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CHAPTER 23: MOOSE MANAGEMENT REPORT

From: 1 July 2011
To: 30 June 2013[1]

LOCATION

GAME MANAGEMENT UNIT: 20B (9,196 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 1992). 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 for bulls only in most of Unit 20B. Moose populations again increased following wolf reduction programs during 1980–1986. Moose hunting seasons were extended from 10 days in 1981 and 1982 to 20 days during 1983–1987. 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 this 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, 2003–2006, 2008, and 2009 indicated that the moose population increased from an estimated 9,800 (about 1.1 moose/mi^2) in 1990 to a peak of about 20,000 (about 2.2 moose/mi^2) in 2009.

Demand for moose hunting opportunities in Unit 20B is high. Extensive road and trail systems provide overland access, and numerous waterways such as the Tolovana, Tatalina, Chatanika, Goldstream, Salcha, and Chena rivers provide boat access.

Both general season and permit hunts are available to meet the demand to harvest moose in Unit 20B. Many of the permit hunts are available only to resident hunters. Fifty-eight permit hunts were available to hunt moose in Unit 20B during RY11 and RY12: 2 hunts for "any moose" and 56 hunts for "antlerless moose" (i.e., 1 in the Fairbanks management area [FMA] by

[1] At the discretion of the reporting biologist, this unit report may contain data collected outside the report period.

bow and arrow, 1 in the Creamer's Field Migratory Waterfowl Refuge [Creamer's Refuge] within FMA by muzzleloader, and 56 in central and western Unit 20B outside FMA).

The Minto Flats management area (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.

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 FMA changed numerous times. The most recent changes went into effect in July 2004. FMA currently encompasses about 300 mi^2, about 50 mi^2 of which have 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: 1) western Unit 20B (2,942 mi^2), including the Minto Flats, Tatalina Creek drainage, Tolovana River drainage, and areas farther west; 2) eastern Unit 20B (2,425 mi^2) including the Little Salcha and Salcha river drainages; and 3) central Unit 20B (3,829 mi^2), the remainder.

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., eastern Unit 20B, central Unit 20B, western Unit 20B, and MFMA).

In addition to our management objective, Alaska Administrative Code 92.108 identifies the Unit 20B moose population as important for providing high levels of harvest for human consumptive use, and established intensive management population and harvest objectives of 12,000–15,000 and 600–1,500 moose, respectively.

METHODS

POPULATION STATUS AND TREND

Weather and snow conditions were not adequate in 2011 to allow us to complete a unitwide survey. In November 2012, we completed the survey in eastern Unit 20B, but conditions deteriorated and the remainder of Unit 20B was not completed. We used the geospatial population estimator (GSPE) method to conduct the survey (Ver Hoef 2001, 2008; Kellie and DeLong 2006). 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 (SU; Kellie and DeLong 2006). We selected a simple random sample of SUs (n = 164) from each stratum using Microsoft Excel® software. Additional SUs (n = 15) were selected to fill in gaps in the coverage. Preliminary studies suggest using a sightability correction factor (SCF) of 1.16–1.25 for moose that were present, but not observed, during the survey using the GSPE method (Boertje et al. 2009). Because an SCF has not been determined in Unit 20B, we used the midpoint of SCF data suggested by Boertje et al. (2009) and applied an SCF of 1.21 to GSPE estimates in Unit 20B to estimate total moose numbers.

In November 2013, snow conditions were adequate in central and western Unit 20B to complete a GSPE survey. We used the same sampling and sightability methodology used in 2012. We surveyed 145 of 425 SUs from eastern and western Unit 20B of which 101 were high density SUs and 44 were low density. To evaluate management objectives, we obtained a unitwide estimate of moose abundance by combining the 2012 population estimate from eastern Unit 20B with the 2013 population estimate for central and western Unit 20B.

Twinning Rate Surveys

Twinning rates were estimated from surveys conducted in traditional twinning survey trend count areas in Minto Flats and areas surveyed in central Unit 20B since 2006. Surveys in MFMA consisted of parallel transects flown at approximately ½-mile intervals at ≤500 feet above ground level in PA-18 or Bellanca Scout aircraft by experienced pilots. This method is most effective in MFMA because of the high density of moose and the open habitat. A high proportion of Central Unit 20B is forested, so surveys in central Unit 20B consisted of searching good moose habitat at 500–1,000 feet above ground level in a Bellanca Scout or PA-18. All moose observed were classified as bull; yearling cow; adult cow without a calf; or adult cow with single, twin, or triplet calves. In past years, we terminated surveys and excluded the data if <15% of the cows had calves. Twinning rate was calculated as the proportion of cows with twins or triplets from the sample of all cows with calves.

2012 Twinning Surveys

Minto Flats Management Area. East–west transects were flown on 24 May between the Tolovana River and Swanneck Slough to the west and Dunbar Trail to the east beginning at 65°02.9′N and working south until a sample of 50 parturient moose were found or we reached a latitude of 64°55.0′N. The survey was flown with a PA-18 Super Cub. Leaf-out was approximately 80%. Weather, turbulence, and airsickness were not factors. Survey flight time was 2.75 hours.

Central Unit 20B. On 30 May, we used a Bellanca Scout aircraft to search from Fairbanks down Goldstream Creek to Standard Creek road, over Luck Dome to Murphy Dome, up the Chatanika River to the Steese Highway, over Fort Knox gold mine to the Little Chena River, down the Little Chena River to the Chena River, up the Chena River to the flood control project and in the vicinity of Eielson Air Force Base and then down the north side of the Tanana River to Fairbanks. Weather, turbulence and airsickness were not factors in the survey. Total survey time was 4.7 hours.

2013 Twinning Surveys

Minto Flats Management Area. East–west transects were flown on 24 May between the Tolovana River and Swanneck Slough to the west and Dunbar Trail to the east beginning at 65°02.9′N and working south until a sample of 50 parturient moose were found or we reached a latitude of 64°55.0′N. The survey was flown with a PA-18 Super Cub. Leaf-out was approximately 50%. Turbulence and airsickness were not factors, but unseasonable warm temperatures (75–89°F) made it hard to locate moose. Many of the moose were found in the more shaded and dense forest or shrubs, likely escaping the heat; therefore they were more difficult to see from the air. Survey flight time was 4.9 hours.

Central Unit 20B. On 30 May, a PA-18 Super Cub aircraft was used to search from Fairbanks down Goldstream Creek to Standard Creek road, over Luck Dome to Murphy Dome, up the Chatanika River to the Steese Highway, over Fort Knox gold mine to the Little Chena River, down the Little Chena River to the Chena River, up the Chena River to the flood control project and in the vicinity of Eielson Air Force Base and then down the north side of the Tanana River to Fairbanks. Weather was 75–80°F, so moose were likely in shaded areas and more difficult to see. Turbulence and airsickness were not factors. Total survey time was 5.0 hours.

MORTALITY

We estimated harvest based on harvest reports. This included report data from general season harvest tickets; the MFMA registration permit hunt; and the FMA, Creamer's Refuge, and central and western Unit 20B antlerless drawing permit hunts. Reminder letters were sent to nonreporting general season hunters, and up to 2 letters and an e-mail 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 (RY), which begins 1 July and ends 30 June (e.g., RY12 = 1 July 2012–30 June 2013).

We estimated accidental mortality by motor vehicles and trains from Alaska Department of Public Safety (DPS) and Alaska Railroad Corporation records. We estimated unreported harvest based on 17.7% unreported harvest (including wounding loss) reported by Gasaway et al. (1992). We estimated illegal and other (defense of life or property, dispatched by DPS or Alaska Department of Fish and Game [ADF&G] personnel, potlatch, stickdance, and other reported deaths) mortality from DPS and ADF&G records and added an additional estimate of mortality caused by snaring calculated from annual estimates of the posthunt moose population × 0.005361 (estimated mortality rate caused by snares based on a radiocollared sample of moose in Unit 20A).

HABITAT

The most recent browse removal surveys were conducted in March 2010 in MFMA. Data on browse production and removal were estimated using plant sampling methods described by Seaton (2002). No browse removal surveys were conducted in RY11 or RY12.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Moose numbers have doubled in Unit 20B since the early 1990s. In 1990 the population was estimated at 9,800 moose (1.1 moose/mi^2; McNay 1992). The population was estimated at 12,499 moose (1.3 moose/mi^2) by 2001 and 16,214 moose (1.7 moose/mi^2) in 2003 (Table 1). The population then appeared to stabilize during 2004–2006. In 2008, the population estimate increased again to 17,954 (1.9 moose/mi^2) moose. In 2009, the population estimate was 20,173, and the lower end of the 90% confidence interval was above the intensive management population objective of 15,000 moose. During 2000–2009, we measured relatively high productivity and recruitment, as well as low snow winters and high predator (black bear, brown bear, and wolf) harvests in Unit 20B, which further indicated a period of population growth (Seaton 2010). Unitwide surveys were not completed during RY11 or RY12. We combined data collected in 2012 in eastern Unit 20B and 2013 in central and western Unit 20B to obtain a unitwide estimate of 14,057 moose (1.5 moose/mi^2). The extremely late spring in 2013 and intentionally high harvest of cow moose likely contributed to the lower population estimate during 2012 and 2013.

Within the 3 geographic zones in Unit 20B, moose numbers in central and western Unit 20B (including MFMA) showed similar increasing trends through 2009 and then a decrease in 2012 and 2013 (Table 1). During 2001–2009, central Unit 20B moose population estimate increased from 4,806 (1.3 moose/mi^2) to 6,856 (1.8 moose/mi^2) and then decreased to 5,841 (1.5 moose/mi^2) in 2013. In western Unit 20B moose numbers increased from 4,562 (1.6 moose/mi^2) to 9,742 (3.3 moose/mi^2) during 2001–2009 and then decreased to 5,419 (1.8 moose/mi^2) in 2013. Population estimates in eastern Unit 20B, however, increased slightly during 2001–2006 and remained stable during 2006–2009 (Table 1). It appears that there might be a slight decrease in the eastern Unit 20B population from 2009 through 2012.

During 2001–2010 the MFMA estimate increased from 2,252 (2.4 moose/mi^2) to 4,181 (4.4 moose/mi^2) and then decreased to 2,455 (2.6 moose/mi^2) in 2013. However, annual estimates of moose densities in MFMA during 2003–2013 were highly variable (Table 1), possibly the result of varying sampling effort, survey conditions and the small size of the area surveyed. The 2010 estimate was the best survey completed in regards to sampling effort. During that survey, 49% of all the sample units in MFMA were surveyed. Therefore our estimate resulted in the lowest 90% confidence interval (±9%) since 2001. However, surveys in MFMA may provide inconsistent results regardless of sampling effort if estimates are influenced by changes in moose distribution and the timing of the October or November migration (P. Valkenburg and R. Boertje, ADF&G wildlife biologists, personal communication to J. Selinger, 2000).

Gasaway et al. (1992) reported that areas of Interior Alaska and Yukon Canada where predators were lightly harvested had densities of 0.1–1.1 moose/mi^2. Higher moose densities occurred

where wolf and/or bear populations were below food-limited levels. Central Unit 20B and MFMA in western Unit 20B have had relatively intensive wolf trapping efforts compared with most of Interior Alaska, including eastern Unit 20B. Black bear harvest is also relatively high in roadside areas of Unit 20B and grizzly bears are rare relative to more remote areas of Alaska. This high predator harvest may have contributed to the increased moose densities in Unit 20B, however, we lack wolf and bear population estimates for this area.

Population Composition

Bull:Cow Ratios. The 2012 survey indicated post hunting bull:cow ratios of 40 bulls:100 cows in eastern Unit 20B. The 2013 central and western Unit 20B bull:cow ratios were 24 and 33 bulls:100 cows, respectively (Table 1). The estimated bull:cow ratio was 23:100 in MFMA in 2013.

Historically, bull:cow ratios in most of Unit 20B have exceeded the lower limit of the management objective of ≥30:100, but varied spatially by harvest intensity within the unit. For example, the overall Unit 20B bull:cow ratio averaged 40:100 through the early 1990s (McNay 1992). The less intensively harvested Salcha River drainage had bull:cow ratios of 44:100 (1990) and MFMA had 49:100 (1989) and 47:100 (1994). In contrast, the more intensively harvested central Unit 20B ratio was 28:100 (1990), and the most intensively harvested FMA had 9–14 bulls:100 cows (1989–1994).

Calf:Cow Ratios. Calf:cow ratios were high during 2001–2013 (Table 1). In general, calf:cow ratios tended to be higher in central and western Unit 20B where predation is likely lower, and lower in eastern Unit 20B, where predation is likely higher (Young 2006). This wasn't the case in the 2012 eastern Unit 20B survey where calf:cow ratio was higher than the ratios found in central and western Unit 20B during 2013. It is unclear whether differences in calf:cow ratios between central-western Unit 20A and eastern Unit 20A reflect actual differences in calf survival or are a spurious result of conducting the moose surveys during different years.

Twinning Rates. Twinning rates in MFMA were relatively stable during 2002–2013 ($\bar{x}$ = 24%; range = 13–34%) (Table 2). The MFMA twinning rate was 13% in 2012, but rebounded to 22% in 2013.

The central Unit 20B twinning rate was 4% in 2012, and 6% in 2013. Twinning surveys have been conducted in central Unit 20B since 2006 and have been consistently lower ($\bar{x}$ = 7%, range = 2–18) than in MFMA during 2006–2013.

Distribution and Movements

Moose are distributed throughout Unit 20B, consisting of nonmigratory and migratory subpopulations (Gasaway et al. 1983). During February–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 Unit 20B foothills during August–October. Boertje et al. (2009) estimated that 9% of the moose that calve in the Tanana Flats in Unit 20A had migrated from Unit 20B.

MORTALITY

Harvest

Season and Bag Limit. Seasons and bag limits in Unit 20B in RY11 and RY12 were as follows:

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Creamer's Field Migratory Waterfowl Refuge		
1 bull with spike–fork or greater antlers by bow and arrow only; or	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
1 antlerless moose by bow and arrow only, by drawing permit; up to 150 permits may be issued in FMA; a recipient of a drawing permit is prohibited from taking an antlered bull moose in FMA; or	1 Sep–27 Nov	1 Sep–27 Nov
1 antlerless moose by muzzleloader only, by drawing permit; up to 10 permits may be issued in FMA; a recipient of a drawing permit is prohibited from taking an antlered bull moose in FMA.	21–27 Nov (RY11) 1 Dec–31 Jan (RY12)	21–27 Nov (RY11) 1 Dec–31 Jan (RY12)
Remainder of Fairbanks management area.		
1 bull with spike–fork or greater antlers by bow and arrow only, or;	1 Sep–30 Sep 21 Nov–27 Nov	1 Sep–30 Sep 21 Nov–27 Nov
1 antlerless moose by bow and arrow only, by drawing permit; up to 150 permits may be issued in FMA; a recipient of a drawing permit is prohibited from taking an antlered bull moose in FMA.	1 Sep–27 Nov	1 Sep–27 Nov

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Minto Flats management area (RY11)		
1 moose by registration permit only	1 Sep–25 Sep or 10 Jan–28 Feb	No open season No open season
1 bull with spike–fork or 50-inch antlers, or antlers with ≥4 brow tines on one side.	11 Sep–25 Sep	No open season
Minto Flats management area (RY12)		
1 bull, or	21 Aug–27 Aug	No open season
1 bull with spike–fork or 50-inch antlers, or antlers with ≥4 brow tines on one side; or	8 Sep–25 Sep	No open season
1 antlerless moose by registration permit.	15 Oct–28 Feb	No open season
Middle fork drainage of Chena River, and Salcha River drainage upstream from and including Goose Creek.		
1 bull; or	1 Sep–20 Sep	1 Sep–20 Sep
1 bull by bow and arrow only; or	21 Sep–30 Sep	21 Sep–30 Sep
1 antlerless moose by drawing permit only; up to 300 permits may be issued; a person may not take a calf or cow accompanied by a calf; or	15 Aug–15 Nov	No open season
1 moose (RY11) or 1 bull (RY12) by muzzleloader permit.	1 Nov–30 Nov	No open season
Southeast of the Moose Creek dike within a half-mile of each side of the Richardson highway except Birch, Harding, and Lost Lake closed areas.		
1 bull; or	1 Sep–20 Sep	5 Sep–20 Sep
1 moose by bow and arrow or muzzleloader.	21 Sep–28 Feb	

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Remainder of Unit 20B		
1 bull; or	1 Sep–20 Sep	5 Sep–20 Sep
1 antlerless moose by drawing permit only; up to 900 permits may be issued; a person may not take a calf or cow accompanied by a calf.	15 Aug–15 Nov	No open season

Alaska Board of Game Actions and Emergency Orders.

Emergency Orders — In January 2013, we issued an emergency order to close the registration permit hunt (RM785) for antlerless moose in MFMA because the harvest quota of approximately 100 antlerless moose had been met.

Board of Game Actions Effective 1 July 2011 — At the spring 2010 meeting, the Alaska Board of Game (board) adopted a proposal to have a drawing permit muzzleloader hunt (DM782) for any moose in the middle fork of the Chena River and the Salcha River upstream of Goose Creek. This proposal was intended to add hunting opportunity in an area where the moose population was being underutilized. The board also adopted a proposal to implement a drawing permit hunt (DM783) for muzzleloader or archery within a half-mile of the Richardson Highway from the Moose Creek dike to the boundary with Unit 20D. The bag limit is 1 moose and the intention of the permit is to reduce the number of moose-vehicle collisions. Because the application period for drawing permits is in November and December (prior to the board passing these new hunts), both DM782 and DM783 were first available to hunters during the RY11 hunting season. Also during this meeting, the board adopted an ADF&G proposal to extend the general moose season 5 days in the remainder of Unit 20B. The intent of this proposal was to allow opportunity to hunt this high moose population with a harvestable surplus of bulls that could sustain a 5-day longer season. The season was lengthened from 1–15 September to 1–20 September. Also at the spring 2010 meeting, the board authorized ADF&G to issue up to 900 drawing permits for antlerless moose in Unit 20B and eliminated the prohibition on taking calf moose or cows accompanied by calves in FMA.

Board of Game Actions Effective 1 July 2012 — At the spring 2012 meeting, the board authorized a 21–27 August general season hunt for any bull in the MFMA area and lengthened the September general season to begin 8 September instead of 11 September. The board also authorized a registration permit for a 15 October–28 February antlerless moose season in MFMA. These changes were in response to a proposal that sought to address the limited registration hunts and the process to obtain those permits.

Earlier board actions are summarized by Hollis (2012), Seaton (2010), and Young (2006).

Harvest by Hunters.

General Season — Reported harvest of 605 bulls in RY11 and 652 bulls in RY12 ($\bar{x}$ = 629) was higher than the average reported harvest of 546 bulls during RY03–RY10 (Table 3). Most harvest during RY11–RY12 was in central Unit 20B, followed by western Unit 20B, then eastern Unit 20B (Table 3).

Reported harvest in FMA was 30 moose in RY11 and 25 in RY12 ($\bar{x}$ = 28; Table 3), a decrease from the RY03–RY10 average of 34. Relatively high harvest in FMA is likely the result of high densities and survival rates of moose in FMA.

Permit Hunts — There were no apparent trends in harvest, effort, or success rates in permit hunts during RY03–RY12 (Table 4). Harvest of antlerless moose increased in drawing permit hunts due to a substantial increase in the number of permits issued. Despite increases in the number of permits issued, success rates in those hunts remained relatively stable. Success rates drastically decreased in the registration hunts in RY12 because the hunt was changed to an unlimited registration permit and the number of permits issued drastically increased.

Hunter Residency and Success. Primarily local residents hunted moose in Unit 20B (Table 3). Participation by nonlocal Alaska residents and nonresidents was relatively low, but has increased most years since RY04. Nonlocal resident (n = 515) and nonresident (n = 192) hunters peaked in RY12.

The average success rate of 21% during RY11 and RY12 was similar to the average (20%) reported during RY03–RY10. During RY11 and RY12, central Unit 20B had the lowest success rates ($\bar{x}$ = 19%), followed by eastern Unit 20B ($\bar{x}$ = 26%) and then western ($\bar{x}$ = 29%). By comparison, success rates during RY03–RY10 were similar in central ($\bar{x}$ = 19%), eastern ($\bar{x}$ = 23%), and western Unit 20B ($\bar{x}$ = 24%). Typically, success rates are lower in areas with higher hunter densities and/or lower bull:cow ratios, such as central Unit 20B, and higher in areas with lower hunter densities and/or higher bull:cow ratios, such as eastern Unit 20B. Hunter success during the general season was typically lower in Unit 20B than elsewhere in Unit 20. For example, during RY03–RY12, 18–23% ($\bar{x}$ = 20%) of general season hunters in Unit 20B were successful (Table 3), whereas annual success rates in Units 20A and 20C typically exceed 35% (Hollis 2010, Young 2010).

Harvest Chronology. Most harvest was during 16–20 September ($\bar{x}$ = 29%) in RY11 and 11–15 September and 16–20 September ($\bar{x}$ = 25% each) in RY12 (Table 5). Between RY03 and RY10, more bull moose were killed during 1–5 September or during 11–15 September. However, the season was lengthened for the RY11 season, therefore a good portion of the harvest now occurs during the 16–20 of September when the bull moose are more susceptible due to rutting activities.

Transport Methods. Three- or 4-wheelers, followed by highway vehicles, then boats were the primary methods of transportation used by successful hunters (Table 6). Methods of transportation used by successful hunters were relatively consistent during RY03–RY12.

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 roads in the FMA averaged 72 animals during RY08–RY12 compared to 84 animals during RY03–RY07. This is an indication that the increased antlerless hunts in the FMA may be helping to reduce roadkill. An additional 57 and 48 moose were reported killed on roads in the remainder of Unit 20B during RY11 and RY12. Generally, few moose are reported killed by trains in Unit 20B (Young 2006). This trend continued during RY07 and RY08 ($\bar{x}$ = 9; range 6–12) but no data were available for RY09–RY12.

HABITAT

Assessment and Enhancement

A 2010 browse removal study in MFMA estimated browse biomass removal at 29.5% (27–32%, 95% CI), a moderately high removal rate (Paragi and Kellie, *In prep*). This was similar to the 2007 removal rate of 25.1% (20.6–29.6%, 95% CI; Paragi et al. 2008) in central Unit 20B. Short yearling weights in both the MFMA and central Unit 20B were below the threshold of 385 lb (175 kg) used as a signal to begin reducing moose density through liberal antlerless harvest (Boertje et al. 2007). This supported our recommendation to limit population growth through conservative antlerless harvests in portions of western and central Unit 20B during RY09–RY12. Since no browse survey was conducted during RY11 and RY12, and the 2013 population indicates that moose are within the intensive management population objective, it will be prudent to conduct another survey to determine if moose in Unit 20B are utilizing the browse at the same levels or if the levels have changed.

Previous moose habitat enhancement projects in Unit 20B included prescribed fire and promoting regeneration of decadent willows by planting and crushing willows in recently logged areas, as well as habitat improvement projects for grouse which also benefit moose (Young 2006).

NONREGULATORY MANAGEMENT PROBLEMS AND NEEDS

During RY11–RY12 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 important sources 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, we continue to work with the public through direct interaction and through the media to reduce nonhunting mortality and human-moose conflicts.

CONCLUSIONS AND RECOMMENDATIONS

Since no population estimates were available during RY11 and RY12, it is unknown if we met the intensive management population objective of 12,000–15,000 moose. However, the unitwide 2012–2013 estimate falls within the objective so it was met during RY13. Reported harvests reached the intensive management objective's lower limit of 600 moose during RY05–RY12, therefore we met this objective in RY11 and RY12. Because the 2012–2013 population estimate

remains high relative to our population objective, I recommend continuing a conservative antlerless moose harvest (1% of the prehunt moose population) in central Unit 20B and in the MFMA of western Unit 20B to limit population growth, maintain the population within the intensive management population objective, and increase yield to meet the intensive management harvest objective. If unitwide surveys indicate population growth or decline, more aggressive or restrictive antlerless harvest may be necessary to maintain this population level.

During RY11 and RY12 it is unknown if we met our management objective of a posthunting ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each of the 3 geographic zones (i.e., eastern, central, and western Unit 20B), however we did meet this objective in 2013. This is consistent with surveys conducted during 2001–2009 that indicate we consistently met this management objective, except occasionally in the relatively small (900 mi^2) MFMA (e.g. 12 bulls:100 cows in fall 2005). Lower bull:cow ratios in MFMA and FMA (300 mi^2) are of less biological concern than in larger areas because these areas are small in relation to the annual home range of moose. If insufficient bulls are available for breeding, cows in estrus 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 MFMA and FMA to breed estrous cows.

I concur with Dale (1998) that we need to continue to collect annual unitwide population data to better assess the status of the moose population, particularly because we have antlerless hunts in most of western and central Unit 20B, as well as in MFMA and FMA. I recommend continued twinning rate surveys in MFMA and central Unit 20B to evaluate nutritional status of moose in those portions 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. Also, I recommend an intensive survey of FMA or MFMA on alternating 4–6 year cycles to evaluate the effectiveness of increased antlerless harvests to reduce moose numbers and densities and moose–vehicle collisions. Browse utilization surveys should be conducted every few years to evaluate habitat condition.

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Table 1. Unit 20B aerial moose fall composition counts and estimated population size, 2001–2013.

Count area	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	33	15	30	18	751	914	12,499 (±19)[d]	12,499	1.3
Unit 20B	2003	33	23	39	22	399	514	16,214 (±24)[d]	16,214	1.7
Unit 20B	2004	32	18	42	25	551	730	16,710 (±30)[d]	16,710	1.7
Unit 20B	2006	29	22	43	26	838	1,127	16,118 (±23)[d]	16,118	1.6
Unit 20B	2008	28	20	36	24	1,177	1,558	17,954 (±18)[d]	17,954	1.9
Unit 20B	2009	37	16	36	21	891	1,128	20,173 (±22)[d]	20,173	2.2
Unit 20B[e]	2012 and 2013							14,057 (±14)[d]	14,057	1.5
Eastern[f]	2001	47	15	24	11	271	305	2,454 (±22)	2,945	1.2
Eastern[f]	2006	36	24	46	24	180	236	2,728 (±34)	3,274	1.4
Eastern[f]	2008	31	13	26	20	106	132	3,126 (±31)	3,751	1.5
Eastern[f]	2009	40	16	27	18	155	189	2,954 (±41)	3,574	1.5
Eastern[f]	2012	40	15	36	21	439	566	2,310 (±19)	2,795	1.2
Central[g]	2001	27	13	34	*26*	205	278	4,005 (±25)	4,806	1.3
Central[g]	2003	26	21	35	21	191	242	3,995 (±37)	4,794	1.3
Central[g]	2004	33	22	46	27	158	216	5,276 (±41)	6,331	1.7
Central[g]	2005	26	26	40	24	493	645	5,881 (±18)	7,057	1.8
Central[g]	2006	28	22	41	17	328	397	5,451 (±29)	6,541	1.7
Central[g]	2008	26	24	36	26	627	852	6,197 (±20)	7,436	1.9
Central[g]	2009	32	16	33	21	258	328	5,666 (±38)	6,856	1.8
Central[g]	2013	24	12	30	19	472	584	4,828 (±17)	5,841	1.5
Western[h]	2001	30	16	29	17	274	331	3,802 (±22)	4,562	1.6
Western[h]	2006	27	20	44	22	384	494	5,142 (±24)	6,170	2.1
Western[h]	2008	27	22	44	23	444	574	5,515 (±19)	6,618	2.2
Western[h]	2009	39	16	41	22	478	611	8,051 (±19)	9,742	3.3
Western[h]	2013	33	12	33	20	386	485	4,479 (±17)	5,419	1.8
MFMA[i,j]	2001	30	16	28	17	191	230	1,877 (±21)	2,252	2.4
MFMA[j]	2003	44	20	36	23	89	116	1,352 (±63)	1,622	1.7
MFMA[j]	2004	26	11	47	24	302	399	3,447 (±19)	4,136	4.3
MFMA[j]	2005	12	12	40	26	296	400	2,937 (±17)	3,524	3.7
MFMA[j]	2006	19	15	45	28	243	337	2,724 (±23)	3,269	3.4

Count area	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
MFMA[j]	2008	30	23	37	18	309	375	2,487 (±20)	2,984	3.1
MFMA[j]	2009	40	12	40	21	235	298	4,749 (±19)	5,746	6.0
MFMA[j]	2010	34	20	41	23	1,309	1,709	3,455 (±9)	4,181	4.4
MFMA[j]	2013	23	8	41	24	189	250	2,029 (±18)	2,455	2.6
FMA[k,l]	2001	12	13	39	29	70	99	461 (±34)	553	1.7
FMA[k,m]	2008	25	26	56	31	288	417	417[n]	500	1.7

[a] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[b] Geospatial population estimator method (GSPE; Kellie and DeLong 2006).
[c] Preliminary sightability studies suggest a sightability correction factor (SCF) of 1.16 to 1.25 using the GSPE method.
[d] Estimated population and confidence interval are calculated with the SCF.
[e] The 2013 Unit 20B estimate is a combination of data from the 2012 survey from eastern Unit 20B and 2013 survey in central and western Unit 20B. Unitwide composition data are not available for combined data.
[f] Survey area = 2,425 mi^2.
[g] Survey area = 3,829 mi^2.
[h] Survey area = 2,942 mi^2.
[i] Minto Flats management area (MFMA) within western Unit 20B.
[j] Count area = 951 mi^2.
[k] Fairbanks management area (FMA).
[l] Survey area = 318 mi^2.
[m] Survey area = 293 mi^2.
[n] Census, all sample units surveyed.

Table 2. Results of twinning rate surveys for moose in Unit 20B (Minto Flats management area and central Unit 20B), 2002–2013.

		Cows			
Year	Date(s)	w/Single calf	w/Twins	Total	% Twins[a]
2002[b]	29 May	38	10	48	21
2003[b]	29 May	40	10	50	20
2004[b]	25 May	61	21	82	26
2005[b]	25 May	39	15	54	28
2006[b]	24 May	44	15	59	25
2006[c]	24–26 May	23	5	28	18
2007[b]	26 May	47	16	63	25
2007[c]	29–31 May	29	1	30	3
2008[b]	24 May	60	20	80	25
2008[c]	29–31 May	55	7	62	11
2009[b]	25 May	46	16	62	26
2009[c]	28–29 May	50	1	51	2
2010[b]	25 May	42	9	51	18
2010[c]	28–29 May	28	1	29	3
2011[b]	25 May	33	17	50	34
2011[c]	25–26 May	22	2	24	8
2012[b]	24 May	55	8	63	13
2012[c]	30 May	26	1	27	4
2013[b]	29 May	39	11	50	22
2013[c]	30 May	16	1	17	6

[a] Percentage of cows with calves that had twins.
[b] Minto Flats management area.
[c] Central Unit 20B.

Table 3. Unit 20B moose hunter[a] residency and success, regulatory years[b] 2003–2012.

Area/ Regulatory year	Successful						Unsuccessful					Total hunters
	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	
Eastern Unit 20B — Uniform Coding Units[d] (UCUs) 600, 601, 602, 603, 604, 605, 684)												
2003	58	1	10	0	69	20	235	22	15	0	272	341
2004	49	6	11	3	69	22	205	10	20	4	239	308
2005	77	11	8	0	96	25	243	13	24	1	281	377
2006	76	6	7	0	89	24	235	29	15	5	284	373
2007	60	14	8	4	86	24	222	24	22	2	270	356
2008	65	13	6	4	88	26	206	20	12	10	248	336
2009	54	15	6	1	76	23	208	36	7	4	255	331
2010	54	14	6	2	76	22	204	38	15	11	268	344
2011	68	7	9	2	86	25	200	39	11	9	259	345
2012	72	13	11	4	100	27	211	35	17	1	264	364
Central Unit 20B — (UCUs 207, 208, 209, 211, 212, 213, 301, 401, 402, 403, 404, 405, 406, 484, 485,486,487, 501, 583, 584)												
2003	232	33	23	0	288	19	1,099	94	55	5	1,253	1,541
2004	203	18	25	5	251	19	916	56	57	22	1,051	1,302
2005	211	21	29	0	261	17	1,070	97	70	8	1,245	1,506
2006	239	25	28	2	294	18	1,110	109	76	8	1,303	1,597
2007	216	31	33	0	280	18	1,072	118	63	14	1,267	1,547
2008	276	45	20	19	360	23	1,005	100	44	62	1,211	1,571
2009	261	42	25	1	329	21	1,093	106	48	26	1,273	1,602
2010	183	21	18	4	226	17	937	118	48	21	1,124	1,350
2011	227	37	23	4	291	21	838	130	48	27	1,043	1,334
2012	203	36	39	7	285	17	1,088	159	82	49	1,378	1,663
Western Unit 20B — (UCUs 101, 201, 202, 203, 204, 205, 206, 210)												
2003	65	19	3	0	87	21	244	69	17	1	331	418
2004	56	16	6	2	80	22	214	51	13	4	282	362
2005	53	15	8	0	76	20	233	47	15	1	296	372
2006	57	16	5	0	78	20	241	63	8	4	316	394
2007	67	20	8	1	96	23	247	62	12	1	322	418
2008	91	23	6	1	121	28	216	78	12	8	314	435
2009	83	35	11	1	130	29	245	58	15	5	323	453
2010	80	29	4	3	116	25	246	98	7	5	356	472
2011	69	45	10	4	128	30	196	74	9	10	289	417
2012	107	48	4	4	163	28	295	111	10	4	420	583

Area/ Regulatory year	Successful: Local[c] resident	Successful: Nonlocal resident	Successful: Nonresident	Successful: Unk	Successful: Total	Successful: % Successful	Unsuccessful: Local[c] resident	Unsuccessful: Nonlocal resident	Unsuccessful: Nonresident	Unsuccessful: Unk	Unsuccessful: Total	Total hunters
FMA[e] — general archery hunt[f] (UCUs 0212, 0213, 0300, 0301, 0401, 0402, 0403, 0501; archery only)												
2003	54	5	1	0	60							
2004	31	0	2	0	33							
2005	18	2	1	0	21							
2006	21	1	1	0	23							
2007	21	2	0	0	23							
2008	26	1	0	0	27							
2009	48	2	0	0	50							
2010	33	1	2	0	36							
2011	28	2	0	0	30							
2012	24	1	0	0	25							
MFMA[g] — general hunt (UCUs 0201, 0205, 0210; Nonresident hunters and antlerless harvest censored)												
2003	39	10	0	0	49	30	96	19	0	0	115	164
2004	28	8	0	0	36	25	90	16	0	0	106	142
2005	28	10	0	0	38	25	100	17	0	0	117	155
2006	33	11	0	0	44	25	102	30	0	1	133	177
2007	43	8	0	0	51	28	108	25	0	0	133	184
2008	45	11	0	0	56	30	102	26	0	0	128	184
2009	36	14	0	1	51	29	107	16	0	3	126	177
2010	39	15	0	2	56	25	121	45	0	3	169	225
2011	36	13	0	2	51							
2012	51	15	0	3	69							
Unit 20B remainder, general hunt (Includes FMA general archery hunt, but excludes MFMA)												
2003	358	47	38	0	443	18	1,775	198	99	8	2,080	2,523
2004	324	41	45	13	423	20	1,479	129	101	35	1,744	2,167
2005	368	43	47	0	458	19	1,690	170	114	14	1,988	2,446
2006	394	45	42	2	483	19	1,784	203	109	17	2,113	2,596
2007	350	67	54	1	472	18	1,772	241	118	19	2,150	2,622
2008	440	93	33	24	590	22	1,653	221	81	90	2,045	2,635
2009	451	116	54	3	624	22	1,835	262	87	44	2,228	2,852
2010	364	71	44	8	487	19	1,684	301	84	47	2,116	2,603
2011	403	95	48	8	554	22	1,557	285	84	52	1,978	2,532
2012	410	99	48	16	573	19	1,866	348	134	73	2,421	2,994

Area/ Regulatory year	Successful						Unsuccessful					Total hunters
	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	
All general hunts												
2003	397	57	38	0	492	18	1,871	217	99	8	2,195	2,687
2004	352	49	45	13	459	20	1,569	145	101	35	1,850	2,309
2005	396	53	47	0	496	19	1,790	187	114	14	2,105	2,601
2006	427	56	42	2	527	19	1,886	233	109	18	2,246	2,773
2007	394	75	57	2	528	19	1,879	265	119	19	2,282	2,810
2008	486	104	33	25	648	23	1,755	247	82	91	2,175	2,823
2009	487	130	54	4	675	22	1,942	278	87	47	2,354	3,029
2010	403	86	44	10	543	19	1,805	346	84	50	2,285	2,828
2011	439	108	48	10	605	22	1,640	318	84	55	2,097	2,702
2012	461	114	58	19	652	20	2,025	401	134	76	2,636	3,288

[a] Excludes drawing, registration, and Tier II permit hunt harvest.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[c] Residents of Unit 20.
[d] Uniform coding units (UCU) are a numbering system used to differentiate drainages in a game management unit.
[e] Fairbanks management area (FMA), due to the nature of the harvest reporting system, unsuccessful bowhunters cannot be extracted from the data, thus unsuccessful archers are not available for the FMA archery-only hunts.
[f] Subtracted number of bulls reported harvested by bow and arrow on Eielson Air Force Base (in UCU 0501, but outside FMA).
[g] Minto Flats management area (MFMA).

Table 4. Unit 20B moose harvest data by permit hunt, regulatory years[a] 2003–2012.

Hunt	Regulatory year	Permits issued	Successful hunters (%)	Unsuccessful hunters (%)	Did not hunt (%)	Did not report (%)	Bulls (%)	Cows (%)	Harvest
Drawing hunts	2003	100	28 (35)	53 (65)	17 (17)	2 (2)	0 (0)	28 (100)	28
	2004	160	50 (38)	80 (62)	24 (16)	6 (4)	1 (2)	49 (98)	50
	2005	159	38 (32)	81 (68)	39 (25)	1 (1)	2 (5)	39 (95)	41
	2006	360	158 (53)	142 (47)	55 (15)	5 (1)	11 (7)	147 (93)	158
	2007	361	127 (42)	169 (58)	65 (18)	0 (0)	8 (6)	119 (94)	127
	2008	185	63 (40)	93 (60)	29 (16)	0 (0)	0 (0)	63 (100)	63
	2009	867	254 (41)	362 (59)	247 (29)	4 (1)	1 (0)	253 (100)	254
	2010	851	209 (33)	422 (67)	216 (26)	4 (1)	8 (4)	201 (96)	209
	2011	1,276	309 (32)	645 (68)	318 (25)	4 (1)	15 (5)	294 (95)	309
	2012	1,250	286 (33)	593 (67)	369 (30)	2 (1)	15 (5)	271 (95)	286
Registration hunts	2003	0							
	2004	110	62 (76)	20 (24)	2 (2)	26 (24)	30 (48)	32 (52)	62
	2005	115	64 (65)	35 (35)	16 (14)	0 (0)	26 (41)	38 (60)	64
	2006	193	104 (64)	59 (36)	21 (11)	9 (5)	45 (43)	59 (57)	104
	2007	197	107 (64)	60 (36)	29 (15)	1 (1)	46 (43)	61 (57)	107
	2008	211	140 (77)	43 (23)	26 (12)	2 (1)	69 (49)	71 (51)	140
	2009	210	142 (77)	43 (23)	22 (11)	3 (1)	65 (46)	77 (54)	142
	2010	230	150 (75)	50 (25)	25 (11)	5 (2)	78 (52)	72 (48)	150
	2011	237	132 (71)	54 (29)	42 (18)	9 (4)	54 (41)	78 (59)	132
	2012	825	140 (39)	217 (61)	441 (55)	27 (3)	18 (13)	122 (87)	140
Tier II hunts	2003	100	46 (58)	30 (38)	21 (22)	3 (3)	23 (50)	23 (50)	46
Total for all permit hunts	2003	200	74 (47)	83 (53)	38 (19)	5 (3)	23 (31)	51 (69)	74
	2004	270	112 (47)	100 (53)	26 (11)	32 (12)	31 (28)	81 (72)	112
	2005	274	105 (48)	113 (52)	55 (20)	1 (1)	28 (27)	77 (73)	105
	2006	553	262 (56)	201 (44)	76 (14)	14 (3)	56 (21)	206 (79)	262
	2007	558	234 (51)	229 (49)	94 (17)	1 (1)	54 (23)	180 (77)	234
	2008	396	203 (60)	136 (40)	55 (14)	2 (1)	69 (34)	134 (66)	203
	2009	1,077	396 (48)	405 (52)	269 (25)	7 (1)	66 (17)	330 (83)	396
	2010	1,081	359 (43)	472 (57)	241 (22)	9 (1)	86 (24)	273 (76)	359
	2011	1,513	441 (39)	699 (61)	360 (24)	13 (1)	69 (16)	372 (84)	441
	2012	2,075	426 (34)	810 (66)	810 (40)	29 (1)	33 (8)	393 (92)	426

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).

Table 5. Unit 20B moose harvest[a] chronology percent by month/day, regulatory years[b] 2003–2012.

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*
2003	24	26	35	8	1	7	492
2004	33	27	29	6	2	4	459
2005	38	22	27	6	2	4	496
2006	35	20	31	5	2	6	527
2007	27	24	36	8	2	4	528
2008	37	25	29	5	2	3	648
2009	33	29	27	8	2	2	664
2010	29	22	35	8	3	3	543
2011	21	17	24	29	5	4	605
2012	22	20	25	25	4	4	652

[a] Excludes drawing, registration, and Tier II permit hunt harvest.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).

Table 6. Unit 20B moose harvest[a] percent by transport method, regulatory years[b] 2003–2012.

Regulatory year	Harvest percent by transport method									
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Other/ Unknown	*n*
2003	4	0	20	28	0	4	36	3	5	492
2004	4	0	16	30	0	3	39	3	4	459
2005	4	0	21	31	2	5	34	2	3	496
2006	3	1	19	38	1	2	31	3	4	527
2007	3	1	17	35	0	4	33	3	2	528
2008	3	0	17	37	0	6	33	2	2	655
2009	2	0	20	40	0	4	28	1	2	675
2010	3	0	21	40	0	5	26	3	2	543
2011	3	0	19	39	0	5	26	3	5	605
2012	5	0	22	35	0	5	27	3	3	652

[a] Excludes drawing, registration, and Tier II permit hunt harvest.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).

Table 7. Estimate of Unit 20B moose harvest[a] and accidental death, regulatory years[b] 2001–2012.

	Harvest by hunters							Accidental death					
	Reported				Estimated			Road[c]					
Regulatory year	M	F	Unk	Total	Unreported[d]	Illegal/ Other	Total	FMA[e]	Unit 20B remainder	Total	Train[f]	Total	Combined total
2001	531	53	6	590	104	37[g]	141	72	50	122	9	131	862
2002	725	61	2	788	139	47[g]	186	118	71	189	12	201	1,175
2003	549	52	2	603	107	50[g]	157	87	64	151	13	164	924
2004	488	84	1	573	101	56[g]	157	95	62	157	30	187	917
2005	519	77	4	600	106	109[h]	215	79	57	136	6	142	957
2006	571	212	7	790	140	105[h]	245	88	68	156	8	164	1,199
2007	581	183	5	769	136	93[h]	229	73	56	129	12	141	1,139
2008	718	135	4	857	152	112[h]	264	79	67	146	6	152	1,273
2009	664	264	7	935	165	90	255	79	72	151	0[i]	151	1,341
2010	558	278	1	837	148	80	228	78	59	137	0[i]	137	1,202
2011	672	373	2	1,047	185	101	286	60	57	117	0[i]	117	1,450
2012	681	396	2	1,079	191	104	295	65	48	113	0[i]	113	1,487

[a] Includes general, registration and permit hunt harvest.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2001 = 1 July 2001–30 June 2002).
[c] Documented kills; actual number killed by vehicles is certainly greater.
[d] Based on 17.7% unreported harvest (including wounding loss) estimated by Gasaway et al. (1992).
[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.
[g] Includes illegal, defense of life or property, dispatched, potlatch, stickdance, and other reported deaths.
[h] Includes illegal, defense of life or property, dispatched, potlatch, stickdance, and other reported deaths, plus an additional estimate of mortality caused by snaring calculated from annual estimates of the posthunt moose population × 0.005361 (estimated mortality rate caused by snares based on radiocollared sample of moose in Unit 20A).
[i] No data available for these years.