits), 1–25 September, and that recipients of antlerless and calf hunt permits be prohibited that year from hunting for antlered bull moose in Unit 20A. That regulation and the highly controversial calf hunts were rescinded in 2004, although the board adopted a unitwide antlerless moose hunt by registration permit 1 September–10 December.

The board made no changes during RY99–RY04 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–RY04 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 NCUA was eliminated in RY04.

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 and no additional proposals were submitted since.

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. In 2004 the board increased the harvest objective to 1400–1600 moose annually.

Alaska Board of Game Actions, March 2006 — The board took the following actions for moose in Unit 20A:

- Expanded registration permit hunt RM764 for antlerless moose from 1 September–10 December to 25 August–28 February;

- Adopted a drawing permit hunt for “any bull” moose and authorized up to 500 permits be issued; and

- Adopted a SF50/3 bag limit for resident hunters in the HLMA.

Hunter Harvest. Overall reported harvest of 507 moose in RY03 met the IM harvest objective of 500–720 moose (Table 3). However, the reported harvest of 986 moose in RY04 fell short of the IM harvest objective after the board raised the objective to 1400–1600 at the 2004 spring meeting.

General Season — 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 4). 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 September) and unitwide antler restrictions were adopted for nonresident hunters. Reported harvest declined even further to 353 bulls after unitwide antler restrictions were imposed on resident hunters in RY02. Harvest dipped even lower to 331 bulls in RY03. However by RY04, year 3 of unitwide antler restrictions, harvest had increased to nearly 400 bulls probably as a result of higher recruitment of bulls and improved age structure of the population.

Permit Hunts — Hunter participation and harvest were lower than expected for antlerless drawing permit hunts through RY01 (Young 2004:Table 4). Permit hunt harvest increased from 126 to 165 antlerless moose RY02 to RY03 because of a regulation change that prohibited recipients of drawing and registration permits for antlerless moose from taking an antlered bull moose in Unit 20A and the addition of a limited registration hunt (30 permits) in the western Tanana Flats (Table 5). Permit hunt harvest jumped to 602 moose after antlerless hunts were liberalized in RY04.

Hunter Residency and Success. Success rates dropped to 30% after unitwide antler restrictions went into effect in RY02 and continued to decline through RY04 (Table 4). Nonresidents had higher success rates than residents. For example, in RY04, 52% of the nonresident hunters were successful, compared to 20% for resident hunters.

The number of hunters who reported hunting moose during the general season was similar in RY02 and RY03 (Table 4). However, the number of hunters increased 37% (1189 to 1628) in RY04 likely because of liberal antlerless hunts that ran concurrent with the general season.

Harvest Chronology. Moose harvest in Unit 20A has traditionally been well distributed throughout the season and no deviations were apparent during this reporting period (Table 6).

Transport Methods. ATV (3- or 4-wheeler and Other ORV) use by successful hunters increased from 32% RY99–RY03 to 39% in RY04 (Table 7). The FTMA continued to be a popular place for hunters using ATVs, but increased use in the eastern and east central portions of Unit 20A was apparent. The use of boats declined from 19% (RY97–RY03) to 14% (RY02–RY04). The decline in hunters using boats may be related to the increase in hunters who use ATVs, as ATVs have generally become more reliable and popular in recent years.

Other Mortality

A telemetry study of moose mortality began in 1996 and is ongoing through 2011. A 6-year final research report is available (Boertje 2002). The number of moose reported killed in accidents with motor vehicles and trains has been substantial in some years (Dale 1998), but was relatively low during RY03–RY04 (Table 3). This may be because of the lack of deep snows (long-term mean annual snowfall for Fairbanks = 68 in) during winters 2003–2004 (61.1 in) and 2004–2005 (77.7 in) and a result of poor reporting.

HABITAT

Given the poor moose reproductive condition, there has been considerable discussion in recent years about the potential for Unit 20A to support any additional moose. 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 wild, noninsular moose populations in North America (Boertje et al., in press). Therefore, we deem a higher moose density as undesirable 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. Winter benefits to the moose population were not observed until winter 2005–2006, but summer benefits were observed in 2002. Research on mortality implemented in 1996 is evaluating many factors influencing the status of the moose population relative to habitat, predators, and sustainable harvest.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

The Alaska Railroad Northern Rail Extension Project's proposed alignment between Fairbanks and Delta Junction would traverse the Tanana Flats just south of the Tanana River potentially between Salcha and Delta Junction. The rail extension would bisect important moose habitat in the Fairbanks area in Units 20A and 20B. Of greatest concern is potential railroad kill, primarily during winter months. If fences are built, these will be impediments to seasonal moose migrations between the Tanana Flats calving areas and the adjacent Tanana Hills in Unit 20B. The Fairbanks Area management staff is involved in discussions to mitigate these impacts.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates indicate the Unit 20A moose population increased between 1999 and 2003 and remained above 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 all indicate the moose population is relatively unproductive. Current research indicates that moose production in Unit 20A is reduced because of high moose densities and, presumably, declining habitat condition. Therefore, I recommend we continue with liberal antlerless moose hunts to reduce moose density and maintain high harvests. Harvest goals for antlerless moose should be reevaluated annually based on the most current harvest and population estimates. My objective, in the absence of large, landscape-scale improvements in habitat, is to reduce the moose population to the IM population objective of 10,000–12,000 moose. Antlerless 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 (Boertje et al. 1996). 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.

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. I recommend retaining unitwide antler restrictions for both resident and nonresident hunters, but, in addition, adding a limited drawing permit hunt for "any bull" moose to optimize harvest. I recommend a harvest rate for bulls of approximately 15% of the prehunt bull population. 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 RY03. We did not meet the RY04 harvest objective of 1400–1600 moose annually. To meet this harvest objective, it will be necessary to harvest antlerless moose at a relatively high rate that is likely not sustainable over the long term. 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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Please cite any information taken from this section, and reference as:

YOUNG, D. D. 2006. Unit 20A moose management report. Pages 322–343 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 20A aerial moose fall composition counts and estimated population size, 1999–2005

Calendar year	Bulls:100 Cows	Yearlings: 100 Cows[a]	Calves:100 Cows	Percent calves	Adults	Moose observed	Estimated population (90% CI)[b]	Estimated population w/SCF = 1.2[c]	Moose/mi^2 w/SCF = 1.2[d]
1999	23	13	33	21	760	965	11,205 (±14%)	13,446	2.7
2000	23	10	33	21	1089	1377	10,557 (±18%)	12,668	2.5
2001	26	18	26	17	737	887	11,511 (±15%)	13,813	2.8
2002[e]									
2003	32	22	28	18	1212	1483	14,684 (±13%)	17,621	3.5
2004	35	21	36	21	1512	1922	13,566 (±15%)	16,279	3.3
2005	38	18	30	19	1370	1684	13,348 (±15%)	16,018	3.2

[a] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[b] GeoSpatial Population Estimation (GSPE) method.
[c] Preliminary sightability studies suggest a Sightability Correction Factor (SCF) of 1.16 to 1.25 using the GSPE method.
[d] Based on an estimated 5000 mi^2 of moose habitat in Unit 20A.
[e] Surveys were not conducted due to lack of snow.

TABLE 2 Unit 20A central Tanana Flats moose twinning rates from transect surveys, 1998–2005

Calendar year	Date	Cows w/Single calf	Cows w/Twins	Cows Total	% Twins[a]
1998	26 and 30 May	51	4	55	7
1999	25–26 May	62	2	64	3
2000[b]	14 May–9 June	27	3	30	10
2001[b]	14 May–6 June	30	1	31	3
2002	24–25 May	52	6	58	10
2003	27–28 May	53	5	58	9
2004	23 May	57	3	60	5
2005	23 May	49	5	54	9

[a] Percentage of cows with calves that had twins.
[b] 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 1996–2006 (R. Boertje, ADF&G files).

TABLE 3 Estimate of Unit 20A moose harvest[a] and accidental death, regulatory years 1997–1998 through 2004–2005

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
1997–1998	629	68	2	699	124	11	135	2	17[e]	19	853
1998–1999	613	74	4	691	122	3	125	3	15[e]	18	834
1999–2000	660	1	16	677	120	5	125	3	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	4[f]	7	793
2002–2003	363	115	1	479	85	61	146	7	6[f]	13	638
2003–2004	347	160	0	507	90	106	196	0	6[f]	6	709
2004–2005	427	550	9	986	175	106	281	0	11[f]	11	1278

[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 hunter[a] residency and success, regulatory years 1997–1998 through 2004–2005

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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
2003–2004	185	68	78	0	331 (28)	551	202	99	6	858 (72)	1189
2004–2005	191	95	92	15	393 (24)	815	320	85	15	1235 (76)	1628

[a] Excludes hunters in permit hunts.
[b] Residents of Unit 20.

TABLE 5 Unit 20A moose harvest data by permit hunt, regulatory years 2002–2003 through 2004–2005

Permit hunt	Regulatory year	Permits issued	Did not hunt (%)		Unsuccessful hunters (%)		Successful hunters (%)		Male (%)		Female (%)		Unk (%)		Harvest
DM750–DM759	2002–2003	275	166	(60)	77	(71)	32	(29)	14	(44)	18	(56)	0	(0)	32
	2003–2004	217	132	(61)	61	(72)	24	(28)	10	(42)	14	(58)	0	(0)	24
DM760	2002–2003	50	4	(8)	13	(28)	33	(72)	0	(0)	33	(100)	0	(0)	33
	2003–2004	100	24	(24)	25	(33)	51	(67)	0	(0)	51	(100)	0	(0)	51
DM762	2002–2003	50	14	(28)	9	(25)	27	(75)	0	(0)	27	(100)	0	(0)	27
	2003–2004	100	30	(30)	28	(40)	42	(60)	2	(5)	40	(95)	0	(0)	42
DM764	2002–2003	75	36	(48)	20	(51)	19	(49)	0	(0)	19	(100)	0	(0)	19
	2003–2004	100	45	(45)	23	(42)	32	(58)	1	(3)	31	(97)	0	(0)	32
RM767	2002–2003	30	3	(10)	12	(44)	15	(56)	0	(0)	15	(100)	0	(0)	15
	2003–2004	20	1	(5)	3	(16)	16	(84)	1	(6)	15	(94)	0	(0)	16
RM764	2004–2005	5435	3042	(56)	1791	(75)	602	(25)	48	(8)	547	(91)	7	(1)	602
Totals for all permit hunts	2002–2003	480	223	(46)	131	(51)	126	(49)	14	(11)	112	(89)	0	(0)	126
	2003–2004	537	232	(43)	140	(46)	165	(54)	14	(8)	151	(92)	0	(0)	165
	2004–2005	5435	3042	(56)	1791	(75)	602	(25)	48	(8)	547	(91)	7	(1)	602

TABLE 6 Unit 20A moose harvest[a] chronology percent by month/day, regulatory years 1997–1998 through 2004–2005

Regulatory year	Harvest chronology percent by month/day 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	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
2003–2004	18	20	34	24	0	4	331
2004–2005	24	14	20	21	18	3	393

[a] Excludes permit hunt harvest.

TABLE 7 Unit 20A moose harvest[a] percent by transport method, regulatory years 1997–1998 through 2004–2005

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Unknown	*n*
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
2003–2004	32	5	13	26	0	10	3	9	2	331
2004–2005	33	5	14	29	0	10	3	4	2	393

[a] Excludes permit hunt harvest.

WILDLIFE
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[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. Subsequent increases in harvest along with declining bull:cow ratios and evidence of low recruitment in some areas resulted in hunting seasons being shortened to 15 days in 1988. Despite a 5-day reduction in the season, harvests increased further from nearly 400 bulls in 1988 to more than 700 bulls in 1998. Moose population trends from the late 1980s through the 1990s were largely unknown because unitwide surveys were not conducted. However, unitwide surveys conducted in 2001, 2003, and 2004 indicated that the moose population increased from an estimated 9800 (about 1.1 moose/mi^2) in 1990 to 16,000 (about 1.7 moose/mi^2) in 2004.

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 6 permit moose hunts in Unit 20B during this reporting period: 3 in the Minto Flats Management Area (MFMA) for “any moose;” 1 in the Fairbanks Management Area (FMA) for antlerless moose by bow and arrow only; 1 in the Creamer’s Field Migratory Bird Refuge

[a] This unit report may also include data collected after the reporting period ended at the discretion of the reporting biologist.

(Creamer's Refuge) for antlerless moose by muzzleloader only; and the "Take A Child Hunting" (TACH) hunt for bull moose covering Unit 20B, outside the MFMA and 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.

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. The most recent changes went into effect in July 2002. The FMA currently encompasses about 300 mi^2, of which an area of about 50 mi^2 has a relatively dense human population. Even though harvest is generally low, this permit hunt for antlerless moose 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 (regulatory years begin 1 July and end 30 June, e.g., RY00 = 1 July 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

2003 Population Estimation Survey

We surveyed 60 (25 low and 35 high density; 338 mi^2) of 1628 sample units (SU; 9196 mi^2) in Unit 20B during 13–15 November. We used the GeoSpatial 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. In 2003, search intensity averaged 8.0 min/mi^2. Preliminary sightability studies suggest a SCF of 1.16 to 1.25 using the GSPE method. We applied a SCF of 1.2 to GSPE estimates in Unit 20B. Survey conditions with regard to snow (age and cover), light (intensity and type), and wind (strength and turbulence) were reported primarily as excellent (53%) and good (43%) with the remainder reported as fair (3%).

2004 Population Estimation Survey

We surveyed 73 (30 low and 43 high density; 412 mi^2) of 1628 sample units (SU; 9196 mi^2) in Unit 20B during 27 October–30 November. Methods were the same as those described above, except an additional 13 SUs were selected to increase survey intensity in the Minto Flats Management Area.

Search intensity averaged 7.5 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 good (59%) and excellent (40%) with the remainder reported as poor (1%).

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 on 25 May 2004 and 2005 and time spent searching was 5.2–5.3 hours. 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.

MORTALITY

We estimated harvest based on mandatory harvest report cards. This included data from report cards from the general season, the FMA and Creamer's Refuge drawing hunts, the MFMA Tier II and registration permit hunts, and the TACH registration 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

Moose numbers appear to have increased in Unit 20B since the early 1990s. In 1990, the population was estimated at 9800 moose (1.1 moose/mi^2; McNay 1993). Population estimates in 2001, 2003, and 2004 were 12,313 (1.3 moose/mi^2), 16,080 (1.7 moose/mi^2), and 16,572 (1.7 moose/mi^2), respectively (Table 1). In addition, moose numbers in the central portion of Unit 20B have increased from an estimated 4803 (1.3 moose/mi^2) to 7057 (1.8 moose/mi^2), and in the MFMA from 2252 (2.4 moose/mi^2) to 3524 (3.7 moose/mi^2) between 2001 and 2005. Moreover, the increasing trend in moose numbers is supported by high estimates of productivity and recruitment. Calf:cow ratios averaged 37:100 and yearling:cow ratios were nearly 19:100 (2001, 2003, and 2004; Table 1).

Moose densities in the MFMA appeared to increase between 2000 (2.8 moose/mi^2) and 2005 (3.7 moose/mi^2; Table 1). Productivity and recruitment estimates support this observation. For instance, calf:cow ratios averaged 38 calves:100 cows during 2000–2005, and yearling:cow ratios averaged 15 yearlings:100 cows during 2001–2005. 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.

Annual estimates of moose densities in the MFMA during 2000–2005 were highly variable (Table 1). Annual variation may be the result of varying survey conditions and sampling effort. In addition, 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.

Population Composition

<u>Bull:Cow Ratios</u>. Historically, bull:cow ratios in Unit 20B have exceeded the management objective of ≥30:100, but ratios varied by harvest intensity within the unit. For example, the

overall Unit 20B bull:cow ratio averaged 40:100 through the early 1990s (McNay 1993). 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). 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 during 2001–2004 indicate a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in the 3 portions of Unit 20B (i.e., Unit 20B East, Unit 20B Central, and Unit 20B West; Table 1). However, bull:cow ratios in the MFMA appear to be declining. I hypothesize that sustained high harvests of bull moose in areas adjacent to the MFMA that do not have antler restrictions may be contributing to this decline. However, changes in moose distributions (see earlier discussion) may also be to blame.

Calf:Cow Ratios. In general, calf:cow ratios were high 2001–2005 (Table 1). Calf:cow ratios tended to be highest in the central portion of Unit 20B and lowest in the eastern portion of the unit. Elevated calf:cow ratios in central Unit 20B and the MFMA were probably a function of lower predation rates resulting from more people and therefore lower predator abundance.

Twinning Rates

Twinning rates in the MFMA appeared to decline 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 rebounded in 2002 and steadily improved through 2005.

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 summer range 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 RY03 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 one 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).	2 Aug–5 Aug	2 Aug–5 Aug
1 bull.	1 Sep–20 Sep	1 Sep–20 Sep
1 bull by bow and arrow.	21 Sep–30 Sep	21 Sep–30 Sep
Remainder of Unit 20B.		
1 bull by permit (TACH).	2 Aug–5 Aug	2 Aug–5 Aug
1 bull.	1 Sep–15 Sep	5 Sep–15 Sep

Seasons and bag limits in Unit 20B in RY04 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
Creamer's Refuge.		
1 antlerless moose by muzzleloader rifle by drawing permit.	21 Nov–27 Nov	21 Nov–27 Nov
Minto Flats Management Area.		
1 moose by registration permit only;	1 Sep–25 Sep	No open season
or		
1 bull with spike-fork or 50-inch antlers, or with at least 4 brow tines on one side.	10 Jan–28 Feb 11 Sep–25 Sep	No open season No open season
Middle Fork drainage of Chena River, and Salcha River drainage upstream from and including Goose Creek.		
1 bull;	1 Sep–20 Sep	1 Sep–20 Sep
or		
1 bull by bow and arrow.	21 Sep–30 Sep	21 Sep–30 Sep
Remainder of Unit 20B.		
1 bull.	1 Sep–15 Sep	5 Sep–15 Sep

Alaska Board of Game Actions and Emergency Orders.

Historical Alaska 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. In 1993 the board authorized the department to issue up to 250 permits and 200 were issued in each of RY93 and RY94. In RY95 the Tier II bag limit was changed from “1 bull” to “1 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 bull-only hunt with a general season. The number of FMA antlerless moose permits that could be issued was increased from 25 to 100 in RY00 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.

Report Period Alaska Board of Game Actions — At the spring 2004 meeting the board eliminated the TACH early season hunt for moose in Unit 20B; created a new winter (21–27 November) drawing permit hunt for antlerless moose by muzzleloading rifle only in Creamer's Refuge; increased the number of antlerless drawing permits for the FMA from 100 to 150, prohibited drawing permit winners for antlerless hunts in the area from taking an antlered bull in the management area, and redefined the FMA boundaries (that portion of Unit 20B 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, 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 the 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); and in the MFMA, changed the Tier II hunt to registration hunts RM775 (fall) and RM785 (winter) and lengthened the fall seasons (general and registration) to 1–25 September.

Spring 2006 Alaska Board of Game Actions — The board authorized the department to issue up to 300 drawing permits for antlerless moose in the central portion of Unit 20B.

<u>Hunter Harvest</u>.

General Season — The reported harvest of 492 bulls in RY03 and 459 bulls in RY04 was lower than the average reported harvest of 606 bulls during the previous 5-year period (Table 3). This appeared to be the result of reduced effort. Reduced effort may be explained by troops from Fort Wainwright being deployed outside of Alaska and, in RY04, increased moose hunting opportunity through a longer general season and liberal antlerless hunts in adjacent Unit 20A.

The majority of harvest was in Unit 20B Central, followed by Unit 20B West and Unit 20B East (Table 3). Harvest density in Unit 20B Central (70 moose/1000 mi^2) was 2.5 times that reported in Units 20B East (28 moose/1000 mi^2) and 20B West (28 moose/1000 mi^2). Like calf:cow ratios, this is probably a function of higher moose densities due to lower predator densities in Unit 20B Central than in Unit 20B West and 20B East.

In the FMA, harvests were relatively high during the previous 8–9 year period (Young 2000, 2002, 2004; this report). High harvests were likely the result of high densities and survival rates of moose in the FMA during that period. Population estimates and anecdotal information indicating that moose densities, productivity, and early calf survival were high in the FMA between 1993 and 2001 supports this assertion. A decline in general harvest was observed in RY04 (Table 3), but it is too early to determine whether this was a function of potentially lower moose densities resulting from increases in antlerless harvests. The antlerless harvests were designed to reduce moose–human conflicts, particularly moose–vehicle collisions in the FMA.

Permit Hunts — There were no apparent trends in harvest, effort, or success rates in permit hunts RY00 through RY04 (Table 4). Harvest of antlerless moose increased in hunt DM788 in RY04, but that can be explained by a 50% increase in the number of permits issued. Harvest rates of bulls and cows remained stable in the MFMA hunts (i.e., TM785, RM775, and RM785). In RY04 the department issued 50 RM775 and 60 RM785 registration permits for "one moose" in the MFMA.

Hunter Residency and Success. 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 RY04, 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 RY03 and RY04 were similar to the average success rate of 20% reported for RY97–RY02. During RY99–RY00, 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, success rates were more similar in Unit 20B Central ($\bar{x}$ = 19.%), Unit 20B East ($\bar{x}$ = 21%), and Unit 20B West ($\bar{x}$ = 22%).

Harvest Chronology. Between RY97 and RY00, more bull moose were killed during the first 5 days of the season ($\bar{x}$ = 35%) than during any other 5-day period (Young 2004). However, during the RY01–RY03 seasons, harvest shifted slightly towards the 11–15 September period ($\bar{x}$ = 34%; Table 5).

Transport Methods. Highway vehicles and 3- or 4-wheelers were the primary methods of transportation used by successful hunters (Table 6). Methods of transportation used by successful hunters were relatively consistent during RY00–RY04.

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 98 animals annually during RY97–RY04. By comparison, an average of only 70 moose were reported harvested annually by hunters in the FMA during that same period. An additional 65 moose were killed each year on roads in the remainder of Unit 20B. Generally, few moose were reported killed by trains from RY97 through RY04 ($\bar{x}$ = 20), with the exception of RY99 and RY04 when 61 and 30 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 (Young 2004). In response, to increase harvest in order to limit moose population growth, the board lengthened the general season by 5 days and the department increased the number of permits issued in hunts RM775 and RM785 beginning in RY04.

The department has conducted moose habitat enhancement in 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 benefit 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. To date development has not yet begun.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

During RY03–RY04 we continued to collect 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 many complaints about human–moose conflicts, such as moose in gardens or yards, moose attacking dogs in dog yards and along dogsled trails, and moose "trapped" within the confines of the urban area. Besides attempting to reduce moose densities through increased harvest, the department continues to work with the public through direct interaction and through the media to reduce nonhunting mortality and human–moose conflicts.

CONCLUSIONS AND RECOMMENDATIONS

Unitwide population estimates conducted in 2001, 2003, and 2004 suggest that the Intensive Management population objective of 12,000–15,000 moose has been met or exceeded. Reported harvests reached the Intensive Management objective's lower limit of 600 moose in RY03 (n =

603), but not in RY04 (n = 573). At the spring 2006 Alaska Board of Game meeting I will recommend increased harvest of antlerless moose in the central portion of Unit 20B to limit population growth. In addition, in RY06 I will substantially increase the number of registration permits issued in the MFMA to increase harvest, but ultimately to reduce moose density. Increased harvests also will help meet Intensive Management harvest objectives.

Surveys conducted since 2001 suggest we are meeting our management objective of a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each of the 3 geographic zones (i.e., Unit 20B East, Unit 20B Central, Unit 20B West), but not in the relatively small MFMA and FMA. Lower bull:cow ratios in the MFMA (900 mi^2) and FMA (300 mi^2) are of less concern than in larger areas because the areas are small in relation to the annual home range of moose. If not enough bulls are available for breeding, cows in estrous can easily move to the periphery or outside the management areas where bull:cow ratios are higher, and bulls seeking females can readily migrate into the management areas. This is particularly true of the smaller FMA. High calf:cow ratios indicate there have been sufficient bull moose in the MFMA and FMA to breed estrous cows.

I concur with Dale (1998) that we need to collect unitwide population data on an annual basis to better assess the status of the moose population, particularly now that the department will recommend that antlerless hunts be expanded to include not only the MFMA and FMA, but also most of Central Unit 20B. Also, I recommend expanding twinning rate surveys to evaluate nutritional status in the central portion of Unit 20B. Twinning rates and annual population estimates will be necessary to annually reevaluate management objectives and to gain public approval of those management objectives.

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YOUNG, D. D. 2006. Unit 20B moose management report. Pages 344–362 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 20B aerial moose fall composition counts and estimated population size, regulatory years 2001–2002 through 2005–2006

Count area	Regulatory year	Bulls:100 Cows	Yearlings: 100 Cows[a]	Calves:100 Cows	Percent calves	Adults	Moose observed	Estimated population[b] (90% CI)	Estimated population w/SCF = 1.2[c]	Moose/mi^2 w/SCF = 1.2
Unit 20B	2001–2002	33	15	30	18	751	914	10,261 (±17%)	12,313	1.3
Unit 20B	2003–2004	33	23	39	22	399	514	13,400 (±23%)	16,080	1.7
Unit 20B	2004–2005	32	18	42	25	551	730	13,810 (±28%)	16,572	1.7
East[d]	2001–2002	47	15	24	11	271	305	2454 (±22%)	2945	1.2
Central[e]	2001–2002	27	13	34	26	205	278	4005 (±25%)	4806	1.3
Central[e]	2003–2004	26	21	35	21	191	242	3995 (±37%)	4794	1.3
Central[e]	2004–2005	33	22	46	27	158	216	5276 (±41%)	6331	1.7
Central[e]	2005–2006	26	26	40	24	493	645	5881 (±18%)	7057	1.8
West[f]	1999–2000	27	14	34	20	438	546	4881 (±20%)	5857	1.6
West[g]	2001–2002	30	16	29	17	274	331	3802 (±22%)	4562	1.6
MFMA[h,i]	2000–2001	31	8	39	24	546	714	2200 (±14%)	2640	2.8
MFMA[i]	2001–2002	30	16	28	17	191	230	1877 (±21%)	2252	2.4
MFMA[i]	2003–2004	44	20	36	23	89	116	1352 (±63%)	1622	1.7
MFMA[i]	2004–2005	26	11	47	24	302	399	3447 (±19%)	4136	4.3
MFMA[i]	2005–2006	12	12	40	26	296	400	2937 (±17%)	3524	3.7
FMA[j,k]	2001–2002	12	13	39	28	70	99	461 (±34%)	553	1.7
FMA[k]	2005–2006	29	38	35	15	39	46	429 (±59%)	515	1.6

[a] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[b] GeoSpatial Population Estimator method (see methods).
[c] Preliminary sightability studies suggest a sightability correction factor (SCF) of 1.16 to 1.25 using the GSPE method.
[d] A 2425-mi^2 count area.
[e] A 3829-mi^2 count area.
[f] A 3644-mi^2 count area encompassing most of Unit 20B West (3955 mi^2), including the MFMA.
[g] A 2942-mi^2 count area.
[h] Minto Flats Management Area.
[i] A 951-mi^2 count area.
[j] Fairbanks Management Area.
[k] A 318-mi^2 count area.

TABLE 2 Results of twinning rate surveys for moose in Unit 20B (Minto Flats Management Area), 1997–2005

Year	Date	Cows			% Twins[a]
		w/Single calf	w/Twins	Total	
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
2004	25 May	61	21	82	26
2005	25 May	39	15	54	28

[a] Percentage of cows with calves that had twins.

TABLE 3 Unit 20B moose hunter[a] residency and success, regulatory years 2000–2001 through 2004–2005

Area/ Regulatory year	Successful: Local[b] resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk	Successful: Total	% Successful	Unsuccessful: Local[b] resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk	Unsuccessful: Total	Total hunters
Unit 20B East (UCUs 601, 602, 603, 604, 605)												
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
2003–2004	58	1	10	0	69	20	235	22	15	0	272	341
2004–2005	49	6	11	3	69	22	205	10	20	4	239	308
Unit 20B Central (UCUs 207, 208, 209, 211, 212, 213, 301, 401, 402, 403, 404, 405, 406, 501)												
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
2003–2004	232	33	23	0	288	19	1099	94	55	5	1253	1541
2004–2005	203	18	25	5	251	19	916	56	57	22	1051	1302
Unit 20B West (UCUs 101, 201, 202, 203, 204, 205, 206, 210)												
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
2003–2004	65	19	3	0	87	21	244	69	17	1	331	418
2004–2005	56	16	6	2	80	22	214	51	13	4	282	362
FMA[c] general archery hunt[d] (UCUs 0212, 0213, 0300, 0301, 0401, 0402, 0403, 0501; archery only)												
2000–2000[e]	46	1	1	0	48							
2001–2002[e]	38	1	1	0	40							
2002–2003[f]	44	3	1	0	48							
2003–2004[f]	54	5	1	0	60							
2004–2005[f]	31	0	2	0	33							
MFMA[g] general hunt (UCUs 0201, 0205, 0210; Nonresident hunters and antlerless harvest censored)												
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
2003–2004	39	10	0	0	49	30	96	19	0	0	115	164
2004–2005	28	8	0	0	36	25	90	16	0	0	106	142

Area/ Regulatory year	Successful						Unsuccessful					
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	Total hunters
Unit 20B remainder general hunt (Includes FMA general archery hunt, but excludes MFMA)												
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
2003–2004	358	47	38	0	443	18	1775	198	99	8	2080	2523
2004–2005	324	41	45	13	423	20	1479	129	101	35	1744	2167
All general hunts												
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
2003–2004	397	57	38	0	492	18	1871	217	99	8	2195	2687
2004–2005	352	49	45	13	459	20	1569	145	101	35	1850	2309

[a] Excludes drawing, registration and Tier II permit hunt harvest.
[b] Residents of Unit 20.
[c] Fairbanks Management Area.
[d] Subtracted number of bulls reported harvested by bow and arrow on Eielson AFB (in UCU 0501, but outside FMA).
[e] Approximately 330 mi^2.
[f] Approximately 300 mi^2.
[g] Minto Flats Management Area.

TABLE 4 Unit 20B moose harvest data by permit hunt, regulatory years 2000–2001 through 2004–2005

Hunt	Regulatory year	Permits issued	Did not hunt (%)	Unsuccessful hunters (%)	Successful hunters (%)	Bulls (%)	Cows (%)	Unk (%)	Harvest
DM788	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
	2003–2004	100	19 (19)	53 (65)	28 (35)	0 (0)	28 (100)	0 (0)	28
	2004–2005	150	28 (19)	73 (60)	49 (40)	1 (2)	48 (98)	0 (0)	49
DM789	2004–2005	10	3 (30)	7 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0
TM785	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
	2003–2004	100	24 (24)	30 (39)	46 (61)	23 (50)	23 (50)	0 (0)	46
RM775	2004–2005	50	2 (4)	12 (25)	36 (75)	24 (67)	12 (33)	0 (0)	36
RM785	2004–2005	60	26 (43)	7 (21)	27 (79)	6 (22)	20 (74)	1 (4)	27
YM301	2002–2003	257	36 (14)	170 (77)	51 (23)	51 (100)	0 (0)	0 (0)	51
YM301	2003–2004	280	25 (9)	216 (85)	39 (15)	39 (100)	0 (0)	0 (0)	39
Totals for all permit hunts	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
	2003–2004	480	68 (14)	299 (73)	113 (27)	62 (55)	51 (45)	0 (0)	113
	2004–2005	270	59 (22)	99 (47)	112 (53)	31 (28)	80 (71)	1 (1)	112

Table 5 Unit 20B moose harvest[a] chronology percent by month/day, regulatory years 2000–2001 through 2004–2005

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*
2000–2001	37	22	28	6	2	5	597
2001–2002	27	27	33	5	1	7	506
2002–2003	32	23	33	6	1	5	648
2003–2004	24	26	35	8	1	7	492
2004–2005	33	27	29	6	2	4	459

[a] Excludes drawing, registration and Tier II permit hunt harvest.

Table 6 Unit 20B moose harvest[a] percent by transport method, regulatory years 2000–2001 through 2004–2005

Regulatory	Harvest percent by transport method								
year	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Other/ Unknown	*n*
2000–2001	3	0	21	29	0	4	35	3	4	597
2001–2002	3	0	21	31	0	4	34	3	2	506
2002–2003	3	0	21	29	0	5	36	2	3	648
2003–2004	4	0	20	28	0	4	36	3	5	492
2004–2005	4	0	16	30	0	3	39	3	4	459

[a] Excludes drawing, registration and Tier II permit hunt harvest.

TABLE 7 Estimate of Unit 20B moose harvest[a] and accidental death, regulatory years 2000–2001 through 2004–2005

	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
2000–2001	611	58	9	678	120	44	164	105	52	157	9	166	1008
2001–2002	531	53	6	590	104	37	141	72	50	122	9	131	862
2002–2003	725	61	2	788	139	47	186	118	71	189	12	201	1175
2003–2004	549	52	2	603	107	50	157	87	64	151	13	164	924
2004–2005	488	84	1	573	101	56	157	95	62	157	30	187	917

[a] Includes general, registration 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, defense of life and property, 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.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 as indicated by the high proportion of large bulls in the harvest. If harvest rates of bulls were not sustainable, large bulls would be rare in the harvest. Thus we can conclude that harvest is a minor factor affecting population dynamics relative to predation.

These units contain some tracts of mature black spruce that are poor quality moose habitat. However, using aerial reconnaissance, it appears that many riparian areas, subalpine hills, and burns have habitat capable of sustaining 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 this area. Radiocollared moose were monitored in movement, behavior, and reproductive studies. Also, composition surveys and population estimates were conducted by DNPP biologists since 1970.

Moose in these units are an important source of food, antlers, and recreation for many local rural residents, other residents throughout Alaska, and nonresidents. Nonconsumptive uses are also important, particularly in DNPP.

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 in areas with aerial surveys and ≥20% large bulls in the harvest in areas without aerial surveys.

METHODS

Moose composition information was collected in Unit 25C on 30 November. The pilots were Troy Cambier and Andy Greenblatt. The observers were Don Young and Gene Kuhn. The weather was -15 °F to -20 °F with medium and low intensity light conditions. The year 2004 marked a transition from the traditional trend area surveyed between 1986 and 2002 to the new geospatial composition surveys. After 6 trend surveys over those 16 years were compared, the traditional O'Brien Creek trend area provided highly variable information that seemed to be more dependent on moose distribution than sex and age composition of the herd. For the geospatial composition survey, we randomly selected 25 sample units that were 2 minutes of latitude and 5 minutes of longitude on a side (approximately 5.5 mi^2 area). We only selected sample units west of 144 degrees latitude. This excluded a small portion on the east end of Unit 25C, where moose densities and hunter effort are likely very low. The concept behind a spatial composition survey is the same as the GeoSpatial Population Estimator, (GSPE; Ver Hoef 2001) except that search intensity is reduced to about 4 minutes per square mile per sample unit. The objective is to glean the easy-to-see moose from a random selection of the landscape, then put adequate effort into correctly classifying them by sex and age.

We completed a GSPE moose survey in Unit 25C (5000 mi^2) during November–December 1997 in cooperation with the Bureau of Land Management (BLM). This recently derived technique does not yet commonly incorporate a sightability correction factor (SCF). However, preliminary data by Boertje and others suggests 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 (ADF&G memo, Developing a SCF for Nov GSPE survey estimates in forest–shrub mixtures in Interior Alaska, 22 May 2006).

In the Lake Minchumina area (1007 mi^2) of Unit 20C, DNPP biologists conducted a census using Gasaway methods (Gasaway et al. 1986) during November 1994. We completed stratification flights associated with the GSPE technique 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., RY03 = 1 July 2003–30 June 2004).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Based on the 1997 GSPE without a SCF, we conservatively 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 a conservative SCF of 1.12, the estimated moose density was 0.5 moose/mi^2. Both estimates are within the expected range of 0.2–0.8 moose/mi^2 (average ≈ 0.6 moose/mi^2) found in all large areas of Interior Alaska (>800 mi^2) with lightly harvested bear and wolf populations. Very few moose density estimates have been outside this range during the last 30 years, except in areas where predation is reduced by humans.

We conservatively 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 conservatively 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 2004 geospatial composition surveys in Unit 25C, we surveyed 21 sample units, spent an average of 4.2 minutes per square mile searching for moose, and counted 46 moose. The calf to cow ratio was 14:100 (Table 1), which is typical for a low density, predator limited system. The bull to cow ratio was 45:100, which is typical for a lightly hunted population. This population is lightly hunted because access is difficult. We counted fewer moose than we desired. Eleven of the 21 sample units surveyed had no moose. However, even with the small sample size, the new survey method appears to provide more appropriate data than the O'Brien Creek trend count area. Sample size of moose seen will increase in future surveys as we incorporate the 1997 moose density stratification into the random selection of sample units and skew the selection toward plots that contain moose. Costs for the spatial composition survey were a little higher than the old trend count surveys; the geospatial surveys took 2 full airplane days and the old trend count usually lasted between 1 and 2 days. One advantage of the geospatial composition survey method is the continual improvement of sample unit stratification each year, which will improve density estimates in future surveys. Alternatively, we may fly transects throughout Unit 25C to observe more moose and reduce the amount of ferry time between sample units.

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 consistently 30–50% in Unit 20C between RY95 and RY04. The percentage of large bulls in the Unit 20F reported harvest was more variable than Unit 20C, generally ranging between 20% and 60%. These data suggest there was no danger of overharvest of bulls in these units during RY95–RY04.

MORTALITY

Harvest

Season and Bag Limit. The following hunting seasons and bag limits have been in effect since RY93.

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

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident 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 Alaska Board of Game actions were taken and no emergency orders were issued during this reporting period.

Hunter Harvest. During RY03 and RY04 reported moose harvest decreased in Units 20C, 20F, and 25C (Table 2). During this time, the reported harvest was 97–105 moose in Unit 20C, 20–25 in Unit 20F, and 51–52 in Unit 25C. On average, the reported harvest decreased by 25% in Unit 20C, 40% in Unit 20F, and 30% in Unit 25C, compared to the previous 5 years, largely because of a decrease in the number of hunters. Increased moose harvest opportunity nearby, such as in Unit 20A may have reduced the number of moose hunters in remote areas such as Units 20C, 20F, and 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 in Unit 20C were obtained from the Alaska Railroad. During RY98–RY04 documented causes of accidental mortality were minimal (0–3 annually) in Unit 20F and Unit 25C, but mostly higher in Unit 20C (0–21 annually) due to deaths caused by train collisions (Table 3).

Hunter Residency and Success. Between RY98 and RY02 the reported number of hunters increased while the reported number of moose killed remained stable (Table 2). During RY04, all 3 units saw a decrease in number of hunters. Much of Interior Alaska was covered in a thick blanket of smoke in autumn 2004 due to record-setting wildfires. The smoke and fire may have decreased the number of hunters in the field.

During RY98–RY04, up to 6 nonresident hunters reported hunting in Unit 20F (Table 2), 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 illegal 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–RY04 the highest proportion of the harvest occurred during the second week of the season in all 3 units. 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, or 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, or 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, because predators kill a large majority of all calves produced on an annual basis (Gasaway et al. 1992). However, since forage resources determine moose calving rates, enhanced 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. Wildfires also increase deadfall, which may decrease the efficiency of predators (Boertje et al. 1995). Several wildfires and prescribed burns have occurred in the area over the last 25 years, especially during the record wildfire seasons of 2004 and 2005. A map of the burned areas is available from BLM. Some small-scale habitat improvements are being completed in the area. The Bureau of Land Management 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 the Department of Natural Resources and BLM 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. We met our objective to 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, human-caused, 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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SEATON, C. T. 2006. Units 20C, 20F, and 25C moose management report. Pages 363–376 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003 through 30 June 2005. Project 1.0. Alaska Department of Fish and Game. Juneau, Alaska.

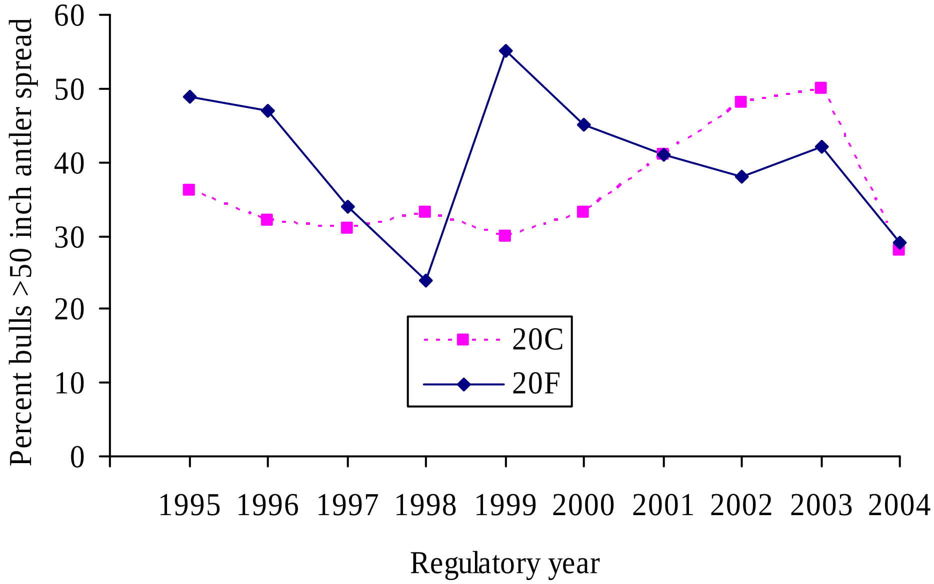

FIGURE 1 Percent of bull moose in the reported fall harvest with an antler spread >50 inches in Units 20C and 20F, regulatory years 1995–1996 through 2004–2005

TABLE 1 Unit 25C fall aerial moose composition counts, 1986–2004

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose observed
1986[a]	103	13	21	8	9	77	85
1987[a]	77	11	28	13	14	83	96
1988[a]	129	37	33	16	13	112	128
1996[a]	119	19	11	3	5	57	60
1996[b]	160	0	20	2	7	26	28
1997[c]	53	13	37	80	20	319	399
2002[a]	71	16	9	4	5	77	81
2002[b]	59	31	19	6	11	51	57
2004[d]	45	14	14	4	9	42	46

[a] O'Brien Creek count area.
[b] Ophir Creek count area.
[c] GeoSpatial Population Estimator moose population estimate.
[d] Spatial trend survey.

TABLE 2 Units 20C, 20F, and 25C reported moose hunter residency and success, regulatory years 1998–1999 through 2004–2005

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
2003–2004	59	36	10	105	(21)	252	116	26	394	(79)	499
2004–2005	66	23	8	97	(21)	228	108	19	355	(79)	452
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
2003–2004	12	8	0	20	(15)	85	29	0	114	(85)	134
2004–2005	18	7	0	25	(22)	60	26	1	87	(78)	112
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
2003–2004	3	43	6	52	(17)	20	210	19	249	(83)	301
2004–2005	4	41	6	51	(21)	15	164	15	194	(79)	245

[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 2004–2005

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
2003–2004	105	0	0	105	19	0	19	0	0	0	124
2004–2005	99	0	0	99	18	1	19	0	0	0	118
Unit 20F											
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
2003–2004	20	0	0	20	4	1	5	0		0	25
2004–2005	27	0	0	27	5	0	5	0		0	32
Unit 25C											
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
2003–2004	52	0	0	52	9	0	9	0		0	61
2004–2005	52	0	0	52	9	1	10	1		1	63

[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 2004–2005[a]

Regulatory year	Harvest chronology by month/day				
	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
2003–2004	21	55	26		102
2004–2005	30	26	36		92
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
2003–2004	5	6	7	1	19
2004–2005	7	11	8	1	27
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
2003–2004	22	27			49
2004–2005	23	29			52

[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 2004–2005

	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
2003–2004	27	5	24	24	0	12	7	2	105
2004–2005	30	1	27	22	0	14	5	0	99
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
2003–2004	0	0	50	30	5	10	5	0	20
2004–2005	0	0	37	22	4	11	26	0	27
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
2003–2004	6	0	29	44	0	8	12	2	52
2004–2005	4	0	17	46	0	4	27	2	52

WILDLIFE
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[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- to 72-day bull season and a 1- to 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).

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

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.

In 1983 the closed area around Delta Junction, 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 because 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 (BRYHMA) was created in 2002 to regulate moose hunting in the fields of the Delta Junction Bison Range. This drawing permit hunt was implemented primarily 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 GeoSpatial 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 optimized for the GSPE 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 one sampled pair. I grouped SUs with similar anticipated moose densities, habitat types, and topographic features. Ten percent of available SUs were not allocated initially, but held in reserve and placed in the survey area where SUs had greater separation than 50 km. If SUs are separated by greater than 50 km, autocorrelation cannot be calculated for the population estimate.

Sample units were surveyed with a Piper PA-18 Super Cub and a Robinson R-22 helicopter in 2003 and only Piper PA-18 Super Cubs in 2004 and 2005. 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 0.25 degrees of longitude. A global positioning system receiver was used to follow transect headings. In hilly or mountainous terrain, the flight path followed terrain contours within SU boundaries, rather than transects. Our objective 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 these SUs 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 the WinfoNet internet software application developed by ADF&G staff (DeLong 2006) to calculate a population estimate of observable moose, i.e., we did not correct for moose not seen during the survey (Kellie and DeLong 2006).

Population estimates for southern Unit 20D were smoothed by using parametric empirical Bayes (PEB) methods (Ver Hoef 1996). PEB methods use 2 sources of variation with one 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. 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.

GSPE methodology allows survey areas to be subdivided into smaller portions with separate population estimates calculated for each separate area if there are at least 20 SUs in each stratum for each separate area. In southern Unit 20D, separate population estimates were calculated for southwest and southeast Unit 20D for those years when GSPE surveys met the criteria.

Because the Board of Game has adopted specific moose population objectives for Unit 20D, a sightability correction factor (SCF) was applied to GSPE estimates based on recent research by Boertje and others (ADF&G memo dated 22 May 2006, Developing a sightability correction factor [SCF] for Nov GSPE survey estimates in forest–shrub mixtures in Interior Alaska). A SCF of 1.20 was applied to estimates for southern Unit 20D and a SCF of 1.25 was applied to estimates for northern Unit 20D.

Population estimates in southern and northern Unit 20D were combined to estimate a total unitwide estimate following the methods described in Gasaway et al. (1986), with the area specific SCFs applied to the area population estimates before calculation of the standard error for the combined estimate. The SCF does not have a standard error; therefore the standard error of the observed estimate was used for the combined estimate.

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 0.25 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 Site 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 an 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 in spring 2004. The Sawmill Creek North (16.2 mi^2), Delta

Agricultural Project East and Delta Agricultural Project West (156.0 mi^2), and Clearwater (13.0 mi^2) SUs were unchanged. The Granite–Rhodes SU was eliminated in spring 2005 and replaced with the Donnelly SU (17.7 mi^2). In addition to surveying the SUs listed above, we also classified and recorded moose observed while flying en route to SUs.

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., RY04 = 1 July 2004–30 June 2005). One reminder letter was sent to holders of harvest tickets and 2 letters to holders of permits.

Habitat Assessment. Moose browse surveys were conducted in southwest Unit 20D using a plant architecture method developed by Seaton (ADF&G, personal communication). Linear transects were established and browse species were sampled every 5 steps along the transect. At each sample point, the nearest moose browse species was identified and the height measured to the nearest 0.1 m. The plant architecture was recorded as 1) broomed (more than one-half of current annual growth arises from lateral shoots that were a result of moose browsing in previous years), 2) browsed (less than one-half of current annual growth arises from lateral shoots that were a result of moose browse in previous years), or 3) unbrowsed (no sign that moose have ever browsed this plant). The plant was also recorded as mature if more than half of current annual growth was higher than 3 m above the ground. The objective of this data was to examine the history of browsing on the plant. Other data recorded included latitude–longitude of the transect; date; sampling crew; slope of the transect; snow depth; the presence or absence of preferred browse species and their mean height, distance apart, and % broken; nonpreferred species present with mean height and mean distance apart; whether the site had been burned by wildland fire; and a habitat description. I tested this method as a technique that biologists could conduct rapidly over large areas to evaluate moose browsing pressure on the habitat.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

2003

A GPSE survey was flown in Unit 20D south of the Tanana River during 11–18 November 2003 for approximately $11,355. The southern Unit 20D survey area included 320 SUs and covered 1890.2 mi^2 averaging 5.9 mi^2 per SU. The high-density stratum had 186 SUs totaling 1098.2 mi^2

and the low-density stratum had 134 SUs totaling 792.0 mi^2. Forty-seven SUs were searched during the survey including 30 highs (64%) and 17 lows (36%), meeting the objective of surveying 60% high SUs. 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, which was below the search-effort objective.

The population estimate was 5493 observable moose (without a SCF applied) with a 90% confidence interval of 3924–7061 moose (Table 1). The smoothed estimate was 4456 moose (3752–5209, Table 2). Appling a SCF to the smoothed estimate resulted in a SCF estimate of 5347 moose (Table 3), and a density of 2.8 moose/mi^2. The 2003 southern Unit 20D estimate was not combined with the 1999 northern Unit 20D to calculate a total unit estimate because the time interval between the surveys was considered too long.

The observed population estimate in southwest Unit 20 grew substantially from 2583 moose in RY01 to 4524 moose in RY03, with composition of 32 calves:100 cows and 21 bulls:100 cows. Most of the population growth in Unit 20D occurred in the southwest portion. The observed population estimate in southeast Unit 20D increased modestly from 853 moose in RY01 to 968 in RY03, with composition of 24 calves:100 cows and 39 bulls:100 cows (Table 4).

Twinning surveys were flown on 27–30 May and 1 June 2004 for a total of 12.4 hours of survey time and a cost of $2685. Morning surveys began from 0526–0630 hours and were completed by 0849 hours. Evening surveys began from 2003–2024 hours and were completed by 2234 hours. Moose were seen at the rate of 23.7 moose/hour with 294 moose observed. Sixty-four cow–calf groups were observed with 18 (28.1%) being cows with twins (Table 5).

2004

A GSPE survey was flown in Unit 20D north of the Tanana River during 2–22 November 2004 for a cost of $11,837. The US Army contributed funds to the survey as part of their Integrated Natural Resource Management Plan to support wildlife surveys associated with military land. The northern Unit 20D survey area included 546 SUs and covered 3173.6 mi^2 averaging 5.8 mi^2 per SU. The high-density stratum had 139 SUs totaling 806.2 mi^2 and the low-density stratum had 407 SUs totaling 2367.4 mi^2. Sixty SUs were searched during the survey including 38 highs (63%) and 22 lows (37%), meeting the objective of surveying 60% high SUs. Search effort during this survey was below the objective and averaged 44.0 minutes in high density SUs (7.6 min/mi^2) and 39.0 minutes (6.7 min/mi^2) in low density SUs.

The population estimate was 1929 observable moose (without a SCF applied) with a 90% confidence interval of 1443–2415 (± 25%, Table 6). Applying a SCF resulted in a corrected estimate of 2411 moose and a density of 0.8 moose/mi^2.

The 2004 northern Unit 20D and 2003 southern Unit 20D smoothed estimate, each corrected for sightability, were combined to calculate a total Unit 20D estimate of 7758 moose (Table 7). This population estimate is 242 moose less than the lower population objective.

Twinning surveys were flown on 24, 25, and 31 May 2005 for a total of 10.6 hours of survey time and a cost of $2590. Morning surveys began from 0532–0625 hours and were completed by

0930 hours. Evening surveys began from 1940–2130 hours. Moose were seen at the rate of 19.5 moose/hours with 217 moose observed. Fifty cow–calf groups were observed with 11 (22.0%) being cows with twins (Table 5).

2005

A GSPE survey was flown in Unit 20D south of the Tanana River during 2–29 November 2005 for a cost of $11,970. The southern Unit 20D survey area included 320 SUs and covered 1890.2 mi^2 averaging 5.9 mi^2 per SU. The high-density stratum had 187 SUs totaling 1104.1 mi^2 and the low-density stratum had 133 SUs totaling 786.1 mi^2. Fifty-nine SUs were searched during the survey including 38 highs (64%) and 21 lows (36%), nearly meeting the objective of surveying 60% high SUs. Search effort during this survey met the objective in high density SUs and averaged 48 min/SU (8.3 min/mi^2) but did not meet the objective in low density SUs that averaged 43.6 (7.5 min/mi^2).

The population estimate was 5553 observable moose (without a SCF applied, Table 1) with a 90% confidence interval of 4513–6593 (±25%). The 2005 estimate has not been "smoothed" at this time. Applying a SCF to the unsmoothed estimate resulted in a SCF corrected estimate of 6664 moose (Table 3) for a density of 3.5 moose/mi^2.

The southwest Unit 20D population estimate increased modestly in RY05 to 4863 moose with composition of 34 calves:100 cows and 20 bulls:100 cows. The southeast Unit 20D population estimate decreased to 690 moose in RY05 with composition of 24 calves:100 cows and 51 bulls:100 cows (Table 4).

The 2004 northern Unit 20D and 2005 southern Unit 20D population estimates were corrected for sightability and combined to calculate a total Unit 20D estimate of 9074 (7901–10,247) (Table 7). This estimate meets the population objective.

RY05 moose twinning surveys had not been flown when this report was written.

Population Composition

<u>2003</u>. Southern Unit 20D population composition from the fall 2003 GSPE survey was 23 bulls:100 cows (19–26) and 32 calves:100 cows (27–37; Table 1).

<u>2004</u>. Northern Unit 20D population composition from the fall 2004 GSPE survey was 47 bulls:100 cows (28–66) and 31 calves:100 cows (19–43; Table 6).

<u>2005</u>. Southern Unit 20D population composition from the fall 2005 GSPE survey was 24 bulls:100 cows (17–31) and 33 calves:100 cows (28–38; Table 1).

Distribution and Movements

No data were collected on moose distribution or movements during RY03–RY05.

MORTALITY

Harvest

Season and Bag Limit. Hunting seasons and bag limits are listed in Table 8.

Alaska Board of Game Actions and Emergency Orders.

2004 — At the February 2004 meeting, the Alaska Board of Game adopted regulation proposal 109 to eliminate Tier II moose hunt TM787 in Unit 20D. The department submitted the proposal because overall interest and participation in the hunt was declining by local residents and it had a very low harvest.

The board adopted regulation proposal 110 submitted by the Delta Bison Working Group and the Delta Fish and Game Advisory Committee to change moose hunting regulations in the BRYHMA. 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 from 1 bull to 1 bull per lifetime with spike-fork antlers or antlers at least 50-inches wide or with at least 4 brow tines on one side, and restricted motorized vehicles for all hunting from 1 July to 30 September.

Proposal 111 was submitted by the president of the Dot Lake Village Council to align the moose hunting seasons between eastern Unit 20D and Unit 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 DJMA. The justification was to reduce the number of moose within the DJMA. The proposal was not adopted.

2006 — At the March 2006 meeting, the board adopted proposal 88 which established a drawing permit hunt for cow moose unaccompanied by calves in Unit 20D south of the Tanana River and west of the Johnson River, with authorization for the department to issue up to 75 permits. Justifications for the proposal were that density of moose in southwest Unit 20D was very high, moose twining and browse surveys demonstrated some density dependent effects which can be expected to increase if the population continues to increase, and an abundance of high quality habitat created during the 1970s–1980s is aging and growing out of reach of moose. The season date was established as 1–15 October. The DJMA was included in the hunt area and the BRYHMA bag limit was modified to include cow moose unaccompanied by calves, with a maximum of 10 permits issued for the youth hunt.

The board also considered proposal 84 submitted by the public to change the moose bag limit in the BRYHMA from 1 bull with spike-fork antlers or 50-inch antlers or 4 or more brow tines on at least one side, to 1 bull. The board took no action on this proposal based on changes in proposal 88.

The board did not adopt proposal 132, submitted by the public, to create a community subsistence moose harvest area in southwest Unit 20D because the proposed area is within the Fairbanks nonsubsistence area, where adoption of subsistence hunting regulations and a subsistence priority is prohibited.

Human-Induced Mortality

RY03. Estimated moose mortality from all human causes during RY03 was 322 moose (Table 9). This included 227 moose reported killed by hunters during the hunting season, known illegal harvest of 12 moose, and an estimated unreported harvest of 40 moose. An additional 43 moose were killed on the roads. The total reported hunting mortality of 227 was below the harvest objective of 500–700.

RY04. Estimated moose mortality from all human causes decreased in RY04 to 294 moose (Table 9). This included 202 moose reported killed by hunters during the hunting season and an estimated unreported harvest of 36 moose and a known illegal harvest of 13 moose. Illegal harvest is thought to be much higher but undocumented. Accidental deaths by reported road kill totaled 43 moose. The total reported hunting mortality of 202 was below the harvest objective of 500–700. The reported hunting harvest was 2.6% of the corrected population estimate. Total known human-induced mortality was 3.8% of the corrected population estimate.

RY05. Estimated moose mortality from all human causes in RY05 was not available because the regulatory year had not been completed (Table 9). However, known data included 232 moose reported killed by hunters in fall 2005, an estimated unreported harvest of 41 moose, and an illegal harvest of 14 moose. Illegal harvest is thought to be much higher but undocumented. Accidental deaths will not be summarized until the end of the regulatory year. The total reported hunting mortality of 232 was below the harvest objective of 500–700. The reported hunting harvest was 2.6% of the corrected population estimate. Total known human-induced mortality was not yet calculated.

Southwestern Unit 20D Hunter Harvest. Southwestern Unit 20D has the highest harvest in the unit. Reported hunter harvest in RY03 was 137 moose, with 124 killed during the general hunting season (Table 10), 6 killed during hunt DM790 (Table 11) and 7 killed during hunt DM792 (Table 12). During the general season, 447 hunters killed 124 moose for a 28% success rate. This is the largest number of hunters who have reported since at least RY84. Southwestern Unit 20D had 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. Sixty percent of hunters with DM790 permits killed moose and 29% of hunters with DM792 permits killed moose.

Reported hunter harvest in RY04 totaled 113, with 107 taken during the general hunting season (Table 10), 4 during the DJMA permit hunt DM790 (Table 11), and 2 during hunt DM792 (Table 12). During the general season, 415 hunters killed 107 moose (Table 10) for a 26%

success rate. Forty percent of hunters with DM790 permits killed moose, and only 8% of hunters with DM792 permits killed moose due mainly to the bag limit changing from 1 bull to 1 bull with spike-fork or 50-inch antlers or 4 or more brow tines on at least one side.

Reported hunter harvest in RY05 totaled 139 moose, the largest harvest in this area since at least RY84. Hunters reported taking 126 moose during the general season (Table 10), hunters with DM790 permits took 8 moose (Table 11), and hunters with DM792 permits took 5 moose (Table 12). During the general season, 407 hunters killed 126 moose (Table 10) for a 31% success rate. Eighty percent of hunters with hunt DM790 permits killed moose, but only 21% of hunters with DM792 permits killed moose due mainly to the bag limit changing from 1 bull to 1 bull with spike-fork or 50-inch antlers or 4 or more brow tines on at least one side.

<u>Southeastern Unit 20D Hunter Harvest</u>. Moose harvest remained low in southeastern Unit 20D. During the RY03–RY05 general seasons, only 12–19 moose were reported killed annually (Table 10). Hunter success rates varied from 24–40% during this period. 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.

Tier II subsistence hunt TM787 was held for the last time in RY03 with 15 permits issued. Forty percent of permit recipients did not hunt and only 22% of recipients killed moose, for a harvest of 2 moose killed (Table 13).

<u>Northwestern Unit 20D Hunter Harvest</u>. Northwestern Unit 20D has the second highest harvest in the unit. During the RY03 general season, 53 moose were killed by 230 hunters (Table 10) for a 23% success rate. During the RY04 general season, 56 moose were killed by 238 hunters (Table 10) for a 24% success rate. During the RY05 general season, 61 moose were killed by 206 hunters (Table 10) for a 30% success rate. There were no permit hunts in northwestern Unit 20D.

<u>Northeastern Unit 20D</u>. The number of hunters and harvest remained low in northeastern Unit 20D during the RY03–RY05 general seasons. Harvest was 13–14 moose annually, with 30–42 hunters, and success rates of 32–43% (Table 10). 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.

Number of moose hunters and harvest remained low during the August moose hunting season in the Healy River drainage during RY03–RY05, despite the fact that the Healy River drainage was the only area in Unit 20D with an August hunting season. During RY03–RY05 no moose were reported killed during the Healy River drainage August season and all moose were taken during the general season in September (Table 14).

<u>Hunter Residency</u>. The proportion of local resident hunters varied substantially during RY03–RY05. Although the trend indicated increasing numbers of nonlocal hunters in recent years, that trend reversed itself in RY03 with 69% of hunters being local residents (Table 15). This may have resulted from the military closing much of military land to hunters during the moose hunting season where many nonlocal residents hunt. However, in RY04–RY05, nonlocal

residents were the majority of hunters with 55% and 58% respectively. Nonresident hunters ranged from 5 to 8% during RY03–RY05.

Hunter Effort. Mean days hunted during the general hunting season ranged from 5.3 to 6.2 days for successful hunters and 6.5–6.9 days for unsuccessful hunters during RY03–RY05 (Table 16).

Permit Hunts. Tier II permit hunt number TM787 was conducted for the last time during 1 January–15 February RY03. Fifteen permits were issued with a harvest quota of 5 bulls. Two moose were killed in RY03 (Table 13).

Permit hunt DM790 (DJMA) had 10 drawing permits issued each year during RY03–RY05. Participation by permit recipients declined slightly with 10–30% of recipients not hunting. Harvest ranged from 4–8 moose (Table 11).

Permit hunt DM792 (BRYHMA) had 24 permits issued annually in RY03–RY05. Hunters killed 7 bull moose in RY03 when the bag limit was 1 bull. When the bag limit changed in RY04 to 1 bull with spike-fork or 50-inch antlers or 4 or more brow tines on at least one side harvest declined to only 2 bulls, but harvest increased in RY05 to 5 bulls (Table 12).

Harvest Chronology. During RY03–RY05 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 17).

Transport Methods. During RY03–RY05 3- or 4-wheelers, highway vehicles, and boats continued to be the most common modes of transportation used by successful hunters (Table 18).

Natural Mortality

No estimates of natural mortality were calculated during RY03–RY05. 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

On 22 March and 3–4 April 2006, I conducted 11 plant architecture browse transects in southwest Unit 20D to evaluate their usefulness for assessing browse usage. It was my impression that plant architecture surveys did not provide the type of browse survey data that I needed. Therefore, data were not completely analyzed and plant architecture surveys will be replaced in the future by plant biomass surveys which measure year to year browse usage (Seaton, ADF&G, personal communication).

Enhancement

During RY03–RY05, major wildland fires burned in northern Unit 20D. During summer 2003, Alaska Fire Service (AFS) fire #312284 burned 49,818 acres in the Goodpaster River drainage of northwest Unit 20D.

In summer 2004 the Camp Creek Fire (AFS #312) burned 179,599 ac in the Shaw Creek and Goodpaster River drainages of northwest Unit 20D and the Salcha River drainage of Unit 20B. Also AFS fire #515 burned 5752 acres in the Goodpaster River drainage. In northeast Unit 20D, AFS fire #592 burned 6036 acres in the upper Healy River drainage and AFS fire #274 burned the upper portions of Billy Creek and Sand Creek as part of the 463,994 acres that also burned into Unit 20E.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates were completed in southern and northern Unit 20D. Although the population objective was not met during the report period, results indicated the RY05 moose population estimate of 9075 met the objective for the first time since it was established in 1995. The bull:cow ratio in southern Unit 20D appeared to be stable during the reporting period with ratios of 23 and 24:100, respectively.

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 more 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 given the extent of wildfires in this area in 2003 and 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 despite moderate to high nutritional status (Boertje et al., in press).

Unitwide harvest of moose was well below the objective established by the board, with a 3-year average reported harvest of 220 moose. Cow moose must be harvested in southwestern Unit 20D to achieve the Unit 20D harvest objective, because the bull:cow ratio in southern Unit 20D is currently low enough that substantial additional bull-only harvest will further reduce the bull:cow ratio to unacceptable levels. Only moose in southwestern Unit 20D will support this additional cow harvest. Yet, it is unrealistic to expect southwestern Unit 20D to provide the majority of harvest necessary to meet the overall Unit 20D 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 generally higher.

In conclusion, the Unit 20D moose population did not meet the objective set by the Board of Game during the report period, but did meet the objective in RY05. The harvest objective was also not met during the report period nor during RY05. An antlerless moose hunt is recommended for southwest Unit 20D where moose density is high and the bull:cow ratio is relatively low. The antlerless moose hunt will help make progress toward the harvest objective. Substantial acreage in northern Unit 20D was burned by wildland fire in 2003 and in 2004. The moose population in northern Unit 20D should start growing and contributing toward the population objective. The extent of the growth may be determined by the amount of predation that occurs on the moose population.

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

DuBois, S. D. 2006. Unit 20D moose management report. Pages 377–408 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

TABLE 1 Results of observed population estimates for southern Unit 20D using a Gasaway[a] method survey (GAS) and GeoSpatial Population Estimator (GSPE) surveys, 1995–2005

Parameter	1995 GAS	1998 GAS	1998 GSPE	2000 GSPE	2001 GSPE	2003 GSPE	2005 GSPE
Total pop est.	2522	4050	3630	3932	3435	5493	5553
LCI[b]	1979	2826	2533	3245	2643	3924	4513
UCI[c]	3065	5275	4727	4618	4227	7061	6593
Total calves	552	937	863	676	575	1097	1219
LCI	411	682	630	498	453	830	984
UCI	693	1191	1097	855	697	1364	1453
Total cows	1626	2580	2321	2530	2424	3476	3473
LCI	1271	1741	1570	2021	1840	2363	2757
UCI	1981	3418	3072	3039	3009	4588	4188
Total bulls	343	530	479	671	392	790	817
LCI	249	350	305	530	281	462	560
UCI	437	710	653	813	504	1118	1075
Bulls:100 Cows	21	21	21	27	16	23	24
LCI	17	16	16	19	10	19	17
UCI	25	25	25	34	22	26	31
Calves:100 Cows	34	36	37	27	24	32	33
LCI	29	32	32	22	16	27	28
UCI	39	41	42	31	32	37	38

[a] Gasaway et al. (1986).
[b] LCI = Lower Confidence Interval.
[c] UCI = Upper Confidence Interval.

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 are years surveys were flown. Other years were estimated from the population trend line.

TABLE 3 Observed, smoothed, and sightability corrected GeoSpatial Population Estimator (GSPE) moose population estimates for southern Unit 20D, 1995–2005

Year	Observed estimate	Smoothed estimate	Sightability corrected estimate
1995	2522	2507	3008[a]
1998	3360	3242	3890[b]
2000	3932	3719	4463[b]
2001	3435	3920	4704[b]
2003	5493	4456	5347[b]
2005	5553	--	6664[c]

[a] Sightability Correction Factor (SCF) calculated during Gasaway survey.
[b] SCF applied to GSPE smoothed population estimate.
[c] SCF applied to GSPE observed, unsmoothed population estimate.

TABLE 4 Results of observed population estimates for southwest and southeast Unit 20D using GeoSpatial Population Estimator (GSPE) surveys, 2001–2005

Parameter	2001	2003	2005
East of Johnson River			
Total pop estimate	853	968	690
LCI[a]	544	321	290
UCI[b]	1162	1616	1090
Total calves	128	87	97
LCI	74	16	6
UCI	182	158	189
Total cows	463	356	402
LCI	185	139	130
UCI	740	573	676
Total bulls	106	139	205
LCI	65	47	117
UCI	147	230	292
Bulls:100 Cows	23	39	51
LCI	5	29	19
UCI	41	49	84
Calves:100 Cows	28	24	24
LCI	5	9	10
UCI	50	40	38
West of Johnson River			
Total pop estimate	2583	4524	4863
LCI	1190	3269	3933
UCI	3175	5779	5792
Total calves	447	1049	1121
LCI	358	719	913
UCI	537	1379	1330
Total cows	1962	3229	3070
LCI	1507	2137	2432
UCI	2416	4320	3708
Total bulls	286	664	613
LCI	203	393	396
UCI	370	936	829
Bulls:100 Cows	15	21	20
LCI	9	17	13
UCI	20	24	27
Calves:100 Cows	23	32	34
LCI	16	27	29
UCI	30	38	39

[a] LCI = Lower Confidence Interval.

[b] UCI = Upper Confidence Interval.

TABLE 5 Results of moose twinning surveys in southwest Unit 20D, 2001–2005

Year	Cows w/single calves	Cows w/twin calves	% Cows w/twins	Moose per hour	Total moose
2001	40	7	14.9	22.4	282
2002	48	13	21.3	22.5	268
2003	41	10	19.6	21.2	273
2004	46	18	28.1	23.7	294
2005	39	11	22.0	19.5	217

TABLE 6 Results of northern Unit 20D moose population estimation surveys, 1996–2004

Parameter	1996 and 1997 GAS[a]	1999 GSPE[b]	2004 GSPE[b]
Total estimate	2026	2395	1929
LCI[c]	1583	2070	1443
UCI[d]	2469	2719	2415
Total bulls	504	957	515
LCI	364	805	351
UCI	644	1109	679
Total cows	1255	1181	1101
LCI	967	979	776
UCI	1543	1384	1426
Total calves	268	213	338
LCI	171	165	189
UCI	365	262	486
Bull:100 cows	NW 1996 = 47 NE 1997 = 32	81	47
LCI		69	28
UCI		93	66
Calves:100 cows	NW 1996 = 24 NE 1997 = 18	18	31
LCI		14	19
UCI		22	43

[a] GAS is a Gasaway population estimate with a sightability correction factor applied to the observable number of moose estimated. northwestern Unit 20D was surveyed in 1996 and northeastern Unit 20D was surveyed in 1997 with the results combined to calculate an overall northern Unit 20D population estimate.

[b] GSPE is a GeoSpatial Population Estimator survey conducted with a higher search intensity than a GAS, but without a sightability correction factor applied to the observable moose estimate. Northern Unit 20D was surveyed in it's entirety each GSPE survey.

[c] LCI = Lower Confidence Interval.

[d] UCI = Upper Confidence Interval.

TABLE 7 Results of Unit 20D combined southern and northern population estimates, 1995–2005

Year and Location	Population estimate
1995 southern + 1996 northwestern + 1997 northeastern	4548
1998 southern + 1999 northern	6684
1999 northern + 2000 southern	7457
2003 southern + 2004 northern	7758
2004 northern + 2005 southern	9074

TABLE 8 Unit 20D moose hunting seasons and bag limits, regulatory years 2003–2004 through 2005–2006

Regulatory year	Area	Season		Bag limit
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 one 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.
	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 one 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.

Regulatory year	Area	Season		Bag limit
2004–2005 and 2005–2006	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 one 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 with spike-fork or 50 inch antlers or 4 or more brow tines on at least one side, by permit DM792.
		Nonresident	1–30 Sep	1 bull by permit DM792.
	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.
		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 Jan–15 Feb	1 bull.
		Nonresident	5–15 Sep	1 bull with 50-inch antlers, or at least 4 brow tines on at least one side.
	Within the Healy River drainage.	Resident:	15–28 Aug	1 bull with spike-fork antlers.
			1–15 Sep	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 one side.

TABLE 9 Unit 20D moose harvest and accidental death, regulatory years 1986–1987 through 2005–2006

Regulatory year	Harvest by hunters: Reported M	F	Unk	Total	Estimated: Unreported[a]	Illegal	Total	Accidental death: Road	Total	Total
1986–1987	130	0	0	130	23	4	27	15	15	172
1987–1988	126	0	0	126	22	10	32	26	26	184
1988–1989	126	0	0	126	22	13	35	27	27	188
1989–1990	128	0	0	128	23	9	32	16	16	176
1990–1991	118	1	0	119	21	4	25	11	11	155
1991–1992	143	1	0	144	25	11	36	13	13	193
1992–1993	143	0	1	144	25	5	30	32	32	206
1993–1994	154	0	1	155	27	14	41	30	30	226
1994–1995	128	0	0	128	23	7	30	31	31	189
1995–1996	138	0	0	138	24	20	44	25	25	207
1996–1997	214	0	0	214	38	22	60	39	39	313
1997–1998	210	0	0	210	37	15	52	48	48	310
1998–1999	234	0	0	234	41	11	52	31	31	317
1999–2000	184	0	0	184	33	7	40	40	40	264
2000–2001	246	0	0	246	44	20	64	37	37	347
2001–2002	182	0	0	182	32	17	49	32	32	263
2002–2003	228	0	0	228	40	6	46	33	33	307
2003–2004	227	0	0	227	40	12	52	43	43	322
2004–2005	202	0	0	202	36	13	49	43	43	294
2005–2006[b]	232	0	0	232	41	14	55	--	--	287

[a] Based on 17.7% unreported harvest estimated by Gasaway et al. (1992).
[b] Preliminary data.

TABLE 10 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 2005–2006

Regulatory	Moose harvest						Hunters					
year	SW	SE	NW	NE	Unk	Total	SW	SE	NW	NE	Unk	Total
1984–1985	39[a]	9[b]	40[c]	14[c]	0	102	236[a]	47[b]	294[c]	48[c]	10	635
1985–1986	48[d]	8[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]	8[b]	43[d]	9[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]	9[c]	40[g]	7[d]	4	118	270[f]	29[c]	195[g]	26[d]	28	548
1991–1992	54[f]	12[c]	66[g]	9[d]	3	144	331[f]	51[c]	231[g]	26[d]	19	658
1992–1993	59[f]	12[c]	58[g]	5[d]	9	143	329[f]	49[c]	257[g]	34[d]	48	717
1993–1994	74[h]	9[c]	58[c]	11[c]	2	154	324	33[c]	259[c]	29[c]	47	692
1994–1995	61[h]	7[c]	49[c]	9[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]	5[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
2004–2005	107[h]	12[c]	56[c]	14[i]	8	197	415[h]	50[c]	238[c]	42[i]	27	772
2005–2006	126[h]	19[c]	61[c]	13[i]	0	219	407[h]	56[c]	206[c]	30[i]	22	721

[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 one antler.
[f] Subsistence–resident season 1–15 Sep; 1 bull with spike-fork or 50-inch antlers or 3 brow tines on one antler. Nonresident season 5–15 Sep; 1 bull with 50-inch antlers or 3 brow tines on one 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 one 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 one antler. Nonresident season 5–15 Sep; 1 bull with 50-inch antlers or 4 brow tines on one antler.
[i] Resident season 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 11 Unit 20D Delta Junction Management Area moose drawing permit harvest, regulatory years 1996–1997 through 2005–2006

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
DM790	2004–2005	10	30	30	40	100	0	0	4
DM790	2005–2006	10	10	10	80	100	0	0	8

TABLE 12 Unit 20D Bison Range Youth Hunt Management Area moose drawing permit harvest, regulatory years 2002–2003 through 2005–2006

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
DM792	2004–2005	24	4	88	8	100	0	0	2
DM792	2005–2006	24	17	63	21	100	0	0	5

TABLE 13 Unit 20D moose Tier II permit harvest, regulatory years 1989–1990 through 2003–2004[a]

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

[a] TM787 was discontinued after regulatory year 2003–2004.

TABLE 14 Unit 20D Healy River (Uniform Coding Unit 501) reported moose harvest, regulatory years 1993–1994 through 2005–2006

Regulatory	Unit 20D Healy River	
year	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
2004–2005[c]	15	1
2005–2006[c]	14	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.
[c] Resident moose hunting season: 15–28 Aug, 1 spike-fork bull; 1–15 Sep, 1 bull.

TABLE 15 Unit 20D general hunting season moose hunter residency and success[a], regulatory years 1986–1987 through 2005–2006

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
2004–2005	70	101	13	6	190 (24)	213	315	44	14	586 (76)	776
2005–2006	73	138	21	2	234 (26)	233	381	46	4	664 (74)	898

[a] Excludes hunters in permit hunts.
[b] Local means reside in Unit 20D.

TABLE 16 Southwestern, southeastern, northwestern, and northeastern Unit 20D general season moose and mean days hunted[a], regulatory years 1986–1987 through 2005–2006

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
2004–2005	10.0	5.0	5.9	4.4	6.2	5.9	6.1	7.2	6.0	6.8
2005–2006	5.3	3.8	5.9	4.9	5.3	6.4	6.3	7.0	6.1	6.5

[a] Excludes permit hunt harvest.

TABLE 17 Unit 20D moose harvest[a] chronology percent by month/day, regulatory years 1990–1991 through 2005–2006

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
2004–2005	40	29	29	3	189
2005–2006	50	21	27	2	230

[a] Excludes permit hunt harvest.

TABLE 18 Unit 20D moose harvest percent[a] by transport method, regulatory years 1987–1988 through 2005–2006

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
2004–2005	5	3	22	39	0	6	21	0	5	190
2005–2006	5	2	18	45	0	4	22	0	5	235

[a] Excludes permit hunt harvest.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

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 1976–2006 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 (ADF&G) 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 ADF&G and public trapping efforts. In addition, grizzly bear hunting regulations were liberalized in 1981, causing moderate increases of grizzly bear harvest in portions of the unit, 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 2006 it remained at 0.5–0.6 moose/mi^2.

For more than 20 years, local communities expressed concern about chronically low moose density due to predation, and proposed various predator control programs to increase moose numbers and moose harvest to meet their needs.

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the reporting period.

Prior to 1992, moose in Unit 20E were hunted primarily 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 drainage. During 1992–2006, more hunters from Southcentral Alaska traveled to Unit 20E to hunt moose in response to more restrictive moose hunting regulations in that area, 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 southern Unit 20E, within the Tok West and Tok Central survey areas in 2003–2006. We used a GeoSpatial Population Estimator (GSPE;

Ver Hoef 2001; Kellie and DeLong 2006), a modification of the standard Gasaway technique (Gasaway et al. 1986). In 2003 a GSPE survey was conducted in a 1200-mi^2 portion of northern Unit 20E within the Yukon–Charley Rivers National Preserve (YCNP) by the National Park Service (NPS; J. Burch, NPS, personal communication).

These data were used to determine population trends and composition in the survey areas and to estimate moose numbers in the entire unit. The Tok West, Tok Central and YCNP 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.

The Fortymile Nonlethal Wolf Control Program (nonlethal program) was conducted in western Unit 20E, northern Unit 20D, and eastern Unit 20B during 1997–2001. To evaluate effects of the nonlethal program on moose, ADF&G surveyed portions of western Unit 20E and northern Unit 20D (Tok West study area; Boertje and Gardner 1999) during RY98–RY05 using the GSPE. The portion of this study area within Unit 20E was included in the Tok West moose survey area.

COMPOSITION SURVEYS

We estimated sex and age composition in 2003–2006, 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.

TWINNING SURVEYS

Twinning rates were estimated in 2004–2006 from spring surveys conducted in southern Unit 20E. Reconnaissance-style twinning rate surveys were flown on 28 May 2004 (9.0 hr), on 26–27 May 2005 (11.9 hr), and on 31 May 2006 (6.9 hr) in areas historically used as moose calving areas. Roughly parallel contour-transects were flown at approximately ½-mile intervals at ≤500 feet above ground level in PA-18 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. Between 1 and 2 reconnaissance flights were conducted each year prior to the twinning survey to locate an adequate number of cows. If <50% of the cows had calves, we terminated surveys, excluded the data, and attempted the survey a few days later when more cows had calved. For statistical reasons we established, a priori, a minimum sample size of 30 cows with calves. Twinning rate was calculated as the proportion of cows with twins or triplets from the sample of all cows with newborn calves.

HARVEST

Harvest was estimated from harvest reports from drawing and general season hunts (after reminder letters were sent), and in 2001–2006 within most of Unit 20E by registration permit reports. Information obtained from these 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., RY03 = 1 July 2003–30 June 2004).

HABITAT ENHANCEMENT

Natural wildfires were managed under the Alaska Interagency Fire Management Plan. No prescribed fires were planned in Unit 20E during RY03–RY06.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Available evidence suggests the moose population in Unit 20E was much higher (1.0–1.5 moose/mi^2) in the 1960s, but since the late 1970s, it has been at low density (<1.0 moose/mi^2). During 1981–2006 we conducted 12 moose density estimation surveys, which confirmed persistently low numbers. I discuss moose population trends in Unit 20E during 1981–2002 in the 2004 moose management report (Gross 2004).

The highest densities of moose were in a portion of southern Unit 20E where habitat availability and quality were highest. This area was entirely within the Tok West and Tok Central moose survey areas and included the Mosquito Fork Fortymile River drainage downstream from and including the Mosquito Flats, the West Fork Fortymile River drainage and the north Mount Fairplay–lower Dennison Fork Fortymile River areas. The moose density averaged 0.59 moose/mi^2 (0.37–0.98 moose/mi^2) during RY03–RY06 (Table 1). The remainder of southern Unit 20E had lower moose densities, but higher densities than northern Unit 20E.

The NPS conducted population estimation surveys in northern Unit 20E within the YCNP west of Washington Creek and south of the Yukon River in 1994 and 1997, and found about 0.30 moose/mi^2 during both years (B. Dale, ADF&G, personal communication). Additionally, the NPS surveyed both north and south of the Yukon River, including a 1200-mi^2 portion of Unit 20E, and estimated the moose density for the entire area at 0.37 and 0.22 moose/mi^2 in 1999 and 2003 (Burch 1999, 2003). The portion of the survey area outside Unit 20E had a higher moose density than the portion within Unit 20E. Therefore, to help estimate unitwide moose numbers during RY04–RY06, I used a density estimate of 0.2–0.4 moose/mi^2 for the 1200-mi^2 portion of Unit 20E surveyed by the NPS.

No formal surveys were conducted in northeastern Unit 20E (approximately 2170 mi^2 of moose habitat) during RY03–RY06. I estimated the moose population size (0.3 moose/mi^2) in northeastern Unit 20E by using a combination of data, including the amount of suitable moose habitat, harvest data, and the number of moose concentration areas in comparison to the areas in the unit that were sampled.

Most wolf packs affected by the nonlethal program began recovery during RY03–RY06. Studies of the effects of the nonlethal program are ongoing (Boertje et al. 2006) and will be presented in a future ADF&G research publication. No effects from the nonlethal program were apparent on the moose population in Unit 20E during RY03–RY06, presumably because grizzly bears were the major predator on moose, particularly calves, in this area (R. Boertje, ADF&G, personal communication). Wolves are the major predator on caribou in this area, and the nonlethal wolf control program was designed to increase caribou numbers.

RY03. Combining all available population data for the unit, the 2003 population estimate for Unit 20E was 4000–4800 moose, with an estimated density of 0.50–0.60 moose/mi^2 of moose habitat (8000 mi^2). Only habitat clearly not suitable for moose was excluded, e.g., high portions of mountains (Gasaway et al. 1986).

RY04. Combining all available population data for the unit, the 2004 population estimate for Unit 20E was 2600–3900 moose, with an estimated density of 0.32–0.49 moose/mi^2 of moose habitat (8000 mi^2).

RY05. Combining all available population data for the unit, the 2005 population estimate for Unit 20E was 3200–4600 moose, with an estimated density of 0.40–0.58 moose/mi^2 of moose habitat (8000 mi^2).

RY06. Combining all available population data for the unit, the 2006 population estimate for Unit 20E was 3600–5200 moose, with an estimated density of 0.45–0.64 moose/mi^2 of moose habitat (8000 mi^2).

Predator–prey relationships between moose, wolves and brown bears in Unit 20E, including management and research findings by ADF&G during RY81–RY03, were discussed previously (Gasaway et al. 1992; Gross 2004). Future research on sightability will likely result in increasing these moose population estimates by 15% to 35%, but the trend appears approximately stable since 1990.

Population Composition

Previously, I discussed the moose sex and age composition trends in Unit 20E during 1981–2002 (Gross 2004). During RY98–RY02, calf survival to 5 months (≤25:100) was below levels expected to result in an increasing population. Calf survival to fall was poor in RY03 in both the Tok Central and Tok West survey areas (11–15 calves:100 cows; Table 1), indicating a decline in the population. In RY04, calf survival to fall increased slightly (23–26 calves:100 cows), but remained below the level that might indicate a population increase.

Following the RY04 wolf and brown bear control in the Upper Yukon–Tanana Predator Control Program (UYTPCP), the RY05 calf survival in the Tok West survey area increased to 30 calves:100 cows, but remained low (16 calves:100 cows) in the Tok Central survey area. In RY06, after 2 years of wolf reductions under the UYTPCP, the calf:cow ratio in the Tok West survey area was 37 calves:100 cows, while calf numbers remained at low levels (24 calves:100 cows) in the Tok Central survey area. More wolves killed though predator control as well as hunting and trapping during RY05–RY06 in the Tok West, compared to the Tok Central survey area, may have contributed to the higher calf survival in the Tok West area, but several more years of surveys are required to test whether moose numbers increase.

The Unit 20E bull:cow ratio remained above 40 bulls:100 cows during RY03–RY06, but varied across the unit. In the most popular hunting areas (Nine Mile Trail, Mitchell's Ranch, and along the Yukon River and Taylor Highway) bull populations were noticeably lower, but remained ≥40:100.

Modeling data indicate that if unitwide calf recruitment remains below 30 calves:100 cows and harvest levels remain the same, the bull:cow ratio in Unit 20E will decline. While the fall calf:cow ratio met or exceeded 30 calves:100 cows in the Tok West survey area (31% of the moose habitat in Unit 20E) for the past 2 years, the calf:cow ratio in the remainder of the unit (69% of the moose habitat in Unit 20E) remained below 30 calves:100 cows, which resulted in a unitwide calf:cow ratio below 30 calves:100 cows. Several more years of composition data will be required to detect a trend in the bull:cow ratio.

Twinning Rates

Twinning rates in southern Unit 20E were moderate at 24–30% in 2004 and 2005, but higher in 2006 at 47%. We can conclude that nutritional status is adequate to support an increase in the moose population, because moose in Unit 20A increased in recent years with far lower nutritional status (Boertje et al. 2007).

Distribution and Movements

Moose are distributed throughout Unit 20E below elevations of 4500 feet. During 1984–1986 most radiocollared moose 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 during RY03–RY06 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 and 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 moose harvest due to increasing numbers of hunters in most of Unit 20E, and were designed to reduce hunter success and stabilize harvest to maintain the bull:cow ratio in Unit 20E above the management objective. 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 August and 8–17 September). 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.

In spring 2000 the board identified the moose population within the Fortymile and Ladue River drainages, in Unit 20E, as important for providing 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 May 2005 the board identified the entire moose population in Unit 20E as being important for providing high levels of human consumptive use.

The board kept the intensive management objectives at 8000–10,000 moose with an annual harvest objective of 500–1000 moose.

For more than 20 years, communities in and adjacent to Units 12 and 20E expressed concern about chronically low moose densities due to predation by wolves and bears, and proposed various predator control programs to increase moose numbers. During the spring 2004 Board of Game meeting, the Upper Tanana–Fortymile Fish and Game Advisory Committee and the public provided testimony to explain the problem, and made proposals to increase the moose population. The Board of Game subsequently requested that ADF&G prepare a draft wolf and brown bear predation control implementation plan.

At the request of the board, ADF&G developed the Upper Yukon–Tanana Predator Control Plan (UYTPCP) to increase moose survival in portions of Units 12 and Unit 20E. At the spring 2004 meeting, the board approved the UYTPCP, which allowed the department to conduct a wolf and brown bear population reduction or regulation program for up to 5 years, beginning 1 January 2005 in the Upper Yukon–Tanana predator control area in Units 12 and 20E. Wolf control was approved for 6600 mi^2 in southern Unit 20E and the portion of Unit 12 north of the Alaska Highway. Grizzly bear control was approved for a 2700-mi^2 portion of Unit 20E.

During the May portion of the spring 2006 meeting, the Upper Yukon–Tanana predator control area was enlarged to 18,750 mi^2 by the board to include most of the Fortymile caribou herd's annual range, with the goal of increasing caribou. Wolf control was authorized for the entire predator control area. Brown bear control was limited to a 4050-mi^2 portion of southern Unit 20E to reduce predation on moose calves.

<u>Hunter Harvest</u>. During RY03–RY06, reported harvest of bull moose during the general season averaged 123 (93–137) bulls annually (Table 3), about 3% of the estimated population. The average reported bull harvest for RY98–RY02 was 143 (127–169). The numbers of people who hunted moose in Unit 20E increased from 472 in RY98 to 913 in RY02, but remained below the 2002 level during RY03–RY06 ($\bar{x}$ = 651, range = 484–798). Probable causes for the increase in hunter participation during RY98–RY02 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 15-day any bull bag limit with relatively liberal season dates gave hunters a false impression that numbers of moose were high; and 4) more hunters came looking for large antlered bulls. Probable causes for the subsequent decline in hunter participation during RY03–RY06 include: 1) increasing opportunity for antlerless moose hunting in Unit 20A and increasing moose densities in southwest Unit 20D drew hunters away from Unit 20E, where they experienced low success rates; 2) hunters learned that the relatively liberal any bull bag limit in Unit 20E was not an indication of high moose densities; 3) the extensive fires in Unit 20E during 2004 created poor hunting conditions and hunters were discouraged from coming to Unit 20E that year; and 4) the Fortymile caribou season closed along the Taylor Highway in Unit 20E before the moose season began in RY05 and RY06.

Antler data collected during fall composition surveys indicated that restricting hunters to bulls with at least 50-inch antlers in Unit 20E would not stop the declining bull:cow ratio. Much of the bull population was 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 is a 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. The split hunting season throughout Unit 20E and the shortened season along the Yukon River appear to have reduced hunter efficiency and lowered harvest. If these harvest management methods do not hold the harvest at current levels, more restrictive regulations will be necessary.

Permit Hunts. Two winter drawing permit hunts (DM794 and DM796) occurred within portions of the Ladue River Controlled Use Area. These hunts allowed greater hunting opportunity in remote areas that supported a high proportion of bulls (bull:cow ratio >60:100) but were rarely hunted due to difficult access in the fall.

During RY03–RY06, 3 DM794 and 7 DM796 permits were issued annually. Two bulls were harvested in the DM794 hunt and 0 bulls were harvested in the DM796 hunt (Table 3). During RY03–RY06, an average of 60% of DM794 permit holders hunted each year, and an average of 39% DM796 permit holders hunted. Hunting conditions, including access, were extremely difficult, with unpredictable snow conditions and extreme cold. This likely accounted for the low participation in these hunts. Hunters who applied for these hunts often expected an easy moose hunt, but once they called our office and determined how remote the hunt areas were, and how difficult the conditions could be, many hunters chose not to participate. In addition, conversations I had with hunters indicated that they were searching for larger bulls during RY03–RY06 than the bulls that hunters took in previous years. I will continue to encourage hunters to travel to this remote area when snow conditions allow, to harvest large bulls with antlers ≥60 inches.

Hunter Residency and Success. Of the 93–137 bulls harvested annually during the general season in RY03–RY06, 59–72% were taken by nonlocal Alaska residents (Table 4). Prior to 1992, most nonlocal hunters were from Interior and Southeast Alaska, but since RY92 most nonlocal hunters were from Southcentral Alaska. Nonlocal hunters made up 61–66% of the hunters during RY03–RY06. Local hunters represented 21–25% of the hunters and took 15–21% of the harvest. Nonresident hunters were prohibited from hunting moose in Unit 20E during RY83–RY90. During RY91–RY02, nonresidents represented 9% of the hunters and accounted for an average of 9% of the harvest. During RY03–RY06, nonresidents represented an average of 13% (12–14%) of the hunters and took and average of 19% (13–21%) of the harvest.

Hunter success was 16%, 19%, 22% and 19% during RY03, RY04, RY05 and RY06. The success rate declined from an average of 28% during RY93–RY00 to 19% during RY01–RY06. This decline was likely primarily due to implementation of the more restrictive regulations and perhaps lower bull:cow ratios in accessible areas.

Harvest Chronology. During RY90–RY94, an average of 35 bulls were harvested during 1–6 September, averaging 40% (range = 27–50%) of the fall harvest. During RY95–RY00, total harvest during 1–6 September remained the same (36 bulls) but represented only 25% of the harvest (range = 16–33%). As hunter numbers increased, a greater percentage hunted later in the season.

During RY93–RY00, 16–42 bulls ($\bar{x}$ = 31) were harvested during 1–5 September. In RY01 the hunting season in most of Unit 20E was split into 2 periods: 24–28 August and 8–17 September. During RY01–RY06, 2–14 bulls ($\bar{x}$ = 9) were harvested during 24–28 August, a 71% reduction in the average harvest during the first 5 days of the general season (Table 5).

Transport Methods. During RY01–RY06 there was an increase in the percentage of moose harvested by hunters who used 4-wheelers and a decrease in use of highway vehicles compared to previous years. Use of 4-wheelers increased from an average of 28% (range = 22–32%) during RY92–RY00, to an average of 39% (range = 34–49%) during RY01–RY06 (Table 6). In addition, the proportion of the harvest by hunters who used highway vehicles declined significantly from an average of 21% during RY92–RY00 to an average of 11% during RY01–RY06. This indicates the decline in the roadside bull:cow ratios and more restrictive regulations during RY01–RY06. The number of hunters who used other transportation types, and the 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 in portions of Unit 20E. The increasing quality and dependability of ATVs allowed hunters to access areas further off the road system that had previously been refugia for moose. This group of hunters tended to have a concentrated effect on local populations of moose in areas along trail systems.

Other Mortality

Predation by wolves and grizzly bears was identified as the greatest source of moose mortality in Unit 20E (Gasaway et al. 1992) and maintained the population at a low density (0.32–0.64 moose/mi^2). Using the model presented by McNay and DeLong (1998), I estimated at least 33% of the postcalving moose population was killed by wolves and grizzly, compared to 41% in the earlier telemetry study (Gasaway et al. 1992). Harvest accounted for about 1.6% of the immediate postcalving moose population.

HABITAT

Assessment

Availability of browse in Unit 20E did not appear to limit 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 southern portion of the unit, and much of this habitat is the result of 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 during 1998–1999 and >1.2 million acres within or adjacent to Unit 20E in 2004–2005. Habitat quality in these areas is expected to improve during the next 10–15 years.

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. 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 that resulted from the 1990 Tok wildfire. This change in attitude allowed ADF&G 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 appear to be increasing and may continue to increase over the next 15–20 years, likely due in part to lessened grizzly bear densities in large burns in Unit 20E (Craig Gardner, ADF&G, personal communication).

In RY03 one wildfire burned 2400 acres of moose habitat in Unit 20E. In RY04 and RY05, over 1 million (1600 mi^2) and 187,000 acres (290 mi^2) of moose habitat burned within or immediately adjacent to Unit 20E due to extremely dry conditions. These were the most substantial fire years on record in Unit 20E. In RY06, wet conditions resulted in a low fire year with only 4800 acres of moose habitat burned. The large fires of RY04 and RY05 are expected to contribute significantly to moose habitat quantity and quality for the next 30–40 years. By RY06, benefits to the moose population were already being realized in much of the burned areas, primarily due to aspen and willow regeneration.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates during RY03–RY06 indicated we did not meet the unitwide intensive management objectives of 8000-10,000 moose with an annual harvest of 500–1000 moose. Unitwide harvest of 123 moose was well below the intensive management objective. During RY01–RY04 the moose population declined and was estimated at 0.32–0.49 moose/mi^2 in fall 2004. During RY05–RY06 the population remained stable to slightly increasing and was estimated at 0.40–0.64 moose/mi^2.

Research indicated that predation by wolves and grizzly bears was the primary factor limiting the moose population. Unitwide wolf predation on moose may continue at a reduced rate during the next few years. Wolf numbers were reduced in portions of southern Unit 20E for the past 9 winters (RY98–RY06) and further reductions in wolf numbers may be forthcoming. Brown bear numbers were not reduced under the UYTPCP; however, the revised UYTPCP will be implemented in RY06. This revised plan will allow more liberal methods of killing brown bears and could result in a reduced brown bear population over the next few years.

I recommend both wolf and brown bear numbers be further reduced in an attempt to approach the unitwide moose population objective. We continued to meet the management objective of 40 bulls:100 cows. Human-induced mortality had little impact on the moose population but caused some reduction in local bull:cow ratios. Annual harvest rates were historically less than 2% of the fall population estimate but increased above 2% in RY95 and were 2.5–3.5% during RY97–RY06.

The number of moose hunters in Unit 20E increased significantly (P = 0.001) from RY91 to RY06. Most of the additional hunters were from Southcentral Alaska. As during previous years, the preferred transportation type during RY04–RY05 was 4-wheelers.

Regulation changes in RY01 that prohibited hunters from hunting moose and caribou at the same time in most of Unit 20E appeared to reduce moose hunter success. More specifically, this regulation appeared to reduce the incidental take of moose by caribou hunters. During RY01–RY06 fewer hunters took the opportunity to hunt both moose and caribou compared to RY93–RY00.

Since the late 1990s more local residents accepted the role of fire in improving moose habitat in Unit 20E. During 2004 and 2005, over 1600 mi^2 of Unit 20E burned in wildfires. Under the current Division of Forestry and Bureau of Land Management leadership, the interagency fire management plan has a great chance of benefiting the moose population.

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

GROSS, J. A. 2006. Unit 20E moose. Pages 409–426 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

TABLE 1 Unit 20E moose population estimates, fall 1998–2006

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Percent calves	Total moose observed	Density estimate	Population estimate
1998[a]	64	18	19	10	278	0.56 (90% CI±44%)	1086 (90% CI±44%)
1998[b]	59	14	23	14	450	0.62 (90% CI±25%)	1694 (90% CI±25%)
1999[a]	80	16	22	10	365	0.47 (90% CI±20%)	901 (90% CI±20%)
2000[a]	60	11	14	8	561	0.58 (90% CI±19%)	1115 (90% CI±23%)
2000[c]	49	11	21	13	347	0.70 (90% CI±24%)	1272 (90% CI±24%)
2001[a]	76	9	14	7	531	0.47 (90% CI±19%)	915 (90% CI±17%)
2001[d]	51	6	10	6	624	0.75 (90% CI±23%)	2026 (90% CI±23%)
2002[a]	59	10	25	14	364	0.60 (90% CI±19%)	1166 (90% CI±27%)
2002[d]	71	8	20	10	396	0.63 (90% CI±28%)	1707 (90% CI±28%)
2003[e]	64	9	15	9	355	0.58 (90% CI±25%)	1128 (90% CI±25%)
2003[d]	53	5	11	6	297	0.51 (90% CI±23%)	1379 (90% CI±23%)
2004[f]	61	11	26	14	283	0.59 (90% CI±22%)	1435 (90% CI±22%)
2004[g]	48	11	23	14	233	0.37 (90% CI±19%)	802 (90% CI±19%)
2005[f]	55	13	30	16	543	0.73 (90% CI±17%)	1801 (90% CI±17%)
2005[g]	48	8	16	10	344	0.50 (90% CI±19%)	1097 (90% CI±19%)
2006[f]	39	9	37	20	584	0.98 (90% CI±19%)	2398 (90% CI±19%)
2006[g]	46	3	24	14	520	0.45 (90% CI±19%)	979 (90% CI±19%)

[a] Tok West Survey Area (1932 mi^2) sampled using GeoSpatial Population Estimator (GSPE) sampling method (Ver Hoef 2001).
[b] Tok Central Survey Area (2750 mi^2) sampled using GSPE.
[c] Tok Central Survey Area (1821 mi^2) sampled using GSPE.
[d] Tok Central Survey Area (2703 mi^2) sampled using GSPE.
[e] Tok West Survey Area (1944 mi^2) sampled using GSPE.
[f] Tok West Survey Area (2452 mi^2) sampled using GSPE.
[g] Tok Central Survey Area (2178 mi^2) sampled using GSPE.

TABLE 2 Unit 20E moose hunting seasons and bag limits, regulatory years 2003–2004 and 2006–2007

Regulatory year	Area		Season	Bag limit[a]
2003–2004	Unit 20E draining into the Middle Fork of the Fortymile River upstream from the drainage of the North Fork of the 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 one side.
	Remainder of Unit 20E.	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:	Registration 8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side by permit RM865.
2004–2005 through 2006–2007	Unit 20E drainages of the Middle Fork of the Fortymile River upstream from and including the Joseph Creek drainage.	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
	Remainder of Unit 20E.	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:	Registration 8–17 Sep	1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one 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 one side.

TABLE 3 Unit 20E moose harvest and accidental death, regulatory years 1998–1999 through 2006–2007

Regulatory year	Harvest: Reported M (%)	Reported F (%)	Reported Unk	Reported Total	Estimated Unreported	Estimated Illegal	Estimated Total	Drawing permit hunts DM794	Drawing permit hunts DM796	Accidental death Road	Accidental death Total	Total
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	170	0–5	5–10	5–15	1	3	0	0	179-189
2003–2004	129 (100)	0 (0)	0	129	0–5	5–10	5–15	0	0	0	0	134–144
2004–2005	93 (99)	0 (0)	1	94	0–5	5–10	5–15	1	0	0	0	100–110
2005–2006	137 (100)	0 (0)	0	137	0–5	5–10	5–15	1	0	0	0	143–153
2006–2007[a]	129 (99)	1 (1)	0	130	0–5	5–10	5–15	0	0	0	0	135–145

[a] Preliminary data.

TABLE 4 Unit 20E moose hunter residency and success during the general season, regulatory years 1998–1999 through 2006–2007

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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	744 (82)	913
2003–2004	21	81	26	1	129 (16)	143	448	74	4	669 (84)	798
2004-2005	20	55	19	0	94 (19)	102	238	47	3	390 (81)	484
2005-2006	25	83	29	0	137 (22)	129	311	58	1	499 (78)	636
2006-2007[b]	19	94	17	0	130 (19)	136	351	67	2	556 (81)	686

[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.
[b] Preliminary data.

TABLE 5 Unit 20E moose harvest chronology by month/day during the general hunt, regulatory years 1998–1999 through 2006–2007

Regulatory year	Harvest chronology by month/day							Total[a]
	8/15–8/31	9/1–9/6	9/7–9/13	9/14–9/20	9/21–9/27	9/28–10/5	11/1–11/30	
1998–1999	0	35	78	23	6	2	11	161
1999–2000	0	30	57	28	13	0	12	143
2000–2001	1	22	61	41	8	0	8	143
2001–2002	14	0	71	43	7	0	8	146
2002–2002	7	0	103	51	2	0	4	173
2003–2004	8	3	76	32	0	1	0	129
2004–2005	2	2	57	30	1	0	1	95
2005–2006	12	4	73	44	2	0	1	138
2006–2007[b]	11	0	72	43	2	0	0	130

[a] Difference between total and summation of harvests by week represents moose taken on unknown dates.
[b] Preliminary data.

TABLE 6 Unit 20E moose harvest and percent by transport method during the general season, regulatory years 1998–1999 through 2006–2007

Regulatory year	Harvest and percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
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
2004–2005	20 (21)	1 (1)	8 (9)	32 (34)	1 (1)	15 (16)	17 (18)	0 (0)	94
2005–2006	27 (20)	1 (1)	15 (11)	48 (35)	1 (1)	27 (20)	17 (12)	1 (1)	137
2006–2007[a]	27 (21)	0 (0)	13 (10)	46 (35)	0 (0)	19 (15)	24 (18)	1 (1)	130

[a] Preliminary data.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNITS: 21A and 21E (23,270 mi^2)[2]

GEOGRAPHIC DESCRIPTION: Unit 21A, the Innoko River drainage upstream from and including the Iditarod River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers Unit 21E, the Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage, and the Innoko River drainage downstream from the Iditarod River drainage.

BACKGROUND

Moose are a relatively recent addition to western Interior Alaska. According to oral history, their initial arrival was apparently sometime after the turn of the 20th century. As recently as the 1970s, populations were probably at record highs. Currently, moose are found throughout Units 21A and 21E. The major factors influencing moose abundance in the area include predation, weather, and hunting. Hunting pressure is thought to be low to moderate except in a few easily accessible areas. Failure to report harvests, particularly by local residents, is a continuing chronic problem.

Units 21A and 21E have distinct differences in moose habitat, user access, and hunting practices. Unit 21A contains the upper Innoko and Nowitna River drainages and access is largely restricted to aircraft. Few people live in Unit 21A, and those who travel there are primarily nonlocal Alaskans and nonresidents. Unit 21E contains the lower Innoko and the adjoining Yukon River and is easily accessible by boat. Hunters in Unit 21E are generally local residents from Units 18 and 21E, and a few nonresidents or nonlocal Alaskans.

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the reporting period.

[2] As of 1 July 2006 Unit 21A will no longer include the upper Nowitna drainage; this will reduce the combined size of units 21A and 21E to 18,817 mi^2.

The Alaska Department of Fish and Game (ADF&G) has limited information on the moose population in Unit 21A and has not conducted trend counts, spring calving surveys, or population estimates in this unit. Density estimates conducted by Innoko National Wildlife Refuge (INWR) as well as extrapolated data from Unit 21E have been used to estimate moose numbers in Unit 21A. In Unit 21E, aerial composition surveys have been the primary means of assessing population status and trend.

In general, long-term historical moose survey information is limited. A combination of changes in moose survey techniques and the logistical challenges of moose surveys in remote areas have resulted in a discontinuous database of moose count results that often are not comparable. Since the general standardization of survey techniques in the 1980s however, we have attempted to establish trend count areas and survey areas in Unit 21E which balance the information needs of management with fiscal and logistical limitations.

Regulations used to manage moose hunting and reduce conflicts between user groups have existed in the area for many years. The Paradise Controlled Use Area (CUA) is closed to the use of aircraft for hunting moose, restricting access primarily to local residents with boats. This CUA includes the area between the Innoko River and the Yukon River and falls primarily within Unit 21E.

MANAGEMENT DIRECTION

In 2005 a planning effort was initiated to establish management direction for Units 21A and 21E. The Yukon–Innoko Moose Management Plan (YIMMP) emerged from this effort in December 2006 (Alaska Department of Fish and Game 2006). This plan established that future management of moose in the area would be proactive in order to maintain an abundant moose population which provides for high levels of human consumptive use.

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 Unit 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

Twinning surveys were conducted in Unit 21E during June along the Yukon and Innoko Rivers between Holy Cross, Anvik, and Shageluk each year from 2000 through 2004, except for 2001. Twinning surveys were also attempted in 2005 and 2006, but leaf out occurred early during those years resulting in poor survey information.

Estimates of moose numbers in Unit 21E were derived from aerial surveys in February 2000 and March 2005 using the GeoSpatial Population Estimator method (GSPE) (Ver Hoef 2001). Surveys were conducted in a 5070-mi^2 area on the eastern side of Unit 21E and extrapolated to all of Unit 21E. Operational methods using this estimator are found in Kellie and DeLong (2006).

INWR has conducted aerial moose surveys since 1994 in Unit 21A, primarily along river corridors. We derived estimates for Unit 21A based on INWR surveys and population data from Unit 21E.

Two methods were used to determine harvest in Units 21A and 21E. First, we used harvest ticket reports, on which hunters report residency, effort, location of hunt, transportation method, commercial services used, success, sex of kill, and antler width. Second, ADF&G/Division of Subsistence conducted household surveys to determine the number of moose harvested by local residents. Population and harvest data were summarized by regulatory year (RY), which begins 1 July and end 30 June (e.g., RY03 = 1 July 2003–30 June 2004).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Unit 21A. ADF&G has not conducted trend counts, June calving surveys, or spring population estimates for moose in Unit 21A. However, based on survey data from INWR, and ADF&G data extrapolated from Unit 21E, we estimate there are 4300–6480 moose in the unit (0.4–0.6 moose/mi^2). Survey data from INWR indicate that moose densities declined in Unit 21A during 1998–2002.

Unit 21E. The February 2000 GSPE survey indicated a density of 1.0 moose/mi^2 or 5151 moose ±13% (90% CI). Survey results in March 2005 indicated a density of 0.9 moose/mi^2 or 4673 moose ±17% (90% CI). These surveys are not statistically different and indicate the moose population in Unit 21E was likely stable during 2000–2005.

Population Composition

No fall composition counts have been conducted in Unit 21E since 1998. However, the February 2000 and March 2005 GSPE surveys estimated 16% and 18% of the population to be calves, indicating good production and survival. Twinning surveys were conducted on the lower Innoko River in Unit 21E in early June 2000, 2002, 2003 and 2004. Respective results from those surveys indicated 14/36 (38%), 8/40 (20%), 14/47 (30%), and 9/28 (32%) of observed cows had twins.

Distribution and Movements

During the 1980s a cooperative moose radiotelemetry study was conducted by INWR, BLM and ADF&G. In this study 15 cows and 20 bulls were radiocollared. Approximately half the cows and 25% of the bulls spent the entire year in the lowlands. Most of the remaining moose spent winters in the lowlands and summers in the mountains. Two bulls spent the entire year in the mountains, and 1 bull and 1 cow showed extreme movements. The bull was caught near Holikachuk in Unit 21E and spent summers in the upper Iditarod River area. The cow was caught north of Holy Cross and spent summer downriver of Mountain Village in Unit 18.

MORTALITY

Harvest

Seasons and Bag Limits. Bag limits and season dates by regulatory year:

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
Unit 21A 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 one 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 one 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 one side.		5 Sep–25 Sep

Regulatory Year 2004–2005 Unit and Bag Limits	Open Season
Unit 21A 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 one 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 one side.	5 Sep–25 Sep
Unit 21E	
RESIDENT HUNTERS: 1 antlered bull.	5 Sep–25 Sep

Regulatory Year 2004–2005 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 one side.	5 Sep–25 Sep

Regulatory Year 2005–2006 Unit and Bag Limits	Open Season
Unit 21A 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 one 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 one 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 one side.	5 Sep–25 Sep

Regulatory Year 2006–2007 Unit and Bag Limits	Open Seasons
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 one side.	5 Sep–20 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 one side.	5 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. At the spring 2003 meeting, the board eliminated the February resident season for any moose in Unit 21E beginning in RY03. This was due to concern by the local advisory committee about declining moose numbers, lack of a current ADF&G population estimate, and local observations of increasing harvest.

At the spring 2004 meeting, the board further restricted the moose seasons in Unit 21A by eliminating the November resident hunt beginning in RY04. Additionally the board changed the bag limit for resident hunters from 1 bull to 1 antlered bull in Unit 21A and Unit 21E.

At the spring 2006 meeting, the board revised the boundary between Units 21A and 21B. The upper Nowitna River drainage was transferred from Unit 21A to Unit 21B and Unit 21A now encompasses only the Innoko River drainage. Further changes in RY06 included a 5-day reduction in the nonresident season in Unit 21E to align it with the season in Unit 21A and the establishment of a winter drawing permit requirement for nonresidents in Unit 21E to be implemented in RY07.

Hunter Harvest. Hunter harvest is reported in Tables 1A–1C. Recent annual harvest in Unit 21A was at its lowest in RY03 and RY04, but increased in RY05. In Unit 21E, recent annual harvest was at its lowest in RY04 and RY05. Because the reporting rate by local hunters was low, actual harvest rates may have been at least 33% greater, which would put harvest at 157 moose for these 2 years.

Permit Hunts. There were no permit hunts in Units 21A or 21E during RY03–RY06. Beginning in RY07 nonresidents will be required to obtain a drawing permit to hunt moose in Unit 21E.

Hunter Residency and Success. Tables 2A–2C show hunter residency and success. Hunter residency in Unit 21A was mixed over the years, with some years having more nonresidents than residents. However, in general Unit 21A hunters were almost entirely nonlocal. Limited boat access was likely the primary factor determining hunter residency in Unit 21A.

Historically the majority of hunters in Unit 21E were Alaska residents with a large percentage of those being local residents from the communities of Anvik, Grayling, Holy Cross, and Shageluk. The total number of nonlocal resident hunters was lower than average in RY01–RY05, however the total number of hunters remained relatively stable.

From RY01 to RY05, average success in Unit 21A was 37% and ranged from a high of 45% in RY02 to a low of 30% in RY04. In Unit 21E, average success was 62% over the same period and declined from a high of 75% in RY01 to 50% in RY04.

Antler Size. The average antler size for harvested bulls in Unit 21A (50.43 inches) remained larger than in Unit 21E (45.68 inches). However, Unit 21A had a high proportion of nonresident hunters, who were required to take bulls with a minimum antler size of 50 inches or at least 4 brow tines on one side. Unit 21E had a higher proportion of resident hunters who were not restricted by a minimum antler size.

Transport Methods. Transportation methods used by moose hunters are reported in Tables 3A and 3B. In Unit 21A aircraft and boats were the most common method of transportation of hunters during RY01–RY05. All other transportation methods, such as 4-wheelers, represented no more than 4% of hunter transport in any year. As in previous years, boats were the most commonly used method of transportation in Unit 21E followed by aircraft during RY01–RY05.

Other Mortality

Predation is potentially important to the dynamics of the moose population in Unit 21E. Based on information from local residents, predation on moose increased in recent years, and residents believed the moose population was declining. ADF&G surveys conducted in 2000 and 2005 did not detect a decline, however it is possible that a decline occurred through the 1990s and moose populations have since stabilized.

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. Riparian habitat in Units 21A and 21E is found along the Yukon and Innoko Rivers and their tributaries. Additional riparian habitat exists along smaller creeks and around boreal lakes and ponds. Limited suppression of naturally occurring wildfires has created a mosaic of vegetative successional stages.

In spring 2006, ADF&G conducted a moose browse survey in Unit 21E. Snow depth and age of dominant plant species were recorded at 77 individual sites. Observers noted abundant felt leaf willow on the islands and floodplain of the middle Yukon River and diamond leaf willow in extensive meadows adjacent to the Yukon and lower Innoko Rivers. Overall, browse availability was less abundant than historic highs because the last major flooding disturbance on the Yukon River was in the early 1970s. This has allowed willow on the higher terraces to grow beyond the reach of moose. Snow was also deep enough during these surveys to restrict movements of moose.

A direct measure of carrying capacity is difficult to estimate for free-ranging wildlife populations due to variability in habitat composition at the landscape scale. Additionally, annual weather conditions influence forage production of both summer and winter range and affect winter energy expenditure. Based on browse removal rates and twinning rates in Unit 21E, nutritional status was adequate to support growth of the moose population (Boertje et al., in press). Thus non-nutritional factors are likely limiting growth of the moose population.

Enhancement

Allowing natural forces to create or rehabilitate successional forage communities used by moose is a good long-term strategy. We continued to cooperate 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. Wildland fires occurred over approximately 325,000 acres of diverse vegetation types in the McGrath area during summer 2002.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

In January 2005 a citizen advisory group called the Yukon–Innoko Moose Management Working Group (YIMMP) convened to develop a plan which would proactively manage moose populations in the area. The Yukon–Innoko Moose Management Plan was the result of this process and was finalized in December 2006. Several nonregulatory management issues were raised by the working group.

Management of predation on moose to maintain an abundant moose population for human consumptive use was recommended by the YIMMP. At this time however, ADF&G does not have the resources to invest in additional intensive management programs.

Maintaining or improving moose habitat was also recommended by the working group and habitat quality was assessed in Unit 21E in 2005. However, no work has been conducted in Unit 21A. Continued habitat assessments in Unit 21E as well as new work in Unit 21A should be conducted to ensure nutrition is adequate to support growth of the moose population.

Land management in Units 21A and 21E is complex, with a mix of federal, state, and Native lands. The working group identified the need to develop cooperative management programs which involve local residents and improve overall moose management in the area.

Finally, continued monitoring of moose populations and status needs to occur. Fall composition counts have not been successfully conducted since 1998 in Unit 21E and have never been conducted in Unit 21A. Twinning surveys are an excellent indicator of habitat quality and should be conducted annually in both units. A population estimate was conducted for Unit 21E in 2005, however there is limited information for Unit 21A. Surveys in this area should be conducted on a regular basis to provide trend information from which to base management decisions.

CONCLUSIONS AND RECOMMENDATIONS

Populations over the reporting area appear to be stable to declining although ADF&G has not conducted population estimates for moose in Unit 21A in recent years. No fall composition counts have been conducted in the Unit 21E Holy Cross Trend Count Area since 1998. However, the February 2000 and March 2005 GSPE surveys estimated 16% and 18% respectively of the population in Unit 21E to be calves, indicating good production and survival. Twinning surveys on the lower Innoko River in Unit 21E indicate high twinning rates and nutritional status was adequate to support population growth.

A lack of data for Unit 21A continues to be an issue. Efforts need to be made to improve data collection in this unit as the first step in developing sound long-term management. 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) are the best and most cost-effective way to assess yearly changes in population composition and to monitor population trends.

A successful management plan was developed in 2006 which should guide moose management in Units 21A and 21E. This plan identifies both harvest and population goals, as well as many other management objectives. The plan was adopted by local residents, the Alaska Board of Game, and the Federal Subsistence Board.

Average antler size of moose harvested during the reporting period in Unit 21A was 50.43 inches, which met the management objective of at least 48 inches.

Progress was also made in assessing the accuracy of harvest reporting in Unit 21E, which has been historically poor. ADF&G's Division of Subsistence conducted household surveys in portions of the area. From the planning effort it was estimated that unreported harvest was 50% in the area. This is important information when assessing population levels, trends, and the impact of hunting.

Finally, we accomplished our objective to encourage wildfires by maintaining communications with DNR Forestry and the local Native corporations to advocate a "let burn" policy when possible.

The following management goals, objectives, and activities were based on recommendations in the YIMMP and will be in effect during the next reporting period:

MANAGEMENT GOALS

- Work toward achieving the intensive moose management moose population objective in Unit 21E of 9000–11,000.

- Work toward achieving the intensive moose management harvest objective in Unit 21E of 550–1100.

- Work to ensure the moose population is stable or growing using current moose population, habitat, harvest, predation, and weather data.

- Maximize hunting opportunity when possible while ensuring that harvest remains within sustained yield and there is a priority for subsistence use.

MANAGEMENT OBJECTIVES

Population Objectives

- Maintain or increase moose numbers and harvest levels in Unit 21A.

- Maintain a minimum posthunt bull:cow ratio of 25–30 bulls:100 cows.

- Maintain a minimum posthunt calf:cow ratio of 30–40 calves:100 cows.

- Maintain a minimum calf overwinter survival of 20% of the total population in late winter moose population surveys.

Harvest Objectives

- Maintain a harvest of <4% of the estimated moose population, until the intensive management population objective has been achieved.

- Provide for the harvest of approximately 310 moose in Unit 21E by residents of Unit 21E and other Alaska residents.

- Provide for harvest of up to 40 antlerless moose in winter.

MANAGEMENT ACTIVITIES

- Conduct a moose twinning survey in Unit 21E every spring.
- Conduct a moose composition survey in Unit 21E every other fall.
- Conduct early winter composition surveys in Unit 21A every 2–3 years.
- Conduct a moose population estimation survey in Unit 21A in spring 2008.
- Conduct a moose population estimation survey in Unit 21E in spring 2010.
- Develop information and education programs to encourage better harvest reporting and understanding of state and federal hunting regulations.
- Work with tribal councils to track winter harvest of moose.
- Maintain the Paradise Controlled Use Area.
- Implement a permit hunt in Unit 21E to cap nonresident harvest at 30 bulls.
- Increase harvest of predators through liberalized regulations.
- Prepare an intensive management plan for the March 2008 Board of Game meeting.
- Ensure optimal moose habitat is maintained so that it does not become a factor limiting moose productivity.

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

PEIRCE, J. M. 2006. Units 21A and 21E moose. Pages 427–441 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

TABLE 1A Units 21A and 21E moose harvest, regulatory years 2001–2002 through 2005–2006

Regulatory year	Reported harvest Male	%	Female	%	Unknown	Total	Unreported harvest[a]	Total
2001–2002	245	90	24	9	3	272	90	362
2002–2003	220	92	17	7	2	239	79	318
2003–2004	207 (195)[b]	100	1 (1)[b]	0	0 (0)[b]	208 (196)[b]	69 (65)[b]	277 (261)[b]
2004–2005	169 (160)[b]	97	5 (5)[b]	3	0 (0)[b]	174 (165)[b]	57 (54)[b]	231 (219)[b]
2005–2006	188 (177)[b]	96	6 (6)[b]	3	2 (2)[b]	196 (185)[b]	65 (61)[b]	261 (246)[b]

[a] Unreported harvest estimated at 33% of total reported harvest.
[b] Does not include data from the upper Nowitna River drainage.

TABLE 1B Unit 21A moose harvest, regulatory years 2001–2002 through 2005–2006

Regulatory year	Reported harvest Male	%	Female	%	Unknown	Total	Unreported harvest[a]	Total
2001–2002	89	96	1	1	3	93	31	124
2002–2003	81	99	1	1	0	82	27	109
2003–2004	60 (48)[b]	100	0 (0)[b]	0	0 (0)[b]	60 (48)[b]	20 (16)[b]	80 (64)[b]
2004–2005	56 (47)[b]	100	0 (0)[b]	0	0 (0)[b]	56 (47)[b]	18 (16)[b]	74 (63)[b]
2005–2006	75 (64)[b]	96	1 (1)[b]	1	2 (2)[b]	78 (67)[b]	26 (22)[b]	104 (89)[b]

[a] Unreported harvest estimated at 33% of total reported harvest.
[b] Does not include data from the upper Nowitna River drainage.

TABLE 1C Unit 21E moose harvest, regulatory years 2001–2002 through 2005–2006

Regulatory	Reported harvest						Unreported	
year	M	(%)	F	(%)	Unk	Total	harvest[a]	Total
2001–2002	156	(87)	23	(13)	0	179	59	238
2002–2003	139	(89)	16	(10)	2	157	52	209
2003–2004	147	(99)	1	(1)	0	148	49	197
2004–2005	113	(96)	5	(4)	0	118	39	157
2005–2006	113	(96)	5	(4)	0	118	39	157

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2A Units 21A and 21E moose hunter residency and success, regulatory years 2001–2002 through 2005–2006

Regulatory year	Successful: Local resident[a]	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk	Successful: Total	Unsuccessful: Local resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk	Unsuccessful: Total	Total hunters
2001–2002	32	152	81	7	272	8	95	84	2	189	461
2002–2003	38	120	79	2	239	12	82	80	2	176	415
2003–2004	43 (43)[b]	100 (91)[b]	60 (57)[b]	5 (5)[b]	208 (196)[b]	15 (15)[b]	99 (94)[b]	91 (86)[b]	1 (1)[b]	206 (196)[b]	414 (392)[b]
2004–2005	34 (34)[b]	87 (80)[b]	47 (45)[b]	6 (6)[b]	174 (165)[b]	22 (22)[b]	115 (106)[b]	103 (97)[b]	5 (4)[b]	245 (229)[b]	419 (394)[b]
2005–2006	39 (39)[b]	111 (104)[b]	46 (42)[b]	0 (0)[b]	196 (185)[b]	13 (13)[b]	99 (94)[b]	95 (92)[b]	1 (1)[b]	208 (200)[b]	404 (385)[b]

[a] Local resident from Anvik, Grayling, Holy Cross, or Shageluk.
[b] Does not include data from the upper Nowitna River drainage.

TABLE 2B Unit 21A moose hunter residency and success, regulatory years 2001–2002 through 2005–2006

Regulatory year	Successful: Local resident[a]	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk	Successful: Total	Unsuccessful: Local resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk	Unsuccessful: Total	Total hunters
2001–2002	0	38	55	0	93	0	59	69	0	128	221
2002–2003	0	39	43	0	82	0	47	51	1	99	181
2003–2004	0 (0)[b]	29 (20)[b]	30 (27)[b]	1 (1)[b]	60 (48)[b]	0 (0)[b]	54 (49)[b]	62 (57)[b]	0 (0)[b]	116 (106)[b]	176 (154)[b]
2004–2005	2 (2)[b]	33 (26)[b]	21 (19)[b]	0 (0)[b]	56 (47)[b]	0 (0)[b]	65 (56)[b]	62 (56)[b]	1 (0)[b]	128 (112)[b]	184 (159)[b]
2005–2006	1 (1)[b]	44 (37)[b]	33 (29)[b]	0 (0)[b]	78 (67)[b]	0 (0)[b]	50 (45)[b]	70 (67)[b]	0 (0)[b]	120 (112)[b]	198 (179)[b]

[a] Local resident from Anvik, Grayling, Holy Cross or Shageluk.
[b] Does not include data from the upper Nowitna River drainage.

TABLE 2C Unit 21E moose hunter residency and success, regulatory years 2001–2002 through 2005–2006

Regulatory year	Successful: Local resident[a]	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk	Successful: Total (%)	Unsuccessful: Local resident[a]	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk	Unsuccessful: Total (%)	Total hunters
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
2003–2004	43	71	30	4	148 (62)	15	45	29	1	90 (38)	238
2004–2005	32	54	26	6	118 (50)	22	50	41	4	117 (50)	235
2005–2006	38	67	13	0	118 (57)	13	49	25	1	88 (43)	206

[a] Local resident from Anvik, Grayling, Holy Cross or Shageluk.

TABLE 3A Unit 21A moose harvest percent by transport method of successful hunters, regulatory years 2001–2002 through 2005–2006

Regulatory year	Harvest percent by transport method								
	Airplane	Dog team/ Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Unknown
2001–2002	38	1	48	0	10	1	1	0	1
2002–2003	35	0	54	<1	8	1	1	0	1
2003–2004	50 (59)[a]	0 (0)[a]	42 (35)[a]	2 (2)[a]	2 (0)[a]	2 (0)[a]	2 (0)[a]	0 (0)[a]	2 (0)[a]
2004–2005	66 (70)[a]	0 (0)[a]	30 (26)[a]	4 (4)[a]	0 (0)[a]	0 (0)[a]	0 (0)[a]	0 (0)[a]	0 (0)[a]
2005–2006	63 (60)[a]	0 (0)[a]	31 (33)[a]	3 (3)[a]	1 (1)[a]	1 (1)[a]	0 (0)[a]	0 (0)[a]	1 (1)[a]

[a] Does not include the upper Nowitna River drainage.

TABLE 3B Unit 21E moose harvest percent by transport method of successful hunters, regulatory years 2001–2002 through 2005–2006

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Unknown
2001–2002	38	1	48	0	10	1	1	0	1
2002–2003	35	0	54	<1	8	1	1	0	1
2003–2004	9	0	85	0	1	<1	<1	0	2
2004–2005	14	0	77	3	4	0	0	0	2
2005–2006	14	0	76	0	9	0	0	0	<1

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNIT: 21B (9311 mi^2)

GEOGRAPHIC DESCRIPTION: Nowitna River drainage east of Poorman Road, Yukon River drainage 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.

[1] At the discretion of the reporting biologist, this unit report may include data collected outside the reporting period.

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 difference in 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% CI) from those of the 1990 survey. More recently, the 2001 population estimation survey, the first without a sightability correction factor (SCF), indicated the population was not significantly different from the 1995 estimate.

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 drainages. These areas produce 36–46% of the reported Unit 21B harvest. The Alaska Board of Game (board) made several changes to Unit 21B in 2004 and 2006 that substantially changed the data collection and analysis that are reflected in this report. In 2004 the board adopted regulations to implement 3 drawing hunts and a registration hunt for the entire area. In 2006 the board adopted regulations to change the unit boundary to include all of the Nowitna River drainage that was formerly part of Unit 21A, and they adopted an additional drawing permit and a registration permit hunt in a portion of the area added.

In contrast to previous reports for Unit 21B, 3 significant changes to the data analysis should be noted. The first change was the size of Unit 21B nearly doubled from 4871 mi^2 to 9311 mi^2 in July 2006 with the addition of the Nowitna River upstream from the Little Mud River. This portion was previously part of Unit 21A. The second change was the modest increase in harvest data from the upriver portion of the Nowitna River drainage, beginning in regulatory year (RY) 2003 (RY = regulatory year, which begins 1 July and ends 30 June, e.g., RY03 = 1 Jul 2003–30 Jun 2004). The third change was an increase in the reported hunter participation and harvest beginning RY04, as a result of the improved reporting rates when the new registration and drawing permit hunts were implemented.

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, whichever is less.

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 (TCA) 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 the Geospatial Population Estimator techniques (GSPE; Kellie and DeLong 2006; Ver Hoef 2001) 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.

Hunting mortality and harvest distribution was monitored through the statewide harvest ticket system, registration permits, drawing permits, door-to-door subsistence surveys, and operating a moose hunter checkstation on the Nowitna River. General season hunters received 1 reminder letter to report harvest. Hunters with registration, or drawing permits received 1 reminder letter 3 weeks after the end of the hunt and a second reminder letter 3 weeks later. Report and survey information obtained was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Survey and harvest data were summarized by regulatory year.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Using the results of the 1995 population estimation survey and a survey conducted in 1990, Woolington (1998) estimated there were 2324–3530 moose in Unit 21B. 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, for the former 4781-mi^2 portion of Unit 21B, the total moose estimate for RY03–RY04 is unchanged from the previous report. However, a higher proportion of the population was calves and yearlings, which have higher mortality rates than adults. Only 2 TCA surveys were conducted in the added portion of Unit 21B upstream of the Little Mud River drainage, and results from those surveys indicated very low densities of moose. Based on densities in similar habitat in Unit 21B and Unit 21D, I extrapolated a density of 0.20 moose/mi^2 for a total of 888 moose. For RY03–RY04, I estimated the total population for Unit 21B was 4049 moose (±1600; without an SCF).

Survey data collected in early winter from established TCAs along the lower Nowitna suggested stable or slightly increasing moose densities during 1991–1998 then declining in the 2000s (Tables 2 and 3). Point estimates for the western portion of Unit 21B, data from surveys conducted from 1999 to 2001 also indicated the population was probably decreasing. Recent TCA data indicated that moose densities along the riparian corridor were relatively constant.

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). Bull:cow ratios were lowest near the mouth of the Nowitna River (10–20 bulls:100 cows) since RY01, where hunting was concentrated. Calf:cow ratios ranged widely among years (18–42 calves:100 cows) as in much of Alaska. Overall, the values indicated a fairly stable population trend since RY03, yet still lower than what was observed in the 1990s.

The 2001 population estimation data indicated the bull:cow ratio over the entire area (38 bulls:100 cows) was not as depressed as near the mouth of the Nowitna River (15 bulls:100 cows) or at the confluence of the Nowitna and Sulatna Rivers (18 bulls:100 cows). For the entire 2001 survey area the GSPE analysis indicated 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). The trend of the proportion of yearling bulls:100 cows indicated stable recruitment (7–10 yearling bulls:100 cows).

Distribution and Movements

Based on movements of radiocollared cow–calf pairs, most cows spend the 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. Seasons and bag limits in Unit 21B for RY03 were:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21B, that portion within the Nowitna River drainage downstream from and including the Little Mud River.		
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 one side.		5 Sep–20 Sep
Unit 21B, that portion within the Nowitna River drainage upstream from the Little Mud River (formerly part 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 one side.		5 Sep–20 Sep
Remainder of Unit 21B.		
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 one side.		5 Sep–25 Sep

Seasons and bag limits in Unit 21B in RY04 were:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21B, that portion within the Nowitna River drainage upstream from the Little Mud River (formerly part 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 one side.		5 Sep–20 Sep
Remainder of Unit 21B		
RESIDENT HUNTERS: 1 bull, by registration permit only: or	5 Sep–25 Sep (Subsistence hunt only)	
1 bull, by drawing permit only; up to 250 permits may be issued in Unit 21B excluding that portion upstream from the Little Mud River.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only, up to 250 permits may be issued in Unit 21B excluding that portion upstream from the Little Mud River.		5 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. In 2002 the Alaska Board of Game 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. 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 wide corridor on the Nowitna River as one permit area, and the lands east and west of the corridor as the other 2 permit areas. Additionally, the board eliminated the November season in the Nowitna River drainage upstream from the Little Mud River (within Unit 21A at that time) and changed the bag limit from 1 bull to 1 antlered bull. Unit 21B boundaries were expanded at the January 2006 board meeting and at the March 2006 meeting, an additional drawing permit hunt was implemented for a 4-mile wide corridor on the Nowitna River above the Little Mud River. The nonresident season was extended to 25 September to simplify regulations.

Harvest. Reported harvest for the unit averaged 64 (range = 52–74) moose annually during RY97–RY05 (Table 5; including harvest in Nowitna River drainage above Little Mud River after RY02). In addition, the Unit 21B unreported harvest was estimated at 5 moose per year for Ruby residents, 15 moose per year for Tanana residents, and 5 moose per year taken in the Nowitna River drainage above Little Mud River. The Nowitna drainage produced 42–90% ($\bar{x}$ = 68%) of the unit's reported harvest during RY97–RY05 (Tables 6 and 7). However, in RY04 and RY05, the proportion of harvest coming from the Nowitna River averaged 47% compared to 75% during RY97–RY03, which indicates that regulations to improve distribution of harvest were successful in moving hunters away from the Nowitna River corridor.

To estimate the unreported harvest of 25 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 harvest reported 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–RY02 and an additional 5 moose beginning in RY03 to account for the area of the upper Nowitna River drainage that was added to Unit 21B.

Checkstation Results. 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 increased from 132 during RY94–RY96 to 167 during RY01–RY03 when regulations in Unit 21D deflected some hunters to Unit 21B (Table 6). The mean number of hunters then declined in RY04–RY06 to 138 due to implementation of new drawing and registration hunt regulations.

Hunter Residency and Success. Based on harvest reports, the majority of Unit 21B hunters were Alaska residents who resided outside the unit, particularly in Fairbanks (Table 6). Average success rate for all hunters during RY99–RY03 was 41% (range = 37–43%). For RY04–RY05, success rate dropped (Table 7) to 29%, probably due to 2 issues. First, more hunters were forced to hunt in the areas off of the Nowitna corridor due to the new drawing and registration hunt regulations. Second, reporting rates by unsuccessful hunters probably increased with the higher level of reporting accountability associated with the registration and drawing permit systems. Both outcomes were implemented by design, and improved our ability to manage moose in Unit 21B.

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 when bulls are actively engaged in rutting behavior.

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 (RY03–RY05; $\bar{x}$ = 75%) used boats to hunt moose (Table 9). Most airplane access was by commercial transporters. Highway vehicle transportation occurred exclusively on the Poorman Road south of Ruby. 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 River. A reconnaissance survey flown in spring 2001 indicated wolf numbers were stable (Stout 2003). 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 RY03–RY04. Moose twinning rates were 58% in 1984 and 48% in 1988 during the calf mortality studies (Osborne et al. 1991). These twinning rates were relatively high and indicate above average nutritional status (Boertje et al. 2007) that could support a population increase if predation declines. 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. The dense stand of black spruce between the 1986 burn and the Nowitna River should be considered for a prescription burn.

CONCLUSIONS AND RECOMMENDATIONS

Classification data from TCAs indicated a near stable trend from 2003 to 2006. Bull:cow ratios improved in both TCAs along the heavily hunted portion of the Nowitna River due to reduced harvest after new drawing and registration permit regulations were implemented. The previous low bull:cow ratios were instrumental in the board's decision to implement a drawing permit hunt on the Nowitna River corridor, with the understanding that the department would issue permits to achieve at least a 50% reduction in harvest of bulls within the corridor. Ratios of approximately 25 bulls:100 cows would improve fall hunter success rates and provide for an increase in the number of desirable large bulls that are harvested, and serves as a practical management objective.

The management goal, to 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, was met during RY03–RY04. The moose population continued to support the consumptive demands as well as the nonconsumptive uses identified.

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 was confounded by differences in the size of the area, the statistical analysis used, and survey techniques. Based on the 2001 population survey and recent TCA data, the current estimate for the former area of Unit 21B is unchanged from the previous reporting period at 3160 moose (1828–4494; 90% CI; without an SCF), which is above the moose population range that would require notification of other agencies for RY03–RY04. The number of moose in Unit 21B with the new boundaries is estimated to be 4049 moose (±1600; without an SCF).

We also met the harvest objective not to exceed 150 moose or 5% of the population. Total estimated harvest ranged from 85 to 94 moose during the reporting period, less than 3% of the total Unit 21B estimated population for RY03–RY04.

The objective to implement habitat enhancement projects was not met. Activities to meet this objective were limited to review of fire management plans and fire suppression policies. I recommended a prescribed burn in the upland area east of the Nowitna floodplain and north of the Little Mud River to Bering Creek. In 2005, a wildfire burned 193,400 acres in the upper drainage of the Little Mud River drainage that effectively addressed the need to convert the spruce communities to an earlier seral habitat. No efforts were made to suppress the Little Mud fire and the burn should be monitored to evaluate the benefits for moose in 10–20 years. The area west of the Nowitna in the upper Big Creek drainage is also dominated by late seral spruce and birch communities 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.

The management goals, objectives and activities for the next report period will be changed to address the expansion of the boundaries for Unit 21B. Following, is a summarization of the objectives, and activities that will be adopted for the next 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 of 50–200 moose or 5% of the annual moose population estimate, whichever is less.

Objective 2: In combination with Unit 21C, implement at least 2 habitat enhancement activities every 5 years.

Objective 3: Maintain a moose population of ≥4000–5000.

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 4000–5000 moose.

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

STOUT, G. W. 2006. Unit 21B moose. Pages 442–460 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

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]	6[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	20	25.8	19.4	7.2	0.50
2001–2002/Total[e]	4754	3161	42	38.2	18.3	9.0	0.67

[a] Confidence interval (% ±).
[b] MOOSEPOP analysis.
[c] Ratios calculated from observed values.
[d] MOOSEPOP analysis of regression survey.
[e] Geospatial population estimate analysis without sightability correction factor.

Table 2 Unit 21B Nowitna/Sulatna confluence aerial moose composition counts, regulatory years 1991–1992 through 2006–2007[a]

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yrlg bulls: 100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1991–1992	76	21	9	29	8	20	200	2.7
1992–1993	76	18	1	48	7	29	171	2.3
1993–1994	76	22	7	20	0	14	195	2.6
1994–1995	76	16	6	20	4	15	191	2.5
1995–1996	76	15	4	33	6	22	148	2.0
1996–1997	76	18	8	23	6	13	216	2.9
1998–1999	76	19	2	28	6	19	180	2.5
1999–2000[b]	76	6	1	23	12	18	106	1.5
2000–2001	149	25	7	11	0	8	202	1.4
2001–2002	120	18	6	18	0	12	200	1.7
2003–2004	143	15	10	28	3	20	172	1.2
2004–2005	149	23	12	41	15	25	188	1.3
2005–2006	149	29	10	37	12	22	167	1.1
2006–2007[b]	149	25	7	25	3	16	207	1.4

[a] U.S. Fish and Wildlife Service.
[b] Low snow conditions during survey.

TABLE 3 Unit 21B Nowitna mouth aerial moose composition counts, regulatory years 1992–1993 through 2006–2007[a]

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yrlg bulls:100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1992–1993	59	21	0	31	0	20	138	2.9
1993–1994	59	32	6	32	6	20	189	3.2
1994–1995	59	19	8	23	0	22	148	2.5
1995–1996	59	16	5	26	0	18	116	2.0
1996–1997	59	21	7	22	0	16	185	3.1
1998–1999	59	20	3	12	0	9	182	3.0
1999–2000[b]	59	11	8	21	0	16	87	1.4
2000–2001	102	21	6	7	0	5	206	2.0
2001–2002	102	15	7	15	6	18	191	1.9
2003–2004	102	10	5	42	10	28	206	2.0
2004–2005	102	19	13	39	7	25	194	1.9
2005–2006	102	20	9	24	0	16	195	1.9
2006–2007[b]	102	19	8	37	17	24	208	2.0

[a] U.S. Fish and Wildlife Service.
[b] Low 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 2005–2006[a]

Regulatory year	Harvest by hunters					
	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	74	0	0	74	25	99
2004–2005	64	1	0	65	25	90
2005–2006	73	0	0	73	25	98

[a] Beginning RY03, data includes Nowitna drainage above Little Mud River.

TABLE 6 Unit 21B Nowitna River checkstation hunters (R), harvest (H) and success (S%), regulatory years 1990–1991 through 2006–2007[a,b]

Regulatory	Local villages[c]			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	62	21	34	48	8	17	23	5	22	160	34	21
2002–2003	18	3	17	56	25	45	45	20	44	15	3	20	134	51	38
2003–2004	22	4	18	80	29	36	80	19	24	26	4	15	208	56	27
2004–2005	19	2	11	59	13	22	60	12	20	13	0	0	151	27	18
2005–2006	17	2	12	44	14	32	61	19	31	8	3	38	130	38	29
2006–2007	18	2	10	66	17	26	41	14	34	5	0	0	133	33	25

[a] U.S. Fish and Wildlife Service.
[b] Beginning RY03, data includes Nowitna drainage above Little Mud River.
[c] Tanana, Ruby, and Galena.

TABLE 7 Unit 21B moose hunter residency and success, regulatory years 1990–1991 through 2005–2006[a]

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[b]	Nonlocal resident	Nonresident	Unk	Total	Local resident[b]	Nonlocal Resident	Nonresident	Unk	Total	
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	13	51	10	0	74	19	86	18	1	124	198
2004–2005	16	43	5	1	65	38	108	22	1	169	234
2005–2006	17	48	8	0	73	60	100	9	2	171	244

[a] Beginning RY03, data includes Nowitna drainage above Little Mud River.
[b] Tanana, Ruby, and Galena.

TABLE 8 Unit 21B moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2005–2006[a]

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	32	68	73
2004–2005	40	60	63
2005–2006	34	66	68

[a] Beginning RY03, data includes Nowitna drainage above Little Mud River.

TABLE 9 Unit 21B moose harvest percent by transport method, regulatory years 1990–1991 through 2005–2006[a]

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	15	0	74	1	3	0	5	1	74
2004–2005	12	0	77	0	0	3	8	0	65
2005–2006	19	0	75	1	0	0	3	1	73

[a] Beginning RY03, data includes Nowitna drainage above Little Mud River.

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNIT: 21C (3671 mi^2)

GEOGRAPHIC DESCRIPTION: Melozitna River drainage upstream from Grayling Creek, and Dulbi River drainage upstream from and including the Cottonwood Creek drainage

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 there are no human settlements in this area and harvest has been low, 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 for moose. 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.

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[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

MANAGEMENT OBJECTIVE

- Maintain ≥20% large bulls (bulls with antlers 60" or greater) in the harvest.

METHODS

POPULATION STATUS AND TREND

We conducted a moose stratification survey during 18 and 19 April 2000 using the Geospatial Population Estimator (GSPE), a modification of the Gasaway technique (Gasaway et al. 1986) using spatial statistics (Ver Hoef 2001; Kellie and DeLong 2006). 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 unit unless it was judged to be good habitat and >5 sets of tracks were noted. Areas not surveyed (e.g., the Kokrines Hills) included primarily high mountainous terrain and were considered “low strata” or “non-moose habitat” for population estimation purposes. We surveyed a total of 438 sample units (1971 mi^2). 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. General season hunters received 1 reminder letter to report harvest. Hunters with registration and drawing permits received 1 postcard reminder, a telephone call, and a certified letter. 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., RY03 = 1 July 2003–30 June 2004).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

No surveys were completed in Unit 21C during RY03–RY04. However, elsewhere where moose persist with lightly harvested populations of 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).

Survey conditions during 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, the current 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).

Moose density (0.35–0.45/mi^2 of all terrain for purposes of this report; 1284–1651 moose) was estimated 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) but is probably high, given the estimate was based more on extrapolation than observation. Based on the original stratification and declines observed in moose numbers in similar habitat in Unit 24 to the north, we believe that the moose population in Unit 21C is generally declining.

Population Composition

No moose population composition surveys were conducted in Unit 21C during RY03–RY04.

MORTALITY

Harvest

Season and Bag Limit for RY03.

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

Season and Bag Limit for RY04.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 21C, the Dulbi River drainage.		
RESIDENT HUNTERS: 1 bull by permit DM812; or 1 bull by permit RM834.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side, by permit DM812.		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Remainder Unit 21C.		
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 one side.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. During March 2004, the Alaska Board of Game adopted a regulation to establish a drawing permit hunt (DM812) and a resident registration permit hunt (RM834) for the Dulbi River drainage portion of Unit 21C. The board also adopted a regulation that limited nonresident hunters throughout the unit to harvesting bulls with 50-inch antlers or antlers with 4 or more brow tines on one side.

Hunter Harvest. Annual moose harvest in Unit 21C during RY95–RY04 was 26±2.6 ($\bar{x}$ ±SE) moose (Table 1). However, an average of 18 moose/year were harvested during this reporting period (RY03–RY04), a 36% decrease in harvest relative to that observed during the preceding 8 years (28 moose/year, RY95–RY02). Although the data are preliminary, similar declines in numbers of moose harvested per year were noted during RY05 and RY06 (Table 1). During the last 10 years (RY95–RY04), the numbers of hunters in Unit 21C averaged 46±3.3 ($\bar{x}$ ±SE). The total number of hunters during RY03–RY04 (41 per year) declined 13% relative to the preceding 8-year average (47 per year, RY95–RY02). It is possible that the change in regulations to registration and drawing permit hunts resulted in these declines in harvest and hunter numbers. Higher costs for transportation, increasing moose numbers and liberal seasons elsewhere, and more restrictive regulations in Unit 21C beginning in RY04, may also have reduced the harvest and number of hunters. An alternative hypothesis is that the moose population declined.

Six moose have been reported harvested on drawing hunt permit DM812 since 2004 (Table 2). To date, no moose harvest was reported by hunters using registration hunt permit RM834 in Unit 21C.

At high harvest levels, the percentage of large bulls in the harvested population would be expected to decline within a few years. Except for RY99 (14%), the percentage of large bulls (≥60") in the reported harvest in Unit 21C ranged from 25% to 43% during RY95–RY04. Furthermore, average antler size of all bulls in the RY04 reported harvest was 58" (n = 15), the highest average observed since RY95. These data suggest that bulls were not overharvested in Unit 21C, presumably because of the regulation that restricts harvest by nonresidents to bulls with antlers ≥50". Implementation of the drawing and registration permits (including a stipulation to destroy the trophy value of antlers) during RY04 may also have contributed to lower harvest levels.

Hunter Residency and Success. Alaska residents composed 51% of the 82 hunters who hunted moose in Unit 21C during RY03–RY04 (Table 1). On average, only 4 residents were successful per year during this period, while 12 resident hunters per year successfully harvested moose during RY95–RY02, a 67% decline in resident hunter success. Nonresident hunter numbers were previously relatively stable. Yet, similar to numbers of residents, nonresident hunters declined by 19% during RY03–RY04 ($\bar{x}$ = 13 successful nonresidents per year) compared to the previous 8-year period. Percent success for all hunters was >60% during RY95–RY02, and decreased to an average of 43% during RY03–RY04. Despite these declines, success rates were relatively high for Alaska and probably due to relatively low hunter numbers and concentrations of moose along the river corridors in September.

Harvest Chronology. Moose were harvested throughout the season, and most harvest consistently occurred during the third week in September (Table 3). However, a slight shift from the second (9/11–9/15) to the first week (9/5–9/10) of the season appeared to occur during RY03–RY04.

Transport Methods. While boats are used by moose hunters in Unit 21C, hunters mainly used aircraft for transport (Table 4). 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 (Gasaway et al. 1992) and may be increasing. Wolf and bear harvests were low (<10 annually) because hunter access is limited.

CONCLUSIONS AND RECOMMENDATIONS

Total moose density in Unit 21C was estimated at 0.35–0.45 moose/mi^2 of all terrain, with an estimated 1284–1651 moose present in the unit. 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 harvest along the river corridor might be exhibiting the first signs of approaching maximum desirable levels. Therefore, ADF&G supported changes that restricted nonresidents to harvesting large bulls and implemented registration and drawing permit hunts on the Dulbi River drainage portion of Unit 21C.

We generally 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 previous management objective to maintain a bull harvest of ≤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 estimate to more closely monitor effects of harvest on the population.

During this reporting period, the previous management objective to “maintain a harvest of bulls that is 6% of the estimated population” was changed to “maintain ≥20% large bulls (bulls with antlers 60" or greater) in the harvest.” Data indicate that we achieved this management objective during RY03–RY04. As access to Unit 21C is difficult and expensive, and most hunters who use the area are nonlocals, it is generally believed that those who hunted in Unit 21C were primarily interested in harvesting large-antlered (≥60") bulls. Harvest composition data suggest no declines in average bull antler spread occurred in harvest either by residents or nonresidents during RY95–RY04 (Fig. 1). Since nonresidents are limited to taking moose with antler spreads ≥50 inches, excessive harvest should be reflected in declines in the size of antler spreads in moose harvested by residents.

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

SZEPANSKI, S. M. 2006. Unit 21C moose. Pages 461–471 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

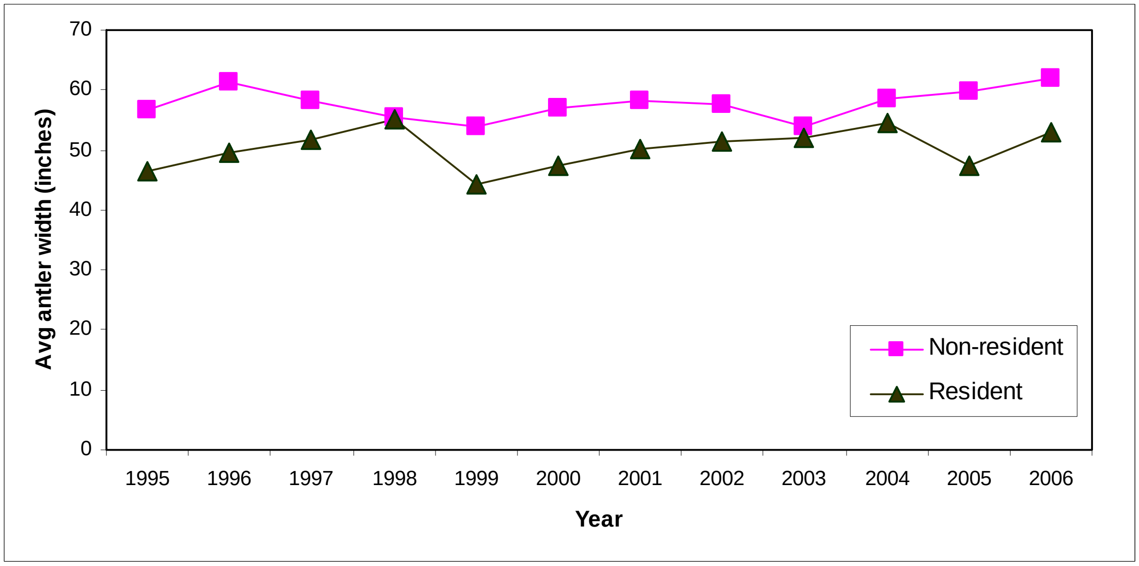

FIGURE 1 Average bull moose antler spread by hunter residency, Unit 21C, 1995–2006

TABLE 1 Unit 21C moose hunter residency and success, regulatory years 1990–1991 through 2006–2007

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	0	5	16	0	21 (46)	0	19	6	0	25	46
2004–2005	0	3	11	1	15 (41)	0	15	7	0	22	37
2005–2006	1	4	11	0	16 (37)	0	12	15	0	27	43
2006–2007[b]	0	5	6	0	11 (35)	0	10	10	0	20	31

[a] Local resident resides in Units 21C or 21B.
[b] Preliminary data.

TABLE 2 Unit 21C, outside Koyukuk Controlled Use Area, moose harvest by permit hunt, regulatory years 2004–2005 through 2006–2007

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
DM812	2004–2005	6	0	33	67	4 (100)	0 (0)	0	4
	2005–2006	4	0	50	50	2 (100)	0 (0)	0	2
	2006–2007	1	0	100	0	0 (0)	0 (0)	0	0
RM834	2004–2005	4	0	100	0	0 (0)	0 (0)	0	0
	2005–2006	0	0	0	0	0 (0)	0 (0)	0	0
	2006–2007	2	0	100	0	0 (0)	0 (0)	0	0

TABLE 3 Unit 21C moose harvest chronology percent by month/day, regulatory years 1995–1996 through 2006–2007

Regulatory year	Harvest chronology percent by month/day 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	19	14	43	24	21
2004–2005	33	7	40	20	15
2005–2006	27	27	33	13	15
2006–2007[a]	9	27	45	18	11

[a] Preliminary data.

TABLE 4 Unit 21C moose harvest percent by transport method, regulatory years 1990–1991 through 2006–2007

Regulatory year	Harvest percent by transport method 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	76	0	14	0	0	0	10	21
2004–2005	67	0	33	0	0	0	0	15
2005–2006	81	0	19	0	0	0	0	16
2006–2007[b]	100	0	0	0	0	0	0	11

[a] Includes airboats.
[b] Preliminary data.

WILDLIFE
MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 115526
Juneau, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNIT: 21D (12,096 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 (TCA) established in 1981 in the floodplain areas of the lower Koyukuk and Yukon Rivers indicated generally increasing moose densities through about 1993 (Tables 1–9). 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 corroborated 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.

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the reporting period.

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, 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 declined slightly by winter 2005–2006, based on our population estimation survey in 2004 and TCA surveys, and I estimated 8342 moose (±1000) by the end of RY05. Relative to the previous estimate, yearlings and calves still made up a large proportion of the population and the population included proportionally more bulls.

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 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. Registration permitting and educational and enforcement efforts have further improved the reporting rate by local residents, but more than 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 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 one side. In 1992 the minimum number of brow tines on one 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. By 2006, all of Unit 21D was managed through subsistence registration hunts with antler cutting disincentives or limited drawing permit hunts.

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 (30–49" 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. We also established TCAs using a grid system based on latitude and longitude coordinates (Kellie and DeLong 2006). 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 2004 using similar techniques described by Gasaway et al. (1986) but modified for analysis using the Geospatial Population Estimator (GSPE; Ver Hoef 2001; Kellie and DeLong 2006). 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. In the 2001 survey, of the 985 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. All sample units were stratified in advance of the intensive survey; 254 of the sample units were classified as high moose density and the remaining 731 sample units were classified as low moose density (Bryant and Stout 2003). In 2004 the survey area included 986 sample units of which 271 were stratified as high density and 715 were low density. In 2004, 452 sample units were surveyed intensively with an average survey time of 27.0 minutes per 5.6 mi^2 sample unit.

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 might cause underestimation of twinning rates.

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 reminder letter 3 weeks after the end of the hunt and a second reminder letter 3 weeks later. 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., RY03 = 1 July 2003 through 30 June 2004).

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 who came 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. At least 1 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). Winter calf and yearling mortality was also monitored beginning October 2005, when FWS deployed 30 radio collars on calves in Unit 21D and an additional 29 calves in October 2006.

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 browse removal rate (Boertje et al. 2007).

The formal planning process to address concerns related to the continued increase of hunters in the Koyukuk River drainage ended during this reporting period. 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, Fairbanks) 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 endorsed the plan at its January 2001 meeting. Public meetings were hosted by the department in January 2004 and October 2005 to update interested individuals concerning the status of activities related to the moose management plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

As noted previously, the unitwide moose population increase observed for almost 2 decades ended between 1993 and 1997 and some localized areas showed marked declines by 1997 (Stout 2000). Although peak densities were apparently reached between 1993 and 1997, declining calf numbers and recruitment of yearlings began to be apparent in fall of 1998 or 1999 in most TCAs (Tables 1–9). Estimates of poor recruitment during 1998–2005 in the Three Day Slough TCA suggested a decline of as much as 25%. From the peak around 1994 the Unit 21D population trend was downward through RY03, and the unitwide population may have declined by 12–25%. Counts from several TCAs during 1999–2003 supported this conclusion, as did the 2001 and 2004 population estimation surveys. However, by 2001–2003, the rate of decline appeared to be decreasing, and by 2005 and 2006 the Koyukuk River drainage portion of Unit 21D appeared to be stabilizing. The population estimate calculated from the 2004 survey was not significantly different (95% CI) from the 2001 estimate; however, the point estimate for 2004 was lower than 2001, and the regression analysis of the 1987–2004 survey estimates indicated a declining trend (Fig. 1). Unfortunately, no population estimation surveys were conducted between 1987 and 1997, so the regression analysis does not include a data point during the estimated peak in the population that occurred during RY93–RY97.

My population estimate of 8342 moose (±1000) moose is based on previously reported values, trend count surveys conducted in RY05, and the population estimation surveys completed in 2001 and 2004. Declining moose recruitment among the trend areas was a key indicator of the apparent overall decline in the population. In fall 2004, 5526 mi^2 were surveyed in Unit 21D and the southern portion of Unit 24. Of the 986 sample units in the survey area, 452 sample units were surveyed intensively. We counted 6309 moose during the intensive surveys with an average survey time of 27.0 minutes per 5.6 mi^2 sample unit. Nine hundred eighty-six sample units were stratified in advance of the intensive survey, with 271 of the sample units classified as high moose density, and the remaining 715 sample units classified as low moose density. In the 3684-mi^2 portion of Unit 21D that was surveyed, we estimated 4786 moose, not including a sightability correction factor (Table 10). In the remaining 8412 mi^2 of Unit 21D not surveyed, I subdivided the area by drawing hunt areas (Table 11). I used survey data to estimate moose numbers in drawing hunt areas when that information was available. If a portion of the hunt area was not surveyed, I used density estimates from comparable habitats that were surveyed and extrapolated that data to estimate the population size for the remainder of the hunt area.

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 suggest little hunting pressure in most cases, but 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, and the fall 2003 ratio was the lowest recorded (Table 1). Bull:cow ratios vary widely among other TCAs (Tables 2–9), but most indicated some level of decline since 1995 or 1996. The percentage of large bulls (antlers ≥50") observed in the Three Day Slough TCA was 19–33% in the early 2000s, while the percentage of large bulls in the harvest from Three Day Slough was 37–58% (Table 12). Bull:cow ratios from the 2004 GSPE survey were estimated at 30:100, well above the minimum needed for adequate productivity. For the area surveyed in 2004, the calf:cow ratio was estimated at 37:100. That calf ratio was within the target range (20–40:100) for maintaining a stable population. Data from most of the TCAs also had high ratios. TCA data in RY05 and RY06 indicated substantial improvements in calf:cow ratios and yearling bull:cow ratios which could be attributed to moderate winters. However, improved productivity and recruitment parameters do not yet appear to have translated to increased numbers of adults.

Moose twinning rates in spring 2003 through spring 2006 suggested above average nutritional status and productivity in Unit 21D riparian habitats (Tables 13 and 14) and the Huslia Flats–Treat Island TCAs just to the north in Unit 24 (Boertje et al. 2007). These above-average values are, in part, likely related to the mild winters from RY03 through RY05 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 in recent years. I do not believe a density-dependent effect temporarily decreased twinning during RY97–RY01 because twinning rates declined only temporarily while the riparian moose population maintained relatively high 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 unit. 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 Limits. Seasons and bag limits in Unit 21D in RY03 were:

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; a person may not take a cow accompanied by a calf; 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 one 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 only during 21 Sep–25 Sep and during a 5-day season during the period 1 Feb–28 Feb to be announced by emergency order; a person may not take a cow	5 Sep–25 Sep (To be announced)	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
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

Season and Bag Limits. Seasons and bag limits in Unit 21D in RY04 were:

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21D, that portion within the Koyukuk River drainage west of the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 bull by registration permit only; or	5 Sep–25 Sep (Subsistence hunt only)	
1 bull, by drawing permit only: up to 500 permits may be issued in Unit 21D outside the Koyukuk Controlled Use Area; or	5 Sep–25 Sep	
1 bull.	1 Dec–10 Dec	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit; up to 500 permits may be issued in Unit 21D outside the Koyukuk Controlled Use Area		5 Sep–25 Sep
Unit 21D, that portion north of the Yukon River and east of the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 bull by registration permit only; or	5 Sep–25 Sep (Subsistence hunt only)	
1 bull, by drawing permit only; up to 500 permits may be issued in Unit 21D outside the Koyukuk Controlled Use Area: or	5 Sep–25 Sep	
1 bull.	1 Dec–10 Dec	
		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit; up to 500 permits may be issued in Unit 21D outside the Koyukuk Controlled Use Area.		
Unit 21D, that portion within the Koyukuk Controlled Use Area.	27 Aug–31 Aug (Subsistence hunt only)	
RESIDENT HUNTERS: 1 moose by registration permit only; a person may not take a cow accompanied by a calf; or	1 Sep–20 Sep (Subsistence hunt only)	
1 bull by registration permit only; or	5 Sep–25 Sep (General 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	1 Dec–10 Dec	
1 bull.		5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit; up to 80 permits may be issued in combination with Unit 24, that portion within the Koyukuk Controlled Use Area.		
Remainder of Unit 21D	5 Sep–25 Sep	
RESIDENT HUNTERS: 1 moose per regulatory year; however, antlerless moose may be taken only from 21 Sep–25 Sep; a person may not take a cow accompanied by a calf; or	1 Dec–10 Dec	
1 bull.		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side.		

Alaska Board of Game Actions and Emergency Orders. The antlerless moose hunting seasons were reauthorized by the Alaska Board of Game for RY03 and RY04, but we notified the board that the antlerless seasons would be closed by emergency order because of conservation concerns. The board closed fall antlerless seasons outside the KCUA in 2004, then closed all the remaining antlerless seasons at the spring 2006 meeting.

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 in the Bear Creek drainage. The board also closed the February any-moose season and opened a 10-day December bulls-only season. At the 2006 meeting, the board then closed the December season and opened a subsistence season on 22 August–31 August. The board also voted to expand the drawing and registration permit hunts to all of Unit 21D, eliminating all general harvest ticket options in the unit. With the establishment of the additional drawing permit hunts, some nonresident permit hunts were also divided according to a 50:50 allocation to guided and non-guided hunters.

Hunter Harvest. Continuing the trend of the previous reporting period, harvest of moose in Unit 21D during RY03–RY04 was stable compared to the increases observed during the 1990s (Tables 15–17). The decline in the bull segment of the population in some TCAs was probably linked to the harvest during that period. Reduced harvest has reversed the trend of declining bull:cow ratios in the KCUA portion of Unit 21D. Reported cow harvest was low in RY03–RY05, primarily due to elimination of the antlerless moose seasons in the KCUA. However, illegal and unreported cow harvest continued to occur during the winter, when harvest reporting was poor. Potlatch and stickdance moose harvest was also primarily cows.

Checkstation Results. Ella's cabin checkstation, located 15 miles upstream from the village of Koyukuk on the Koyukuk River, was made mandatory in RY90. The number of hunters who checked 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 17). 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 12). Consistently over a 23-year period (1981–2003), 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 when it was initially implemented. 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. 2). Among those 20 data points (5 age classes × 4 years), 10 of 20 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 RY97–RY00. Declines in antler development and twinning rates have been associated with energy deficits, and the 4-year declines in both of these measurements for the KCUA suggest the occurrence of a temporary negative environmental effect.

Meat evaluation surveys conducted at the checkstation indicated meat care was generally very good with an average overall score of 4.8 in RY05 (4.6 in RY04, 4.2 in RY03, 4.3 in RY02) (Table 18). In RY05 the majority of hunters (81%) had their meat out of the field in 4 days or less (81% in RY04, 69% in RY03, 73% in RY02). In RY05, 4 hunters (4.3%) had their meat out 7 days or longer, and in RY04 there were 8 hunters (8.4%) that kept their meat out that long (12 hunters [6%] in RY03, 16 hunters [9%] in RY02). In RY04, 11 hunters (11.4%) were given average overall scores of 3 or less, while that number decreased to 5 hunters (5.3%) in RY05 (43 hunters [22%] in RY03, and 27 hunters [15%] in RY02). In general, meat scores have improved in the last four years and the number of days hunters are keeping their meat in the field is decreasing.

Wildlife viewing surveys were conducted voluntarily at the checkstation. There were 59 people who filled out the wildlife viewing questionnaire at Ella's Cabin in 2005. The survey card was a 3×5 card with 8 questions. Typically, we handed out one card per party rather than each individual. We presented the card to hunters while we were checking them on their way out of the area. There were 354 hunters who registered at Ella's, so this is roughly a 17% sample (15% in RY04, 16% in RY03, 25% in RY02) of all the people who registered at the checkstation this fall.

Not all hunters answered all questions; so percentage values presented are based on the number of responses to the particular question. The questions asked and the answers given are summarized below for RY02–RY05:

Question 1: How many days spent viewing wildlife?

Respondents reported spending an average of 7.2 days viewing wildlife in RY05, which was up from 5.2 in RY04, but more consistent with 6.9 days in RY03 and 7.0 days in RY02. RY05 was a very wet season and hunting was difficult, so it was not surprising that the average days spent viewing increased as a result of having to be in the field hunting for a longer period of time.

Question 2: Why were you visiting the Koyukuk?

In RY05 the majority (51%) (58% in RY04, 53% in RY03, 55% in RY02) of the people said they were "hunting and viewing", while 47% (40% in RY04, 45% in RY03, 43% in RY02) said they were hunting only, and 2% (2% in RY04, 1% in RY03, 2% in RY02) said they were viewing only.

Question 3: Did you view any wildlife that you were not hunting?

The majority (85%) (73% in RY04, 81% in RY03, 83% in RY02) of the people said yes, while only 15% (27% in RY04, 19% in RY03, 17% in RY02) of the respondents said no. Again, the results were comparable to previous years, but RY04 now appears to be more of an outlier.

Question 4: What wildlife species did you see and how many?

There were 47 people who listed some of the animals they saw in RY05. Porcupine, beaver, moose, ducks, geese, and wolves were the top species listed. There were 23 species identified this year compared to 19 in 2004, 32 in 2003, and 23 in 2002.

Question 5: Viewing which of these animals was most important to you?

The top 3 species people wanted to see in RY05 were moose, bears and wolves, consistent with recent years: moose = 96% of first place rank (96% in RY04, 86% in RY03, 74% in RY02); bears = 57% of the second place rank (63% in RY04, 75% in RY03, 58% in RY02); wolves = 63% of the third place rank (57% in RY04, 56% in RY03, 57% in RY02). Waterfowl were back up with 85% of the fourth place rank (sixth in RY04, fourth in RY03, fourth in RY02). Caribou were ranked fifth (fifth in RY04, sixth in RY03, eighth in 2002), and furbearers fell to seventh this year (fourth in RY04, fifth in RY03, fifth in RY02). Songbirds and small mammals were ranked sixth (eighth in RY04, seventh in RY03, seventh in RY02) and eighth (seventh in RY04, eighth in RY03, sixth in RY02) respectively. The percentage calculation is a cumulative percentage.

Question 6: How important was the activity of viewing wildlife for you?

This question was revised and obviously improved from 2 years ago to include only 3 categories. Of the people who responded, 53% (63% in RY04, 62% in RY03) said viewing was VERY IMPORTANT, 42% (33% in RY04, 33% in RY03) said it was SOMEWHAT important, and only 5% (4% in RY04, 5% in RY03) said it was NOT IMPORTANT. Considering the responses to Question #2 and Question #6 together, I am inclined to believe that there was probably no change in viewing activities in RY05.

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, 56% (71% in RY04, 52% in RY03) said viewing was VERY IMPORTANT, 39% (25% in RY04, 44% in RY03) said it was SOMEWHAT important, and only 5% (4% in RY04, 4% in RY03) said it was NOT IMPORTANT.

Question 8: Where did you get information about the Koyukuk?

Friends were tied with personal knowledge as the number-one source this year, with friends at 37% (42% in RY04, 51% in RY03, 45% in RY02) and personal knowledge (i.e., I live here) at 37% (31% in RY04, 18% in RY03, 23% in RY02). Family ranked third at 17% (18% in RY04, 9% in RY03, 4% in RY02), ADF&G ranked fourth at 6% (7% in RY04, 9% in RY03, 17% in RY02), and the Internet ranked last at 4% (2% in RY04, 5% in RY03, 3% in RY02). This question appears to be biased by the changing demography of fewer nonlocal hunters.

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 RY03 through RY05 varied by only 4% (Table 19). So, it appears that use of the RM832 permit has stabilized. It is apparent that use of the registration permit increased among Unit 21D residents while use of the permit by other Alaska residents is down somewhat (Table 17). With the implementation of the drawing hunts, hunter numbers were better regulated and distribution of hunters was improved (Table 20). Hunters who did not want to destroy the trophy value of their bull moose applied for a drawing permit. 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. However, with repeated warm weather patterns in the last several seasons, an increasing number of local hunters were requesting that hunting be allowed into October.

Hunter Residency and Success. Hunter residency and success can be misleading because Unit 21D residents often did not report unsuccessful hunt information (Table 21). Harvest and hunter participation by Unit 21D residents was relatively constant according to Subsistence Division surveys (Anderson et al. 1998; Table 15). In contrast, nonresident and nonlocal resident hunter participation increased steadily from 1983 through 1999, but declined beginning RY00. 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 (RY01–RY05). Success rates in RY03 (34%), RY04 (28%), and RY05 (26%) are still low compared to RY90–RY97, when success rates averaged 62%. It is unclear how much declines in success rates were due to an actual change in harvest effort or whether reporting rates for unsuccessful activities improved. 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 when more than 60% of the moose harvested are cows.

Harvest Chronology. Table 22 shows the chronology for reported harvest; however, about 20 percent of the annual harvest probably occurred during winter, when reporting rates were low. 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 23). Snowmachines were the main transportation during winter.

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 had increased substantially 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. Twinning data indicate a ranking of moderate to high nutritional status during RY03–RY05 relative to 14 other areas in Alaska (Tables 13 and 14; Boertje et al. 2007) Nutritional status is adequate to support an increasing population if predation decreases, as indicated by the increasing moose population in Unit 20A where nutritional status was poorest (Boertje et al. 2007).

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 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 21D. 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 21B. Two public meetings were hosted by the department, one in January 2004 and the other in 2005, to provide an update on the status of management-related activities outlined in the moose management plan. Participants at the 2005 meeting recommended that the department extend the active period of the plan through 2007.

CONCLUSIONS AND RECOMMENDATIONS

Moose were relatively numerous in the riparian lowlands of Unit 21D. I estimated 8342 (±1000) moose in the unit without a sightability correction factor. Unitwide populations likely declined slightly based on reduced recruitment, at least during 1998–2004, but numbers may have stabilized in the northern portion of the unit. Reduced recruitment parameters such as calf:cow ratios and yearling bull:cow ratios indicated predation had a negative influence on the moose population. Nutritional status was above average and could support an increasing population (Boertje et al. 2007). Four years of liberalized cow harvest removed an important reproductive component of the population. The apparent slight decline in moose numbers was consistent with the increasing trend 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 may continue to decline unless an effort to reduce predation is implemented and the harvest of antlerless moose continues to decrease.

The 3 key management issues facing Unit 21D include (1) the repercussions of declining fall success rates by local hunters, (2) cow harvest, and (3) declining moose numbers and unregulated harvest in the Kaiyuh portion of Unit 21D. Although harvest data indicate local villages are harvesting more moose, public input and Emergency Petitions for additional hunting opportunities suggest subsistence needs are not being achieved. Local villages are increasingly pursuing additional opportunity through federal regulations and possibly additional potlatch requests. Cow harvest must continue to decrease, especially during the winter seasons and particularly in the Kaiyuh Flats area if the moose population is to return to previous levels. More than two-thirds of the moose harvested in the winter are cows. Actions were taken to close all the fall cow seasons by emergency order in RY02 through RY05, and in RY06 the antlerless seasons were eliminated. Additionally, the winter season was eliminated in favor of a "bulls only" season in August. However, it is clear that dependency on moose harvested during the winter will continue as long as fall hunting success declines. 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 observable moose was not achieved. However, the Intensive Management (IM) population objective of 7000–10,000 moose set by the board of game in regulation 5 AAC 92.108 may have been achieved. Analysis of RY04–RY06 data indicated improved recruitment; however, adult numbers were not increasing. Poor recruitment prior to RY04, due in part to high predation, appeared to be the primary factor causing the decline. The objective to provide for a harvest of moose not to exceed 700 moose was achieved. The IM harvest objective of 450–1000 moose set by the board of game in regulation 5 AAC 92.108 was achieved in RY03, but not in RY04 or RY05. During RY03–RY05, estimated total harvest was highest during this reporting period in RY03 at 484 moose, a harvest rate of no more than 5.2–6.6% using the RY05 moose population estimate. The objective to provide for moose hunting opportunity, not to exceed 950 hunters per regulatory year was achieved with a total of only 767 hunters in RY03, 772 hunters in RY04, and 728 in RY05.

The long-term objective of implementing at least 2 habitat enhancement activities was achieved during RY03–RY05. The FWS treated 9610 acres of grass/willow meadows in the area of Three Day Slough using prescribed fire in spring 2006 and in summer 2004 they burned an unspecified number of acres near Bishop Creek and Squirrel Creek as part of the Bonanza Creek fire suppression effort. Two large fires, the Bonanza Creek fire in 2004 and the Holtnakatna Creek fire in 2005, burned 265,915 and 194,015 acres respectively. Both 2004 and 2005 were active fire seasons and many other fires burned throughout Unit 21D; however, most of the fires burned in upland sites predominately in spruce forest and relatively small amounts of prime riparian habitat were affected.

In RY03 and RY04 we continued to monitor the objective of reducing spoiled meat observed at Ella’s cabin and at hunting camps by 10% each regulatory year. Although it is early in the program, I believe it has had a positive impact on meat care within the KCUA, but the variation in responses does not allow a statistical determination at this time. 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 also a positive move toward achieving the objective of reducing spoiled meat. This requirement was expanded to all of Unit 21D in RY02. Finally, our monitoring program to evaluate the number of people engaged in nonconsumptive activities was continued 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. Due to the variation in the responses, we have not been able to determine whether the objective was achieved at this time.

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

STOUT, G. W. 2006. Unit 21D moose. Pages 472–513 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

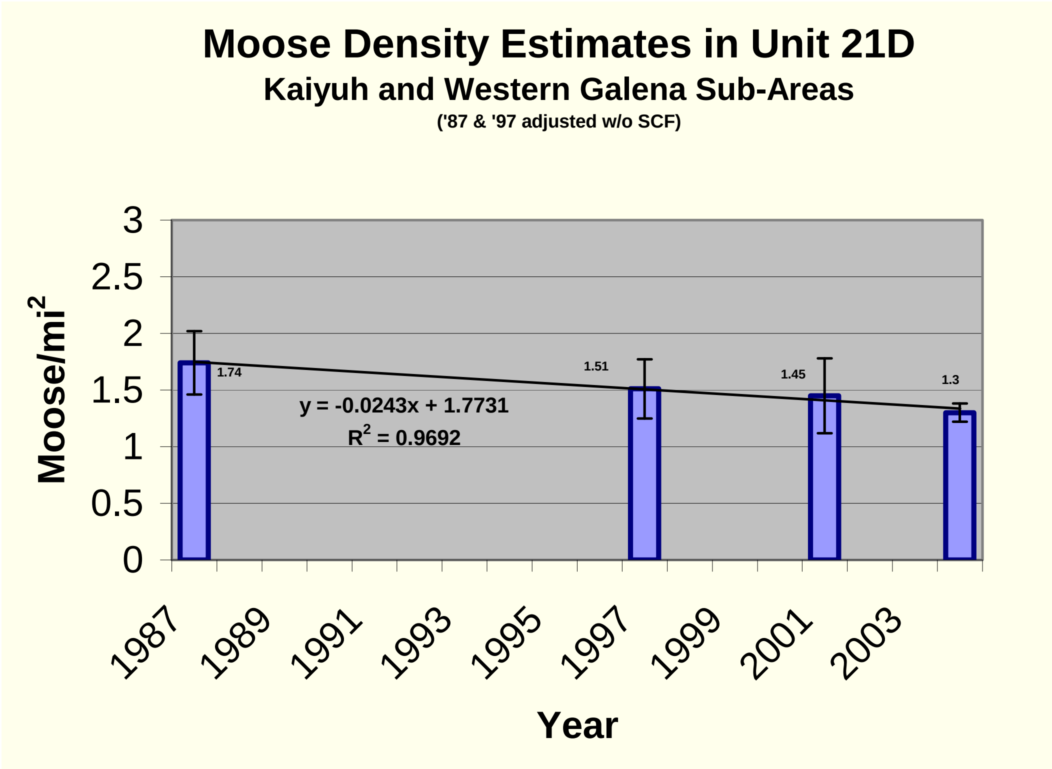

FIGURE 1 Moose density estimates and regression analysis based on 4 population estimation surveys. The 1987 estimate was calculated using MOOSEPOP, 1997 was a regression analysis estimate, 2001 and 2004 were geospatial population estimates. All values presented do not include sightability correction factors and are presented as density of observable moose/mi^2.

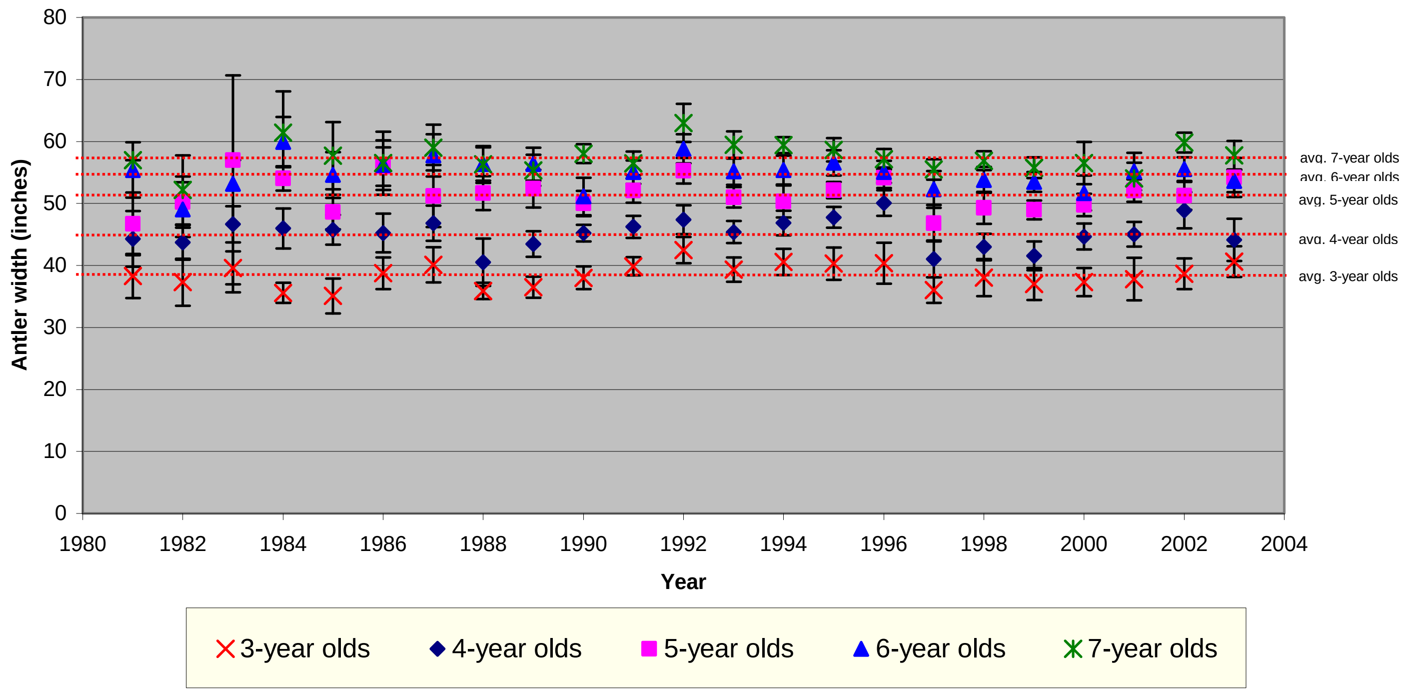

FIGURE 2 Moose antler widths and ages determined by incisor cementum annuli for 3- to 7-year-old moose checked at Ella's cabin, regulatory years 1983–1984 through 2003–2004

TABLE 1 Unit 21D Three Day Slough trend count area aerial moose composition counts, regulatory years 1981–1982 through 2006–2007

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	85.1	35	12	42	10	24	327	3.8
1982–1983	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	83.3	36	13	32	11	19	791	9.5
1988–1989	83.3	33	13	45	14	25	832	10.0
1989–1990[b]	83.3	28	8	25	11	16	763	9.2
1991–1992	83.3	34	10	31	6	19	909	10.9
1992–1993	83.3	35	10	31	7	18	1088	13.1
1993–1994	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[a,b]	83.3	20	9	24	3	17	721	8.7
1998–1999	83.3	30	9	13	0	9	990	11.9
1999–2000[a,b]	83.3	17	3	17	18	13	568	6.9
2001–2002	85.0	22	7	13	0	8	678	8.0
2003–2004[b]	85.0	15	8	21	14	14	586	6.9
2004–2005[b]	85.0	24	10	21	6	14	623	7.3
2005–2006[b]	85.0	24	5	20	8	14	494	5.8
2006–2007[a]	85.0	26	7	43	11	25	795	9.4

[a] Low snow year.
[b] Late survey (after 21 Nov).

TABLE 2 Unit 21D Dulbi River mouth trend count area aerial moose composition counts, regulatory years 1982–1983 through 2006–2007[a]

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	122.3	21	6	16	3	11	343	2.8
2003–2004	116.7	17	6	23	5	17	411	3.5
2004–2005	122.0	21	6	40	7	25	406	3.3
2005–2006	122.0	18	8	23	4	16	333	2.7
2006–2007	116.7	24	6	32	8	21	403	3.5

[a] Beginning in regulatory year 2001, geospatial population estimate units replaced Gasaway units (Stout 2004).

TABLE 3 Unit 21D Kateel River mouth aerial moose composition counts, regulatory years 1984–1985 through 1997–1998

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

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 2006–2007[a]

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	53.9	43	10	36	6	20	175	3.2
1996–1997	66.5	42	6	45	7	24	308	4.6
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	118.8	40	8	16	0	11	429	3.6
2003–2004	118.8	25	11	35	6	22	521	4.4
2004–2005	118.8	33	15	47	12	24	551	4.6
2005–2006	118.8	24	10	38	7	24	443	3.7
2006–2007	118.8	21	7	25	8	17	457	3.9

[a] Beginning in regulatory year 2001, geospatial population estimate units replaced Gasaway units (Stout 2004).

TABLE 6 Unit 21D Squirrel Creek aerial moose composition counts, regulatory years 1981–1982 through 2006–2007[a]

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	4.5
1997–1998	48.6	54	24	32	8	17	253	5.2
1998–1999	48.6	41	12	31	13	18	283	5.8
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	102.3	44	5	24	2	15	332	3.2
2003–2004	96.6	32	8	25	23	16	242	2.5
2004–2005	102.3	44	14	45	9	24	248	2.4
2005–2006	90.9	32	7	23	9	15	252	2.8
2006–2007	90.9	35	4	35	3	21	164	1.8

[a] Beginning in regulatory year 2001, geospatial population estimate units replaced Gasaway units (Stout 2004).

TABLE 7 Unit 21D Pilot Mountain Slough aerial moose composition counts, regulatory years 1983–1984 through 2006–2007[a]

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	91.0	18	8	21	5	15	299	3.3
2003–2004	91.0	13	10	48	11	30	342	3.8
2004–2005	91.0	10	3	41	12	27	377	4.1
2005–2006	102.4	19	7	54	11	31	365	3.6
2006–2007	91.0	16	8	31	15	21	326	3.6

[a] Beginning in regulatory year 2001, geospatial population estimate units replaced Gasaway units (Stout 2004).

TABLE 8 Unit 21D Kaiyuh Slough aerial moose composition counts, regulatory years 1985–1986 through 2006–2007[a]

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	229.8	70	6	9	0	5	159	0.7
2003–2004	178.0	55	19	38	14	20	204	1.2
2004–2005	229.8	53	18	52	25	25	252	1.1
2005–2006	229.8	66	18	29	0	15	180	0.8
2006–2007	126.3	42	5	21	5	13	171	1.4

[a] Beginning in regulatory year 2001, geospatial population estimate units replaced Gasaway units (Stout 2004).

TABLE 9 Unit 21D Ruby Slough aerial moose composition counts, regulatory year 2006–2007

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
2006–2007	154	20	12	41	10	25	178	1.2

TABLE 10 Unit 21D moose population estimates of 1987 and 2004 population estimation surveys

Survey area	1987 Population estimate[a]	1987 Survey area (mi^2)	1997 Population estimate[b]	1997 Survey area (mi^2)	2001 Population estimate[c]	2001 Survey area (mi^2)	2004 Population estimate[c]	2004 Survey area (mi^2)
Kaiyuh Slough Sub-Area	1790±322	1582	1335±230	1582	1800±591	1843	1487±144	1843
Western Galena Sub-Area	4118±576	1508	3250±403	1508	3403±603	1734	3299±161	1841
Upper Koyukuk Sub-Area[d]	n/a	n/a	n/a	n/a	3642±572	1949	3181±148	1843
Total survey area	5908±898	3090	4585±633	3090	8924±1161	5526	7967±290	5526

[a] MOOSEPOP analysis estimate, with sightability correction factor.
[b] Regression analysis estimate, with sightability correction factor.
[c] Geospatial population estimation, without sightability correction factor.
[d] Predominantly within Unit 24.

TABLE 11 Unit 21D moose population estimate by drawing hunt areas regulatory year 2005–2006

Drawing hunt area	Density estimate	Moose estimate
(DM816) Yuki R./Bishop Creek	(545 mi^2 @ 1.30 moose/mi^2)	698
	(1555 mi^2 @ 0.35 moose/mi^2)	544
	Subtotal	1242
(DM817) Nulato R./Kaiyuh Flats	(612 mi^2 @ 1.30 moose/mi^2)	796
	(2329 mi^2 @ 0.35 moose/mi^2)	815
	Subtotal	1611
(DM818) Papa Willie Slough	(360 mi^2 @ 1.30 moose/mi^2)	468
	(1096 mi^2 @ 0.35 moose/mi^2)	383
	Subtotal	851
(DM823–DM830) KCUA	(1841 mi^2 @ 1.79 moose/mi^2)	3299
	(559 mi^2 @ 0.35 moose/mi^2)	196
	Subtotal	3495
(DM814/DM815/DM819) Bear Creek	(916 mi^2 @ 0.75 moose/mi^2)	687
(DM820) Gisasa/Kateel	(2283 mi^2 @ 0.20 moose/mi^2)	456
Unit 21D total	(12,096 mi^2)	8342 (±1000)

TABLE 12 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 2006–2007

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	58	108	25
2004–2005	42	138	19
2005–2006	45	120	33
2006–2007	52	126	27

[a] 50-inch or greater antler spread.
[b] No survey.

TABLE 13 Unit 21D moose aerial twinning surveys in the Three Day Slough trend count area, regulatory years 1989–1990 through 2005–2006

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	45	100	23–25
1993–1994	110	39	11	22	55	23–24
1994–1995	78	37	18	33	38	22
1995–1996	200	39	14[b]	26	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
2004–2005[d]	77	27	16[b]	37	25	24–27
2005–2006	118	26	24	48	62	25–27

[a] Percent of cows with calves that 2 or more calves.
[b] Including 1 cow w/3 calves.
[c] The 1999 survey was delayed to 4–7 June due to weather.
[d] Extensive flooding and early leaf-out, survey conditions difficult.

TABLE 14 Unit 21D moose aerial twinning surveys in the Pilot Mountain Slough to Kaiyuh Slough trend count areas, regulatory years 2003–2004 through 2005–2006[a]

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[b]	Yearlings	Dates in May
2003–2004	52	32	18	36	28	24,25
2004–2005	63	26	31	54	12	24–26
2005–2006	86	32	20	38	29	25,26

[a] U.S. Fish and Wildlife Service data.
[b] Percent of cows with calves that had twins.

TABLE 15 Unit 21D moose harvest, regulatory years 1990–1991 through 2005–2006

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	310	9	1	320	150	14	484
2004–2005	227	0	0	227	150	12	389
2005–2006	214	0	0	214	150	13	377

[a] Unreported harvest based on Subsistence Division's door-to-door survey.

TABLE 16 Ella's cabin checkstation moose harvest, regulatory years 1990–1991 through 2006–2007[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	266	11	4	278[b]
2001–2002	183	3	2	187[b]
2002–2003	217	0	0	217
2003–2004	248	0	0	248
2004–2005	153	0	0	153
2005–2006	147	0	0	147
2006–2007	164	1	1	167[c]

[a] Contains moose harvested in Units 21D and 24.
[b] Including one moose of unknown sex.
[c] Including two moose of unknown sex.

TABLE 17 Ella's cabin checkstation[a,b] moose hunter residency and success, regulatory years 1983–1984 through 2006–2007

Regulatory	Unit 21D resident		Nonlocal 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
2004–2005	255	74	184	75	10	4	449	153
2005–2006	261	73	194	68	10	6	465	147
2006–2007	265	92	157	67	11	8	433	167

[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 18 Overall scores for meat evaluation at Ella's cabin, regulatory years 2002–2003 and 2005–2006

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
2004–2005	2.6	4.3	4.8	4.8	4.6	96
2005–2006	2.7	4.8	4.8	4.8	4.8	95

[a] Subjective ranking scale of 1–5, with a score of 1 being lowest.

TABLE 19 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2005–2006[a]

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters[b]	Percent successful hunters[b]	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
	2004–2005	399	8	62	38	141	(100)	0	(0)	0	141
	2005–2006	415	8	66	34	129	(100)	0	(0)	0	129
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
DM823	2005–2006	2	0	0	100	2	(100)	0	(0)	0	2
DM825	2005–2006	3	33	0	100	2	(100)	0	(0)	0	2
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
	2004–2005	5	20	25	75	3	(100)	0	(0)	0	3
	2005–2006	3	33	0	100	2	(100)	0	(0)	0	2
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
	2004–2005	20	55	43	57	4	(100)	0	(0)	0	4
	2005–2006	20	55	56	44	4	(100)	0	(0)	0	4

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters[b]	Percent successful hunters[b]	Bulls	(%)	Cows	(%)	Unk	Total harvest
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
	2004–2005	5	40	67	33	1	(100)	0	(0)	0	1
	2005–2006	2	50	100	0	0	(0)	0	(0)	0	0
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
	2004–2005	20	60	43	57	4	(100)	0	(0)	0	4
	2005–2006	20	45	27	73	8	(100)	0	(0)	0	8
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	223	(100)	0	(0)	0	223
	2003–2004	659	22	50	50	246	(99)	0	(0)	2	248
	2004–2005	449	13	62	38	153	(100)	0	(0)	0	153
	2005–2006	465	12	62	38	147	(100)	0	(0)	0	147

[a] RM830 ended in regulatory year 2000–2001 and was replaced by drawing hunts DM827, 828, 829, and 830.

[b] Percent successful and percent unsuccessful were calculated using the total number of hunters who completed their report cards with enough information to determine whether they harvested a moose.

TABLE 20 Unit 21D outside Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 2004–2005 through 2006–2007

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
DM814	2004–2005	15	13	67	33	4 (100)	0 (0)	0	4
	2005–2006	15	53	67	33	2 (100)	0 (0)	0	2
	2006–2007	15	40	33	67	6 (100)	0 (0)	0	6
DM815	2004–2005	3	33	50	50	1 (100)	0 (0)	0	1
	2005–2006	3	33	50	50	1 (100)	0 (0)	0	1
	2006–2007	3	0	33	67	2 (100)	0 (0)	0	2
DM816	2006–2007	25	12	50	50	11 (100)	0 (0)	0	11
DM817	2006–2007	16	25	25	75	9 (100)	0 (0)	0	9
DM818	2006–2007	4	25	50	50	1 (100)	0 (0)	0	1
DM820	2004–2005	22	55	100	0	0 (0)	0 (0)	0	0
	2005–2006	22	59	13	88	7 (100)	0 (0)	0	7
	2006–2007	22	73	60	40	2 (100)	0 (0)	0	2

TABLE 21 Unit 21D moose hunter residency and success, regulatory years 1990–1991 through 2005–2006

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	Local[a] resident	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	115	159	45	3	322	222	169	49	5	445	767
2004–2005	127	88	11	1	227	334	166	44	1	545	772
2005–2006	108	89	15	2	214	307	171	27	9	514	728

[a] Subunit resident only.

TABLE 22 Unit 21D moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2005–2006

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	45	49	7	302
2004–2005	41	59	0	209
2005–2006	38	62	0	202

TABLE 23 Unit 21D moose harvest percent by transport method, regulatory years 1990–1991 through 2005–2006

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	4	0	88	0	6	0	1	1	322
2004–2005	3	0	81	2	3	2	6	3	227
2005–2006	4	0	88	2	1	2	1	2	214

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 2004 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 are the current management goals for Unit 22:

- 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: maintain a population of 450–525 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 available habitat can support. In Units 22A, 22B, 22D and 22E our goal is to increase and stabilize the population, to reverse a period of steady decline in moose numbers. In Unit 22C, the goal was revised slightly upward (from reduce and maintain a population of 450–475 moose) based on results of a 2004 habitat survey and is intended to 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 rotation 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 2004, a moose census of Unit 22B and Unit 22C was completed using the geostatistical population estimator technique (J. VerHoef, ADF&G, personal communication). In March of 2005 the same technique was used to census moose in Unit 22A. We summarized harvest reports returned by hunters and harvest data collected during big game harvest surveys in St. Michael, Shaktoolik, and Unalakleet. The department administered registration moose hunts in the most heavily hunted areas along the Nome road system in Units 22B, 22C, 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 2005 in Unit 22A an expanded census area of the Unalakleet River drainage showed a continued decline in moose numbers since previous censuses in 1989 and 2003 (Table 2). 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 higher numbers observed during fall composition surveys substantiates reports from long-time 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.

In western Unit 22B a 2004 census found a continued decline in moose numbers. The population has declined 64% since the 1987 census and 27% since 1999. Recruitment rates in the area continue to be <10% (Table 2). We have no census data for eastern Unit 22B and recruitment surveys completed in 1999 and 2000 found low recruitment rates (<10%), however data from surveys completed in 2004 and 2005 found increased recruitment rates (13% and 18% respectively) and suggest the population may be increasing (Table 4).

In 2004 the Unit 22C the population was estimated at 530moose, showing a 5% decline (not statistically significant) since 2001. The management goal for Unit 22C is 450–525 moose and the Alaska Department of Fish and Game (ADF&G) implemented an antlerless hunt in 2000 that allows up to 20 cows to be taken each fall in an attempt to slightly reduce and stabilize the population.

A 2002 moose census in Unit 22D estimated 1593 moose (90% C.I. +/-12.4%) in the Kuzitrin and Agiapuk drainages, indicating a 45% population decline since the area was first censused in 1988 (Table 2). Recently collected composition data shows higher calf:adult ratios, suggesting the Unit 22D moose population may be stabilizing. The scheduled 2006 spring census should provide additional information on the population's trend.

The first stratified census of Unit 22E was completed in March 2003, and yielded 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 radio collar studies have shown considerable seasonal migration between Units 22E and 22D and the increase observed is probably due to unusually sparse snow cover; moose that normally winter in Unit 22D drainages were able to remain on their summer range in Unit 22E. In 2006 we will census Units 22D and 22E together to account for seasonal distribution and migrations of moose between the two areas.

Population Size

An expanded moose census was completed in the central portion of Unit 22A during 10-30 March 2005 using the geostatistical population estimation technique and found adult moose densities of 0.05 (Nr./mi^2) which was similar to densities found during the 2003 census (Table 2).

The size of the 2005 census area was 2400 mi^2, encompassing the Unalakleet River drainage (same as previous efforts), and was expanded approximately 20% to include the Egavik River drainage and other small coastal drainages west of the Unalakleet drainage, between the Golsovia River drainage to the south and the Tagoomenik River drainage to the north.

The census found 123 moose ± 33.8% (81 to 164 moose) at 90% C.I and a density of 0.05 moose/mi^2 The recruitment rate was 8% and the calf ratio was 9 calves:100 adults (±78% at 90% C.I.). Since the 2005 census was expanded it is not directly comparable to previous efforts, however, the 2003 moose density estimate was 0.04 moose/mi^2, which is similar to the 2005 density estimate. If the 2003 and 2005 estimates are compared without considering the differences in the census areas, the increase seen in 2005 is not statistically significant at the 90% confidence interval.

A combined moose census of Units 22B and 22C was completed 6-17 March 2004. The Unit 22B census area encompassed the 2400 mi^2 portion of Unit 22B west of the Darby Mountains previously censused in 1987 and 1999, and estimated 586 moose (±17% at 90% C.I.) (Table 2). The calf:adult ratio was 10 calves:100 adults and the recruitment rate was 9%. The low number of calves is consistent with fall composition and spring recruitment surveys over the last decade, which have repeatedly found fewer than 10% calves.

The Unit 22C census covered the entire 1368 mi^2 subunit, which was censused in 1990, 1995 and 2001. The 2004 census estimated 530 moose (±18% at 90% C.I.) which represents a 5% decline since our 2001 estimate of 557 moose, but the decline is not statistically significant. The calf:adult ratio was 23 calves:100 adults, and the recruitment rate was 19%.

Population Composition

<u>Fall.</u> We completed fall composition surveys in several areas during the reporting period. In November 2003, we surveyed portions of the Unalakleet and Golsovia River drainages in Unit 22A and portions of the Kuzitrin and Agiapuk River drainages in Unit 22D. In November 2004 we surveyed portions of the Koyuk River drainage in Unit 22B, portions of the Snake and

Stewart River drainages in Unit 22C, and portions of the Kuzitrin drainage in Unit 22D. Composition surveys are completed using a Robertson R44 helicopter when resources allow, because the aircraft greatly improves our ability to find moose when snow cover is minimal. We also use a Cessna 185 and Piper PA-12 to complete surveys. Results of all composition surveys are found in Table 3.

Unit 22A. In October 2003, Alaska Department of Fish and Game (ADF&G) and Bureau of Land Management (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 66 moose, which was close to the March 2003 census estimate of 46-103 moose for the entire drainage. 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, the bull:cow ratio was likely skewed upwards. 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 November 2004 a moose composition survey was conducted in a portion of the Koyuk River drainage in eastern Unit 22B and 56 moose were classified. Limited fuel, wind, and reduced sightability in timbered areas prevented the survey crew from covering a large area. The survey resulted in a bull:cow ratio of 12 bulls:100 cows and no calves were observed during the survey.

Unit 22C. In November 2004 a moose composition survey was conducted in the Snake and Stewart River drainages in Unit 22C and 129 moose were classified. The survey resulted in a bull: cow ratio of 11 bulls:100 cows and although Unit 22C composition surveys have commonly recorded bull:cow ratios below the department’s management goal of 20 bulls:100 cows for the area, the subunit produced between 15% and 26% percent calves since 1992 (Table 3). The 2004 survey yielded 31 calves: 100 cows and 22% calves.

In November 2005 a moose composition survey was conducted in the Snake and Stewart River drainages in Unit 22C and 110 moose were classified. The survey resulted in a bull: cow ratio of 27 bulls:100 cows. The high bull cow: ratio is encouraging because it is an indicator that the harvest quota of 40 bulls, imposed in the fall of 2005, had a positive effect. The 2005 survey yielded 39 calves:100 cows and 24% calves.

Unit 22D. In November 2003 we flew composition surveys in the Kougarok and Noxapaga Rivers within the 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 in 2003 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. The management goal for the area is 30 bulls: 100 cows. We found 15 calves:100 cows which is similar to calf:cow ratios documented in this area since 2000.

In November 2004 we repeated the survey and found 30 bulls:100 cows (n=73) and a higher proportion of medium and large bulls. The increase in bull:cow ratios in 2003 and 2004 was an encouraging sign that may indicate improving long-term health and stability of the population. The survey found 9 calves: 100 cows and 7% calves.

The November 2005 composition survey completed in the same area found 20 bulls:100 cows (n=145) and 21% calves. The bull:cow ratio could be low because moose were widely dispersed during the survey and large bulls located in habitat along the upper portion of drainages were probably missed. It is possible that increased bull: cow ratios documented in 2003 and 2004 played a positive role in the increased percentage of calves documented during the 2005 survey (Table 2).

A November 2003 survey of the American 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.

<u>Spring</u>. We completed short yearling recruitment surveys in several areas of Unit 22 during the reporting period. In 2003 we completed spring surveys in portions of the Unalakleet, Shaktoolik, Ungalik, Golsovia, and Pikmiktalik River drainages in Unit 22A. In Unit 22B we completed surveys in portions of the Niukluk River drainage, and in Unit 22D we completed surveys in portions of the Kougarok, Kuzitrin, and Agiapuk River drainages. In 2004 we completed short yearling recruitment surveys in a portion of the Koyuk river drainage in Unit 22B. Results of all short yearling recruitment surveys are found in Table 4.

Unit 22A. Spring surveys completed during 2003 found significantly fewer moose than surveys completed in 2000. In 2003 staff observed and classified 79 moose in the Unalakleet, Shaktoolik, Ungalik, Golsovia, and Pikmiktalik River drainages compared to surveys in the same area completed in 2000 when staff observed 179 moose. Excluding the Golsovia River drainage, the decline in moose observed during spring surveys supports department and local beliefs that the area’s moose population continued to decline during the reporting period.

Unit 22B. In 2003 a spring survey was completed in a portion of the Niukluk River drainage. The survey found 65 moose and a 9% recruitment rate. There has been a significant decline in moose observed in spring surveys since 1991, when 349 moose were classified. However, low recruitment rates have changed little and remained between 7%-10% during surveys completed from 1991-2003.

A survey completed in a portion of the Koyuk River drainage in 2004 found 66 total moose and an 18% recruitment rate. There has been a significant decline in moose observed in spring surveys since 1999 and 2000, when 229 and 242 moose were observed, respectively. Recruitment rates in Unit 22B east have fluctuated between 8% and 18% since 1999. The calf: adult ratios found in 2004 and 2005 in the Koyuk River drainage are higher than our previous estimates in 1999 and 2000, and higher than calf: adult ratios found in adjoining areas. Although this is a hopeful sign, the recruitment rate is still probably too low to sustain the population given the abundance of bears and wolves in the area.

Unit 22D. In 2003 we completed spring surveys in several areas of Unit 22D. We found 328 total moose and 16% recruitment in the upper portions of the Kuzitrin and Noxapaga River drainages, and in the Kuzitrin River below the bridge we classified 103 moose and found 15% calves. We found 320 total moose and 23% calves in a portion of the Agiapuk River drainage.

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 2003–2004 seasons and bag limits were unchanged from 2002–2003 in the previous reporting period. In 2004-2005 changes were implemented in Units 22A, 22B, 22C and 22D.

2003–2004 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 one 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 one side		1 Nov–31 Dec

2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Remainder of Unit 22B	10 Aug–23 Sep	
Residents: 1 antlered bull by registration permit only; or		
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 one side		1 Sep–14 Sep
Unit 22D, that portion within the Kougarok, Kuzitrin and Pilgrim River drainages	20 Aug–14 Sep	
Residents: 1 antlered bull by registration permit only; or		
1 bull by registration permit only	1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season
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	20 Aug–14 Sep	
Residents: 1 antlered bull by registration permit only; or		
1 bull by registration permit only	1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season

2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
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 one side		1 Sep–14 Sep
Unit 22E		
Residents: 1 antlered bull	1 Aug–31 Dec	
Nonresidents:		No open season

2004–2005 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22A, that portion north of and including the Tagoomenik and Shaktoolik River drainages Residents: 1 bull	1 Aug–30 Sep	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least one side		1 Sep–14 Sep
Unit 22A, that portion in the Unalakleet River drainage and all drainages flowing into Norton Sound north of the Golsovia River drainage and south of the Tagoomenik and Shaktoolik River drainages Residents: 1 bull	15 Aug–25 Sep	
Nonresidents:		No open season

2004–2005 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Remainder of Unit 22A		
Residents: 1 bull; or	1 Aug–30 Sep	
1 antlered bull	1 Dec–31 Dec	
Nonresidents: 1 bull with 50-inch antlers or with 4 or more brow tines on at least one side		1 Sep–14 Sep
Unit 22B, that portion east of the Darby Mountains, including the drainages of the Kwiniuk, Tubutulik, 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 one side		1 Nov–31 Dec
Remainder of Unit 22B		
Residents: 1 bull by registration permit only; or	10 Aug–23 Sep	
1 antlered bull by registration permit only	1 Jan–31 Jan	
Nonresidents:		No open season
Unit 22C		
Residents: 1 bull by registration permit only; 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 one side		1 Sep–14 Sep

2004–2005 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22D, that portion within the Kougarok, Kuzitrin and Pilgrim River drainages Residents: 1 antlered bull by registration permit only; or 1 antlered bull by registration permit only	20 Aug–14 Sep 1 Jan–31 Jan (Season may be announced by emergency order)	
Nonresidents:		No open season
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 bull by registration permit only; or 1 bull by registration permit only	20 Aug–14 Sep 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 one side, by registration permit only		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 (EO)</u>.

In November 2003 the Board of Game (BOG) made changes in moose regulations in Units 22A, 22B, 22C, and 22D, effective in regulatory year 2004–2005. In Unit 22A seasons were shortened and three hunt areas with differing seasons and bag limits were established to take into account the different hunting patterns in different parts of the unit. 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 one antlered bull. The nonresident season was shortened 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 are no longer necessary. The bag limit was changed from one bull to one 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 one registration permit which will be valid in four 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 we issued an emergency order that closed the winter moose season in Unit 22A north of the Golsovia River drainage, shortened the winter season by one month to 1 – 31 Dec in the remainder of Unit 22A, and changed the bag limit to one 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 antlered bulls in Unit 22B and 3 antlered bulls in 22D southwest.

In September 2004, the department issued an EO that closed fall registration moose hunt RM840 in western Unit 22B. The hunt was closed 10 days early to prevent overharvest of the 23 bull moose quota.

In September 2004, the department issued an EO that closed fall registration moose hunt RM840 in the Kuzitrin River drainage in Unit 22D. The registration hunt had a harvest quota of 33 bull moose, which was close to being reached with several days left in the season. The EO was issued to prevent overharvest.

In January 2005, the department issued an EO that closed winter registration moose hunt RM849 in western Unit 22B. The registration hunt had a harvest quota of 7 antlered bull moose, which was close to being reached with several weeks left in the season. The EO was issued to prevent over harvest.

In April 2005, the department issued an EO that created a uniform 2–week, 1–14 September hunting season along all areas of the Nome road system in registration hunt RM840. This action was intended to avoid overharvest and reduce hunting pressure in the areas where serious concerns about declining moose populations exist.

In November 2005 the board made four changes in Unit 22 moose regulations, effective in regulatory year 2006-2007: 1) the moose season was closed in the portion of Unit 22A, in the Unalakleet drainage and all drainages flowing into Norton Sound north of the Golsovia River drainage and south of the Tagoomenik and Shaktoolik River drainages; 2) in Southern Unit 22A the winter moose season was changed from the month of December to the month of January; 3) in eastern Unit 22B a nonresident drawing hunt for moose was established with up to 10 permits available; and 4) the moose season was shortened to 1-14 September in western Unit 22B, 22D Kuzitrin and 22D SW to create a uniform 2–week season in all areas adjacent to the Nome road system.

Hunter Harvest. Harvest report data from the 2003-2004 season shows that 587 hunters harvested 196 moose (182 males, 12 females and 2 unknown). A harvest of 192 moose (179 males and 13 females) was reported taken by 530 hunters during the 2004–2005 season (Table 1).

In 2003 and 2004 moose harvests and success rates were slightly higher than during the previous reporting period, but harvest remained well below harvest levels seen in the 1980s and 1990s. Declining numbers of moose have resulted in shortened seasons and harvest quotas in many parts of the unit, which have reduced harvest in recent years.

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 2004 household surveys were conducted in St Michael and Shaktoolik. St Michael residents reported harvesting 5 moose during the 2003 regulatory year and hunters had a 27% success rate. Shaktoolik residents reported harvesting 10 moose and the hunter success rate was 26%. Forty percent of the harvest in St Michael (2 moose) and 20% of the Shaktoolik harvest (2 moose) were reported by harvest ticket. In June 2005 harvest surveys were conducted in Unalakleet and Koyuk. Survey results for Unalakleet show 8 moose were taken during the 2004 regulatory year, one of which was harvested in the Yukon River drainage outside of Unit 22; 50% of the harvest (4 moose) was reported by harvest ticket. Koyuk residents reported a harvest of 27 moose of which 26% (7 moose) was reported by harvest ticket.

In 2003–2004, 6% (12 cows) of the reported harvest was cows and in 2004–2005 cow harvest was 7% (13 cows) of the total harvest (Table 1). Ninety-two 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, public comments indicate that illegal cow harvest may be more common in southern Unit 22A than indicated by survey results.

Harvest surveys in previous years have shown that more cows are harvested than are reported by harvest ticket, particularly in Unit 22D Remainder, where cow harvest is legal in December.

Permit Hunts. Two registration permit hunts for antlerless moose are administered in Unit 22C. Hunt RM850 occurs in the Nome and Snake River drainages with up to 5 available permits. RM852 occurs in the remainder of Unit 22C and up to 15 permits may be available. During this reporting period all permits were issued for both hunts. In 2003 2 cows and 1 bull were harvested in RM850, and 9 cows were harvested in RM852. In 2004 4 cows were taken in RM850 and 8 cows were harvested in RM852 (Table 5).

Since 2002 registration moose hunts with harvest quotas have been in place in the heavily hunted portions of Units 22B and 22D along the Nome road system. In 2003 registration hunt RM846 in Unit 22B west of the Darby Mountains was combined with RM856, which included the Kuzitrin River drainage in Unit 22D and Unit 22D SW, to establish RM847; this simplified permit requirements (Table 5). Although combined under one permit, there continued to be separate season dates and harvest quotas for the three areas. In 2003 a total of 349 people reported hunting in RM847 and 80 moose were harvested (78 bulls and 2 unknown). In Unit 22B west, 153 hunters harvested 41 bulls out of a 42 bull quota. In Unit 22D, Kuzitrin, 176 hunters harvested 37 bulls, exceeding the 33 bull harvest quota by 4 moose. In 22D SW 48 hunters harvested 2 moose out of an 8 bull quota.

In 2003 winter registration hunt RM848 was replaced by RM849 which has a 1–31 January season in Unit 22B west and a January “may be announced” season in Unit 22D Kuzitrin and 22D SW. In 2003 in Unit 22B west 12 hunters harvested 7 moose from a 10 moose quota. In Unit 22D SW no one reported hunting and 0 moose were taken from a 3 moose quota. No winter season was announced for Unit 22D Kuzitrin because the fall quota was exceeded.

In 2004 a registration hunt for bull moose was established in Unit 22C so that all parts of the Nome road system could be included in one registration hunt, RM840, which replaced RM847 (Table 5). Separate season dates and harvest quotas were retained in the four hunt areas (Unit 22B west, Unit 22C, Unit 22D Kuzitrin and Unit 22D SW). In 2004 a total of 435 people reported hunting in RM840 and 122 moose were harvested (121 bulls and 1 cow). In Unit 22B west the overall harvest quota was reduced from 48 bulls to 30 bulls with 23 bulls allotted to the fall RM840 hunt. In Unit 22B west 120 hunters harvested 27 bulls, exceeding the quota by 4 bulls. In Unit 22C there was no quota and 206 hunters took 52 bulls. In Unit 22D Kuzitrin 138 hunters harvested 40 bulls, exceeding the quota by 7 bulls and in 22D SW 53 hunters filled the 8 bull quota.

In the January 2004 registration hunt RM849 12 hunters harvested the quota of 7 antlered bulls in Unit 22B west. No winter season was announced in Unit 22D (Table 5).

In 2004 nonresident registration moose hunt RM842 began in Unit 22D Remainder. Six permits were issued, 5 nonresidents hunted and 4 bulls were taken (Table 5).

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. 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. Unit 22 residents accounted for 84% of the harvest in 2003-2004 and 78% of the harvest in 2004–2005 (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% to 74%. The 2002 regulatory changes that closed nonresident seasons in large parts of the unit and established harvest quotas tend to discourage nonlocal hunters from flying to Unit 22 and are probably responsible for the decrease in nonlocal harvest. The nonresident portion of the harvest continued to decrease during this reporting period, accounting for 5% of the harvest in 2003 and 9% in 2004, compared to 10%–15% 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 (74%), and August 12%. In October moose season was open only 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.

Data from community-based harvest assessment in Koyuk, Shaktoolik, Saint Michael, 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 previously highest in March, but the season now closes 31 December (Georgette 2001) and the majority of Unit 22E harvest is now reported primarily in December and September. 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).

Transport Methods. During this reporting period 39% of successful moose hunters used four wheelers, 24% used boats, 18% used highway vehicles and 9% used snowmachines (Table 8). Only 3% 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 four-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 radio collar 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

In 2004 we began conducting moose browse surveys in Unit 22 as a first step to help determine whether habitat limitations are contributing to the long-term decline of moose populations in parts of the unit. Tom Paragi from the Fairbanks Fish and Game office trained Nome staff to assess habitat using transects to: 1) categorize shrub architecture to estimate the proportion of shrubs that exhibit a "broomed" growth form caused by repeated heavy browsing; and 2) categorize shrub health to estimate the proportion of the plants that have more dead stems than live biomass. The percentage of browsed plants that are broomed ("brooming index") can be compared to percentages obtained from moose ranges in other parts of Alaska where correlations have been made between the brooming index and forage removal, moose density and productivity (twinning rates) for the purpose of assessing resource limitation (Seaton et al. *In Press*).

In March 2004 we conducted browse transect surveys in Unit 22C (Paragi 2004) and in August 2004 we ran transects in western Unit 22B and in the Kuzitrin drainage in Unit 22D. Results are summarized in Table 9. Our overall impression after sampling in the Snake, Nome, Flambeau, Fish and Kuzitrin River drainages is that although moose have substantially influenced shrub architecture on the central Seward Peninsula, shrubs generally appeared to be sustaining a compensatory response to browsing pressure without substantial shrub mortality.

The broomed index calculated from Seward Peninsula transects ranged from 46.7 in Unit 22B to 69.5 in Unit 22D. The central Seward Peninsula range is clearly more affected by moose browsing than areas of Unit 18 (lower Yukon and Kuskokwim Rivers), where brooming indices were 0-28 among four sampling areas with relatively low moose density (Paragi 2002). Seward Peninsula brooming indices were less than that of the Tanana Flats and foothills of central Unit 20A (77 [73-81]), where forage removal was 42.5% [40.8-44.1) and twinning rate averaged only 6% (Seaton et al. *In Press*), signaling resource limitation. Brooming indices found on the Seward Peninsula were most comparable to the eastern portion of Unit 19D (64, [60-68]), where forage removal was 18.9% of current annual growth, moose twinning rates were 45% (Seaton et al. *In Press*) and resource limitation is not considered to be a significant limiting factor for moose.

While these results suggest that resource limitation is not currently a driving factor in moose population dynamics in Units 22B, 22C and 22D, further investigation is recommended.

During August 2005 the Department conducted a moose browse assessment survey along the Unalakleet River in Unit 22A (Persons 2005). The results are summarized in Table 9.

The survey found the overall impact of browsing on shrubs by moose in the Unalakleet River drainage to be less than in other parts of Unit 22 where similar surveys have been conducted. Of the 859 live shrubs sampled, 55.3% were browsed and the brooming index was 19.3. Also, a significant portion (not quantified) of the browsed shrubs observed were browsed many years ago, perhaps when moose numbers peaked in the Unalakleet drainage. Recently browsed shrubs accounted for a relatively small portion of the sample. Nowhere did we find recent browsing activity that appeared to be responsible for shrub mortality.

The Unalakleet River moose range is clearly less affected by moose browsing than other areas sampled in Unit 22. The survey found no evidence to suggest that winter browse availability is currently limiting moose numbers in the Unalakleet River drainage.

Enhancement

There were no habitat enhancement activities conducted in Unit 22 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Efforts initiated during the previous reporting period to determine a cause for the high incidence of tooth breakage in Seward Peninsula moose have not reached a conclusion. Hypotheses that attributed tooth breakage to fluorosis or excessive levels of lead and zinc were not supported by laboratory analysis. Currently Dr. Larry Gough (U.S. Geological Survey, Reston, VA) is investigating cadmium levels in Seward Peninsula moose after his research team found elevated levels of cadmium in some Seward Peninsula willow species that are commonly browsed by moose. During this reporting period we provided his team with kidneys and jaws from 12 hunter-killed moose taken in Units 22B, 22C and 22D. Laboratory analysis is ongoing.

CONCLUSIONS AND RECOMMENDATIONS

The moose population on the Seward Peninsula grew steadily in size 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 7,000–10,000 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 and 22B, 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 currently exceeding recruitment and that populations are declining.

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. Other factors, including a population dominated by older cows, frequent severe winter snow conditions, and factors resulting in periodontal disease may be acting in combination to lower productivity and produce calves that are less vigorous at birth with subsequent lowered survival (Persons 1998). Some or all of these factors may influence recruitment in other parts of the unit. Additionally, during the last 10 years, wolf numbers have increased on the Seward Peninsula since Western Arctic herd caribou began wintering there.

Moose browse surveys initiated during this reporting period in Units 22A, 22B, 22C and 22D suggest that current browse availability and condition are unlikely to be limiting the unit's moose population. However, browse transect data alone provide insufficient evidence to discount the possibility that habitat limitations may be a factor. If funding permits, we recommend that other indices of resource limitation, such as obtaining weights of short-yearlings or determining browse removal rates or twinning rates, be applied in Units 22B, 22C and 22D.

In November 2003 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 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.

In November 2005 (after the reporting period) the board implemented additional restrictions to further protect declining populations. In the central portion of Unit 22A the moose season was closed at the request of the Southern Norton Sound Advisory Committee. In western Unit 22B, Unit 22D Kuzitrin and Unit 22D SW the moose season was shortened to 1–14 September to create a uniform 2 week season in all areas adjacent to the Nome road system. In eastern Unit 22B a nonresident drawing hunt for moose was established with up to 10 permits available. The public is well aware of declining moose numbers and played an active role in developing all regulations adopted by the Board. While the uniform 2 week season along the Nome road system is likely to be a good strategy for a time to come, it will be important to continue work with the public in Unit 22A to develop a plan for reestablishing a limited hunt in Central Unit 22A as the moose population grows.

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 overutilization of the limited winter habitat. The 2004 moose census showed the area's population has stabilized at 530 moose and is close to our management goal of 450–525 moose.

The department has amended the spring census schedule in response to declining moose populations in Unit 22. A stratified moose census is completed in each of the units once every 3 years and future censuses are scheduled as follows:

2006 – Units 22D/E; 2007 – Units 22B/C; 2008 – Units 22A; and 2009– Units 22D/E.

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

PERSONS, K. AND T. GORN. 2006. Unit 22 moose management report. Pages 514–542 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 22 historical moose harvest by sex, hunter effort, and success rate for regulatory years 1969–1970 through 2004–2005

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
2003-2004	182	12	2	196	587	33
2004-2005	179	13	0	192	530	36

[a]Minimum known number of hunters.

TABLE 2 Summary of Unit 22 spring moose censuses, 1987–2005

Area	Year	Size (mi^2)	Census estimate (Nr.)			Density ($Nr./mi^2$)		Calves per 100 Adults	Percent calves	Census method
			Adults	Calves	Total	Adult	Total			
Unit 22A Unalakleet Drainage	1989	1124	273	52	325	0.24	0.29	19	16	Gasaway
Unit 22A Unalakleet Drainage	2003	2000	71	11	75	0.04	0.04	15	15	Geostatistical
Unit 22A Unalakleet Drainage	2005	2400	113	10	123	0.05	0.05	9	8	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	Mod. 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 22B West	2004	2400	529	53	586	0.22	0.24	10	9	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	Mod. Gasaway
Unit 22C	2001	1368	413	139	557	0.30	0.41	34	25	Geostatistical
Unit 22C	2004	1368	442	102	530	0.32	0.39	23	19	Geostatistical
Unit 22D Kuzitrin Drainage	2002	1456	911	114	1028	0.63	0.71	13	11	Geostatistical
Unit 22D Kuzitrin Drainage	1988	1456	1673	278	1951	1.14	1.34	17	14	Gasaway
Unit 22D Kuzitrin Drainage Reduced	1993	856	943	153	1096	1.10	1.28	16	14	Mod. Gasaway
Unit 22D Kuzitrin Drainage	1997	1456	1019	232	1251	0.70	0.86	23	19	Mod. Gasaway
Unit 22D Agiapuk Drainage	1988	1041	782	159	941	0.75	0.90	20	17	Gasaway
Unit 22D Agiapuk Drainage Reduced	1993	723	406	77	483	0.56	0.66	19	16	Mod. Gasaway
Unit 22D Agiapuk Drainage	1997	1041	451	127	578	0.43	0.56	28	22	Mod. Gasaway
Unit 22D Agiapuk Drainage	2002	1041	485	82	567	0.47	0.54	17	14	Geostatistical
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 2000–2005

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	11	59	66
Golsovia River	2003	50	67	8	31	18	26
Unit 22B							
American Creek	1992	58	10	4	10	38	42
	1994	28	28	8	18	37	45
Niukluk River	2000	27	8	7	6	108	115
	2001	30	14	8	10	73	81
Koyuk River	2004	12	0	0	0	56	56
Unit 22C							
Snake River	1992	11	30	11	21	41	52
	1994	14	32	12	22	42	54
	2000	10	25	16	19	69	85
Snake/Stewart Rivers	2001	25	21	24	15	140	164
	2002	24	43	32	26	93	125
	2004	11	31	28	22	101	129
	2005	27	39	26	24	84	110
Unit 22D							
Henry/Washington Ck.	1994	40	23	22	14	133	155
Kougarok/Noxapaga	2000	16	11	19	9	197	216
	2001	15	19	16	14	98	114
	2003	26	15	24	10	208	232
	2004	30	9	5	7	68	73
	2005	20	33	31	21	114	145
American River	2000	44	23	43	14	275	318
	2001	30	6	5	4	107	112
	2003	24	27	40	18	183	223

TABLE 4 Unit 22 short yearling recruitment surveys, spring 1991–2005

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
2004	12	54	66	18
2005	13	89	102	13
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	16
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 2003–2004 and 2004-2005

Reg Year	Hunt	Total moose killed	Males killed	Females killed	Unknown killed	Total permittees reporting	Hunted	Did not hunt
2003	RM850	3	1	2	0	6[a]	5	1
2003	RM852	9	0	9	0	15	15	0
2003	RM847	80	78	0	2	508	352	156
2003	RM849	7	7	0	0	22	15	7
2004	RM850	4	0	4	0	6[a]	5	1
2004	RM852	8	0	8	0	15	14	1
2004	RM840	122	121	1	0	525	435	90
2004	RM842	4	4	0	0	6[a]	5	1
2004	RM849	7	7	0	0	14	12	2

[a] An additional permit was issued due to a returned permit.

TABLE 6 Residency and success of moose hunters in Unit 22, regulatory years 2003–2004 and 2004–2005

Regulatory	Residency of successful hunters					Residency of unsuccessful hunters				
Year/Unit	Local[a]	Nonlocal[b]	Nonresident	Unknown	Total	Local[a]	Nonlocal[b]	Nonresident	Unknown	Total
2003–2004										
22A	13	1	3	0	17	58	3	8	1	70
22B	47	6	4	0	57	123	17	2	3	145
22C	50	6	0	0	56	114	11	2	0	127
22D	48	7	3	0	58	146	18	1	6	171
22E	6	0	0	2	8	9	1	0	0	10
22 unknown	0	0	0	0	0	10	0	0	0	10
Total	164	20	10	2	196	460	50	13	10	533
2004–2005										
22A	2	0	3	5	10	1	1	3	11	16
22B	41	2	10	1	54	76	20	0	0	96
22C	54	10	0	0	64	114	7	0	0	121
22D	46	5	4	1	56	71	16	1	0	88
22E	6	1	0	1	8	4	0	0	0	4
22 unknown	0	0	0	0	0	43	1	0	0	44
Total	149	18	17	8	192	309	45	4	11	369

[a] Resident of Unit 22

[b] Other Alaska resident

TABLE 7 Chronology of Unit 22 moose harvest, regulatory years 2003–2004 and 2004–2005

Regulatory year/ Unit	Month of harvest								
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Unknown	Total
2003–2004										
22A	5	11	0	0	0	0	0	0	0	16
22B	6	39	0	3	0	6	0	0	0	54
22C	0	55	1	0	0	0	0	0	0	56
22D	10	39	3	0	2	2	1	0	0	57
22E	0	0	1	1	5	0	0	1	0	8
22 Unknown	0	0	0	0	0	0	0	0	5	5
Total	21	144	5	4	7	8	1	1	5	196
2004–2005										
22A	2	7	0	0	0	1	0	0	0	10
22B	12	25	0	10	0	6	0	0	0	53
22C	0	64	0	0	0	0	0	0	0	64
22D	10	42	3	0	1	0	0	0	0	56
22E	0	7	0	0	1	0	0	0	0	8
22 Unknown	0	0	0	0	0	0	0	0	1	1
Total	24	145	3	10	2	7	0	0	1	192

TABLE 8 Means of transportation reported by successful Unit 22 moose hunters, regulatory years 2001-2002 through 2004-2005

Regulatory Year/Unit	Aircraft	Horse	Boat	3 or 4 Wheeler	Snowmobile	Off-road vehicle	Highway vehicle	Air boat	Unknown	Total
<u>2001–2002</u>										
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
<u>2002–2003</u>										
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
<u>2003–2004</u>										
22A	1	0	8	8	0	0	0	0	0	17
22B	0	0	22	15	10	1	6	0	3	57
22C	0	0	10	24	0	2	20	0	0	56
22D	3	0	16	26	5	0	6	1	1	58
22E	1	0	0	0	7	0	0	0	0	8
Total	5	0	56	73	22	3	32	1	4	196
<u>2004–2005</u>										
22A	0	0	4	4	1	0	1	0	0	10
22B	7	0	14	18	10	0	4	0	1	54
22C	0	0	4	26	0	4	28	0	2	64
22D	1	0	12	30	1	2	6	2	2	56
22E	0	0	4	2	1	0	1	0	0	8
Total	8	0	38	80	13	6	40	2	5	192

TABLE 9 Categorization of browse shrub architecture and health of moose winter range in parts of Unit 22, 2004 and 2005

Area	Date	n[a]	% unbrowsed	% browsed by moose	Broom index[b]	% browsed by hare	% none dead	% less dead	% more dead	Average Nr. dead[c]
22A Unalakleet	Aug 2005	859	24.3	55.3	19.3	6.7	3.8	90.7	5.5	0.41
Unit 22C	Mar 2004	960	7.6	32.6	64.7	0	1.1	87.0	11.9	0.44
22B Fish/Niukluk	Jun 2004	531	8.7	47.5	46.7	2.2	0	96.4	3.6	0
22D Kuzitrin	Jun 2004	545	4.5	29.0	69.5	.2	.4	92.1	7.5	0

[a]Number of shrubs categorized along linear transect, across all transects in count area.

[b]Index is proportion of shrubs receiving any browsing that were broomed ((broomed / [browsed + broomed])* 100), by respective herbivore.

[c]Average number of dead shrubs encountered during the course of getting 30 live shrubs to evaluate.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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 Alaska resident (nonlocal) and nonresident hunters who live outside this unit. 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 had been growing throughout the region. Severe winters and extensive spring flooding occurred during 1988–1991. Many adult moose starved, and at least 2 cohorts of calves appeared weak. These factors, combined with predation by grizzlies and wolves, likely caused moose populations to stabilize or decline throughout the Kotzebue Basin. From the mid 1990s through this reporting period calf recruitment throughout most of the unit has been low and, as a result, moose density has reached low levels in large portions of the unit.

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, Kobuk, Selawik and Northern Seward Peninsula drainages through aerial surveys.

- 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

During this reporting period population trend and sex/age composition data were collected through aerial moose censuses using the geospatial technique (Kelly and DeLong 2006). No fall moose censuses were conducted during this reporting period because of poor survey conditions. Four moose censuses were conducted in Unit 23 since the last report was prepared:

1. That portion of Unit 23 west of and including the Buckland River drainage (April 2004).

2. That portion of the Noatak drainage below and including the Kaluktavik drainage combined with that portion of the Squirrel drainage above and including its North Fork drainage (April 2005; cooperative project with NPS and the Bureau of Land Management).

3. That portion of the Kobuk drainage below and including Kobuk Valley National Park; however, the area above the North Fork of the Squirrel River was excluded from this census (March 2006; cooperative project with NPS, BLM and U.S. Fish and Wildlife Service).

4. That portion of the Kobuk drainage above and including the Shungnak and Pick drainages (April 2006; cooperative project with NPS).

In defining geospatial moose census areas within Unit 23 we excluded only high alpine areas (typical of sheep habitat) and very large lakes. We included large areas of open tundra as well as the headwaters of rivers and creeks, even though such areas are obviously poor moose habitat. We do this because at densities as occurred during the late 1980s moose commonly use these areas. Even now at much lower densities a few moose still use these poor to marginal habitats. An inclusive approach that includes all potential moose habitat facilitates maintaining consistent census areas through time. For the lower Kobuk moose census in March 2006, we excluded sample units from the census area if >75% of the area was at >1500 ft. elevation. In all other moose censuses we subjectively excluded sample units from the census if they consisted of steep alpine habitat or were within a large lake.

In addition to moose censuses, I conducted qualitative aerial fall classification flights in the western half of Unit 23 during October-early December 2004 and 2005 to 1) learn about the fall distribution of moose to facilitate future fall censuses, and 2) determine bull:cow and calf:cow ratios as red flags for potential biological problems. I attempted to maximize the number of moose classified each day. I did not identify count areas during these flights and searched areas at low intensity (~2-6 min/mi^2). I covered a broad range of habitat types from riparian corridors to treeline but moved quickly through areas where I saw few moose or moose tracks. I searched the Noatak drainage below and including the Nimiuktuk drainage; the main stem of the lower Kobuk drainage; the main stem of the Squirrel drainage; the Kiana and Selawik Hills; the Selawik drainage below and including the Purcell Mountains; and most drainages on the Northern Seward Peninsula, over the course of each year. All areas searched during fall 2004 were searched during fall 2005. Weather was poor during fall 2004 so I only covered that portion of the Kobuk River from the delta to Kiana. In 2005, I searched the Kobuk River from the delta to Kavet Creek. In 2004 I was unable to cover the Goodhope or Cripple drainages; in 2005 I covered the Goodhope drainage. I estimated the proportion of the total population classified during these fall classification surveys using appropriate spring census results.

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" in this unit report refers to all hunters who reside outside Unit 23, including those who reside outside Alaska, and "local hunter" refers to residents of Unit 23.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Spring geospatial censuses of large areas (4000-6000 mi^2) indicate Unit 23 moose densities are currently $\geq$0.1–0.6 adult moose/mi^2 (Table 1). We have not applied a sightability correction factor (SCF) to any geospatial moose census conducted in Unit 23. As a result we have undoubtedly underestimated densities to some degree. Sightability of moose in fall (October–December) geospatial censuses has been examined using radiocollared moose in 3 areas of forest-shrub habitat in Interior Alaska (Boertje, unpublished data). At search intensities of $\geq$6 min/mi^2, approximately the same intensity used during Unit 23 geospatial censuses, the SCF was 1.07 in the central foothills of the Alaska Range, where estimated density was ~5 moose/ mi^2. The physiography of this area is similar to many portions of Unit 23. The mean SCF for 3 geospatial censuses in a 500-mile area surrounding McGrath (density~1 moose/mi^2) was 1.26. Sightability of moose is probably somewhat better in Unit 23 than in the Interior because forested areas are less prevalent in northwestern Alaska, the canopy is less well developed where forests do occur, and spring censuses probably afford maximum sightability because snow cover is complete and moose tend to be concentrated in riparian corridors. These differences preclude applying the SCFs determined in Boertje's study to Unit 23 geospatial results. However, Boertje's results are consistent with those reported by Gasaway et al. (1986) that under typical survey conditions sightability of moose is never 100%. Given the relatively low density of moose throughout Unit 23, we feel that slightly conservative estimates of moose afford a small measure of additional protection for these populations.

Even though we have likely underestimated moose densities in Unit 23 to some degree, the large disparity in density between Unit 23 and other portions of Alaska (Hicks 1998) suggest these differences are real and not an artifact of conservative estimates here. Of course, within this unit localized densities reach much higher levels in preferred habitat than the 0.1-0.6 moose/ mi^2 reported for large areas here. Riparian areas in the Kobuk Delta and near Kiana have higher density and higher calf recruitment than other portions of the unit (Table 1). The Mulgrave Hills, upper Squirrel drainage and northern portion of the Selawik Hills also have high, localized densities of moose on a seasonal or even annual basis. This uneven distribution of moose within the unit is important in several ways: First, not surprisingly, hunters and commercial operators focus their efforts on these high-use areas during the fall hunting season so guides and hunters often have an inflated opinion of overall moose densities throughout the unit. Second, it is probably misleading to concentrate survey efforts on high-use areas to monitor abundance of moose throughout the unit. Census areas should contain a mix of habitat types and qualities representative of the overall area. Finally, heavy, localized harvest of moose in fall concentration areas has the potential to affect abundance and sex/age ratios of moose in much broader areas during other times of the year.

Problems with interpreting Unit 23 moose census data from 1992-2000 have been reported previously (Dau 2004). In 2001 the Alaska Department of Fish and Game (ADF&G) adopted the geospatial technique to census moose over large areas (i.e., 4000-6000 mi^2) to minimize these difficulties in Unit 23. Covering large census areas minimizes the effects of snow-induced movements of moose on density estimates and ensures that a representative range of habitat types and conditions are included in census areas. The geospatial technique has proven to be much more ‘user-friendly’ and better able to accommodate temporary weather delays than the Gasaway technique.

We now have completed at least 2 geospatial censuses in each of 3 large census areas within the unit: 1) northern Seward Peninsula drainages, 2) lower Noatak-upper Squirrel drainages, and 3) upper Kobuk drainages (Table 1). In each of these areas moose density has been low and stable. Calf recruitment may be beginning to improve in portions of the unit although additional censuses are needed before any trend becomes clear.

Residents of Unit 23 have long reported that moose move near villages to escape wolves and bears. Initially, I dismissed these reports because I thought the din of human activity and occasional harvest would discourage moose from doing so. In virtually every census we’ve conducted our observations have been consistent with those public reports. There have been more moose and disproportionately more calves within 5 miles of villages than in areas farther away. Protection from predators afforded by communities may partially explain the high density and high calf ratio in the lower Kobuk drainage as well. The Kobuk delta is poor habitat for black and brown bears and the high level of snow machine activity there during winter probably keeps wolf numbers low.

During this reporting period we continued to receive reports from the public that moose density is very low on the Seward Peninsula, especially in the Buckland drainage (L. Hadley, personal communication), in the upper Kobuk drainage (G. Bamford, personal communication) and in the upper Noatak drainage (S. Kantner, personal communication). These reports are consistent with my opportunistic observations.

Population Composition

As previously reported (Dau 2004), spring recruitment rates have generally been low throughout Unit 23 since the late 1990s (Table 1). Public reports and my opportunistic observations suggest parturition rates have been high, and I have observed far more twins since 1998 than prior to that time. Bear predation on neonates is likely contributing to low recruitment of moose.

Moose classification flights conducted during late fall 2004 and 2005 suggest that there is no biological problem with bull:cow ratios in this unit (Table 2). The spatial pattern of bull:cow ratios was surprisingly consistent between 2004 and 2005. Additional surveys may reveal whether this pattern is real or merely coincidence. Conceptually, as the percentage of a moose population classified increases, ratio estimates should approach actual population levels regardless of how the moose were located, if no factions of the population were disproportionately missed. Of course, the problem with unstructured classification flights is that it is never possible to evaluate that assumption. Two ways to minimize this problem are to 1) observe a large proportion of the moose population each year, and 2) consistently collect data through time to evaluate trends vs. the ratios *per se*. Advantages of unstructured classification flights are: 1) a large air force is not required to collect a substantial amount of composition data – this minimizes complex logistics, reduces dependency on charter operators and other agencies, and substantially reduces cost; 2) you see far more moose/hr of flight time compared to any type of spatial sampling technique; 3) you have the flexibility to go where weather and snow conditions are best so can make the most of flyable weather; 4) you can collect composition information in multiple drainages each year (in Unit 23, fall weather and snow conditions only rarely allow even a single large, rigorous census to be completed); 5) you can collect data even during very short (i.e., 1-day) periods of favorable weather (large censuses are usually not initiated until the forecast for favorable weather is $\geq$3-4 days long); and 6) they provide other information relevant to management of moose (e.g. the distribution of predators and alternative prey). Of course, there are serious disadvantages associated with unstructured classification flights as well: 1) they never produce estimates of abundance; 2) they do not provide confidence intervals around ratio estimates; and 3) they are vulnerable to bias attributable to spatial variation in population composition.

Development of the Gasaway census technique in the mid 1980s caused most biologists throughout the state to forgo less rigorous techniques, such as trend counts and classification surveys, to monitor moose populations. Subsequent experience showed that the 2000-mi^2 limitation on maximum size of Gasaway census areas was a serious shortcoming of this technique. Even now, with development of the geospatial technique that is more user-friendly and capable of covering large census areas, weather, availability of staff and airplanes, and funding preclude conducting large-scale, rigorous censuses as frequently as we would like. For these reasons, no fall moose composition data was collected in Unit 23 during 1999-2003. Even with all of its disadvantages, fall moose composition data from unstructured flights is beneficial, especially given its low cost, as long as abundance can be estimated from spring censuses.

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 (e.g. movement to traditional rutting areas during fall and the tendency for moose to 'yard up' during periods of deep snow).

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
2003-2004		
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 one 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 one side		1 Sep–15 Sep
Remainder of Unit 23 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 one side		1 Sep–20 Sep

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
2004-2005		
Unit 23 north of and including the Singoalik River drainage: One antlered moose with 50-inch antlers or antlers with 4 or more brow tines on one side	1 Sep–20 Sep (general hunt)	1 Sep–20 Sep (general hunt)
One antlered moose by registration permit only; however, antlerless moose may be taken from 1 Nov–31 Dec; calves and cows with calves may not be taken	1 Jul-31 Dec (registration hunt)	
Remainder of Unit 23: One antlered moose with 50-inch antlers or antlers with 4 or more brow tines on one side	1 Sep–20 Sep (general hunt)	1 Sep–20 Sep (general hunt)
One antlered moose by registration permit only; however, antlerless moose may be taken from 1 Nov–31 Dec; calves and cows with calves may not be taken	1 Aug-31 Dec (registration hunt)	

Board of Game Actions and Emergency Orders. The board reauthorized antlerless moose seasons for the 2003-2004 and 2004–2005 regulatory years. At their November and December 2003 meetings 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 in 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 7 nonresident drawing permit hunts for moose with boundaries corresponding to existing Guide-Outfitter Areas; these hunts went into effect in September 2005.

4. Established a registration permit hunt for resident hunters beginning during the 2004-2005 regulatory year; the season is 1 Aug-31 Dec and the bag limit is 1 bull; however, antlerless moose can be taken 1 Nov-31 Dec; permits are only issued in person within Unit 23 during 1 June-15 July.

5. Restricted the general season and bag limit for resident hunters beginning during the 2004-2005 regulatory year; the season is 1-20 September and the bag limit is 1 bull with 50-inch or 4+ brow tine antlers.

These regulations were established in response to low numbers of moose and consistently low calf recruitment in large portions of Unit 23.

Moose hunting in that portion of Unit 23 SW of and including the Buckland drainage was closed by Emergency Order 05-04-03 during 16 August-30 November 2003 and 1 January-31 March 2004 in response to low numbers of moose. Emergency Order 05-04-04 closed moose hunting in that portion of Unit 23 west of and including the Buckland and Kauk drainages during 16 August-30 November 2004.

Hunter Harvest. Community-based harvest assessments indicate approximately 400-425 moose are harvested annually by residents of Unit 23 (Table 3). This is approximately the upper range of the Unit 23 'Amount Needed for Subsistence' level of 325-400 moose annually (ADF&G Subsistence Division, unpublished data). The community-based estimate of moose harvest is substantially higher than the 37 and 50 moose unit residents reported through the statewide harvest ticket system in 2003-2004 and 2004–2005, respectively. We think harvest ticket and registration permit data are reasonably accurate for nonlocal hunters based on observations by Department of Public Safety staff when checking hunters' licenses and tags. Combining harvest ticket data for nonlocal hunters (143 moose in 2003-2004 and 116 moose in 2004-2005) with community harvest assessments for local hunters (mean harvest of 412 moose annually) indicates the total annual moose harvest in Unit 23 was roughly 555 moose during 2003-2004 and 528 moose during 2004-2005.

All community-based estimates of moose harvests in Unit 23 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 harvests during 1979–1994 (Figure 3) as the result of increased caribou availability during that time.

There has been no trend in the total moose harvest from harvest ticket data since the late 1970s (Table 4; Figure 1). Total harvest has varied substantially from year to year throughout this period, though, probably at least in part due to weather and economic factors. In contrast, the total number of moose hunters generally increased from the late 1970s through this reporting period. The exception to this was 1978-1979 when an unusually high number of local hunters reported hunting moose (Figures 1 and 3). This increase in local moose hunters may have been associated with the decline of the Western Arctic Caribou herd in the early to mid 1970s. As the number of moose hunters slowly increased but harvests remained flat, success rates slowly declined (Figure 4). As in the past, the reported harvest of female moose was small during 2003-2004 and 2004–2005 in terms of absolute numbers (11 and 0 females reported taken, respectively; Table 4), and in relation to total harvest (6% and 0% of the total harvest in 2003-2004 and 2004-2005, respectively).

The decline in moose harvests that occurred in the Noatak drainage from 1988-1989 through 2001-2002 appears to have reversed (Fig 2). Hunter numbers in the Kobuk and Selawik drainages remained near the upper range of previous levels during this reporting period. The Selawik drainage is roughly half the size of the Kobuk or Noatak drainages, and much of the Selawik drainage is open tundra. As a result, this concentrates both moose and hunters in riparian corridors and in the lake-dominated flats northeast of the Selawik Hills. Even so, at this time there is no evidence that moose sex or age ratios are skewed against old bulls in the Selawik drainage. Also, because most nonlocal hunters use the upper reaches of the Selawik and Tagagawik drainages, while hunters from the community of Selawik use the lower section of these rivers, user conflicts have been mainly limited to disruption of subsistence hunters by numerous, low-flying airplanes transporting hunters. Numbers of moose hunters remained low and stable in the Wulik/Kivalina drainages and in northern Seward Peninsula drainages.

<u>Permit Hunts</u>. The resident moose registration permit hunt, RM880, went into effect during the 2004-2005 regulatory year. The BOG established RM880 as one component of a suite of changes intended to incrementally reduce the harvest of moose in Unit 23 (other changes established nonresident moose drawing permit hunts, restricted resident antlerless hunts, and shortened the resident general season). This gave residents of Alaska 2 options for hunting moose in Unit 23:

	Season	Bag Limit
General Hunt	1–20 Sep	1 bull with >50” or 4-brow-tine antlers
Registration Hunt (RM880)	1 Aug–31 Dec (1 Jul–31 Dec northwest of and including the Singoalik drainage)	1 bull; however, 1 moose of either sex may be taken 1 Nov–31 Dec

In order to participate in RM880, hunters must register to hunt in person within Unit 23 during the period 1 June–15 July. Harvest data indicate this change reduced the harvest of moose by nonlocal resident hunters: the mean annual nonlocal resident moose harvest during 1999-2000 through 2003-2004 was 59 moose per year, and in 2004-2005 it was 35 moose. In contrast, the number of moose taken by residents of Unit 23 may have increased: 50 moose were reported taken by residents of Unit 23 during 2004-2005 while the 5-year mean from 1999-2000 through 2003-2004 was only 32 moose/year. It is not clear whether this constituted an actual increase in the local moose harvest during 2004-2005, or if merely more hunters complied with license and reporting requirements as a result of the heightened awareness of this hunt.

Most local resident moose hunters (89%) participated in RM880 (Table 5). In contrast, most nonlocal resident moose hunters (88%) hunted under the general hunt. Patterns in moose harvest by hunt type were similar: 82% of the local resident moose harvest was through RM880 while only 8% of the nonlocal resident harvest occurred under this hunt.

Hunter Residency and Success: Numbers of nonresident and nonlocal Alaska resident moose hunters continued to increase during this reporting period ($R^2 = 0.91$; 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., 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.

The number of Unit 23 resident moose hunters declined from the late 1970s to mid 1990s, rapidly at first and then very slowly, reportedly as caribou availability increased with growth of the Western Arctic herd. From 1994-1995 through 2003-2004 the number of local moose hunters slowly edged up; then, during the 2004-2005 regulatory year, this number exhibited a modest spike. This increase during 2004-2005 probably did not reflect an actual, abrupt increase in local effort to harvest moose. Instead, increased awareness of moose regulations associated with establishment of RM880 may have merely improved compliance with license and tag requirements. The general trend toward a slow increase in number of local moose hunters may be real, though. Results of community harvest assessments suggest moose harvest ticket data should be viewed with caution as it is likely incomplete.

From 1977-1978 through 1994-1995 nonresident hunters generally had a higher success rate than local or nonlocal resident hunters. This is probably because nonresident hunters are typically highly motivated to take a moose and because they are more likely to hire a guide than resident hunters. Since 1994-1995 there has been no clear difference in success among nonresident, nonlocal resident and local resident moose hunters (Fig 4). Success rates have slowly trended down for each of these groups of hunters since 1977-1978.

Recent widespread use of float-equipped airplanes by transporters, greater use of 4-wheelers by guides and 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 the supply and demand for transporter services by nonlocal hunters means Unit 23 could experience rapid and substantial increases in numbers of nonlocal hunters if transporter services suddenly increase. This could reduce the quality of hunting in Unit 23, intensify conflicts among user groups, and increase moose harvests.

Harvest Chronology. As in the past, during this reporting period the majority of moose were harvested in September. 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 resident general season, and bulls have completely developed antlers free of velvet. In 2003-2004, 82% of the reported harvest occurred during September, and in 2004–2005 this percentage was 85%. Nine and 8% of the total harvest was taken during August during these regulatory years, respectively.

Transport Methods: Airplanes continued to be the primary mode of transportation for most hunters who reported hunting moose in Unit 23 (Table 6). Fifty-nine percent of all hunters reported using airplanes to access moose hunting areas during each regulatory year in this reporting period. 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 snow machines while most nonlocal hunters at least initially access hunting areas using airplanes. Given the low level of local compliance with reporting requirements, harvest data probably overestimate hunters' reliance on airplanes and underestimate their use of boats and snowmachines.

Other Mortality

From 1992–1997 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. We did not collar cows <24 months old and we did not deploy collars annually so the age structure of the collared sample of moose was older than the overall population. This probably caused us to slightly overestimate adult cow mortality.

HABITAT

Assessment

Moose habitat was not formally evaluated by ADF&G in Unit 23 during this reporting period. In summer 2005 a department biologist with experience evaluating use of willow (*Salix* spp.) by moose floated and hiked extensively in the Squirrel drainage and reported willows did not appear to be overused by moose (T. Paragi, 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 described previously (Dau 2002).

CONCLUSIONS AND RECOMMENDATIONS

I recommend the department:

1. Census large areas (4,000–10,000 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, 4) lower Kobuk-lower Squirrel drainage, and 5) northern Seward Peninsula.
3. Incorporate trend information into census point estimates as soon as possible.
4. Supplement spring moose censuses with low-intensity fall classification surveys to monitor distribution of moose and 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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Please cite any information taken from this section, and reference as:

DAU, J. Unit 23 moose management report. Pages 543–565 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

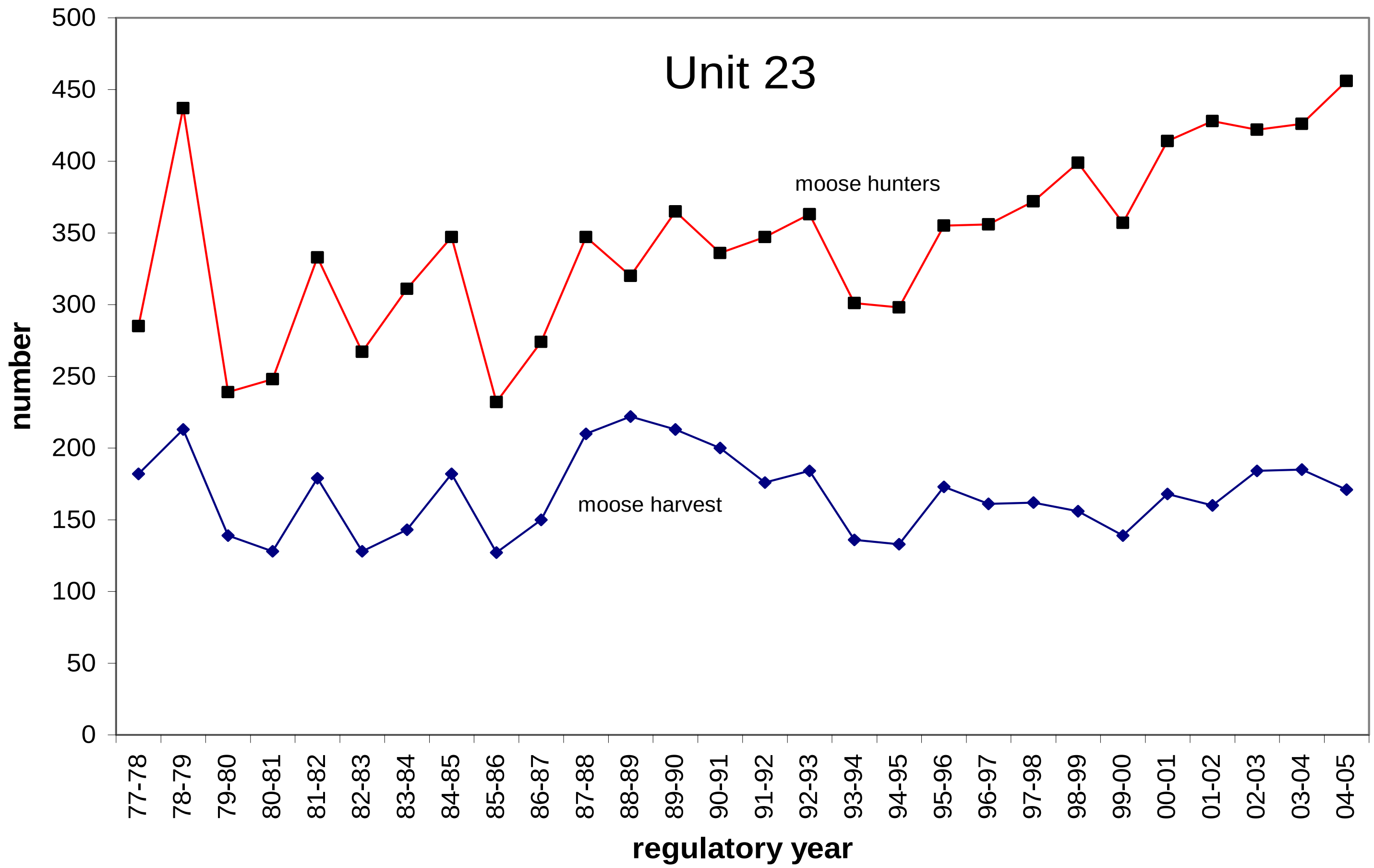

FIGURE 1 Unit 23 moose hunters and harvests reported through the statewide harvest ticket system, 1977–1978 through 2004-2005

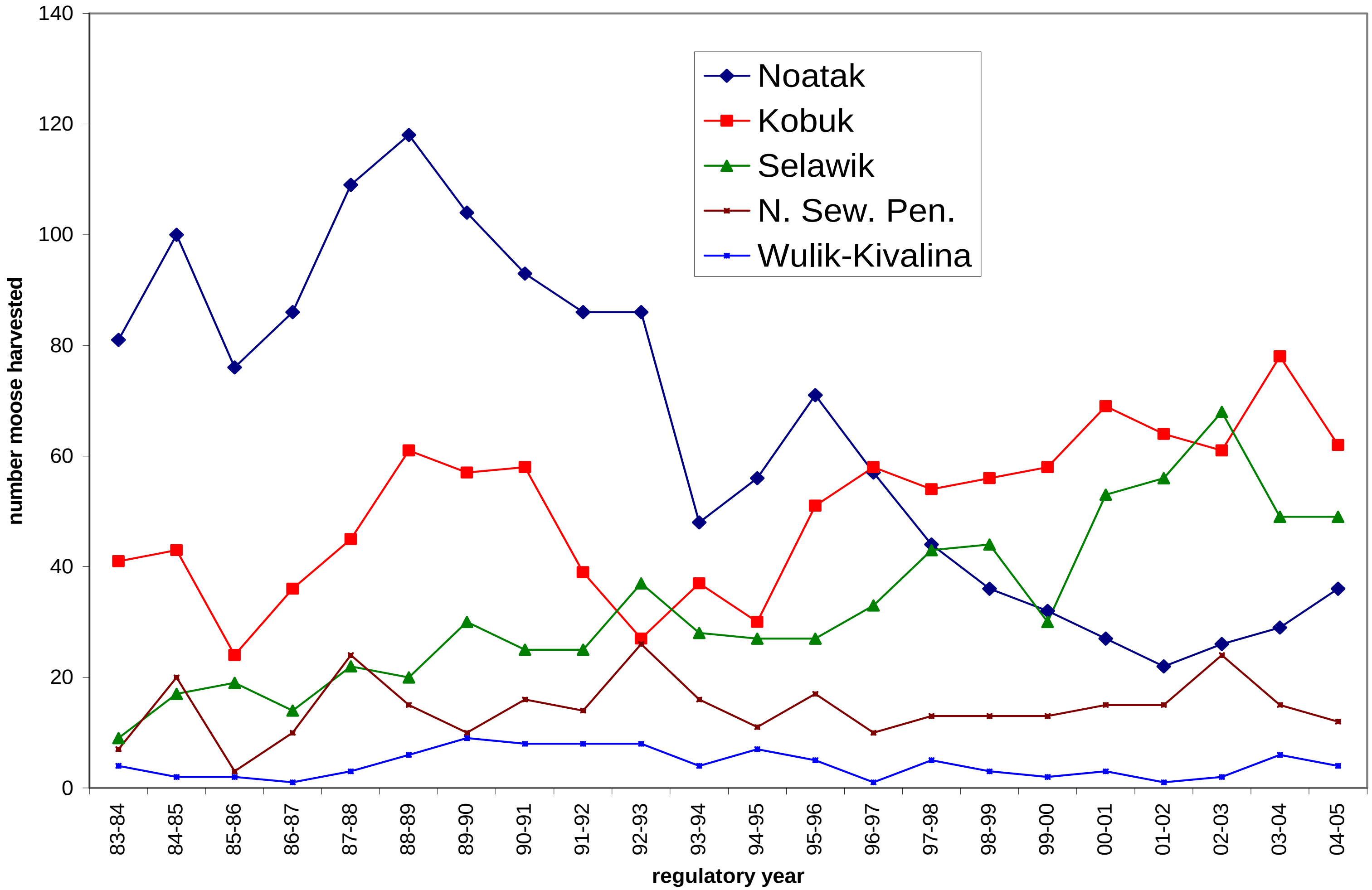

FIGURE 2 Unit 23 moose harvest by drainage (statewide harvest ticket data), 1983–1984 through 2004-2005

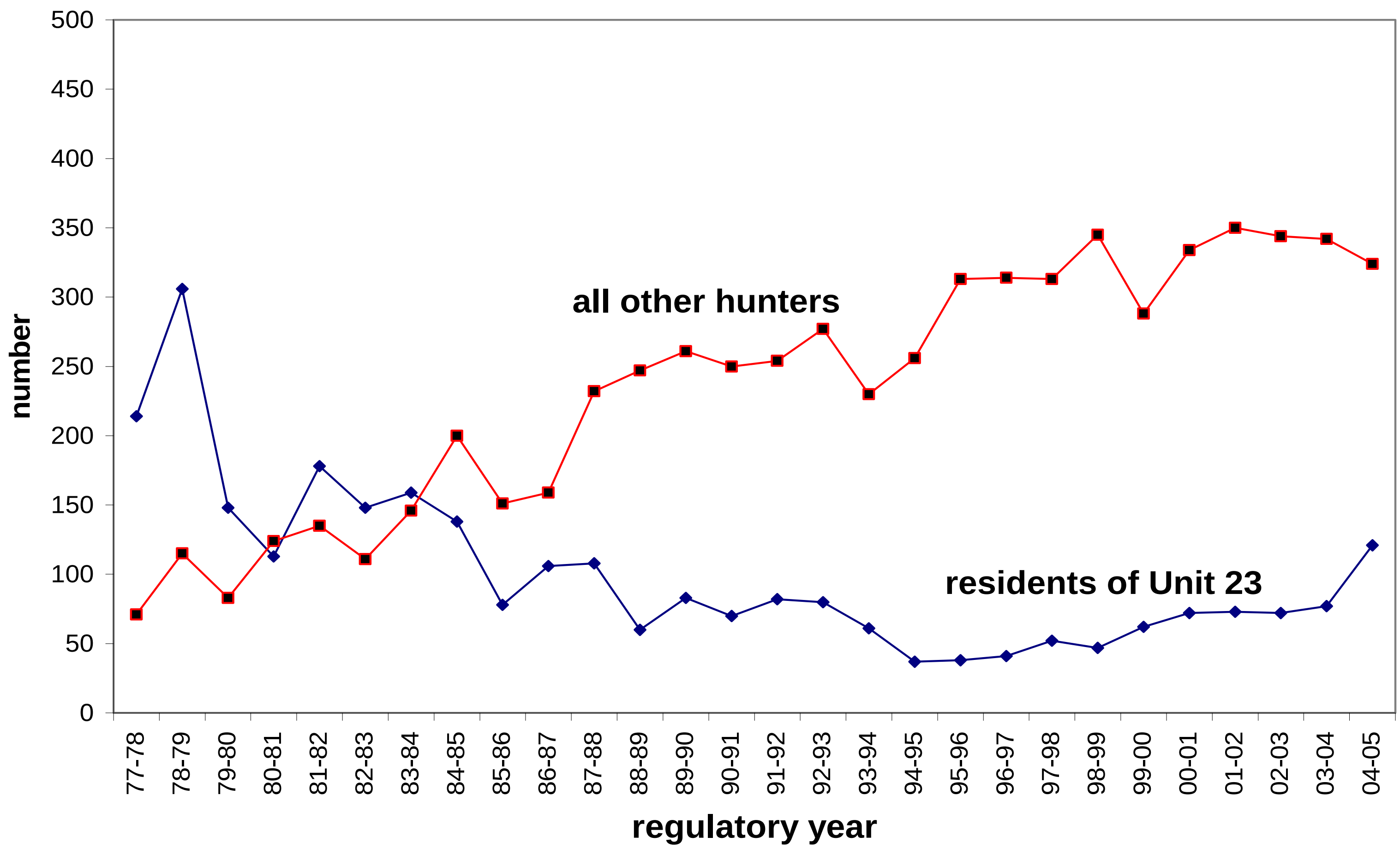

FIGURE 3 Numbers of Unit 23 moose hunters by residence (harvest ticket data), 1977–1978 through 2004-2005

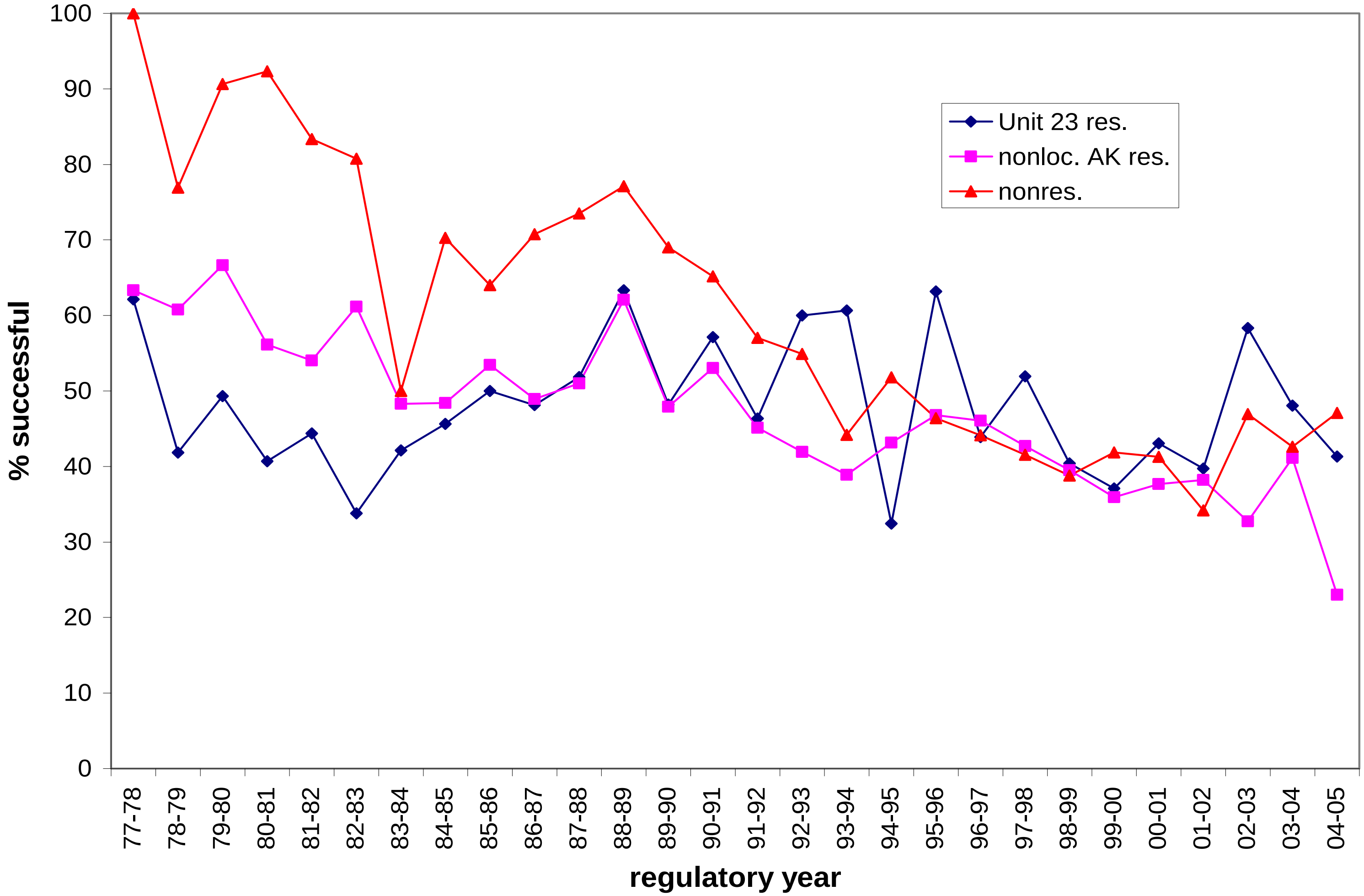

FIGURE 4 Unit 23 moose hunter success by residence (harvest ticket data), 1977–1978 through 2004-2005

TABLE 1 Unit 23 spring moose censuses, 1997–2006

Area	Year	Size (mi^2)	Census estimate (Nr.)			Density ($Nr./mi^2$)		Calves:100 Adults	Method
			Adults	Calves	Total	Adult	Total		
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	Geospatial
Lower Noatak	2000	2111.2	710	59	779	0.34	0.37	8	Geospatial
Lower Noatak	2001	2111.2	1325	130	1453	0.63	0.69	10	Geospatial
Lower Noatak-up. Squirrel	2001	5230.2	1580	151	1731	0.30	0.33	10	Geospatial
Lower Noatak-upper Squirrel	2005	5349.7	1630	208	1838	0.30	0.34	12	Geospatial
N. Seward Pen.	2002	5888.5	576	38	614	0.10	0.10	7	Geospatial
N. Seward Pen.	2004	5882.9	724	86	810	0.12	0.14	12	Geospatial
Up. Kobuk	2003	4001.5	765	91	856	0.19	0.21	12	Geospatial
Up. Kobuk	2006	4001.5	653	96	737	0.16	0.18	15	Geospatial
Lower Kobuk-lower Squirrel	2006	4870.5	2891	511	3398	0.59	0.70	18	Geospatial

TABLE 2 Late fall (October-early December) moose classification counts from western portions of Unit 23, 2004-2005 (approximate percentage of total estimated population reported in Table 1 that was classified shown in parentheses of 'total' column)

Area	Sp-Fk bull	Med. bull	Large bull	C w/0 ca	C w/1 ca	C w/2 ca	C w/3 ca	Lone calf	Total	Bulls:100 Cows	Calves:100 Cows
2004											
Lower Noatak-up. Squirrel	14	48	84	287	29	4	0	0	503 (27)	46	12
N. Sew. Pen.	7	10	24	105	19	1	0	0	187 (23)	33	17
Lower Kobuk-low. Squirrel	23	40	27	208	84	9	0	2	495 (15)	30	35
Selawik	25	45	36	227	30	4	0	0	405 (42)	41	15
Total	69	143	171	827	162	18	0	2	1590	38	20
2005											
Lower Noatak-up. Squirrel	14	73	64	244	31	7	0	0	478 (26)	54	16
N. Sew. Pen.	10	43	46	243	34	3	0	0	419 (52)	35	14
Lower Kobuk-low. Squirrel	29	105	76	481	187	15	1	2	1116 (33)	31	32
Selawik	31	73	57	326	61	6	0	1	628 (66)	41	19
Total	84	294	243	1294	313	31	1	3	2641	38	23

TABLE 3 Estimated moose harvest in Unit 23 villages from community harvest estimates (Subsistence Division unpublished data, except as noted)

Village	Year of survey	Mean pop. in survey years	Mean # moose reported harvested	Per capita moose harvest	Estimated village pop. in 2000	Estimated annual moose harvest in 2003-2005
Ambler[c]				0.082	309	26
Buckland [d]	1996	318			406	41
Deering	1994	148	15	0.10	136	14
Kiana	1999	388	8	0.02	388	8
Kivalina	1982 1983 1992	295	10	0.03	377	12
Kobuk[c]					109	9
Kotzebue	1986 1991	3165	150	0.05	3082	146
Noatak	1994 1999 2001	404	3	0.01	428	3
Noorvik[c]	1996 2002	583	47	0.08	634	51
Point Hope[d]	1992	685	14	0.02	787	16
Selawik	1999	772	64	0.08	772	64
Shungnak	1998	248	21	0.08	256	22
Total					**7684**	**412**

[a] estimated from Shungnak 1998 data
[b] estimated from Deering 1994 data
[c] Noorvik IRA, unpublished data
[d] North Slope Borough, unpublished data

TABLE 4 Number of moose hunters by residency and success, and moose harvests by sex for Unit 23, 1981–1982 through 2004-2005

	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
1981–1982	178	87	48	20	333	179	154	54	163	15	1
1982–1983	148	85	26	8	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	182	165	52	162	17	3
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	0
1987–1988	108	100	132	7	347	210	137	61	194	15	1
1988–1989	60	116	131	13	320	222	98	69	207	15	0
1989–1990	83	119	142	21	365	213	152	58	200	11	2
1990–1991	70	115	135	16	336	200	136	60	185	14	1
1991–1992	82	133	121	11	347	176	171	51	143	33	0
1992–1993	80	155	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	146	110	5	298	133	165	45	127	6	0
1995–1996	38	188	125	4	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	47	162	183	7	399	156	243	39	146	8	2
1999-2000	62	128	160	7	357	139	218	39	127	11	1
2000-2001	72	162	172	8	414	168	246	41	157	11	0
2001-2002	73	157	193	5	428	160	268	37	150	9	1
2002-2003	72	165	179	6	422	184	238	44	172	11	1
2003-2004	77	180	162	7	426	185	241	43	174	11	0
2004-2005	121	152	172	11	456	171	285	38	171	0	0

TABLE 5 Numbers of resident Alaskan moose hunters and harvests in Unit 23 by hunt type and location of residence, 2004-2005

	General Hunt	RM880	Total
Hunters:			
Residents of Unit 23	17	104	121
Nonlocal AK residents	133	19	152
Total	150	123	273
Moose harvest:			
Residents of Unit 23	9	41	50
Nonlocal AK residents	31	4	35
Total	40	45	85

TABLE 6 Number of moose hunters by transportation type in Unit 23, 1987-1988 through 2004-2005

Year	Airplane	Boat	Snow machine	Horse/dog team	3- or 4-wheeler	Off-road vehicle	Highway vehicle	Airboat	Unk.	Total hunters
1987-1988	165	93	25	0	21	0	4	0	39	347
1988-1989	207	63	13	1	13	0	1	0	22	320
1989-1990	229	89	16	1	7	0	2	0	21	365
1990-1991	224	61	19	0	10	1	1	0	20	336
1991-1992	231	65	28	2	7	0	3	0	11	347
1992-1993	248	63	23	1	7	0	3	0	18	363
1993-1994	193	72	17	0	9	1	2	0	7	301
1994-1995	191	74	13	2	5	1	4	0	8	298
1995-1996	240	77	11	0	16	0	1	0	10	355
1996-1997	234	77	20	1	16	0	2	0	6	356
1997-1998	250	74	19	2	13	0	2	0	12	372
1998-1999	289	76	10	1	11	1	0	0	0	388
1999-2000	245	78	18	2	11	0	2	0	0	356
2000-2001	262	115	17	3	7	1	2	2	11	414
2001-2002	282	117	14	0	7	1	2	1	4	428
2002-2003	273	118	13	1	6	0	2	4	5	422
2003-2004	252	150	7	3	3	2	2	0	7	426
2004-2005	267	161	13	0	8	0	1	0	6	456

WILDLIFE

MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

LOCATION

GAME MANAGEMENT UNIT: 24 (26,068 mi^2) (24A = 4,146 mi^2, 24B = 13,523 mi^2, 24C = 3,049 mi^2, 24D = 5,350 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 and aquatic vegetation in summer and fall. 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 River 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

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the reporting period.

(CUA), the Koyukuk CUA and the Kanuti CUA, restrict use of aircraft for moose hunting activities. The Dalton Highway Corridor Management Area (DHCMA) prohibits use of off-road vehicles and firearms for hunting within 5 miles on either side of the Dalton Highway, except for federally qualified rural residents. Access to portions of the unit increased with the opening of the highway in 1981.

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 moose, but did not exceed 100 moose until 1980. Unreported harvests during this period probably were 160–300 moose per year (Woolington 1998). 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 (TCA) 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 in the TCAs at a rate of approximately 5 min/mi^2 to ensure reasonably high sightability, 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 or Global Positioning System units. Surveys were typically 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 or the northern TCAs in 2006 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, a survey of 1949 mi^2 in the southern portion of Unit 24 in 2001 (Bryant and Stout 2003), and in 2004 surveys of 1843 mi^2 and 11,494 mi^2 in the southern and northern portions of Unit 24 respectively (Lawler et al. 2006). Data from those surveys were analyzed using the Geospatial 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 (~5.5 mi^2 in size), with search intensity of ~6 min/mi^2.

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 lead to underestimating twinning rates.

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 reporting system using harvest tickets, 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., RY04 = 1 Jul 2004–30 Jun 2005).

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. 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, Fairbanks) 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. Public meetings were hosted by the department in January 2004 and October 2005 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. Most often, population size is described using generalities, and trends are discernible only for the few areas surveyed.

During RY03–RY04, 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 began to stabilize from previous high levels in the Dulbi Slough, Huslia River Flats, and Treat

Island areas after 2003–2004 (Tables 1–3). Recruitment parameters were generally higher after RY03; the yearling bull:cow and calf:cow ratios improved from previous surveys but only to levels indicative of population stabilization, not population growth. 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 without sightability correction factors (SCF) (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 RY03–RY04 management report (Stout 2004), the Unit 24 population estimate of 9000 moose ±1500 (10,500–7500) was based on population estimation surveys (Martin and Zirkle 1996; Huntington 1998; Woolington 1998; Stout 2004), 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 were collected over relatively small areas within the unit.

Recent surveys helped refine the overall estimate within Unit 24 (Table 8). From the 2004 GSPE survey conducted in the area from Dulbi Slough and the lower Huslia River up to the lower Hogatza River, we calculated an estimate of 3181 moose ±148, not including a sightability correction factor, over the 1843-mi^2 survey block within the Koyukuk CUA. That estimate was lower than reported in Stout (2004). I estimated densities on the upper Huslia, upper Dakli, upper Indian and upper Hogatza River drainages were 0.25 moose/mi^2 based on stratified sample units that were considered habitat with low moose density in the 2001 survey.

For the Unit 24 portion of Zone 1 (Unit 24D), I estimated 4058 ± 400 moose in the 5350-mi^2 area. This area of analysis was 654 mi^2 larger in size than previously reported and is contiguous with the Unit 24D boundary. In Zone 2 (Units 24A, 24B, and 24C), the estimate for the 2004 GSPE survey block of 11,494 mi^2 was 2805 ± 629 moose, not including a sightability correction factor. The 2004 survey covered 3104 mi^2 of area not surveyed in 1999. Most of the additional survey area was in the Gates of the Arctic National Park, which eliminated the need to extrapolate data from Unit 23 (Lawler et al. 2003). I estimated 158 ± 100 moose (0.05 moose/mi^2) in the remaining 3150 mi^2 of Unit 24 that provides little moose habitat in the highest elevations of the Gates of the Arctic National Park. For the remaining 6074 mi^2 of Zone 2, I estimated 1063 ± 250 moose (0.175 moose/mi^2), which includes all of Unit 24C, and the relatively sparsely occupied habitats in Units 24A and 24B that were not part of the 2004 survey. Therefore, the total Unit 24 population was estimated to be 8084 moose ±1500 (6584–9584) without an SCF at the end of RY05 (Table 8).

In Zone 1 (Unit 24D), standardizing for area using density, the current estimate of 0.76 moose/mi^2 was slightly lower than the previous estimate of 0.85 moose/mi^2, but the difference could be explained by the variability in survey conditions. In Zone 2 (Units 24A, 24B, and 24C), the current estimate of 4058 was nearly 1000 fewer moose than previous estimates. The decline from 1993 to 2005 is estimated to be 30% to 50% in Zone 2 (Fig. 1), and 12% to 25% in Zone 1 during that same period. However, based on TCA recruitment parameters it appears that the population in Zone 1 began to stabilize about RY04 to RY05, while Zone 2 continued to decline.

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 RY05 were variable.

Bull:cow ratios were generally high in the Huslia River Flats and Henshaw–Peavy Creek TCAs and on the Kanuti Refuge. However, bull:cow ratios in the Dulbi Slough, Treat Island, Kanuti Canyon, and Middle Fork TCAs 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. Therefore, breeding activity was likely normal even in southern Unit 24. Ratios for RY01–RY02 in the Middle Fork TCA were questionable due to small sample size but improved for RY03–RY05. In general, most ratios in the TCAs with counts of less than 100 moose tended to have larger annual variation that made interpretation difficult.

High bull:cow ratios indicate the bull component of the population was not overharvested in any of Unit 24. During RY04–RY06, recruitment parameters for TCAs in Zone 1 indicated the population was producing calves (3-yr avg. = 29.9 calves:100 cows) and recruiting yearlings (3-yr avg. = 10.9 yearling bulls:100 cows) in the range that would be consistent with a stable population. TCA recruitment parameters were consistent with population estimation data, and indicated the population declined through RY03 in Zone 1, but began to stabilize in RY05–RY06, while Zone 2 continued to decline through RY05.

Calf twinning rates in spring 2004 and 2005 suggested improved productivity in Unit 24 (Tables 9–10) in the Huslia Flats–Treat Island–Dulbi Slough TCAs. I believe this improvement was 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 RY02–RY04, I observed no dramatic changes in vegetative characteristics that would account for the apparent improvements in twinning rates. I do not believe a measurable density-dependent effect was acting on the population because twinning rates were only low in RY01, while the moose population maintained relatively high densities.

Distribution and Movements

Little data are available on movements of moose within Unit 24. 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, utilizing 10- to 20-year-old burns, and move into the river bottoms during late winter and summer. In the southern portion of Unit 24, moose appear to occupy the broad riparian habitats year-round with much shorter seasonal migrations.

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
RY03		
Unit 24, that portion within the Koyukuk Control 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 21D, that portion within the Koyukuk Control Use Area; or	5 Sep–25 Sep (General 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 one side by drawing permit; up to 80 permits may be issued in combination with 21D, that portion of the Koyukuk Control 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

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 24, that portion of the North Fork of the Koyukuk River drainage within the Gates of the Arctic National Park.		
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 of the Koyukuk River, except that portion of the John River and North Fork of the Koyukuk River drainages within Gates of the Arctic National Park.		
RESIDENT HUNTERS: 1 moose; however, antlerless moose may be taken only from 21 to 25 Sep.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 from 21–25 Sep and 1–10 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 one side.		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 24, that portion in the Dalton Highway Corridor Management Area.		
RESIDENT HUNTERS: 1 bull by drawing permit; up to 70 permits may be issued in combination with Unit 25A, that portion within the Dalton Highway Corridor Management Area.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 one side		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
RY04–RY06		
Unit 24A, that portion in the Dalton Highway Corridor Management Area.		
RESIDENT HUNTERS: 1 bull by drawing permit; up to 70 permits may be issued in combination with Unit 25A, that portion within	1 Sep–25 Sep	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
the Dalton Highway Corridor Management Area.		
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one 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 Unit 24A.		
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 one side.		5 Sep–25 Sep
Unit 24B all drainages of the Koyukuk river upstream from the Henshaw Creek drainage, excluding the North Fork of the Koyukuk River drainage.		
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 one side.		5 Sep–25 Sep
Remainder Unit 24B.		
RESIDENT HUNTERS: 1 bull.	1 Sep–25 Sep 1 Dec–10 Dec	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side.		5 Sep–25 Sep
Unit 24C, that portion within the Koyukuk Controlled Use Area.		

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
RESIDENT HUNTERS: 1 bull by registration permit only; or	27 Aug–20 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 320 permits may be issued in combination with Units 21D and 24D, those portions within the Koyukuk Controlled Use Area; or	5 Sep–25 Sep	
1 bull.	Dec 1–Dec 10 (Subsistence hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 80 permits may be issued in combination with Units 21D and 24D, those portions within the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Remainder of Unit 24C.		
RESIDENT HUNTERS: 1 bull by registration permit only; or	5 Sep–25 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 450 permits may be issued in combination with Unit 24D outside the Koyukuk Controlled Use Area.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 450 permits may be issued in combination with Unit 24D outside the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Unit 24D, that portion within the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 bull by registration permit only; or	27 Aug–20 Sep (Subsistence hunt only)	
1 bull by drawing permit only;	5 Sep–25 Sep	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
up to 320 permits may be issued in combination with Units 21D and 24C, those portions within the Koyukuk Controlled Use Area; or		
1 bull.	Dec 1–Dec 10 (Subsistence hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 80 permits may be issued in combination with Units 21D and 24C, those portions within the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Remainder of Unit 24D.		
RESIDENT HUNTERS: 1 bull by registration permit only; or	5 Sep–25 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 450 permits may be issued in combination with Unit 24C outside the Koyukuk Controlled Use Area.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 450 permits may be issued in combination with Unit 24C outside the Koyukuk Controlled Use Area.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. Drawing and registration permit hunts continue to be the predominant regulatory feature of Unit 24. Key issues that we attempted to manage with regulation changes were declining bull:cow ratios and even distribution of hunters in Unit 24D. From RY02 to RY05, fall antlerless moose seasons were closed by emergency order due to continued declines in recruitment in Units 24B and 24C, as well as lack of growth in Unit 24D. At the 2006 Board of Game meeting, all antlerless hunts in Unit 24 were eliminated.

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 regulations were designed to improve distribution of hunters around the perimeter of the CUA and to improve success rates of local hunters. It is important for local hunters to have high success rates during the fall hunting seasons so they can 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. The board also split the nonresident portion of the Koyukuk CUA permit allocation, requiring a 50:50 allocation to "guided-only" and "nonguided-only" hunters formerly using the DM827 and DM829 permits.

At the 2006 Board of Game meeting, the board subdivided Unit 24 into 4 units (Units 24A, 24B, 24C, and 24D) and adopted new intensive management objectives for these units. The primary reasons for subdividing Unit 24 were the improved knowledge of the moose population, landownership, the need to develop intensive management objectives that would reflect differences in the moose populations, and differences in hunting patterns in each of the 4 areas. Minor changes to moose regulations were also adopted to correspond to the new units and simplify regulations. Although the initial regulatory workload with the resulting game management unit boundary changes was not unexpected, a substantial workload was incurred to review and update game management unit boundaries on maps in the hunting regulation book and online references, and to review Uniform Coding Units for the statewide harvest database coding.

<u>Hunter Harvest</u>. Hunting seasons in Unit 24 were diverse and reflected various moose densities and consumptive use patterns. Annual reported harvest during RY95–RY04 averaged 180 moose (127–240, Table 11).

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 11). Moose taken during winter were rarely reported, even when the season was open. Some villages have never had a license vendor. This contributed to the problem of hunters hunting without licenses or harvest tickets or permits. Checkstation results, including the meat evaluation survey and the hunter viewing survey, can be found in the RY03–RY04 Unit 21D moose management report (Stout 2006).

<u>Harvest Chronology</u>. Over 95% of reported harvest occurred in the September seasons (Table 12). However, much of the unreported harvest probably occurred during October–March (Brown et al. 2004).

<u>Permit Hunts</u>. 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 RY04 decreased by only 2 permits (<1%) from RY03 and then increased by 16 permits (4%) in RY05 (Table 13). So it appears that use of the RM832 permit has stabilized. Reported use of the registration permit increased among Unit 21D and Unit 24 residents while other Alaska residents' use of the permit was down slightly. Nonlocal use of the RM832 is linked closely to the number of drawing permits. 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 6 drawing hunts, DM823, DM825, DM827,

DM828, DM829 and DM830, in the KCUA and the 2 permits outside the KCUA (DM892, DM896) hunter numbers can be better managed.

Within the DHCMA, drawing permit hunts DM920 and DM922 resulted in a reduction of moose harvested compared to harvest under the general harvest ticket. Average rates for successfully drawing a DHCMA permit were relatively high in RY03–RY05, at 20.2% for DM920 and 38.9% for DM922. However, hunting success rates among the permitted hunters was low at 7.5% north of Slate Creek (DM920) and an average of 14.5% south of Slate Creek (DM922) (Table 14). Hunter comments about the new permit hunts were positive in terms of the aesthetics of the hunt, but often negative among those hunters unable to successfully draw a permit.

<u>Hunter Residency and Success</u>. Based on harvest reports, the average annual number of moose hunters was 377 during RY95–RY04; most hunters were Alaska residents (Table 15). 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 ADF&G/Division of Subsistence surveys (Brown et al. 2004). However, nonresident and nonlocal resident hunter participation that increased steadily beginning the late 1980s appeared to decline after RY01. 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 24 residents not living in a village. Data reported by Anderson et al. (1998) and Brown et al. (2004) was similar to earlier results. The estimated unreported harvest incorporated recent Subsistence Division data, less the reported harvest by Unit 24 residents (Table 11).

Local hunters reported they were unable to meet subsistence needs in the past 3–4 years, and have made several emergency requests for season extensions and additional seasons. Initially, these reports appeared to conflict with reported harvest, which has increased steadily since RY02. However, analysis of nonresident harvest may explain the deficit of local households, because many nonresident hunters donate most of their moose meat to local residents. Brown et al. (2004) reported increased "receiving" rates in years of higher nonresident reported harvest (Table 15). From RY88 through RY99, combined nonresident and local harvest increased steadily ($y = 4.6469x + 45.379$, $R^2 = 0.7382$). During RY97–RY02, Subsistence Division data indicated mostly stable local demand of moose (Brown et al. 2004), which corresponded to a regression line of the reported combined nonresident and local reported moose harvest of nearly zero ($y = 0.3714x + 90.857$, $R^2 = 0.0025$). However, beginning in RY00 when drawing permits limited nonresident hunters, reported combined nonresident and local harvest declined ($y = –5.1429x + 166.14$, $R^2 = 0.4687$). The analysis of combined local resident and nonresident moose harvest indicates local moose needs were increasing about 4.6 moose/year even though village census figures suggest relatively stable populations. If a consistent proportion of nonresident meat was donated annually, it appears there was a decrease of 5.1 moose per year since 2000, suggesting a growing deficit of nearly 10 moose/per year (4.6 moose + 5.1 moose = 9.7 moose). If the converse relationship of local and nonresident harvest explains the deficit of moose needs reported by locals, it has important management implications regarding the issue of reduced nonresident bull harvest, federal cow harvest, and exportation of federally authorized subsistence moose to nonrural residents.

Transportation Methods. In RY03–RY05, 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 16). Highway vehicles were only used on the Dalton Highway where it crosses the eastern part of Unit 24. 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 RY04–RY05 was similar to previous years (Table 16).

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 Unit 24. 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. Two public meetings were hosted by the department, one in January 2004 and the other in 2005, to provide an update on the status of management-related activities outlined in the moose management plan. Participants at the 2005 meeting recommended to the department to extend the active period of the plan through 2007.

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 RY03–RY04.

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. Without current Subsistence Division survey data, it is uncertain whether Unit 24 residents met their wild food requirements, but public comments and regression analysis of harvest data suggest those needs are not being met. Hunting opportunities cannot be expanded for people living outside Unit 24 until moose numbers increase and bull:cow ratios in the KCUA meet objectives of the Koyukuk Moose Management Plan. 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. A population estimation survey should be undertaken in those areas in cooperation with Bureau of Land Management and Koyukuk National Wildlife Refuge when funding is available. A baseline population estimate for the entirety of Unit 24A should be conducted, and low intensity (100 sample units) population estimates of the Kanuti National Wildlife Refuge should be conducted annually in lieu of trend count surveys. High intensity estimation surveys (150–200 sample units) should be conducted every 5 years on the Kanuti National Wildlife Refuge.

For the first goal concerning harvest within sustained yield principles, my estimated population of 8084 moose, not including a sightability correction factor, did not achieve the objective to maintain a population of 10,000–12,000 moose for the third consecutive reporting period. We achieved the objective to provide for an adequate moose harvest without exceeding 360 moose or a 5% harvest rate (RY05 estimated harvest rate = 3.2%). 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 RY03–RY05, but coordination with the U.S. Fish and Wildlife Service concerning monitoring and potential treatment is in progress. The objective of reducing spoiled meat was monitored in RY02–RY05. 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 were collected. Results of the meat salvage and nonconsumptive activities are reported in the Unit 21D moose management report (Stout 2006).

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

STOUT, G. W. 2006. Unit 24 moose. Pages 566–598 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska, USA.

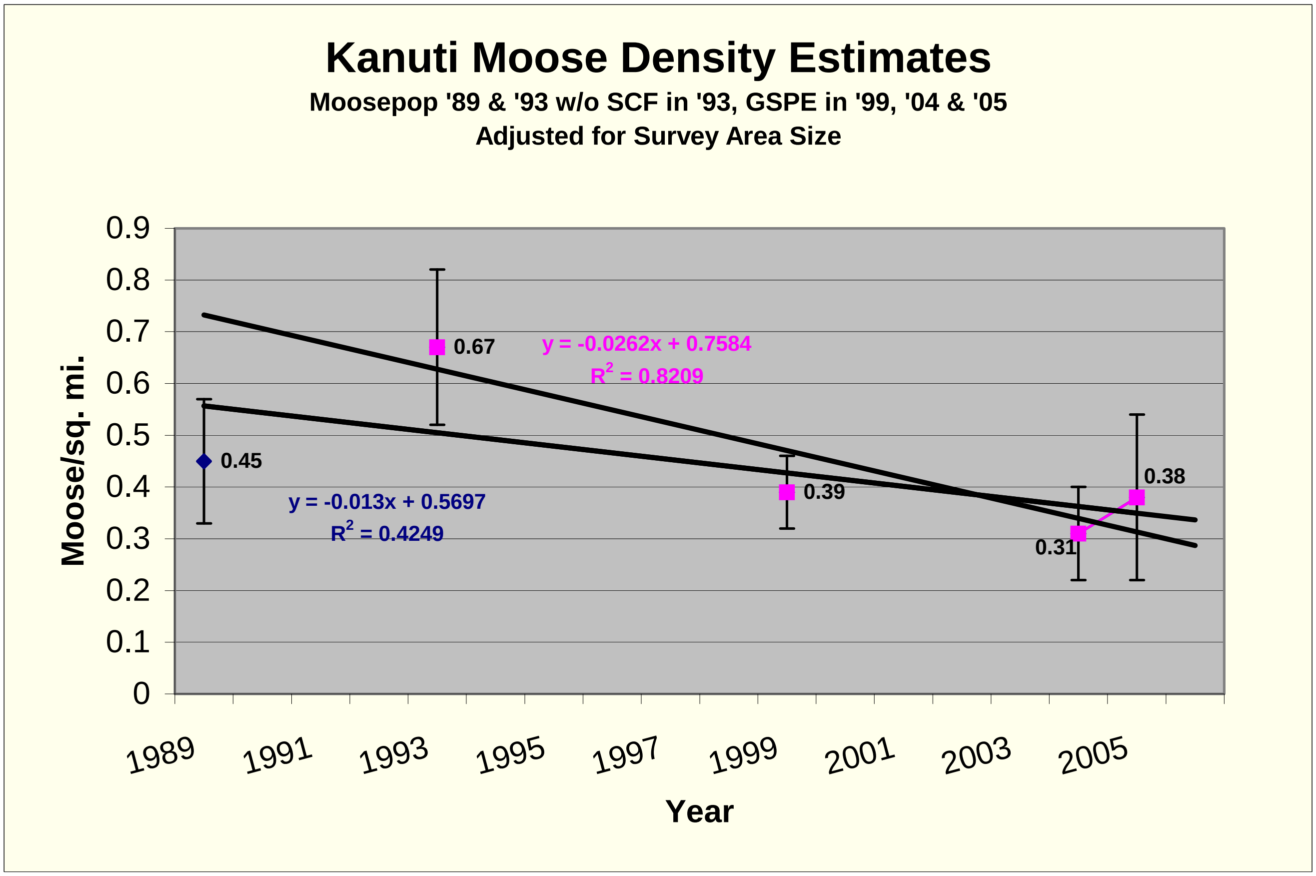

FIGURE 1 Unit 24, Kanuti National Wildlife Refuge moose density estimates and regression lines indicating population decline for regulatory years 1989–1990 through 2005–2006 and 1993–1994 through 2005–2006. Density estimates are used to adjust for different sized survey areas and sightability correction factors were eliminated from regulatory year 1993–1994 estimate, to standardize comparison.

TABLE 1 Unit 24 Dulbi Slough aerial moose composition counts, regulatory years 1982–1983 through 2006–2007[a]

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	132.8	24	8	28	0	18.2	280	2.1
2004–2005	132.8	28	16	40	11	23.7	389	2.9
2006–2007[b]	149.4	23	7	53	15	30.1	436	2.9

[a] Data reported prior to 2001 used Gasaway sample units, beginning in 2001 surveys used GeoSpatial Population Estimator sample units.
[b] Low snow year.

TABLE 2 Unit 24 Huslia River Flats aerial moose composition counts, regulatory years 1983–1984 through 2006–2007[a]

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	125.9	38	9	16	0	10.0	603	4.79
2003–2004	136.8	36	10	29	4	17.7	623	4.55
2004–2005	142.3	38	16	33	7	19.1	768	5.40
2005–2006	142.3	31	14	23	4	15.0	752	5.29
2006–2007[b]	142.3	40	12	37	11	20.8	811	5.70

[a] Data reported prior to 2001 used Gasaway sample units, beginning in 2001 surveys used GeoSpatial Population Estimator sample units.
[b] Low snow year.

TABLE 3 Unit 24 Treat Island aerial moose composition counts, regulatory years 1985–1986 through 2006–2007[a]

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	163.3	23	4	9	2	7.1	604	3.70
2003–2004	174.1	27	9	21	4	14.3	762	4.38
2004–2005	168.7	29	7	30	9	18.9	800	4.74
2005–2006	168.7	25	9	14	9	10.2	566	3.36
2006–2007[b]	168.7	35	8	30	5	18.2	740	4.39

[a] Data reported prior to 2001 used Gasaway sample units, beginning in 2001 surveys used GeoSpatial Population Estimator sample units.
[b] Low snow year.

TABLE 4 Unit 24 Henshaw–Peavy Creek aerial moose composition counts, regulatory years 1991–1992 through 2004–2005

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
2004–2005	106	76	15	33	22	16	69	0.65

TABLE 5 Unit 24 Kanuti Canyon aerial moose composition counts, regulatory years 1988–1989 through 2004–2005

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
2004–2005	86	41	0	18	0	11	35	0.41

TABLE 6 Unit 24 Middle Fork aerial moose composition counts, regulatory years 1987–1988 through 2005–2006

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
2004–2005	113	38	6	22	0	14	110	0.97
2005–2006	113	33	5	14	0	11	86	0.76

TABLE 7 Unit 24 Kanuti National Wildlife Refuge population estimation surveys, regulatory years 1989–1990 through 2005–2006

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 (1372–2199)	0.76
1999–2000	2714	61	4.3	27.8	n/a	14.7	1188 (879–1497)	0.39
2004–2005	2710	62	8.6	46.0	n/a	20.7	842 (602–1083)	0.31
2005–2006[b]	2710	70	20.0	43.0	30.1	19.7	1025 (581–1470)	0.38

[a] Martin and Zirkle 1996.
[b] Lawler et al. 2006.

TABLE 8 Unit 24 population estimation survey summaries, regulatory years 1999–2000 through 2004–2005

Survey area	Area mi^2	Total sample units	Bulls:100 Cows	Calves:100 Cows	Population estimate without sightability correction factor
Management Zone 1[a]					
2001 Survey block	1,949	336	35:100	18:100	3,642 ± 572 (90% CI)
2004 Survey block	1,843	336	33:100	34:100	3,181 ± 148 (90% CI)
Remainder Zone 1	3,507				877 ± 250
Subtotal (2004)	5,350				4,058 ± 400
Management Zone 2[b]					
1999 Survey block	8,390	1,585	65:100	28:100	3,036 ± 647 (90% CI)
2004 Survey block	11,494	2,204	65:100	35:100	2,805 ± 629 (90% CI)
Moose habitat Unit 24/North[c]	6,074				1,063 ± 250
Remainder Unit 24/North[d]	3,150				158 ± 100
Subtotal (2004)	20,718				4,026 ± 1,000
Unit 24 – **Total**	26,068				8,084 ± 1,500

[a] Management Zone 1 (Unit 24 portion) is redefined as Unit 24D (5,350 mi^2).
[b] Management Zone 2 is redefined as Units 24A (4,146 mi^2), 24B (13,523 mi^2), and 24C (3,049 mi^2).
[c] The estimated area of Unit 24 that could potentially support moose year-round.
[d] 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 2005–2006

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
2004–2005[b]	30	21	12	36	13	27 May
2005–2006	36	40	27	40	32	28 and 29 May

[a] Percent of cows with calves that had twins.
[b] Extensive flooding and early leaf-out, so survey flight path was "high-graded" to maximize observations.

TABLE 10 Unit 24D moose aerial twinning surveys in the Dulbi Slough trend count areas, regulatory year 2005–2006

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Date
2005–2006	16	18	16	47	10	29 May

[a] Percent of cows with calves that had twins.

TABLE 11 Unit 24 moose hunter harvest, regulatory years 1988–1989 through 2005–2006

Regulatory year	Harvest by hunters Bull	Cow	Unk	Total	Unreported 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	149	5	1	155	100	255
2004–2005	127	1	0	128	100	228
2005–2006	162	0	0	162	100	262

TABLE 12 Unit 24 moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2005–2006

Regulatory year	Harvest chronology percent by month/day 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	48	48	0	5	145
2004–2005	46	54	0	1	123
2005–2006	34	66	0	0	152

TABLE 13 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2005–2006[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
	2004–2005	399	8	62	38	141 (100)	0 (0)	0	141
	2005–2006	415	8	66	34	129 (100)	0 (0)	0	129
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
DM823	2005–2006	2	0	0	100	2 (100)	0 (0)	0	2
DM825	2005–2006	3	33	0	100	2 (100)	0 (0)	0	2
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
	2004–2005	5	20	25	75	3 (100)	0 (0)	0	3
	2005–2006	3	33	0	100	2 (100)	0 (0)	0	2
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
	2004–2005	20	55	43	57	4 (100)	0 (0)	0	4
	2005–2006	20	55	56	44	4 (100)	0 (0)	0	4

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
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
	2004–2005	5	40	67	33	1 (100)	0 (0)	0	1
	2005–2006	2	50	100	0	0 (100)	0 (0)	0	0
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
	2004–2005	20	60	43	57	4 (100)	0 (0)	0	4
	2005–2006	20	45	27	73	8 (100)	0 (0)	0	8
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
	2004–2005	449	13	62	38	153 (100)	0 (0)	0	153
	2005–2006	465	12	62	38	147 (100)	0 (0)	0	147

[a] RM830 ended in regulatory year 2000–2001 and was replaced by Drawing Hunts DM827, 828, 829, and 830.

TABLE 14 Unit 24 Dalton Highway Corridor Management Area moose harvest by permit hunt, regulatory years 2002–2003 through 2005–2006

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
	2004–2005	20	45	91	9	1 (100)	0 (0)	0	1
	2005–2006	20	20	94	6	1 (100)	0 (0)	0	1
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
	2004–2005	50	46	92	8	2 (100)	0 (0)	0	2
	2005–2006	50	42	79	21	6 (100)	0 (0)	0	6

TABLE 15 Unit 24 moose hunter residency and success, regulatory years 1988–1989 through 2005–2006

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	36	76	35	8	155	20	104	50	10	184	339
2004–2005	45	51	29	2	127	55	139	35	1	230	357
2005–2006	62	73	24	2	161	53	145	38	1	237	398

[a] Unit resident only.

TABLE 16 Unit 24 moose harvest percent by transport method, regulatory years 1988–1989 through 2005–2006

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
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	19	1	69	1	5	0	5	1	155
2004–2005	19	0	59	2	1	0	17	2	127
2005–2006	7	1	75	1	0	0	13	4	161

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 115526
JUNEAU, AK 99811-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

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.

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%). 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 July–30 June, e.g., RY90 = 1 July 1990–30 June 1991).

Moose have been hunted under the Tier II permit system with up to 125 Tier II permits issued each year during 1990–1999. 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 December–20 December) 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. These steps 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). Two educational videos were produced in 1993 in a cooperative effort between the U.S. Fish and Wildlife Service (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.

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. It also agreed with the department's recommendation to increase the harvest 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 Alaska 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 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 fall 1996, 1999, 2000, and 2001, spring 1999, 2003 and 2004, and in Unit 25D East in fall 1995, 1997, 1999, 2000, 2004 and 2005, and spring 2004. A lack of snow precluded fall surveys in 2002 and 2003. An additional survey area was established in the Venetie area, and population estimates were obtained in fall 2004 and 2005. 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 GeoSpatial Population Estimator (GSPE), developed by Ver Hoef (2001). A sightability correction factor (SCF) has not yet been developed for this technique, but a 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 20–30% in lowland Interior habitats in early winter (ADF&G, unpublished data), and recent survey estimates may be revised upward in the future after a 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. Population surveys were conducted in the Sheenjek and Coleen River drainages in eastern Unit 25A in fall 2000 and 2002 (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 in 2000 was about 50% lower than in the 1989 and 1991 surveys and the number of moose observed in 2002 was about 30% lower than in 2000, 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 RY02–RY04. 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).

<u>Unit 25D East</u>. Table 2 summarizes the results of population surveys conducted in 1995, 1997, 1999, 2000, 2001, 2004 and 2005 in eastern Unit 25D, as well as similar data from western Unit 25D, where weather precluded a fall survey in 2005. The fall 1999 stratification identified 209 (38%) high and 344 low density sample units. The stratification was adjusted prior to the 2000, 2001, and 2004 surveys.

The fall 2005 survey included 291 units in the high strata and 262 units in the low strata. As in previous surveys, moose abundance was generally greatest at low elevation north of the Yukon River, southeast of Fort Yukon, and adjacent to the Black and Porcupine Rivers northwest of Fort Yukon. One hundred twenty-one units were surveyed, including 83 (28% of total highs) in the high, and 38 (14% of lows) in the low strata. Sampled units comprised 642 mi^2; 46.5 hours were spent surveying this area, for an average search intensity of 4.3 minutes/mi^2. The moose population in the 2936-mi^2 survey area was estimated at 1008±20% (90% CI), or from 804 to 1212 moose (no SCF). This compares to estimates of 829±20% in fall 1999, 726±25% in fall 2000 and 514±27% in fall 2001, 382±20% (90% CI) in spring 2004, and 773±17% in fall 2004 (Table 1). Calves comprised 25% of the moose observed and an estimated 24% of the total population in 2005. No fall surveys were possible in 2002 and 2003 because of a lack of snow. The fall 2005 survey resulted in estimated densities of 0.38 and 0.27 moose/mi^2 in the high and low density areas, with an overall density of 0.34 moose/mi^2. Moose density in the Venetie survey area appears to be lower than in the Fort Yukon area (Table 2). The estimated number of bulls, cows, and calves; the total population in the Fort Yukon and Venetie areas; and the results of surveys completed by the U.S. Fish and Wildlife Service in western Unit 25D are listed in Table 3.

The earlier downward trend in moose numbers in Unit 25D East probably reflected relatively high adult mortality from predation by wolves and grizzly bears, high hunter harvests and continued predation by bears on moose calves. Population estimates in 2004 and 2005 suggest that moose numbers may have increased somewhat in the Fort Yukon area. Anecdotal accounts and earlier survey data had suggested populations on the eastern Yukon Flats were generally declining for 2 decades or more.

The greatest changes were in the estimated number of bulls and calves in the population in 2005, with the estimated number of cows being stable (Table 3). The apparent increasing trend in numbers in the last 2 years may be the result of several factors acting in combination. These include:

1) A reduction in the harvest of cow moose as a result of increased local concern about the scarcity of moose, and the development and implementation of the Yukon Flats Cooperative Moose Management Plan, which emphasized the importance of protecting cow moose, and reducing predation by bears and wolves.

2) Reduced fall moose harvests caused by low water conditions during 2004 and 2005, when local residents report that boat access to many good hunting areas was precluded, and some increase in the number of bulls in the population.

3) A decline in summer calf mortality, perhaps because of a general increase in bear harvests in and around the Fort Yukon survey area. The increase in the calf:cow ratio and the estimated number of calves in the population indicate improved summer survival rates for calves.

4) Sampling error and differences in sightability inherent in moose surveys, and annual adjustments in stratification which have increased the area included in the high strata and, thus, the population estimate.

The estimated density (moose/mi^2) in the 2936 mi^2 Fort Yukon survey area was 0.28 in 1999, 0.25 in 2000, 0.18 in 2001, 0.13 in spring 2004, 0.26 in fall 2004, and 0.34 in fall 2005. Applying a sightability correction factor of 1.2 to the 2005 population estimate of 1008 moose indicates that the population in the Fort Yukon survey area may be closer to 1200, or about 0.41 moose/mi^2. The trend is encouraging, but the population estimate is still lower than the preliminary goal of doubling the number of moose in the Fort Yukon survey area to about 1600, as outlined in the Yukon Flats Cooperative Moose Management Plan.

Unit 25D West. A March 1999 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 and again in fall 2005, but surveys in March 2004 and fall 2004 (no SCF) resulted in population estimates of 632±20% and 511±25%. The low fall 2004 estimate resulted primarily from an apparent decline in the number of cow moose in the population (Table 3).

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. Previous surveys suggested moose numbers had 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 appeared to be slightly higher in this area than on the eastern flats. Surveys done in fall 2004 and 2005 suggest that moose numbers may have increased on the eastern Yukon Flats. These trends may be related to differences in harvest levels as well as other factors, as noted above. 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, 2000 and 2002 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, although total numbers appear to have declined. 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, 2001, 2004, and 2005 with estimated calf:cow ratios of 59:100, 49:100, 43:100, 51:100, and 58:100. The estimated proportion of calves during these years was 27%, 21%, 18%, 26%, and 24%. We observed 30 cows with single calves and 8 (21% of cows with calves) with twins in 1999, 25 with single calves and 3 (12%) with twins in 2000, 24 with single calves and 1 (4%) with twins in 2001, 35 with single calves and 11 (24%) in 2004, and 36 cows with single calves and 10 (22%) with twins in 2005. 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. The number of bulls, cows, and total adults generally declined during 1996–2001, but increases in the estimated number of bulls and number of calves caused the population estimate to increase between 2004 and 2005 (Table 3).

Composition data indicate a relatively high bull:cow ratio, with estimated ratios of 57:100 in 1999, 79:100 in 2000, 95:100 in 2001, 43:100 in 2004, and 80:100 in 2005. Small, medium, and large bulls were well represented in the population. We observed 24, 19, 20, 10, and 22 yearling bulls:100 cows in 1999, 2000, 2001, 2004, and 2005 (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, 2004). Estimated bull:cow ratios in fall 1999, 2000, 2001, and 2004 surveys were 31:100, 71:100, 52:100, and 72:100, respectively. There were an estimated 31 calves:100 cows in 1999, 22:100 in 2000, 27:100 in 2001 and 34:100 in 2004. Estimated calf:cow and bull:cow ratios and the proportion of yearlings were lower in Unit 25D West than in Unit 25D East during 1999–2004 (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 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

Seasons and Bag Limits.

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 one 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 one 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 one side.		5 Sep–25 Sep

Units and Bag Limits	Resident Open Season	Nonresident Open Season
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 1 bull per community harvest report by community harvest permit in an established community harvest area.	10 Sep–20 Sep 18 Feb–28 Feb	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side.		10 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. There were no regulatory changes during the report period. However, in March 2006 the Alaska Board of Game considered a proposal for intensive management and predation control in Unit 25D. The department and board agreed that the department would explore management measures in addition to those identified in the 2002 Yukon Flats Cooperative Moose Management Plan that might be feasible given the landownership pattern and other constraints. The Yukon Flats moose management planning process resulted in a number of regulatory proposals to the Alaska Board of Game in March 2002. The board reviewed the draft Yukon Flats Cooperative Moose Management Plan 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–RY04 (Tables 6, 7, and 8). Reported harvest for Units 25A, 25B, and Unit 25D East was 71 moose in RY03 and 63 in RY04. The reported harvest in connection with the Tier II and federal permit hunts in Unit 25D West was small (Table 9), with 4–29 moose reported taken annually during RY98–RY04. 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–RY04.

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. However, the harvest of cow moose seems to have declined in recent years, in part because of public concerns and educational efforts that accompanied the development of the Yukon Flats Cooperative Moose Management Plan, which was completed in 2002.

<u>Permit Hunts</u>. 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–RY04. From 12 to 31 people participated in the hunt, with reported harvests ranging from 3 to 12 moose annually (Tables 7 and 8).

<u>Hunter Residency and Success</u>. As in previous years, most hunters reporting from Units 25A, 25B, and 25D during RY03–RY04 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 34–39% in Unit 25A, 23–26% in Unit 25B, and 15–16% in Unit 25D East. Reported success rates are considerably lower in Unit 25D West, but this is partly a result of reporting problems in connection with the Tier II permits, and the fact that additional moose are taken under a federal permit system (Table 9).

<u>Harvest Chronology</u>. In previous years, 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. During RY03 and RY04 it appears that few moose were taken during the first week of September (Tables 13, 14, and 15). The reasons for this apparent change in harvest chronology are unknown. A number of moose were also taken in late August during the state Tier II and federal subsistence seasons in Unit 25D West. 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 69% or more of successful hunters in Units 25B and 25D East, with airplanes used in about 15% of successful hunts (Tables 17 and 18). The use of snowmachines and boats in Units 25B and 25D 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, but the population in the eastern part of the unit may have increased somewhat during 2004–2005. Productivity and recruitment are high compared to 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 1, 3 and 4. Objective 2 was met, with bull:cow ratios remaining well above the specified minimum of 40:100. 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 some hunting for other Alaskans and nonresidents.

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

STEPHENSON, R. O. 2006. Unit 25 moose management report. Pages 599–630 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Units 25A and 25B moose observed during early winter aerial composition counts, 1987–2000 (data source: F. Mauer and Tara Wertz, 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	38	20	14	130	150	
2002[b]	88	4	48	24	19	100	124	0.34
Unit 25B[e]								
1987	119	6	10	6	5	105	111	

[a] Upper Sheenjek River only.
[b] Includes upper Sheenjek (both forks above Double Mtn) 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 1986–2004.

TABLE 2 Summary of moose population estimates in Units 25D East and 25D West, 1992–2005

Survey year and type	Survey area (mi^2)	Strata size (mi^2) L	M	H	Area searched (mi^2) L	M	H	Total search area	No. of moose estimated by strata and total, and density ($moose/mi^2$) L	M	H	Total estimate @ 90% CI	Average density $moose/mi^2$	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
2004 GSPE	2936	1607		1329	175		424	599	138/0.08		648/0.49	773±17%	0.26	113
2005 GSPE	2936	1548		1388	202		440	642	428/0.27		552/0.38	1008±20%	0.34	121
Venetie Survey														
2004 GSPE	2858	1623		1235	109		204	313	105/0.06		413/0.33	551±60%	0.19	60
2005 GSPE	2858	1638		1219	115		418	533	71/0.04		280/0.23	423±32%	0.15	101
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 Geo	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/.19		319/0.57	632±20%	0.28	91
2004 GSPE	2299	1569		700	151		350	501	198/0.13		298/0.43	511±25%	0.29	93

[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 fall and spring surveys in Unit 25D East, Venetie, and 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 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 2004 (2936)	170	394	203	564	773±17%	43	10	51	22	51	26	0.26
Fall 2005 (2936)	337	419	243	761	1008±20%	80	22	58	34	42	24	0.34
Venetie Survey												
Fall 2004	192	257	105	449	551±60%	75	24	41	37	46	19	0.19
Fall 2005	94	213	123	293	423±32%	44	4	58	22	49	29	0.15
Western 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
Fall 2004 (2269)	179	247	85	426	511±25%	72	5	34	35	48	17	0.23

TABLE 4 Moose observed in Unit 25D East during early winter moose composition surveys, 1986–2005

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	13	160	184	0.6
1995[d]	50	7	30	39	17	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	22	172	219	0.28
2000[d]	77	19	45	31	20	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
2004[g]	55	11	54	57	26	165	222	0.26
2004[h]	79	24	41	14	19	61	75	0.19
2005[i]	85	21	61	57	25	174	231	0.34
2005[j]	79	7	57	26	26	75	101	0.15

[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.
[g] Fall 2004 Fort Yukon survey area.
[h] Fall 2004 Venetie survey area.
[i] Fall 2005 Fort Yukon survey area.
[j] Fall 2005 Venetie survey area.

TABLE 5 Unit 25D West moose observed during early winter aerial moose composition counts, 1986–2005

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	12	345	393	0.12
1992[g]	70	11	19	5	10	46	51	0.47
1993[h]	51	14	30	17	17	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[a]								
1999[k]				26	10	222	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[a]								
2003[k]				33	16	168	201	0.37
2004[k]				34	14	209	243	0.42
2004	74	8	36	29	17	139	168	0.34
2005[a]								

[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] Composition observed in early winter population survey; [k] Composition observed in March population surveys.

TABLE 6 Unit 25A reported moose harvest, regulatory years 1986–1987 through 2004–2005

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
2003–2004	36	0	0	36
2004–2005	29	0	0	29

[a] Source: moose harvest reports.

TABLE 7 Unit 25B reported moose harvest, regulatory years 1986–1987 through 2004–2005

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
2003–2004[e]	23	0	0	23
2004–2005[f]	26	0	0	26

[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.
[e] Includes 9 moose taken in Chalkyitsik Community Harvest Permit hunt.
[f] No moose were reported taken in Chalkyitsik Community Harvest Permit hunt.

TABLE 8 Unit 25D East reported moose harvest, regulatory years 1986–1987 through 2004–2005

Regulatory year	Reported[a]			
	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
2003–2004[e]	12	0	0	12
2004–2005[f]	8	0	0	8

[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.
[e] Includes 9 moose taken in Chalkyitsik Community Harvest Permit hunt.
[f] No moose were reported 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 2004–2005

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 (70)	0 (0)	13 (21)	6 (10)	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 (6)	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 (60)	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]
2003–2004	51	31 (61)	7 (14)	10 (20)	3 (6)	3 (100)	0 (0)	0 (0)	3	26[b]
2004–2005	72	29 (40)	27 (38)	15 (21)	1 (1)	1 (100)	0 (0)	0 (0)	1	15[c]

[a] No federal harvest reports have yet been received from Stevens Village.
[b] Includes 6 cows reported taken by Stevens Village hunters.
[c] Includes 5 cows reported taken by Stevens Village hunters.

TABLE 10 Unit 25A moose hunter residency and success, regulatory years 1986–1987 through 2004–2005[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
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 (45)	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
2003–2004	2	9	25	0	36 (39)	5	24	27	0	56 (61)	92
2004–2005	2	7	17	2	28 (33)	3	26	27	1	57 (67)	85

[a] Source: moose harvest reports.
[b] Resident of Unit 25.

TABLE 11 Unit 25B moose hunter residency and success, regulatory years 1986–1987 through 2004–2005[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 (53)	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	0	25	4	0	29 (44)	1	34	2	0	37 (56)	66
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
2003–2004	5	16	1	1	23 (25)	6	54	9	0	69 (75)	92
2004–2005	3	18	5	0	26 (29)	6	48	10	0	64 (71)	90

[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 2004–2005[a]

Regulatory year	Successful					Unsuccessful					
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Hunters
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)	71
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
2003–2004	6	3	3	0	12 (16)	22	34	7	0	63 (84)	75
2004–2005	4	4	0	0	8 (15)	14	25	7	0	46 (85)	54

[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 2004–2005

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
2003–2004	0	26	44	24	6	0	34
2004–2005	0	14	55	28	3	0	29

[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 2004–2005

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]	0	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	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	12	36	36	15	0	0	0	33
2003–2004	9	36	18	14	9	14	0	22
2004–2005	0	12	23	50	15	0	0	26

[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 2004–2005

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]	8	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	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
2003–2004	0	0	50	42	8	0	0	12
2004–2005	0	14	57	28	0	0	0	7

[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 2004–2005[a]

Regulatory year	Harvest percent by transport method								n
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	
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
2003–2004	83	8	8	0	0	0	0	0	36
2004–2005	69	17	10	0	0	0	0	3	29

[a] Source: moose harvest reports.

TABLE 17 Unit 25B moose harvest percent by transport method, regulatory years 1986–1987 through 2004–2005[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
2003–2004	9	3	83	3	0	0	0	0	23
2004–2005	15	0	69	4	0	0	0	12	26

[a] Source: moose harvest reports.

TABLE 18 Unit 25D East moose harvest percent by transport method, regulatory years 1986–1987 through 2004–2005[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
2003–2004	17	0	83	0	0	0	0	0	12
2004–2005	25	0	50	12	0	0	0	12	8

[a] Source: moose harvest reports.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005[1]

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, 1995,1999, and 2002. The population increased steadily from a count of 1219 moose in 1970 to 1535 in 1991, declined to 757 in 1995 and 326 in 1999, then increased to 576 moose in 2002 (Trent, 1989; Carroll, 2004). Trend counts indicated that by 1996 the population had declined to about 25% of the 1991 population; then, numbers increased from 1997 through 2003 (Carroll 2004).

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*

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

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 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 413 moose in 2003 (Carroll, 2004).

Hunters used aircraft to hunt moose during at least part of the season from the early 1970s (Trent 1989) to 1995. In 1996 more restrictive regulations were instituted and since then hunters have not been allowed to use aircraft to hunt moose allowed. 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). Due to the increasing population number, the hunt area and season were increased for the 2002 season and 10 moose were harvested (Carroll, 2004).

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 3–5 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 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 and twinning rate surveys each year during the first 2 weeks 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. We conducted a census during the reporting period in 2005 and a total of 1048 moose were counted (Table 1). During all of these censuses we included moose counted on the Itkillik River, which is part of the Colville River drainage but is in Unit 26B. In 2005 there were 50 moose including 6 calves on the Itkillik River

Trend area counts indicated that the population declined until 1996 to about 23% of the 1991 population and has increased steadily 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. During the reporting period we counted 522 moose in 2004 and 602 moose in 2005 (Table 2, Figure 1). This would indicate an increase of about 16% per year between 1996 and 2005. 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 2003 when between 17% and 26% short yearlings were counted. During the reporting period 22% were observed in 2004 and 20% in 2005 (Table 2, Fig. 1).

We began flying spring calving surveys of radiocollared moose during the first 2 weeks of June in 1996 and continued through 2004, when most of the collars had gone off the air. The number of calves per 100 collared cows ranged from 58 to 92. The number of twins per 100 collared cows ranged from 9 to 33. The twinning rate (number of sets of twins divided by the number of parturient collared females) ranged from 15% to 57%. The twinning rate has generally been higher during the years of population recovery than it was during the years of low numbers (Table 3).

During fall 2003 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). During 2004 composition surveys we observed 313 moose within the trend count area, including 96 bulls (60 bulls:100 cows), 159 cows, and 58 calves (37 calves:100 cows). In 2005 (after the reporting period) we observed 230 moose in the trend count area, including 75 bulls (66 bulls: 100 cows), 113 cows, and 42 calves (37 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 4).

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%

Inches	<30	30–39	40–49	50–59	60+
2003	10%	18%	17%	29%	26%
2004	24%	18%	10%	38%	10%
2005	19%	15%	19%	25%	22%

Distribution and Movements

By late winter most moose can be found along major rivers and tributary streams of the Colville River drainage system. 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:

- 13 June 1996. 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.

2003-2004 Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 26A: that portion in the Colville River drainage down-stream from and including the Chandler River		
One bull*	1 Aug–14 Sep (General hunt with harvest ticket)	No open season
Remainder of Unit 26A		
One bull*	1 Sep–14 Sep (General hunt with harvest ticket)	No open season

*Hunters may not hunt moose during August or 1–14 September using aircraft for transportation or for carrying meat.

2004-2005		
Unit 26A: that portion in the Colville River drainage down-stream from and including the Chandler River		
One bull**	1 Aug–14 Sep (General hunt with harvest ticket)	No open season
Unit 26(A), that portion west of 156° 00’ W. longitude and north of 69° 20’ N. latitude		
One moose**; a person may not take a calf or a cow accompanied by a calf;	1 Jul–31 Aug (General hunt with harvest ticket)	No open season
Or		
One bull**	1 Sep–14 Sep (General hunt with harvest ticket)	No open season
Remainder of Unit 26A		
One bull**	1 Sep–14 Sep (General hunt with harvest ticket)	No open season

**Hunters may not hunt moose from 1 July–14 September using aircraft for transportation or for carrying meat.

Board of Game Actions and Emergency Orders. During its November 2003 meeting the Board of Game increased the hunt area and length of the season in order to provide a hunt for moose that disperse into western Unit 26A during the summer. They opened the area west of 156° 00' W. longitude and north of 69° 20' N. latitude for hunting of either sex moose from 1 July–31 August and for bulls from 1 September–14 September. The bag limit continued to be one bull moose in the rest of the hunt area. 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 July–14 September.

Hunter Harvest. Hunter harvest reports indicate 5 bull moose were harvested during fall of 2003, and 4 bulls and 1 cow in 2004 (Table 5). Antler sizes in 2003 were: 1 from 40–49 inches, 2 from 50–59 inches, and 2 were 60 inches or greater. Antler sizes in 2004 were: 1 from 40–49 inches, 2 from 50–59 inches, and 1 unknown (Table 6).

Permit Hunts. There were no permit hunts for moose in Unit 26A during the reporting period.

Hunter Residency and Success. During 2003, 4 of 5 successful hunters were local residents and 6 of 9 total hunters were local residents. During 2004, all 5 of the successful hunters were local residents and 9 of 13 total hunters were local residents. Hunters had a 56% success rate in 2003 and 38% in 2004 (Table 7).

Harvest Chronology. During 2003, 20% of reported moose were harvested in August and 80% in September. During 2004, 20% of reported moose were harvested in July, 40% were harvested in August, 20% were harvested 1-7 September, and 20% 8-14 September (Table 8).

Transport Methods. All hunters used boats for transportation during 2003 and 80% used boats and 20% used ORV's in 2004 (Table 9).

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 2005 (Table 2).

Mortality due to predation has probably decreased substantially since the mid 1990's. 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 602 in 2005, an increase of 16% 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 immigrated 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 expanded <comment from Patti - Is expanded correct?>the hunt area and season for a bulls-only hunt in 2001 and added a summer hunt in 2003 for moose that disperse into western Unit 26A and continued restrictions on the use of aircraft for moose hunting. This regulation has provided more hunting opportunity but allows for continuing recovery of the population. If the population continues to grow, hunting restrictions may be further liberalized in the future.

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

CARROLL, G. 2006. Unit 26A moose management report. Pages 631–649 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau.

TABLE 1 Number of adult and calf moose from Unit 26A censuses, April 1970–2005

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	71	567	13
2005	863	185	1048	18

*Includes moose counted on the Itkillik River which is part of the Colville River drainage but is in Unit 26B. In 2005 there were 50 moose including 6 calves on the Itkillik River.

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, April, 1970, 1974–1981, and 1983–2005

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	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	10
1990	617	543	74	12
1991	647	516	131	20
1992	510	416	94	18
1993	504	424	80	16
1994	407	396	11	3
1995	307	302	5	2
1996	149	148	1	<1
1997	180	139	41	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
2004	522	407	115	22
2005	602	481	121	20

TABLE 3 Calving surveys with twinning rate, June, 1996–2004

Year	Total cows	Calves:100 Cows	Pairs of Twins	Twins:100 Cows	Percent Twins*
1996	23	91	3	13	17%
1997	44	66	4	9	16%
1998	43	58	5	12	25%
1999	40	92	13	33	54%
2000	35	69	8	23	50%
2001**	18	83	2	11	15%
2002	28	82	6	21	35%
2003	25	92	7	28	44%
2004	16	68	4	25	57%

* Number of sets of twins/number of parturient females

** Incomplete survey

TABLE 4 Unit 26A fall aerial moose composition trend area counts, November, 1983–2005

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	114
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
2004	60	37	19	255	313
2005	66	37	18	188	230

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

TABLE 5 Unit 26A moose harvest, 1985–2005

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
2003-2004	5	0	5
2004-2005	4	1	5

TABLE 6 Number of bull moose harvested in antler width categories (inches) in Unit 26A, 1996–2005

Regulatory year	Unknown	<20	20–29	30–39	40–49	50–59	60+	*N*
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
2003-2004					1	2	2	5
2004-2005	1				1	2		4

TABLE 7 Moose hunter residency and success, Unit 26A, 1985–2005

Regulatory year	Successful hunters						Total hunters				
	Local res[a]	Non-local res[b]	Nonres[c]	Unk[d]	Total	(%)	Local res[a]	Non-local 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	63	40	20	39	0	99
1988–1989	–	–	–	–	57	68	12	30	37	5	84
1989–1990	9	13	21	1	44	65	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
2003-2004	4	1	0	0	5	56	6	3	0	0	9
2004-2005	5	0	0	0	5	38	9	4	0	0	13

[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 8 Percent chronology of moose harvest, Unit 26A, 1996–2005

Regulatory year	Harvest periods						
	July	Aug	1-7 Sep	8-14 Sep	15 Feb-15Apr	Unknown	*N*
1996–1997*	–	–	–	–	–	–	0
1997–1998*		100	–	–	–	–	2
1998–1999*		100	–	–	–	–	5
1999–2000*		100	–	–	–	–	2
2000–2001*	–	–	–	–	–	–	–
2001–2002*		100	–	–	–	–	–
2002–2003		20	80				
2003-2004		20	80				5
2004-2005	20	40	20	20			5

*Season only open in August

TABLE 9 Percent transport methods for moose harvest in Unit 26A, 1987–2005

	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				
2003-2004		100				5
2004-2005		80			20	5

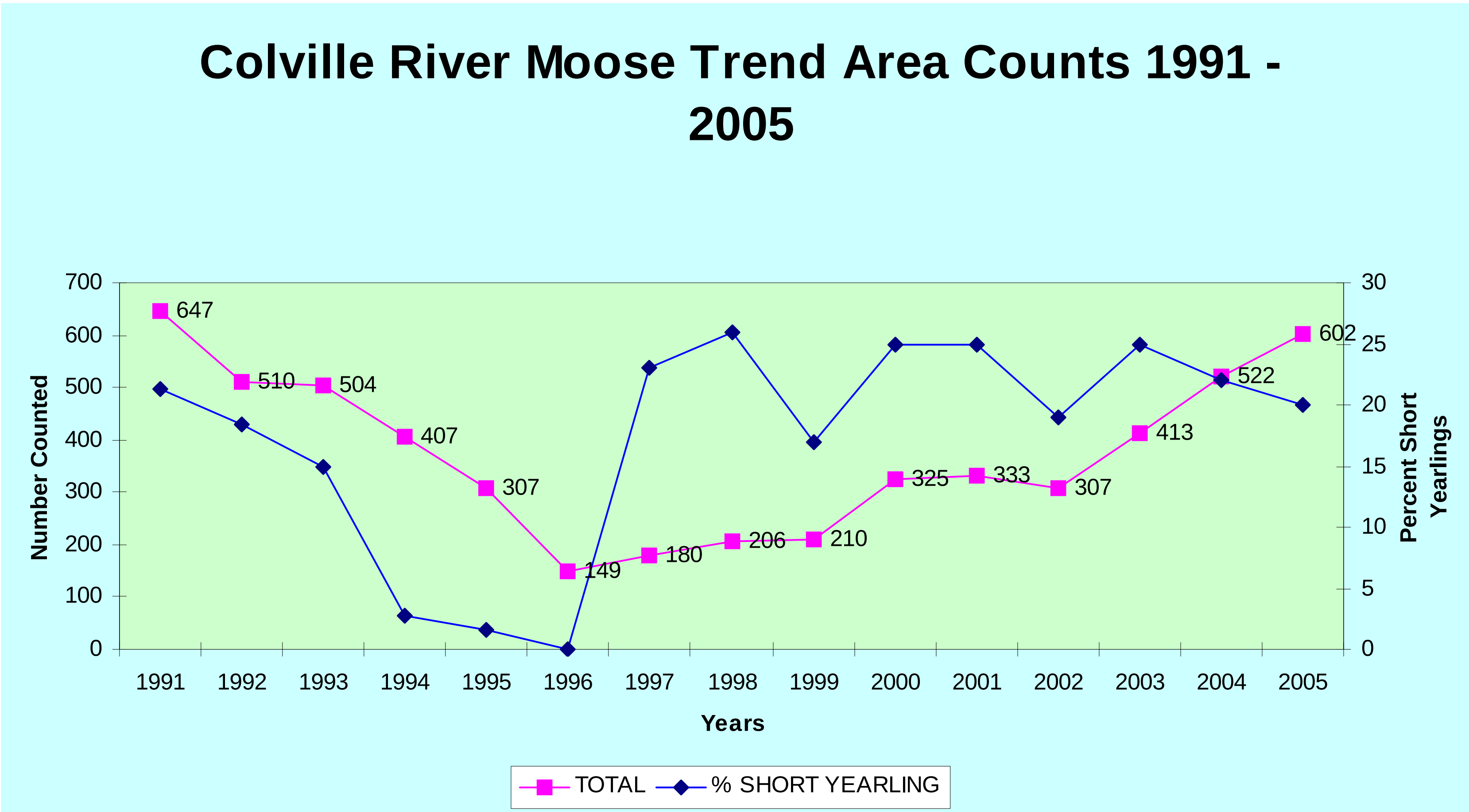

FIGURE 1 Unit 26A moose trend counts and percentage of short yearlings: Colville River between the mouths of Anaktuvuk and Killik Rivers, Anaktuvuk River from the mouth to Sivugak Bluff, Chandler River from the mouth to Table Top Mountain, and, 1991-2005.

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MOOSE MANAGEMENT REPORT

From: 1 July 2003
To: 30 June 2005

LOCATION

GAME MANAGEMENT UNITS: 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 one 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 or more brow tines on one side. During RY90–RY94 there was also a winter season of 1 November–31 December open to residents, with a bag limit of 1 bull with antlers at least 50 inches or 4 or more brow tines on one side. In RY95 the season remained the same for Unit 26B and the Canning River drainage in Unit 26C. The RY95 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 (FWS) 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 by the FWS 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. During RY03–RY04, the moose population appeared to continue a gradual increase from the marked population decline in the 1990s, as indicated below.

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. Surveys have been conducted in the spring since RY98. The moose population increased slowly to 234 moose in RY03 and 288 in RY04 (Table 1). In RY05, we observed 335 moose. 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 to 165 moose during 1977–1984. Surveys conducted in 1984 and 1989 are comparable to standard surveys that began in spring 1996. Moose numbers appeared to be relatively stable during the mid- to late 1980s at approximately 150 moose (Table 2). Harvest data and information from hunting guides and bush pilots indicated that the moose population in this area declined during the early 1990s, as it did in Units 26A, 26B East, 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. This followed the same trend observed in Unit 26B East, where the population appeared relatively stable during 1996–2002. However, in spring 2003 we observed a substantial increase to 159 moose in Unit 26B West, excluding the Itkillik River drainage. This may have been related to changes in distribution or increased sightability because we used a Piper PA-18 after 2002 compared to a Cessna 185 for years 2002 and prior. During the report period, we observed 117 and 152 moose in spring 2004 and 2005 (Table 2). In spring 2006 we observed 150 moose. Additionally, we surveyed the upper Sagavanirktok River (upstream of Happy Valley) and observed 37 moose, including 7 short yearlings. Most of the moose observed in Unit 26B West were found in the Kuparuk drainage. An increase in the number of moose was also observed to the west in Unit 26A in 2003, 2004, and 2005 (Carroll, ADF&G, personal communication).

Spring surveys 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 in Unit 26, in 1999, 2002, and 2003 we observed only 27, 9, and 11 moose, respectively. Either no surveys or incomplete surveys were conducted in 1996, 1997, 1998, 2000, and 2001. During the report period (RY03–RY04), we observed 27 and 44 moose during spring surveys in 2004 and 2005. In spring 2006 we observed

66 moose including 6 short yearlings in the Itkillik drainage. The total number of moose observed in spring 2006 in Unit 26B (including the Canning River) was 518 moose (16.5 % short yearlings).

In eastern Unit 26C, surveys completed by FWS in the upper Kongakut and Firth Rivers and Mancha Creek area in 2000 and 2002 indicate that moose numbers were lower than in 1991 (Table 3). Lower numbers in the 2000s may reflect changes in distribution or density. Moose numbers were higher in 2002 than 2000, but sightability may have been lower in 2000 because a Cessna 185 was used to survey part of the area. A large proportion of the moose in these areas migrate south and east to the Old Crow Flats in Canada during spring and summer (Mauer 1998). In April 2003 and 2005, ANWR staff observed 52 and 47 moose, respectively, during surveys of the lower Kongakut (below Drain Creek) and several other drainages in Unit 26C east of the Canning River. In spring 2006, ADF&G staff surveyed the valleys of the Sadlerochit Mountains and 9 adult moose were observed.

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, 2, and 3; 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, resulting in shorter growing seasons. Also, in summer 1995 there were numerous reports of intense harassment of moose 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. It is also possible 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 browse quality. 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. 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.

Twinning rates of moose in the highest moose densities of Unit 26 were moderate in the mid- to late 1990s, which indicated that nutritional status was not poor (Boertje et al., in press). Quick recovery of nutritional status from overbrowsing is unlikely, so overbrowsing was likely not a major factor causing the decline in moose numbers. Rather it appears that disease, predation, weather, and possibly insect harassment were factors causing the precipitous decline in moose numbers.

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. 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. Survival of calves to 11 months during RY03–RY04 varied. Calf survival in RY03 was poor and only 6% short yearlings were observed in spring 2004, whereas survival during RY04 was good, with 22% short yearlings observed in spring 2005 (Table 1). Similarly, in spring 2006, 18% short yearlings were observed.

In Unit 26B East, bull:cow ratios were below the management objective of 50:100 during fall 1991 and 1994 but ranged from 61 to 69 during fall 1995–1997 (Table 1). Reduced bull:cow ratios during the decline (39 to 47:100) suggested that adult bull mortality was higher than adult cow mortality. The hunting season was closed to hunting in fall 1996 but bull:cow ratios had recovered to 66:100 by fall 1995. 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 with little early antler development. Bull:cow ratios were not available during RY03 and RY04 because surveys were conducted after bulls had shed antlers.

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 during the report period was 18% and 13% in spring of 2004 and 2005, respectively. In spring 2006, we observed 17% short yearlings.

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. Bull:cow ratios were not available during RY03 and RY04 because surveys were conducted after bulls had shed antlers.

In eastern Unit 26C, fall surveys in 2000 and 2002 indicate high bull:cow ratios and modest numbers of calves and yearlings in the population (Table 3). As in other areas, bull:cow ratios in central Unit 26C were not available during RY03 and RY04 because surveys were conducted after bulls had shed antlers.

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. 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 many moose that winter in the upper Kongakut River migrate south and east to summer on the Old Crow Flats in Canada (Mauer 1998), and that moose in the Colville River area in Unit 26A are resident, rather than seasonally migratory (Carroll 2004).

MORTALITY

Harvest

Season and Bag Limit. There was no open season for moose in Units 26B and 26C during RY96–RY04.

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 RY05. 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. In 2004 the Federal Subsistence Board established a federal registration hunt for residents of Kaktovik that applies to federal lands in Units 26B and 26C, with a harvest quota of 3 moose. No more than 2 bulls may be harvested from Unit 26C. Three permits are issued to residents of Kaktovik only, with an open season of 1 July–31 March. Federal public lands in these units are closed to the taking of moose by other hunters. In March 2006, the Alaska Board of Game authorized 2 moose seasons to begin RY07 in Unit 26B, excluding the Canning River drainage. These seasons will be open to resident hunters only and will include up to 30 drawing permits for bulls during 1–14 September and up to a 14-day general season for bulls to be announced during 15 February–15 April.

Hunter Harvest. The hunting season remained closed during the report period. 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 4). 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 5), prior to the season being closed in RY96. The relatively small number of hunters that report hunting in Unit 26C probably results from the lack of airstrips near moose habitat 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 6). 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 7). 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 8).

Natural Mortality

No intensive studies of the causes of moose mortality have begun in the eastern Arctic. The decline in the early 1990s was probably due to a combination of natural mortality factors, as indicated earlier.

There is evidence that mortality rates for adult female moose have been low in the eastern Arctic during recent years. Among radiocollared moose in Unit 26A along the Colville River, the average mortality rate was 6.7% per year during 1996–2003 (Carroll 2004).

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, increased predation by wolves and grizzly bears, and possibly insect harassment. 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. The increasing trend continued in 2004 and 2005, and the population objectives for the unit have been achieved. We have little information on moose movements on the North Slope. However, a radiotelemetry study in the Colville River drainage concluded that radiocollared moose are residents of the Colville drainage, suggesting that observed increases in numbers did not result from immigration from adjacent areas.

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 recovered and our management objectives were met. We did not meet our second goal of providing an opportunity to harvest moose because moose numbers were too low, but we should meet this goal during the next report period. Moose were available for viewing and photographing, our third goal.

During RY03–RY04 we largely 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. The third population objective was to maintain a posthunting sex ratio of 35 bulls:100 cows for Units 26B and 26C. Surveys during 1996–2006 indicated that bull:cow ratios were higher than this objective, as would be expected in an unhunted population. Because population objectives were met, we recommended establishing a limited hunting season for 15 bull moose, or about 3% of the population. This harvest was authorized by the Board of Game beginning in RY07.

Currently we estimate 1000 moose in Unit 26A (Carroll, ADF&G, personal communication), 500–600 moose in Unit 26B, and over 200 moose in Unit 26C for a total of about 1700 moose in Unit 26.

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LENART, E. A. 2006. Units 26B and 26C moose management report. Pages 652–668 *in* P. Harper, editor. Moose management report of survey and inventory activities 1 July 2003–30 June 2005. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska.

TABLE 1 Unit 26B East (east of the Sagavanirktok, including Canning River) aerial moose composition counts, regulatory years 1986–1987 through 2005–2006[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	13	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
2004–2005	Spring	--	--	--	62	22	226	288
2005–2006	Spring	--	--	--	60	18	275	335

[a] Data source for 1988–1989 through 2000–2001: F. Mauer, US 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 2005–2006

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
2004–2005	19	13	133	152
2005–2006	25	17	125	150

[a] No survey.
[b] The Sagavanirktok River was not surveyed.

TABLE 3 Unit 26C, Kongakut (above Mount Greenough) and Firth Rivers and Mancha Creek early winter aerial moose composition, regulatory years 1989–1990 through 2002–2003[a]

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
1989–1990[b]	114	7	24	17	10	152	169	0.47
1991–1992	85	10	34	63	16	343	406	0.47
2000–2001	92	13	35	22	14	135	157	0.27
2002–2003	92	16	24	23	10	204	227	0.40

[a] Compiled from US Fish and Wildlife Service data.
[b] Firth/Mancha area only.

TABLE 4 Unit 26B reported moose harvest and accidental death, regulatory years 1988–1989 through 2005–2006

Regulatory year	Reported harvest				Hunters
	M (%)	F (%)	Unk	Total	
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 2005–2006[a]					

[a] No open season.

TABLE 5 Unit 26C reported moose harvest and accidental death, regulatory years 1988–1989 through 2005–2006

Regulatory year	Reported harvest				Hunters
	M (%)	F (%)	Unk	Total	
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 2005–2006[a]					

[a] No open season.

TABLE 6 Units 26B and 26C moose hunter residency and success, regulatory years 1988–1989 through 2005–2006[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 2005–2006[c]											

[a] Source: moose harvest reports.
[b] Residents of Units 26B or 26C.
[c] No open season.

TABLE 7 Units 26B and 26C moose harvest chronology percent by time periods, regulatory years 1988–1989 through 2005–2006[a]

Regulatory year	Harvest chronology percent by time periods								
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Oct	Nov	Dec	*n*
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 2005–2006[b]									

[a] Source: moose harvest reports.
[b] No open season.

TABLE 8 Units 26B and 26C moose harvest percent by transport method, regulatory years 1988–1989 through 2005–2006[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 2005–2006[b]									

[a] Source: moose harvest reports.
[b] No open season.

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.

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