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CHAPTER 26: MOOSE MANAGEMENT REPORT

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

LOCATION

GAME MANAGEMENT UNIT: 20E (10,680 mi^2 total area, 9,750 mi^2 moose habitat)

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 an estimated minimum of 12,000 moose. The population declined rapidly during 1965 through 1976, reaching an estimated low of 2,200 moose. During 1976–2010, the moose population in Unit 20E increased in some areas but remained at low densities, fluctuating at an estimated 2,200–5,300 moose (0.3–0.7 moose/mi^2 of moose habitat). 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 other variables had little 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 3,800 mi^2 area of Unit 20E using a combination of aerial shooting by ADF&G and trapping by the public. In addition, grizzly bear hunting regulations were liberalized in 1981, causing moderate increases of grizzly bear harvest in portions of the unit, possible local declines in grizzly bear numbers, and changes in the bear population age and sex structure (Gardner 1999). During 1997–2001, ADF&G conducted the Fortymile Nonlethal Wolf Control Program (nonlethal program), designed to benefit the Fortymile caribou herd, in western Unit 20E, northern Unit 20D, and eastern Unit 20B. Effects of the nonlethal program on moose were evaluated by ADF&G in portions of western Unit 20E and northern Unit 20D (Tok West study area) during 1998–2005 (Boertje and Gardner 1999, Boertje et al. 2008) using the geospatial population estimator method (GSPE; Ver Hoef 2001, 2008; Kellie and DeLong 2006). Although surveys indicated that the moose population increased in some areas during 1976–2010, it did not increase beyond the ability of wolves and bears to maintain the population at low densities (≤1.0 moose/mi^2 of moose habitat).

The most recent effort to increase the moose population in Unit 20E began in November 2004, when the Alaska Board of Game (board) implemented the Upper Yukon–Tanana Predation

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

Control Program (UYTPCP), encompassing portions of Unit 20E, to allow the moose population to increase. The control program was expanded by the board in May 2006 to include all of Unit 20E and parts of surrounding units and was ongoing during regulatory year (RY) 2011 (RY = 1 July through 30 June, e.g., RY11 = 1 July 2011–30 June 2012) through RY12.

Historically, moose harvest was low in relation to the population and was largely restricted to the Taylor Highway corridor and the Mosquito Fork Fortymile River drainage. During the 1960s, high moose densities supported a long hunting season and a bag limit of 1 moose. As moose numbers declined, harvest was 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 closed. Since at least 1977, local communities have expressed concern about chronically low moose densities due to predation and have proposed various predator control programs to increase moose numbers and moose harvest. Improved moose density prompted the board to approve a 10-day bulls-only season in 1982, which continued through 1990. In response to further moose population improvement, the board lengthened the moose season to 15 days during 1991–2000.

The primary moose hunters in Unit 20E through 1991 were local residents and residents from Fairbanks and Southeast Alaska. During 1992–2010, more hunters from Southcentral Alaska traveled to Unit 20E to hunt moose, likely in response to more restrictive moose hunting regulations in Southcentral Alaska, and for the opportunity to hunt moose and caribou at the same time. The fall moose season was split in 2001 into a 5-day late August season and a 10-day September season, closing during Labor Day weekend. In response to increased moose harvest due to increasing numbers of caribou hunters, the moose hunting season was managed under a registration permit in most of Unit 20E. Moose and caribou permit conditions stipulated that a hunter could not hold a registration permit for both species at the same time. Remote portions of the upper Middle Fork Fortymile River remained a general season hunt, with the same season dates as the moose registration permit hunt. These actions appeared to stabilize moose harvest during 2001–2007, and although harvest increased during 2008–2010, bull:cow ratios did not decrease below the management objective and the season structure remained 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

- Maintain a population of 8,000–10,000 moose.
- Maintain a harvest of 500–1,000 moose annually.

METHODS

POPULATION STATUS AND TREND

During late October and November 2011 and 2012 we estimated moose population size in southern Unit 20E within the 2,452 mi^2 Tok West and 2,178 mi^2 Tok Central (called Tok East during 1998–2003) survey areas using the GSPE method (Ver Hoef 2001, 2008; Kellie and DeLong 2006). The Tok West and Tok Central moose survey areas include the Mosquito Fork Fortymile River drainage downstream from and including the Mosquito Flats, the West Fork Fortymile River drainage and the northern Mount Fairplay–lower Dennison Fork Fortymile River areas. Survey units (SU) in both the Tok West and Tok Central survey areas were stratified as high density if they were likely to contain >3 moose. In 2011 we selected 83 (49 high density and 34 low density; 486 mi^2) of 419 SUs in the Tok West survey area and 77 (45 high density and 32 low density; 458 mi^2) of 366 SUs in the Tok Central survey area. During 2012, we selected 80 (48 high density and 32 low density; 468 mi^2) SUs in the Tok West survey area and 81 (50 high density and 31 low density; 482 mi^2) SUs in the Tok Central survey area. Population and ratio estimates for the 2 separate survey areas and the combined area were calculated using the WinfoNet GSPE software (DeLong 2006).

A GSPE moose survey was also conducted in northwest Unit 20E within the Yukon–Charley Rivers National Preserve (YCNP) in 2012 by the National Park Service (NPS; Burch 2012). NPS estimated the moose density in the entire 3,096 mi^2 YCNP survey area. We applied this density estimate to the approximately 1,200 mi^2 portion of the YCNP survey area located within Unit 20E to obtain an estimate of observable moose. No other formal surveys were conducted in the remaining 3,960 mi^2 of moose habitat in northern Unit 20E during RY11–RY12. Because habitat is similar, I estimated the moose population in this area by extrapolating the moose density estimated for YCNP in 2012.

We used the following equation to estimate a probable population range for all of Unit 20E in RY11 and RY12:

$$Pop_{20E} = Pop_{west/central} + Pop_{YCNP} + Pop_{REM}$$

where

Pop_{20E} = Lower or upper range of observable moose estimated within Unit 20E.

$Pop_{west/central}$ = Upper or lower 90% CI of observable moose population estimate for the combined Tok West and Tok Central survey areas

Pop_{YCNP} = 2012 observable moose population estimate for the 1,200 mi^2 portion of the YCNP survey area that is located within Unit 20E

Pop_{REM} = Estimated number of observable moose in the remainder of Unit 20E, calculated by applying the YCNP moose density estimate to the 3,960 mi^2 area of northern Unit 20E outside the Tok Central, Tok West, and YCNP survey areas.

All GSPE surveys during 2004–2012 used a search intensity of 5.5–7 min/mi^2 with no sightability correction factor. We use low-to-medium search intensities with the understanding that lower search intensities likely underestimate populations and introduce additional, unmeasured variation among survey years because of differences in survey conditions. However, because the unitwide population estimate remains far below objectives, results from these surveys have provided adequate results to manage this population. In the future, if the population approaches management objectives, it will become necessary to increase search intensities and correct for sightability to improve the accuracy of our estimates.

Data collected during the 2004–2012 GSPE surveys were also used to examine changes in sex and age composition within the survey areas. During GSPE surveys, moose were classified as large bulls (antlers ≥50 inches); medium bulls (antlers larger than yearlings but <50 inches); yearling bulls (spike, forked, or small palmate antlers without brow separation); cows without calves; cows with 1 calf; cows with 2 calves; lone calves; or unidentifiable moose.

Twinning Surveys

Twinning rates were estimated during 2011–2012 from spring surveys conducted in southern Unit 20E. Reconnaissance-style twinning rate surveys were flown in late May during or within a few days of the median calving date (Boertje et al. 2007) in areas historically used as moose calving areas. Roughly parallel contour-transects were flown at approximately ½-mile intervals ≤500 feet above ground level in PA-18 aircraft by experienced contract pilots and ADF&G observers. All moose observed were classified as bull; yearling cow; adult cow without a calf; or adult cow with single, twin, or triplet calves. A minimum sample size of 50 cows with calves is preferable for accurate estimation of twinning rates. However, due to low moose densities in southern Unit 20E and a limited budget for conducting twinning surveys, we established, a priori, a minimum desired 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 observed newborn calves.

HARVEST

We estimated annual harvest from mandatory harvest report cards. During 2011–2012, this included data from the registration hunt RM865 in most of Unit 20E, the general season hunt in the upper Middle Fork Fortymile River drainage, and drawing hunts DM794 and DM796 during November–December in the Ladue River controlled use area. General season hunters received 1 reminder letter and permitted hunters received 1 or 2 reminder letters and usually an e-mail and telephone call if we did not receive timely harvest reports. We summarized data on hunter residency, hunter success, harvest chronology, and transport methods. Harvest data were summarized by regulatory year.

HABITAT ENHANCEMENT

Natural wildfires were managed under the *Alaska Interagency Fire Management Plan* (Alaska Wildland Coordinating Group 1998). No prescribed fires were conducted or planned in Unit 20E during RY11–RY12.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In 2011, survey conditions ranged from poor to good, with the poorest conditions occurring during the beginning of the survey in the lower elevation SUs where complete snow cover was lacking. Search time averaged 5.7 min/mi^2. The estimated number of observable moose in the Tok West survey area was 3,082 moose (±19%, 90% CI; 1.26 moose/mi^2; Table 1), and the estimated number of observable moose in the Tok Central survey area was 1,025 moose (±26%, 90% CI; 0.47 moose/mi^2). The combined Tok West and Tok Central observable moose population estimate was 4,148 moose (±16%, 90% CI; 0.90 moose/mi^2). The 2011 unitwide observable moose population estimate for Unit 20E was 4,530–6,340 observable moose, with an estimated density of 0.46–0.65 moose/mi^2 of moose habitat (9,750 mi^2).

In 2012, survey conditions ranged from good to excellent. Search time averaged 7.0 min/mi^2. The estimated number of observable moose in the Tok West survey area was 2,748 moose (±22%, 90% CI; 1.12 moose/mi^2; Table 1), and the estimated number of observable moose in the Tok Central survey area was 1,299 moose (±16%, 90% CI; 0.59 moose/mi^2). The combined Tok West and Tok Central observable moose population estimate was 4,165 moose (±16%, 90% CI; 0.91 moose/mi^2). NPS estimated the moose density in the entire 3,096 mi^2 YCNP survey area (including 1,200 mi^2 in Unit 20E) at 0.25 moose/mi^2 (±20%, 90% CI) in 2012 (Burch 2012). The 2012 unitwide observable moose population estimate was 4,540–6,370 observable moose, with an estimated density of 0.47–0.65 moose/mi^2 of moose habitat.

The southern Unit 20E moose population likely increased during 2004–2009 and remained stable during 2009–2012. Both the 2011 and 2012 population estimates for the combined Tok West and Tok Central areas are similar to the 2009 and 2010 estimates of 3,968 (±15%, 90% CI) and 3,894 (±12%, 90% CI) moose, respectively, whereas the 2009 population estimate of 3,968 observable moose was 75% greater than the 2004 estimate of 2,267 moose (±17%, 90% CI; 0.49 moose/mi^2), and 90% confidence intervals do not overlap. Nevertheless, the unitwide estimates from 2011 and 2012 remain far below the intensive management population objective of 8,000–10,000 moose.

Population Composition

During 1998–2012, bull:cow ratios in both the Tok West and Tok Central survey areas exceeded the management objective of 40 bulls:100 cows every year except 2006 (39 bulls:100 cows in the Tok West survey area; Table 1).

During RY98–RY04, ratios of 5-month-old calves:100 cows were consistently below 25 calves:100 cows and did not equal or exceed 30 calves:100 cows during any year in the southern Unit 20E survey areas (Tok West and Tok Central; Table 1). Gasaway (1992) summarized data collected from 36 different sites in Alaska and Yukon and concluded that fall calf:cow ratios ≤25 calves:100 cows were generally observed in moose populations with a stable to declining trend, while populations with fall calf:cow ratios ≥30 calves:100 cows were generally observed in moose populations with an increasing trend.

During RY05–RY10, calf:cow ratios in the Tok West survey area exceeded 30 calves:100 cows every year except 2008 (27 calves:100 cows), but remained lower in the Tok Central survey area ($\bar{x}$ = 22 calves:100 cows; range = 15–28). Wolf control in the UYTPCP may have contributed to higher calf survival in the Tok West survey area during RY05–RY10 by reducing wolf predation on calves. Although Gasaway et al. (1992) did not show wolves as the primary predator of calves ≤5 months-of-age in southern Unit 20E, wolves likely do account for some mortality of young calves in this area. Large fires in the Tok West survey area in 2004 and 2005 may have also contributed to higher calf survival because grizzly bears (the primary predator on moose calves in this area identified by Gasaway et al. 1992) may have avoided these recently burned areas (C. Gardner, ADF&G, unpublished data, Fairbanks).

During RY11–RY12, calf:cow ratios were low in both the Tok West ($\bar{x}$ = 18 calves:100 cows) and Tok Central ($\bar{x}$ = 7 calves:100 cows) survey areas. The combined Tok West and Tok Central calf:cow ratio averaged 16:100 during RY11–RY12 compared to 28:100 during RY05–RY10. Although incomplete snow cover during portions of the 2011 survey may have resulted in sightability problems (especially of lone cow-calf pairs), multiple years of low calf:cow ratios indicates low recruitment into the population. Although the mechanism for the decreased recruitment is unknown, it is likely primarily due to grizzly bear predation (Gasaway et al. 1992), and it is unlikely to increase substantially without reductions in grizzly bear numbers. Low calf:cow ratios did not result in a decreased estimated population size, which remained stable during RY11–RY12.

Twinning Rates

To account for variability that can exist between consecutive years and with our relatively low sample size of about 30 cows with calves, we used 3-year average twinning rates to evaluate nutritional condition of the moose population (Boertje et al. 2007). The average for 2012–2014 was 30% (Table 2), which is above rates observed in nutritionally stressed populations (Boertje et al. 2007). Based on this 3-year average, the population can support an increased moose population (Boertje et al. 2007). In the future we may consider deploying radio collars on cows in southern Unit 20E in order to achieve a larger sample size during twinning surveys, which would allow us to more quickly detect a change in twinning rates.

Distribution and Movements

Moose generally occur throughout Unit 20E below elevations of 4,000 feet. Based on this criterion, 9,750 mi^2 (25,252 km^2) of Unit 20E is suitable moose habitat. This is a significant change from the 8,000 mi^2 of moose habitat used in previous reports, which was based on the exclusion of habitat clearly not suitable for moose (Gross 2012). However, it is unclear how the 8,000 mi^2 area was calculated, and it is likely that the 9,750 mi^2 area more accurately represents available moose habitat in Unit 20E. The LANDFIRE vegetation classification based on 2001 Landsat™ imagery was used to estimate 8,938 mi^2 (23,149 km^2) of available winter moose habitat (deciduous woody browse ≥0.5 m tall) and 10,323 mi^2 (26,736 km^2) of summer range (winter range plus all other vegetated types; Paragi and Kellie 2011:Table 2). I chose to use the more general 9,750 mi^2 of moose habitat for this report because the LANDFIRE classification system has not yet been validated. During 1984–1986 most radiocollared moose moved seasonally from lowland summer habitat to upland rutting areas, where they remained until March (D. Kelleyhouse, ADF&G, unpublished data, Tok). Early deep snowfalls (>22 inches) in

fall 1988, 1992, 1999, and 2000 appeared to cause moose to move to lower elevations during November (Gardner 2002).

MORTALITY

Harvest

Seasons and Bag Limit. Season dates and bag limits during RY03–RY13 are summarized in Table 3.

Alaska Board of Game Actions and Emergency Orders.

Predator Control Actions — During the February 2014 meeting, the board reauthorized the UYTPCP through 30 June 2020; however, moose were removed from the intensive management plan because it did not include any predator control efforts specifically intended to benefit moose. Furthermore, the board failed to adopt a proposal to re-implement the grizzly bear control portion of UYTPCP.

Other Board of Game Actions — In March 2012 the board extended the season of the moose draw hunts (DM794 and DM796) in southern Unit 20E from 1–30 November to 1 November–10 December. This was intended to allow hunters additional time to hunt when snow conditions are more favorable for using snowmachines.

Harvest by Hunters. Reported harvest in Unit 20E was 186 bulls and 1 moose of unknown sex in RY11 and 182 bulls and 1 moose of unknown sex in RY12 (Table 4). Harvest during RY08–RY10 was similar, averaging 172 bulls annually (range 165–179). This is an increase from the average harvest of 137 bulls annually (range 130–144) during RY05–RY07. This increase is likely a result of both increased moose numbers since 2004 in areas along the trail systems off the Taylor Highway in southern Unit 20E and an overall increase in moose hunters, especially in southern Unit 20E. Total unitwide harvest was 3.5–4% of the estimated prehunt population in recent years and has likely had little impact on unitwide population dynamics.

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 (>60 bulls:100 cows) but were rarely hunted in the fall due to difficult access caused by access restrictions during 24 August–20 September in the controlled use area.

During RY11–RY12, we issued 3 DM794 and 7 DM796 permits annually, but no moose were harvested (Table 4). Hunting conditions, including access, were extremely difficult with unpredictable snow conditions and extreme cold. This likely accounted for the low harvest. In addition, hunters who applied for these hunts often expected an easy moose hunt. However, once they understood the remoteness and difficulty, many permit holders chose not to participate (e.g. during RY11–RY12, 45% of permit holders did not hunt). A longer season in 2012 (1 November–10 December) did not result in additional harvest or participation.

Hunter Residency and Success. The number of people who reported hunting moose in Unit 20E was 839 in RY11 and 830 in RY12. This is the highest number of hunters compared to the previous 10 years (range 484–822) and is much higher than the previous 5-year average of 699. Of the 183–187 bulls harvested annually in RY11–RY12, 72% were taken by nonlocal Alaska

residents (Table 5). Furthermore, nonlocal resident hunters made up 70–71% of the hunters. Local residents represented 19% of the hunters and took 16% of the harvest, while nonresidents represented 10–11% of the hunters and took 12% of the harvest. This is similar to RY98–RY10 when nonresidents represented 11% of the hunters and averaged 13% of the harvest.

Hunter success rate declined from an average of 28% during RY93–RY00 to an average of 19% during RY01–RY07. However, success rate increased to an average of 23% (range 20–26%) during RY08–RY12, likely a result of increased moose numbers along the trail systems off the Taylor Highway in southern Unit 20E. The success rate in RY12 (20%) was the lowest since RY07 (20%).

Harvest Chronology. 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–RY10, 2–11 bulls ($\bar{x}$ = 7) were harvested during 24–28 August, a 77% reduction in the average harvest during the first 5 days of the general season (Table 6). August harvest during RY11–RY12 remained at similar levels (9–11 bulls; $\bar{x}$ = 10) as reported during RY01–RY10.

Transport Methods. During RY11–RY12, the type of transportation used most by successful hunters was 4-wheelers ($\bar{x}$ = 45%), followed by airplanes ($\bar{x}$ = 17%), highway vehicles ($\bar{x}$ = 15%), other off-road vehicles (ORV, $\bar{x}$ = 12%), and boats ($\bar{x}$ = 10%). No deviations from the previous 10 years were apparent during RY11–RY12 (Table 7).

Although the proportion of successful hunters using 4-wheelers and ORVs (primarily 8-wheeled vehicles equipped with tracks, such as ARGO®[2] [Ontario Drive and Gear Ltd., Ontario, Canada]) has remained relatively constant since RY01, increasing quality and dependability of these machines has allowed hunters to access areas farther from roads and resulted in new trails into areas that previously served as refugia for moose. This has likely resulted in localized reductions in bull:cow ratios in areas with increasing networks of trails.

Several other concerns about the increasing trail systems have been voiced by members of the public. Hunters along the Taylor Highway and trails close to the highway have complained of crowding and conflicts between hunters hunting on foot from the highway and hunters who used ATVs/ORVs. In addition, complaints of trail pioneering and habitat degradation in the Mosquito Flats in southern Unit 20E has resulted in proposals and testimony to the board, and requests from local advisory committees to the department, to implement motorized restrictions in this wetland area.

Other Mortality

Predation by wolves and grizzly bears was identified as the greatest source of moose mortality in Unit 20E (Gasaway et al. 1992). Boertje et al. (2009) summarized cause of death postcalving in 4 moose populations in Alaska and Yukon; 31% of the southern Unit 20E postcalving moose population was killed by wolves and bears in the early 1980s, compared with 41% in the

[2] Use of the product name does not constitute endorsement of the product.

southwestern Yukon, 34% near McGrath prior to predator control, and 19% south of Fairbanks after predator control. Predator-prey relationships between moose, wolves, and grizzly bears in Unit 20E during RY81–RY08 were discussed by Boertje et al. (1987, 1988, 2009), Gasaway et al. (1992), and Gross (2004, 2008, and 2010). Additional information and analysis of predator-prey relationships related to UYTPCP in Unit 20E can be found in the March 2012–2014 *Upper Yukon-Tanana Predation Control Implementation Plan and Activities* annual reports from ADF&G to the Alaska Board of Game (J. Gross, ADF&G, unpublished report, Tok).

HABITAT

Assessment

Availability of browse in Unit 20E does not appear to have limited moose population growth. Boertje et al. (1985) found that use of preferred browse plants by moose was less than 5%. More recently, Paragi et al. (2008) estimated 2006 biomass removal rates by moose of 13.75% (95% CI ± 4.24%) based on 30 sample plots in southern Unit 20E. Although these results indicate a higher rate of biomass removal than previously documented in southern Unit 20E, the authors caution that their estimate was derived from a small sample of a large complex landscape and should not be considered a robust estimate of total removal at the landscape scale. These results illustrate that Unit 20E likely has moderate habitat potential and browse utilization compared to other Interior Alaska units.

Currently, southern Unit 20E appears to have a large amount of high quality moose habitat associated with 2 large mid-1960s wildfires (>1,000,000 acres), 1998–1999 prescribed and wild fires (≥400,000 acres), and the 2004–2005 wildfires (>1,000,000 acres). The 2004–2005 wildfires are expected to contribute significantly to moose habitat quantity and quality for the next 25–35 years. In 2009, 26,700 acres burned primarily within the Ladue River drainage. Wet conditions resulted in only 355 acres burned in 2011, while 9,670 and 36,423 acres burned in 2012 and 2013 respectively (Alaska Interagency Coordination Center, http://fire.ak.blm.gov [Accessed 17 June 2014]).

Enhancement

The *Alaska Interagency Wildland Fire Management Plan* (Alaska Wildland Fire Coordinating Group 1998) calls for restoring 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 limited fire protection on their land, except in areas with marketable timber.

CONCLUSIONS AND RECOMMENDATIONS

Population estimates during RY11–RY12 indicated we did not meet the Unit 20E intensive management objective of 8,000–10,000 moose. The population likely increased slowly during RY04–RY09 and was stable during RY09–RY12. The RY12 unitwide population estimate was 4,540–6,370 observable moose with an estimated density of 0.47–0.65 moose/mi^2 of moose habitat (9,750 mi^2).

Predation by wolves and grizzly bears appears to be the primary factor limiting the moose population. Wolf numbers were periodically reduced in portions of Unit 20E during RY98–RY13. Although moose are no longer included in the UYTPCP intensive management plan, the 6-year reauthorization (1 July 2014–30 June 2020) of UYTPCP by the board will likely benefit the Unit 20E moose population through continued suppression of wolf numbers in portions of the unit. However, it is unlikely that the Unit 20E moose population objective will be achieved without further reductions of wolf and grizzly bear numbers.

We continued to meet the management objective of maintaining a posthunting sex ratio of at least 40 bulls:100 cows. Human-induced mortality had little impact on the overall moose population but likely caused reductions in localized bull:cow ratios along heavily used highway and trail corridors. Although the total number of moose hunters in Unit 20E continues to increase, the annual unitwide harvest remained at 3.5–4% of the estimated prehunt population during RY09–RY12. If moose numbers continue to increase in southern Unit 20E, it may be possible to consider more liberal hunting regulations in portions of the unit. Continued monitoring of the moose population will be critical in determining the feasibility of more liberal hunting regulations.

Unitwide harvests of 187 moose in RY11 and 183 moose in RY12 were well below the intensive management harvest objective of 500–1,000 moose. Limited hunter access to much of the Unit 20E moose population will make it difficult to achieve the intensive management harvest objective even if the intensive management population objective is reached.

Since the late 1990s more local residents have accepted the role of fire in improving moose habitat in Unit 20E. During 2004 and 2005, more than 1,890 mi^2 of Unit 20E moose habitat burned in wildfires. Under leadership of the Department of Natural Resources-Division of Forestry and the Bureau of Land Management, guidelines developed in the interagency fire management plan should implement fire management activities that have a greater chance of benefiting the moose population.

REFERENCES CITED

Alaska Wildland Fire Coordinating Group. 1998. Alaska interagency wildland fire management plan. http://forestry.alaska.gov/pdfs/98AIFMP.pdf (Accessed 17 June 2014).

Boertje, R. D., and C. L. Gardner. 1999. Reducing mortality on the Fortymile caribou herd. Alaska Department of Fish and Game, Division of Wildlife Conservation, Research Progress Report 1 July 1997–30 June 1998, Federal Aid in Wildlife Restoration Study 3.43, Juneau.

Boertje, R. D., C. L. Gardner, and J. A. Gross. 2008. Monitoring of Fortymile ungulates and wolves following wolf sterilization and translocation. Alaska Department of Fish and Game, Division of Wildlife Conservation, Final Research Performance Report 1 July 2007–30 June 2008, Federal Aid in Wildlife Restoration Project 3.48, Juneau.

Boertje, R. D., W. C. Gasaway, S. D. DuBois, D. G. Kelleyhouse, D. V. Grangaard, D. J. Preston, and R. O. Stephenson. 1985. Factors limiting moose population growth in

Game Management Unit 20E. Alaska Department Fish and Game, Division of Game, Research Progress Report 1 July 1983–1 September 1984, Federal Aid in Wildlife Restoration Job 1.37R, Juneau.

Boertje, R. D., W. C. Gasaway, D. V. Grangaard, and D. G. Kelleyhouse. 1988. Predation on moose and caribou by radio-collared grizzly bears in east central Alaska. Canadian Journal of Zoology 55:2492–2499.

Boertje, R. D., W. C. Gasaway, D. V. Grangaard, D. G. Kelleyhouse, and R. O. Stephenson. 1987. Factors limiting moose population growth in Game Management Unit 20E. Alaska Department Fish and Game, Division of Game, Research Progress Report 1 July 1985–30 June 1986, Federal Aid in Wildlife Restoration Job 1.37R. Juneau.

Boertje, R. D., M. A. Keech, D. D. Young, K. A. Kellie, and C. T. Seaton. 2009. Managing for elevated yield of moose in Interior Alaska. Journal of Wildlife Management 73:314–327.

Boertje, R. D., K. A. Kellie, C. T. Seaton, M. A. Keech, D. D. Young, B. W. Dale, L. G. Adams, and A. R. Aderman. 2007. Ranking Alaska moose nutrition: Signals to begin liberal antlerless harvests. Journal of Wildlife Management 71:1494–1506.

Burch, J. 2012. Annual report on vital signs monitoring of moose (*Alces alces*) distribution and abundance in Yukon-Charley Rivers National Preserve, Central Alaska Network: November 2012 survey report. National Park Service, Natural Resource Technical Report NPS/CAKN/NRTR–2012/772, Fort Collins, Colorado.

DeLong, R. A. 2006. Geospatial population estimator software user's guide. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. https://winfonet.alaska.gov/sandi/moose/surveys/documents/GSPESoftwareUsersGuide.pdf (Accessed 26 August 2014).

Gardner, C. 1999. Unit 20E grizzly bear. Pages 211–234 [*In*] M. V. Hicks, editor. Grizzly bear management report of survey–inventory activities. Alaska Department Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 4.0. Juneau.

Gardner, C. 2002. Unit 20E moose management report. Pages 406–429 [*In*] C. Healy, editor. Moose management report of survey and inventory activities 1 July 1999–30 June 2001. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 1.0, Juneau.

Gasaway, W. C., R. D. Boertje, D. V. Grangaard, D. G. Kelleyhouse, R. O. Stephenson, and D. G. Larsen. 1992. The role of predation in limiting moose at low densities in Alaska and Yukon and implications for conservation. Wildlife Monographs 120.

Gross, J. A. 2004. Unit 20E moose. Pages 421–440 [*In*] C. Brown, editor. Moose management report of survey and inventory activities 1 July 2001–30 June 2003. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 1.0, Juneau.

Gross, J. A. 2008. Unit 20E moose. Pages 424–440 [*In*] P. Harper, editor. Moose management report of survey and inventory activities 1 July 2005–30 June 2007. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 1.0, Juneau.

Gross, J. A. 2010. Unit 20E moose. Pages 410–422 [*In*] P. Harper, editor. Moose management report of survey and inventory activities 1 July 2007–30 June 2009. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 1.0, Juneau.

Gross, J. A. 2012 (*In prep*). Unit 20E moose. [*In*] P. Harper, editor. Moose management report of survey and inventory activities 1 July 2009–30 June 2011. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2012, Juneau.

Kellie, K. A., and R. A. DeLong. 2006. Geospatial survey operations manual. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. http://winfonet.alaska.gov/sandi/moose/surveys/documents/GSPEOperationsManual.pdf (Accessed 26 August 2014).

Paragi, T. F., and K. A. Kellie. 2011. Habitat evaluation techniques for moose management in Interior Alaska. Alaska Department of Fish and Game, Project Status Report 1 July 2007–30 June 2010, ADF&G/DWC/PSR-2011-1-R3, Juneau.

Paragi, T. F., C. T. Seaton, and K. A. Kellie. 2008. Identifying and evaluating techniques for wildlife habitat management in Interior Alaska: Moose range assessment. Alaska Department Fish and Game, Division of Wildlife Conservation. Final Research Technical Report, Federal Aid in Wildlife Restoration Project 5.10, Juneau.

Ver Hoef, J. M. 2001. Predicting finite populations from spatially correlated data. Pages 93–98 [*In*] Proceedings of the section on statistics and the environment of the American Statistical Association, 13–17 August 2000, Indianapolis, Indiana.

Ver Hoef, J. M. 2008. Spatial methods for plot-based sampling of wildlife populations. Environmental and Ecological Statistics 15(1):3–13. doi:10.1007/s10651-007-0035-y

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Table 1. Moose population estimates in Tok West and Tok Central moose survey areas in southern Unit 20E, fall 1998–2012[a].

Survey area	Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Percent calves	Total moose observed	Size of survey area (mi^2)	Density estimate (90% CI)	Population estimate (90% CI)
Tok West	1998	64	18	19	10	278	1,932	0.56 (±44%)	1,086 (±44%)
	1999	80	16	22	10	365	1,932	0.47 (±20%)	901 (±20%)
	2000	60	11	14	8	561	1,932	0.58 (±19%)	1,115 (±23%)
	2001	76	9	14	7	531	1,932	0.47 (±19%)	915 (±17%)
	2002	59	10	25	14	364	1,932	0.60 (±19%)	1,166 (±27%)
	2003	64	9	15	9	355	1,944	0.58 (±25%)	1,128 (±25%)
	2004	61	11	26	14	283	2,452	0.59 (±22%)	1,435 (±22%)
	2005	55	13	30	16	543	2,452	0.73 (±17%)	1,801 (±17%)
	2006	39	9	37	20	584	2,452	0.98 (±19%)	2,398 (±19%)
	2007	50	11	30	16	503	2,452	0.86 (±18%)	2,098 (±18%)
	2008	47	11	27	16	509	2,452	0.83 (±15%)	2,040 (±15%)
	2009	63	18	34	18	585	2,452	1.00 (±16%)	2,445 (±16%)
	2010	83	14	37	17	618	2,452	1.03 (±20%)	2,519 (±20%)
	2011	67	8	17	9	799	2,452	1.26 (±19%)	3,082 (±19%)
	2012	50	3	18	10	629	2,452	1.12 (±22%)	2,748 (±22%)
Tok Central	1998	59	14	23	14	450	2,750	0.62 (±25%)	1,694 (±25%)
	2000	49	11	21	13	347	1,821	0.70 (±24%)	1,272 (±24%)
	2001	51	6	10	6	624	2,703	0.75 (±23%)	2,026 (±23%)
	2002	71	8	20	10	396	2,703	0.63 (±28%)	1,707 (±28%)
	2003	53	5	11	6	297	2,703	0.51 (±23%)	1,379 (±23%)
	2004	48	11	23	14	233	2,178	0.37 (±19%)	802 (±19%)
	2005	48	8	16	10	344	2,178	0.50 (±19%)	1,097 (±19%)
	2006	46	3	24	14	520	2,178	0.45 (±19%)	979 (±19%)
	2007	46	11	22	13	440	2,178	0.62 (±22%)	1,348 (±22%)
	2008	82	19	28	13	356	2,178	0.53 (±16%)	1,162 (±16%)
	2009	51	11	25	14	461	2,178	0.68 (±15%)	1,471 (±15%)
	2010	54	6	15	9	369	2,178	0.63 (±23%)	1,379 (±23%)
	2011	61	5	5	3	272	2,178	0.47 (±26%)	1,025 (±26%)
	2012	67	3	9	6	425	2,178	0.59 (±16%)	1,299 (±16%)

[a] Sampled using the geospatial population estimator (GSPE) sampling method (Ver Hoef 2001, 2008; Kellie and DeLong 2006).

Table 2. Twinning rate in northern Unit 12 and southern Unit 20E, 2004–2014.

Year	Date	Cows				% Twins[a]
		w/Single calf	w/Twins	w/Triplets	Total	
2004	26 May	26	11	0	37	30
2005	26–27 May	25	8	0	33	24
2006	31 May	16	15	1	32	50
2007	29 May	27	10	0	37	27
2008	29–30 May	29	6	0	35	17
2009	28 May	16	11	0	27	41
2010	27 May, 1–2 June	25	7	0	32	22
2011	26–27 May	42	11	0	53	21
2012	30 May	17	9	0	26[b]	35
2013	30 May	17	8	0	25	32
2014	29 May	25	8	0	33	24

[a] Percentage of cows with calves that had twins or triplets.
[b] Desired minimum sample size of 30 not achieved likely due to sightability issues associated with early green up.

Table 3. Unit 20E moose hunting seasons and bag limits, regulatory years[a] 2003–2013.

Regulatory year	Area	Season		Bag limit[b]
2003	Unit 20E draining into the Middle Fork Fortymile River upstream from the drainage of the North Fork Fortymile River.	RESIDENT:	24–28 Aug	1 bull, or
			8–17 Sep	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	1 bull by permit RM865, or
			Registration 8–17 Sep	1 bull by permit RM865, or
			Drawing 1–30 Nov	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.
2004–2013	Unit 20E drainages of the Middle Fork Fortymile River upstream from and including the Joseph Creek drainage.	RESIDENT:	24–28 Aug	1 bull, or
			8–17 Sep	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	1 bull by permit RM865, or
			Registration 8–17 Sep	1 bull by permit RM865, or
			Drawing 1–30 Nov	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] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Fifty-inch antlers are defined as having a spread of at least 50 inches at the widest point or at least 4 brow tines on at least one side.

Table 4. Unit 20E moose harvest and accidental death, regulatory years[a] 1998–2012.

Regulatory year	General and registration harvest							Drawing permit harvest		Accidental death		Total
	Reported				Estimated							
	M (%)	F (%)	Unk	Total	Unreported	Illegal	Total	DM794	DM796	Road	Total	
1998	145 (100)	0 (0)	5	150	0–5	5–10	5–15	1	10	0	0	166–176
1999	127 (100)	0 (0)	4	131	0–5	5–10	5–15	2	6	0	0	144–154
2000	135 (100)	0 (0)	0	135	0–5	5–10	5–15	3	9	0	0	152–162
2001	137 (100)	0 (0)	1	138	0–5	5–10	5–15	5	3	0	0	151–161
2002	154 (100)	0 (0)	1	155	0–5	5–10	5–15	1	3	0	0	164–174
2003	119 (100)	0 (0)	0	119	0–5	5–10	5–15	0	0	0	0	124–134
2004	93 (100)	0 (0)	1	94	0–5	5–10	5–15	1	0	0	0	100–110
2005	137 (100)	0 (0)	0	137	0–5	5–10	5–15	1	0	0	0	143–153
2006	129 (99)	1 (1)	0	130	0–5	5–10	5–15	0	0	0	0	135–145
2007	144 (100)	0 (0)	0	144	0–5	5–10	5–15	0	0	0	0	149–159
2008	176 (100)	0 (0)	0	176	0–5	5–10	5–15	1	2	0	0	184–194
2009	169 (100)	0 (0)	0	169	0–5	5–10	5–15	0	3	0	0	177–187
2010	164 (100)	0 (0)	0	164	0–5	5–10	5–15	0	1	0	0	170–180
2011	186 (99)	1 (1)	0	187	0–5	5–10	5–15	0	0	0	0	192–202
2012	182 (99)	1 (1)	0	183	0–5	5–10	5–15	0	0	0	0	188–198

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1998 = 1 July 1998–30 June 1999).

Table 5. Unit 20E moose hunter residency and success, regulatory years[a] 1998–2012.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1998	51	98	12	0	161 (32)	78	217	39	2	336 (68)	497
1999	37	84	17	1	139 (24)	100	311	30	4	445 (76)	584
2000	41	91	15	0	147 (27)	101	258	33	1	393 (73)	540
2001	33	96	16	1	146 (19)	222	327	58	4	611 (81)	757
2002	40	101	16	1	158 (19)	173	417	72	2	664 (81)	822
2003	22	76	21	0	119 (16)	130	411	62	0	603 (84)	722
2004	21	55	19	0	95 (20)	97	243	47	2	389 (80)	484
2005	27	78	33	0	138 (22)	126	305	56	1	488 (78)	626
2006	27	85	18	0	130 (19)	127	362	72	0	561 (81)	691
2007	24	108	12	0	144 (20)	128	356	74	2	560 (80)	704
2008	25	130	23	1	179 (25)	115	347	67	0	529 (75)	708
2009	22	129	21	0	172 (23)	118	407	50	3	578 (77)	750
2010	27	119	19	0	165 (26)	98	326	49	3	476 (74)	641
2011	30	134	23	0	187 (22)	127	462	59	4	652 (78)	839
2012	29	131	22	1	183 (22)	129	446	70	2	647 (78)	830

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1998 = 1 July 1998–30 June 1999).

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

Table 6. Unit 20E moose harvest chronology percent by month/day, regulatory years[a] 1998–2012.

Regulatory year	Percent harvest chronology by month/day								*n*
	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	Unk	
1998	0	23	50	15	4	1	7	6	155
1999	0	22	41	20	9	0	6	3	136
2000	1	15	41	28	5	0	8	3	144
2001	10	0	49	29	5	0	5	3	143
2002	5	0	62	29	1	0	3	0	153
2003	7	3	61	28	0	1	0	0	110
2004	2	2	61	32	1	0	1	1	92
2005	9	3	54	32	1	0	1	0	136
2006	8	0	55	33	2	0	0	3	127
2007	6	1	60	31	1	0	0	1	143
2008	8	2	59	27	1	0	2	2	177
2009	8	1	57	33	0	0	2	0	169
2010	6	1	55	36	1	0	1	0	165
2011	5	0	59	33	2	0	0	1	187
2012	6	1	61	28	4	0	0	0	183

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1998 = 1 July 1998–30 June 1999).

Table 7. Unit 20E moose harvest and percent by transport method, regulatory years[a] 1998–2012.

Regulatory year	Harvest and percent (%) by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1998	32 (20)	0 (0)	23 (14)	40 (25)	12 (7)	12 (7)	41 (26)	1 (1)	161
1999	31 (22)	1 (1)	26 (18)	37 (27)	8 (6)	19 (14)	15 (11)	2 (1)	139
2000	29 (20)	2 (1)	28 (19)	40 (27)	12 (8)	14 (10)	20 (14)	2 (1)	147
2001	23 (16)	0 (0)	14 (10)	68 (46)	4 (3)	15 (10)	18 (12)	4 (3)	146
2002	36 (23)	1 (1)	17 (11)	58 (37)	4 (2)	19 (12)	16 (10)	7 (4)	158
2003	32 (27)	2 (2)	6 (5)	51 (43)	0 (0)	13 (11)	12 (10)	3 (2)	119
2004	20 (21)	1 (1)	8 (8)	32 (34)	1 (1)	15 (16)	17 (18)	1 (1)	95
2005	27 (20)	1 (1)	15 (11)	48 (35)	1 (1)	27 (20)	17 (12)	2 (1)	138
2006	27 (21)	0 (0)	13 (10)	46 (35)	0 (0)	20 (15)	23 (18)	1 (1)	130
2007	23 (16)	1 (1)	20 (14)	52 (36)	0 (0)	21 (15)	24 (16)	3 (2)	144
2008	22 (12)	0 (0)	21 (12)	77 (43)	3 (2)	29 (16)	24 (13)	3 (2)	179
2009	30 (17)	0 (0)	12 (7)	80 (47)	2 (1)	27 (16)	19 (11)	2 (1)	172
2010	33 (20)	1 (1)	20 (12)	72 (44)	0 (0)	14 (8)	18 (11)	7 (4)	165
2011	34 (18)	0 (0)	19 (10)	77 (41)	0 (0)	23 (13)	30 (16)	4 (2)	187
2012	29 (16)	0 (0)	19 (10)	88 (48)	0 (0)	20 (11)	26 (14)	1 (1)	183

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1998 = 1 July 1998–30 June 1999).