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CHAPTER 30: MOOSE MANAGEMENT REPORT

From: 1 July 2011
To: 30 June 2013[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. 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, Alaska Department of Fish and Game [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 by the public (Regelin et al. 2005).

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 (Stout 2008). Initially, we thought this was due to better surveys, but a population estimation survey of the Kaiyuh Flats and the lower Koyukuk River in 1987 corroborated TCA data (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 (Stout 2008). We estimated that 6,340 moose inhabited the portion of Unit 21D where most moose are found in the best habitat of the area, and extrapolation of the data to the remainder of Unit 21D suggested a unitwide population of 9,000–10,000 in 1993.

A population estimation survey in fall 1997 in the lower Koyukuk drainage and the Kaiyuh Flats indicated moose numbers were similar to the 1993 estimate (Huntington 1998). However, a population estimation survey in 2001 suggested the population had declined marginally to

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

8,500–9,500 moose by winter 2001–2002, and declining recruitment parameters observed in the TCAs from 1997 to 2001 seemed to corroborate this. Since 2001 there were fluctuations in the abundance of moose, due to stochastic changes in productivity and survival, but no clear trend in the recent trajectory of the population is apparent.

Residents of the 4 villages within Unit 21D (Kaltag, Nulato, Koyukuk, and Galena) and the village (Ruby) in Unit 21B near the boundary with Unit 21D have traditional hunting areas within Unit 21D. Those local residents often traveled as much as 100 miles up the Koyukuk River in the 1980s–2000s, until fuel prices began to restrict travel in the 2000s–2010s. Nonlocal hunters using Unit 21D mostly concentrated their hunting activities within the Koyukuk River between the Kateel River and Dulbi Slough. Hunting pressure from nonlocal hunters appeared to be gradually shifting farther upriver as hunters from outside the unit learned the logistics of accessing the area.

Since 1983, the department has operated a hunter checkstation on the Koyukuk River, 15 miles upstream from the village of Koyukuk. In 1990 the Koyukuk River checkstation became a mandatory stop for all hunters. The checkstation enables accurate determination of the number of hunters using the river to access the Koyukuk controlled use area (CUA) within Unit 21D during the fall hunting season. 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 during 1975–1981. In 1981–1996 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 Koyukuk CUA 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 Koyukuk CUA, downstream from Huslia. In 2000, resident and nonresident drawing hunts were added. By 2006, all of Unit 21D was managed through subsistence registration hunts with antler destruction disincentives or limited drawing permit hunts.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

Management was directed according to the following management goals and objectives during this 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 9,000–10,000.

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: Maintain an overall meat assessment score of less than "3" for ≤5% of the hunters each regulatory year.

GOAL 4: Maintain opportunities for wildlife viewing, photography, and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

OBJECTIVE 1: Maintain "Hunting and Viewing" as the response to question #2 (Purpose of Trip) among ≥65% of the hunters who respond to the survey each regulatory year.

METHODS

Population Estimation

Beginning in 1999, we conducted population estimation surveys and analyzed data using the geospatial population estimator method (GSPE; Ver Hoef 2001, 2008; Kellie and DeLong 2006). GSPE surveys since 1999 were conducted according to methods and in areas described in Stout (2010).

No new population estimation surveys were completed in Unit 21D since the 2012 management report (Stout 2012a).

The regulatory year (RY) 2011 (RY begins 1 July and ends 30 June; e.g., RY11 = 1 July 2011 through 30 June 2012) and RY12 moose population estimates are based on previously reported values (Stout 2012a), RY11–RY13 trend count surveys, and RY10–RY11 GSPE surveys. I developed the RY13 moose population estimate for Unit 21D by individually estimating moose densities in each of the 6 drawing permit hunt areas within Unit 21D. To accomplish this, I used data from the 2001, 2004, 2010, and 2011 GSPE surveys as well as fall 2004–2013 TCA data (Stout 2010). For those areas that did not have survey data, I used recent density estimates from GSPE surveys in similar habitat within Unit 21D. Therefore, to varying degrees, estimates for

each permit area were a combination of GSPE survey data, trend count survey data, and extrapolated data.

Population Composition

Composition data included results of GSPE surveys and TCA surveys. Moose in 6 TCAs (Dulbi River Mouth, Three Day Slough, Koyukuk Mouth, Pilot Mountain, Squirrel Creek, and Kaiyuh Slough) were classified as cows, calves, yearling bulls (<30″ antler width and no brow tine definition), medium bulls (≥30″ and <50″ antler width), or large bulls (≥50″ antler width) using methods previously described (Stout 2010). TCA surveys were not conducted in RY12 due to poor survey conditions.

Guidelines reported by Franzmann and Schwartz (1998) were used to interpret sex and age indices as reported in Stout (2010).

Twinning Surveys

Beginning in 1990, twinning surveys were conducted to determine the proportion of moose calf twins among all cows with calves in the areas of Three Day Slough, Pilot Mountain Slough, Kaiyuh Slough, Squirrel Creek, and Natlaratlen River. Aerial twinning surveys consisted of parallel transects flown at approximately ¼-mile intervals at ≤500 feet above ground level in a PA-18 or similar aircraft by experienced pilots. Our goal was to observe at least 50 cows with calves (Boertje et al. 2007), but funding and weather sometimes prevented us from achieving that goal. Moose were classified as bull, yearling, calf, cow, cow with 1 calf, or cow with 2 or more calves. Timing was critical, so surveys were flown in late May within a few days of the median calving date (Boertje et al. 2007), when approximately 50% of the cows observed had calves. This avoided early mortality factors such as predation, which could lead to underestimating twinning rates.

Mortality

Hunting mortality and harvest distribution were monitored through the statewide harvest monitoring system, including registration and drawing permit reports, door-to-door subsistence surveys, and a hunter checkstation on the Koyukuk River. Hunters with registration or drawing permits received 1 or 2 reminder letters and usually an e-mail and telephone calls if we did not receive timely harvest reports. Report and survey information was used to determine total harvest, harvest location, hunter residency and success, sex of animal harvested, method and location of harvest, harvest chronology, and transportation used. Harvest reports were collected from most hunters at the checkstation. Additional data collected at the checkstation included time in the field, hunting party size, age structure of harvest (tooth extraction), department-measured antler size, a more precise location of harvest (when needed), and caliber of firearm used. Moose ages were determined by counting cementum annuli of the lower incisors from hunter harvested bull moose (Gasaway et al. 1978, Matson et al. 1993). Harvest data were summarized by regulatory year.

We evaluated meat salvage to measure success in meeting objectives under goals 3 and 4 (Stout 2012a). Every moose checked at the Koyukuk River checkstation was evaluated 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 low performance.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Overall, the moose population trend counts during RY11–RY12 showed a generally stable index to abundance in Unit 21D over recent years (Tables 1–6) as previously described (Stout 2010). Density estimates in the western Galena GSPE analysis area of Unit 21D also indicated a stable trend (Table 7).

In 2010 we classified 769 moose during the GSPE survey (covering 3,516 mi^2 in the upper Bear Creek and upper Dulbi River drainages). In the 2011 GSPE survey (which overlapped survey areas sampled in RY01 and RY04) we classified 5,620 moose. By combining estimates for individual drawing hunt areas in Unit 21D, I estimated a Unit 21D population of 8,611 observable moose in RY11 (Table 8). This estimate did not change for RY13 because no GSPE surveys were conducted. The population estimate for the total area calculated from the 2011 survey was not significantly different (95% CI) from the 2001 or 2004 estimates; however, the 2011 point estimate was lower than 2001 and 2004. The regression analysis of the 1987–2011 survey estimates indicated a slight decline ($P = 0.08$; 95% CI, Fig. 1).

Population Composition

From the 2011 GSPE survey, we calculated 28 calves:100 cows, which is within the range (20–40 calves:100 cows) reported by Franzmann and Schwartz (1998) for maintaining a stable or increasing population. TCA surveys were not conducted in RY12 due to poor survey conditions. Most TCAs had moderate calf:cow ratios in RY11 but low ratios in RY13. The decline to 10–21 calves:100 cow in RY09 followed the severe winter of 2008–2009.

The 2011 GSPE survey data indicated 32 bulls:100 cows, well above the minimum needed for adequate productivity. TCA data in RY11 also indicated stable bull:cow ratios; however, yearling bull:cow ratios were low in some areas. Bull:cow ratios continue to vary widely among TCAs (Tables 1–6). Most TCAs indicated stable parameters through the 2000s, but a decline in RY13 (Fig. 2), particularly in the northern TCAs of Unit 21D. The Koyukuk controlled use area "Core-5" dropped below 30 bulls:100 cows in RY13, for the first time since RY06, likely due to the poor cohorts of 2008 and 2009. Only in the Kaiyuh Slough TCA were calf:cow and yearling bull:cow ratios high and stable in RY11 and RY13.

Moose twinning rates in 2011–2012 (33% Three Day Slough, 41% Pilot Mountain and Kaiyuh Slough) suggest above average nutritional status (Boertje et al. 2007) and productivity in the Three Day Slough, Pilot Mountain Slough and Kaiyuh Slough areas in Unit 21D (Tables 9–10).

Distribution and Movements

Moose generally 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. In spring, bulls leave the riparian areas, followed by cows with calves (Osborne and Spindler 1993; B. Scotton, U.S. Fish and Wildlife Service, Galena, personal communication, 2008).

Approximately 83% of all moose appear to be migratory (Osborne and Spindler 1993). Distribution and movement patterns of moose in Unit 21D are summarized in Stout (2010).

MORTALITY

Harvest

Seasons and Bag Limits. Seasons and bag limits in Unit 21D during RY11 and RY12 were as follows:

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 bull by registration permit only; or	1 Sep–25 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.	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.		5 Sep–25 Sep
Remainder of Unit 21D		
RESIDENT HUNTERS:		
1 bull by registration permit only; or	22 Aug–31 Aug 5 Sep–25 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 600 permits may be issued in Unit 21D outside the Koyukuk controlled use area.	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 only; up to 600 permits may be issued in Unit 21D outside the Koyukuk controlled use area.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. No changes were adopted by the Alaska Board of Game (board) during RY09–RY12 and no emergency orders were issued.

Unit 21D has a positive finding for intensive management (IM). The Unit 21D objectives in Title 5 Alaska Administrative Code, regulation 92.108 during RY11–RY12 were as follows:

Population Objective	Harvest Objective
7,000–10,000 moose	450–1,000

Harvest by Hunters. Harvest of moose in Unit 21D during RY09–RY12 was stable (Tables 11–13). Reduced harvest through restrictive hunting regulation during RY04–RY07 likely reversed the trend of declining bull:cow ratios in the Koyukuk CUA portion of Unit 21D, but hunting pressure relative to harvestable surplus in the Koyukuk River mouth and Pilot Mountain Slough areas was still high and likely suppressed bull:cow ratios in those areas. No cows were reported harvested during RY11–RY12, due to elimination of all antlerless moose seasons in the Unit 21D. However, illegal cow harvest continued to occur during winter. Potlatch, stickdance, and ceremonial moose harvest also included cows.

During RY09–RY13, most harvest in Unit 21D ($\bar{x}$ = 70%) was in the Koyukuk River drainage (northern Unit 21D, Table 14). In contrast, during RY05–RY07 harvest in the Koyukuk River drainage averaged 58%, with a low of 53% in RY06.

Koyukuk River Checkstation Results. 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 adopted by the board in 1992 to address the increase of moose hunters and harvest in the Koyukuk CUA, 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. At the checkstation, all hunters were notified of this regulation when we issued their permits and checked for compliance upon departure from the hunt area. 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 implemented. Beginning in RY00 hunters were required to cut the antlers at the kill site, which improved that aspect of hunter contact at the checkstation.

Total success rates in the Koyukuk CUA were stable at $\bar{x}$ = 52% during RY11–RY12. Harvest success in the fall hunt during RY02–RY12 was high for nonlocal residents ($\bar{x}$ = 55%) and nonresidents ($\bar{x}$ = 71%), but local resident success was lower ($\bar{x}$ = 38%). This was likely because many local hunting parties consisted of several family members who all obtained permits, but not all permit holders intended to harvest their own moose. Success rates generally remained high except in RY04 and RY05 when weather was extremely warm during the fall hunting season. Additionally, success rates were lower ($\bar{x}$ = 40%) during RY02–RY06 due to low bull:cow ratios compared to the recent (RY07–RY13) average ($\bar{x}$ = 51%; Table 13).

The Koyukuk CUA area is well known as an excellent area to hunt for large (≥50-inch antlers) moose. During RY11 and RY12, 54% and 52% of the harvested bulls measured were large, respectively and 40% of the bulls counted in TCAs were large in RY11. Of the bulls observed in the Koyukuk CUA TCAs completed during RY03–RY13, 31% had large antlers (Table 15). During RY03–RY13, 48% of the harvested bulls measured in Koyukuk CUA permit hunts had large antlers.

Meat evaluation surveys conducted at the checkstation indicated meat care was generally very good with an average overall score of 4.9 in RY11 and 4.7 in RY12 (Table 16), with little change since RY05. In RY11 and RY12, 0 hunters were given average overall scores of less than 3. In general, meat scores stabilized at a high level. The number of days hunters kept their meat in the field increased to 2.9 days in RY12 and 3.0 days in RY13.

Permit Hunts. The subsistence registration permit (RM832) was the permit used most by resident Alaskans to hunt within the Koyukuk CUA and antler destruction was required. The number of RM832 permits issued during RY02–RY13 varied less than 19% of average (Table 17). Registration permit use among local residents was relatively stable, while use of the permit by other Alaska residents declined during RY99–RY07 then gradually increased from RY09 through RY13. With implementation of drawing hunts in the remainder of Unit 21D, hunter numbers were better regulated and distribution of hunters improved (Table 18). Resident hunters who did not want to destroy the trophy value of their bull moose and nonresidents could apply for a limited drawing permit.

Hunter Residency and Success. Hunter residency and success can be misleading because Unit 21D residents historically did not report unsuccessful hunt information (Table 19; Stout 2012a). Harvest and hunter participation by Unit 21D residents during RY96–RY02 was relatively constant (Andersen et al. 1998).

Unit 21D local hunter success rates were 31% in RY11 and 33% in RY12. Local hunter success rates were low (RY02–RY12; $\bar{x}$ = 32%; Table 19) compared to RY90–RY99, when success rates averaged 59% (Stout 2010). Success rates for nonlocal resident (RY90–RY99; $\bar{x}$ = 67% vs. RY01–RY10; $\bar{x}$ = 44%) and nonresident (RY90–RY99; $\bar{x}$ = 68% vs. RY01–RY10; $\bar{x}$ = 45%) hunters followed similar trends.

Harvest Chronology. There were no apparent changes in harvest chronology during RY11–RY12 (Table 20). However, about 20% of the annual harvest probably occurred during winter, when reporting rates were low. Much of the unreported harvest was likely taken during October–March (Andersen et al. 1998).

Transportation Methods. The presence of the Koyukuk CUA and the area's extensive river system made boats the primary transportation method during RY11–RY12 (Table 21). Snowmachines were the main transportation during winter, although little winter harvest is reported. These patterns have changed little since 1980.

Other Mortality

Wolves and black bears were common throughout Unit 21D. Grizzly bears were common in the uplands of the Nulato Hills and Kaiyuh Mountains. Wolves and grizzly bears prey on both calf and adult moose. Hunters continued to report increased observations of grizzly bears during the fall moose season. Anecdotal reports by Unit 21D residents also suggested grizzly bears were increasing and becoming more common intruders at fish camps. Black bears were shown to kill more than 40% of moose calves annually in Unit 21D (Osborne et al. 1991).

HABITAT

Assessment

No assessments were conducted during RY11–RY12. Feltleaf willow is an important browse species for moose due to its nutritional quality. In Three Day Slough this species is high in protein compared with feltleaf willow on the Tanana River and is lightly browsed (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 (Tables 13 and 14; Boertje et al. 2007); adequate to support an increasing moose population (Boertje et al. 2007). Previous habitat assessments are summarized in Stout (2010).

CONCLUSIONS AND RECOMMENDATIONS

Moose were relatively numerous in the riparian lowlands of Unit 21D. I did not change the 2012 estimate of 8,611 (with 15% presumed relative error of ±1,300 moose) observable moose in Unit 21D from the previous reporting period. During this reporting period, the Unit 21D population may have increased slightly south of the Yukon River, but numbers were stable in northern Unit 21D based on GSPE and TCA surveys. Cow numbers in TCAs throughout the unit continue to be closely monitored. High calf:cow ratios and yearling bull:cow ratios in RY04, RY06, and RY07 did not appear to increase the population, based on the 2011 population estimate. We recommend annual or biennial GSPE surveys in the high density portions of Unit 21D to develop a reliable population trend analysis, even if those surveys are conducted at a low sampling intensity (Kellie and DeLong 2006; Ver Hoef 2001, 2008). Although high sampling intensity surveys provide narrow confidence intervals and improve precision on an estimate, they are not likely to be conducted on a regular basis. Analysis of GSPE data collected in Unit 24B, shows that low intensity surveys conducted in the intervening years of infrequent, high-intensity surveys provides accurate composition and population estimates, yet the confidence intervals for all survey years were improved (Stout 2012b). This strategy provided managers with better decision-making information for the overall population than TCA composition data alone. Since 2003, high productivity as a result of increased twinning rates was likely an important factor in stabilizing the population in Unit 21D.

The key management issues facing Unit 21D during RY11–RY12 were 1) cow harvest, 2) evaluation of harvest success rates, and 3) reallocation of harvest from state-qualified hunters to local federally-qualified subsistence hunters.

Cow harvest must decrease throughout the area if we are to achieve our population management objectives of 9,000–10,000 observable moose. To work toward that objective, we closed all fall hunting seasons for cow moose by emergency order during RY02–RY05 and in RY06 the Board of Game eliminated these antlerless seasons. Additionally, the winter season was eliminated in favor of a bulls-only season in August. However, moose harvest during the winter will likely continue, depending on the level of fall hunting success. The stable trend in bull:cow ratios within the Koyukuk CUA appeared to reflect the stable fall success rates since RY07, thereby decreasing demand for the winter harvest. Management efforts must continue to improve fall success rates by local hunters in order to reduce the winter harvest of cows.

The current population estimate of 8,611 observable moose (±1,300) in Unit 21D did not likely meet our management objective of 9,000–10,000 observable moose. However, the IM population objective of 7,000–10,000 moose was likely achieved. Analysis of RY11 and RY13 TCA data indicated poor recruitment in northern Unit 21D, but good recruitment in the southern Unit 21D. The objective to provide for a harvest of moose not to exceed 700 moose or 7% of the population was met. Estimated total harvest was highest in RY12 at 406 moose including the estimate of unreported harvest (4.1–5.6% of the estimated population of 8,611). However, the IM annual harvest objective of 450–1,000 moose was not achieved in RY11 or RY12. The objective to provide for moose hunting opportunity, not to exceed 950 hunters per regulatory year, was achieved with a total of 739 hunters in RY11 and 721 hunters in RY12.

The long-term objective to implement at least 2 habitat enhancement activities was not achieved during RY08–RY12. We will continue to encourage land managers to liberalize fire management options and implement habitat enhancement activities.

In RY11 and RY12 we continued to monitor the objective to maintain an overall meat assessment score of less than "3" for ≤5% of the hunters each regulatory year at the Koyukuk River checkstation. Fewer than 5% of the hunters scored less than 3 on the overall meat care (0.0% in RY11, 0.0% in RY12), and the average number of days hunters stayed in the field with their meat was less than 2.9 days. Therefore, the meat care objective was met.

Finally, we discontinued our program to monitor and evaluate the number of people engaged in nonconsumptive activities due to poor public participation.

MANAGEMENT OBJECTIVES

Activity 2 of Goal 1, Objective 2 will be removed in the next reporting period. Funding and methods to accomplish monitoring social and environmental impacts on private lands are unlikely to be available in the foreseeable future.

Objective 1 of Goal 2 will be removed in the next reporting period. There have been no habitat enhancement projects in Units 21D or 24 and it is unlikely that resources will be available to do so in the foreseeable future.

Objective 1 of Goal 4 will be removed in the next reporting period due to poor public participation and interest.

Therefore, management goals, objectives, and activities for the next reporting period are as follows:

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 9,000–10,000 observable moose.

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: Develop programs to improve moose population and harvest data 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.

GOAL 3: Reduce meat spoilage by hunters.

OBJECTIVE 1: Maintain an overall meat assessment score of less than "3" for ≤5% of the hunters each regulatory year.

GOAL 4: Maintain opportunities for wildlife viewing, photography and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

REFERENCES CITED

Andersen, D. B., C. J. Utermohle, and L. Brown. 1998. The 1997–1998 harvest of moose, caribou, and bear in middle Yukon and Koyukuk River communities, Alaska. Alaska Department of Fish and Game, Division of Subsistence, Technical Paper No. 245, Juneau.

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

Franzmann, A. W., and C. C. Schwartz. 1998. Ecology and management of the North American moose. Wildlife Management Institute. Smithsonian Institution Press, Washington, D.C.

Gasaway, W. C., D. B. Harkness, and R. A. Rausch. 1978. Accuracy of moose age determinations from incisor cementum layers. Journal of Wildlife Management 42:558–563.

Huntington, O. 1998. Koyukuk/Nowitna National Wildlife Refuge Complex Lower Koyukuk River and Kaiyuh Flats 1997 moose census, Unit 21D, Alaska. U.S. Fish and Wildlife Service, Final Progress Report, Galena, Alaska.

Huntington, S. 1993. Shadows on the Koyukuk: An Alaskan Native's life along the river. Alaska Northwest Books, Portland, Oregon.

Kellie, K. A., and R. A. DeLong. 2006. Geospatial survey operations manual. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. http://www.adfg.alaska.gov/static/home/library/pdfs/wildlife/propubs/GSPEOperationsManual.pdf (Accessed 8 July 2014).

Kielland, K. 1997. Browse relations of moose in the middle Koyukuk River. Final report to Alaska Department of Fish and Game. University of Alaska Fairbanks, Institute of Arctic Biology, Fairbanks.

Matson, G., L. Van Daele, E. Goodwin, L. Aumiller, H. Reynolds, and H. Hristienko. 1993. A laboratory manual for cementum age determination of Alaska brown bear premolar teeth. Matson's Laboratory, Milltown, Montana, and Alaska Department of Fish and Game, Anchorage. http://www.matsonslab.com/images/publications/Alaska_Brown_Bear_First_Premolar_Teeth.pdf (Accessed 8 July 2014).

Osborne, T. O. 1996. Unit 21D moose. Pages 373–385 [*In*] M. V. Hicks, editor. Moose management report of survey and inventory activities 1 July 1993–30 June 1995. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 1.0, Juneau.

Osborne, T. O., T. F. Paragi, J. L. Bodkin, A. J. Loranger, and W. N. Johnson. 1991. Extent, cause, and timing of moose calf mortality in western Interior Alaska. Alces 27:24–30.

Osborne, T. O., and M. A. Spindler. 1993. Moose population identification study: Three Day Slough, Koyukuk NWR, Alaska, Unit 21D. U.S. Fish and Wildlife Service, Progress Report 93-3, Galena, Alaska.

Regelin, W. L., P. Valkenburg, and R. D. Boertje. 2005. Management of large predators in Alaska. Wildlife Biology in Practice 1:77–85.

Stout, G. W. 2004. Unit 21D moose. Pages 462–495 [*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.

Stout, G. W. 2008. Unit 21D moose. Pages 487–529 [*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.

Stout, G. W. 2010. Unit 21D moose. Pages 477–521 [*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.

Stout, G. W. 2012a (*In prep*). Unit 21D 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.

Stout, G. W. 2012b (*In prep*). Unit 24 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.

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

Woolington, J. D. 1998. Unit 21D moose. Pages 361–377 [*In*] M. V. Hicks, editor. Moose management report of survey and inventory activities. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 1.0, Juneau.

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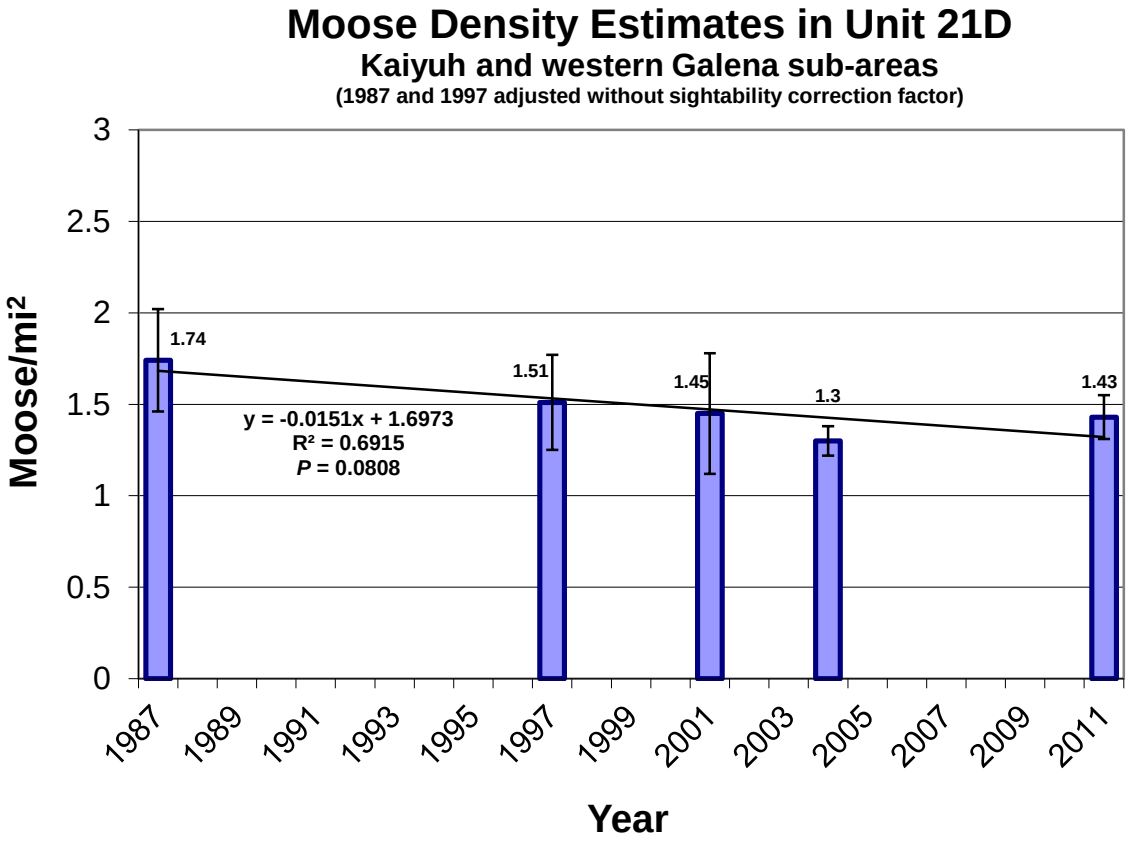

Figure 1. Moose density estimates and regression analysis based on 5 population estimation surveys. The 1987 estimate was calculated using MOOSEPOP; 1997 was a regression analysis estimate; and 2001, 2004, and 2011 were geospatial population estimates. All values presented do not include sightability correction factors and are presented as density of observable moose/mi^2. Although survey areas differed in size (see Table 7), survey areas overlapped substantially between years. Error bars are 90% CI, regression equation 95% CI.

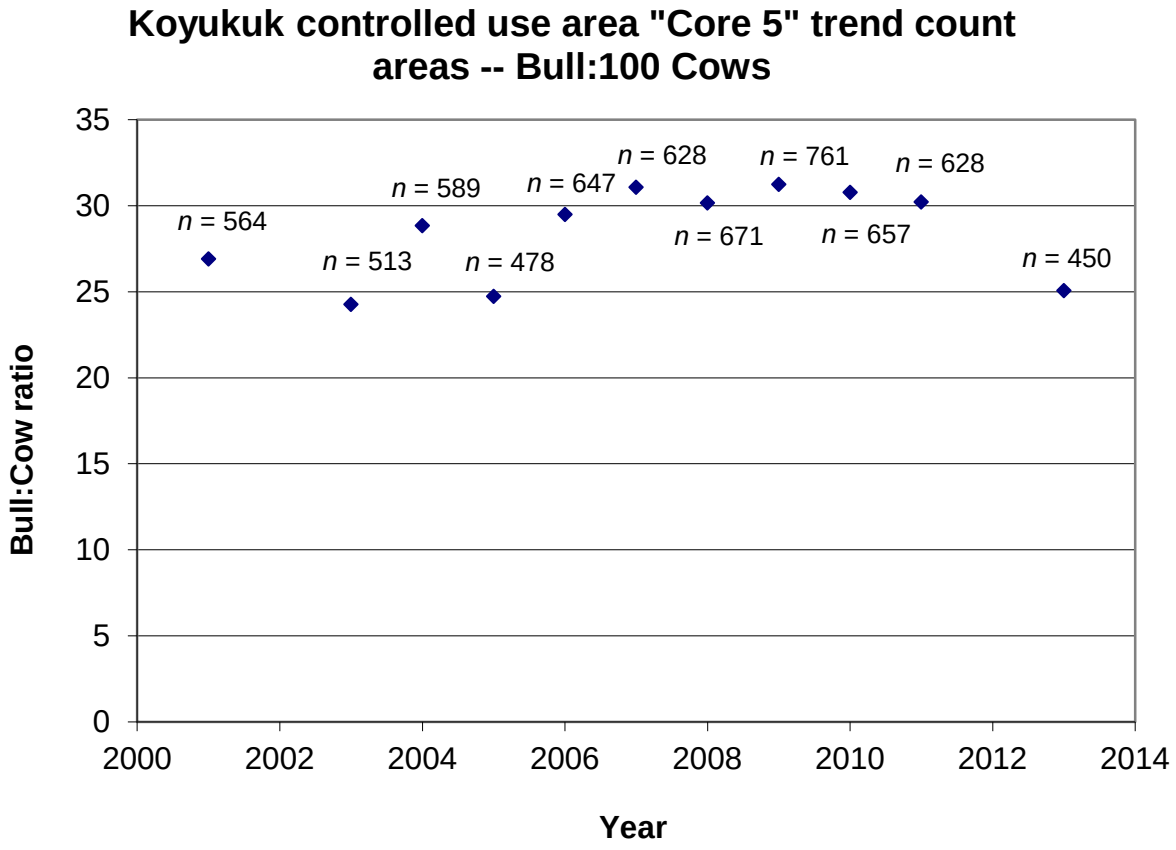

Figure 2. Cumulative bull:100 cow ratio for the Koyukuk controlled use area that includes the 5 aerial trend count survey areas surveyed each year since 2001. These "Core 5" trend count areas are the Three Day Slough, Dulbi River mouth, and Koyukuk River mouth trend count areas in Unit 21D, and the Treat Island and Huslia Flats trend count areas in Unit 24 (Stout 2014, *In prep*).

Table 1. Unit 21D Three Day Slough trend count area aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003[c]	160.4	17	7	21	8	15	846	5.3
2004[c]	193.6	22	9	23	8	16	935	4.8
2005[c]	193.6	21	5	21	6	15	863	4.5
2006[d]	193.6	25	5	40	12	24	1177	6.1
2007[c]	193.6	30	10	34	7	21	967	5.0
2008	193.6	28	8	19	5	13	1270	6.6
2009[c]	193.6	26	8	13	2	9	1151	5.9
2010	193.6	31	4	26	3	17	1148	5.9
2011	193.6	31	11	23	5	15	921	4.8
2013	193.6	21	4	17	3	12	794	4.1

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).
[c] Late survey (after 21 November).
[d] Low snow year.

Table 2. Unit 21D Dulbi River mouth trend count area aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003	116.7	17	6	23	5	17	411	3.5
2004	122.0	21	6	40	7	25	406	3.3
2005	122.0	18	8	23	4	16	333	2.7
2006	116.7	24	6	32	8	21	403	3.5
2007	116.7	36	13	47	11	26	454	3.9
2008	116.7	33	12	32	5	19	505	4.3
2009	116.7	36	11	16	6	11	534	4.6
2010	116.7	24	2	32	8	19	414	3.6
2011	111.1	24	7	29	3	19	506	4.4
2013	111.1	25	7	13	0	10	365	3.3

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).

Table 3. Unit 21D Koyukuk River mouth aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003	118.8	25	11	35	6	22	521	4.4
2004	118.8	33	15	47	12	24	551	4.6
2005	118.8	24	10	38	7	24	443	3.7
2006	118.8	21	7	25	8	17	457	3.9
2007	118.8	23	7	46	9	27	528	4.5
2008	118.8	32	16	38	7	22	427	3.6
2009	118.8	32	14	13	0	9	478	4.0
2010	118.8	23	3	27	10	18	493	4.2
2011	118.8	20	5	24	1	17	503	4.2
2013	118.8	23	9	11	0	8	450	3.8

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).

Table 4. Unit 21D Squirrel Creek aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003	96.6	32	8	25	23	16	242	2.5
2004	102.3	44	14	45	9	24	248	2.4
2005	90.9	32	7	23	9	15	252	2.8
2006	90.9	35	4	35	3	21	164	1.8
2007	96.6	45	17	29	11	17	248	2.6
2008	96.6	45	14	20	7	12	252	2.6
2009	90.9	34	10	17	0	12	278	2.9
2010	90.9	25	5	42	18	25	289	3.2
2011	96.6	24	7	37	12	23	288	3.0
2013	96.6	39	11	30	3	18	205	2.1

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).

Table 5. Unit 21D Pilot Mountain Slough aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003	91.0	13	10	48	11	30	342	3.8
2004	91.0	10	3	41	12	27	377	4.1
2005	102.4	19	7	54	11	31	365	3.6
2006	91.0	16	8	31	15	21	326	3.6
2007	91.0	15	7	40	9	26	409	4.5
2008	91.0	15	7	31	7	21	354	3.9
2009	91.0	12	3	21	6	16	345	3.8
2010	91.0	17	2	48	5	29	466	5.1
2011	91.0	18	9	30	9	25	563	6.2
2013	91.0	23	8	23	12	16	472	5.2

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).

Table 6. Unit 21D Kaiyuh Slough aerial moose composition counts, regulatory years[a] 2003–2013[b].

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
2003	178.0	55	19	38	14	20	204	1.2
2004	229.8	53	18	52	25	25	252	1.1
2005	229.8	66	18	29	0	15	180	0.8
2006	126.3	42	5	21	5	13	171	1.4
2007	126.3	45	7	27	7	16	190	1.5
2008	126.3	59	8	47	19	23	136	1.1
2009	126.3	50	12	10	0	6	180	1.4
2010	126.3	44	11	52	9	26	190	1.5
2011	126.3	45	19	56	20	28	261	2.1
2013	126.3	51	19	43	15	22	274	2.2

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] Beginning in regulatory year 2001, geospatial population estimator sample units replaced Gasaway units (Stout 2004).

Table 7. Unit 21D aerial moose population estimates, regulatory years[a] 1987–2011.

Area/Regulatory year	Area mi^2	Bulls:100 Cows	Calves:100 Cows	Yrlg bulls:100 Cows	Percent calves	Adults	Population estimate (90% CI[b])	Density (moose/mi^2)
Unit 21D–Kaiyuh Flats								
1987[b]	1,582	60.6	46.4	15.0	22.4	1,389	1,790±18%	1.13
1997[c]	1,582	42.3	28.4	13.0	16.6	1,113	1,335±17%	0.84
2001[d]	1,843	44.5	22.1	8.8	13.4	1,558	1,800±32%	0.98
2004[d]	1,843	35.1	43.3	12.2	24.7	1,119	1,487±10%	0.81
2011[d]	1,843	30.5	38.6	10.4	22.9	1,463	1,897±11%	1.03
Unit 21D–Western Galena								
1987[b]	1,508	36.7	38.2	12.4	21.8	3,220	4,118±14%	2.73
1997[c]	1,508	31.3	32.1	8.0	19.6	2,612	3,250±12%	2.15
2001[d]	1,734	26.6	17.1	6.4	12.0	2,995	3,403±19%	1.96
2004[d]	1,841	26.2	36.2	10.5	22.3	2,564	3,299±5%	1.79
2011[d]	1,841	29.0	25.0	8.8	16.3	2,811	3,360±7%	1.83
Unit 21D–Yuki River–Bear Creek								
2010[d]	3,516	64.3	27.4	9.9	14.5	1,477	1,727±14%	0.49
Unit 24D–Upper Koyukuk								
2001[d]	1,949	35.0	17.6	6.1	11.4	3,228	3,642±16%	1.87
2004[d]	1,843	32.7	33.9	12.6	20.4	2,531	3,181±5%	1.73
2011[d]	1,843	38.4	23.4	9.2	14.4	2,249	2,627±8%	1.43
Total Area								
1987[b]	3,090	43.1	40.4	13.1	6.7	4,609	5,908±15%	1.91
1997[c]	3,090	34.4	31.1	9.4	17.8	3,725	4,585±14%	1.48
2001[d]	5,526	33.4	18.3	6.7	12.0	7,849	8,924±13%	1.62
2004[d]	5,527	30.4	36.5	11.6	18.2	6,514	7,967±4%	1.44
2011[d]	5,527	32.4	27.6	9.3	17.3	6,524	7,885±4%	1.43

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1987 = 1 July 1987–30 June 1988).
[b] Gasaway survey, MOOSEPOP analysis estimate (Woolington 1998), with sightability correction factor.
[c] Gasaway survey, regression analysis estimate, with sightability correction factor.
[d] Geospatial population estimation survey, without sightability correction factor.

Table 8. Unit 21D moose population estimate by drawing hunt areas, regulatory year[a] 2013[b].

Drawing hunt area	Density estimate	Moose estimate
(DM816) Yuki River and Bishop Creek	(545 mi^2 @ 1.44 moose/mi^2)	785
	(1,555 mi^2 @ 0.35 moose/mi^2)	575
	Subtotal	1,360
(DM817) Nulato River and Kaiyuh Flats	(612 mi^2 @ 1.03 moose/mi^2)	630
	(2,329 mi^2 @ 0.30 moose/mi^2)	1,071
	Subtotal	1,701
(DM818) Papa Willie Slough	(360 mi^2 @ 1.30 moose/mi^2)	468
	(1,096 mi^2 @ 0.35 moose/mi^2)	383
	Subtotal	851
(DM823–DM830) Koyukuk controlled use area	(1,841 mi^2 @ 1.83 moose/mi^2)	3,360
	(559 mi^2 @ 0.35 moose/mi^2)	196
	Subtotal	3,556
(DM814, DM815, DM819) Bear Creek	(916 mi^2 @ 0.75 moose/mi^2)	687
(DM820) Gisasa and Kateel rivers	(2,283 mi^2 @ 0.20 moose/mi^2)	456
Unit 21D total	(12,096 mi^2)	8,611 (±1,300)[c]

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2013 = 1 July 2013–30 June 2014).
[b] Population estimates for each permit area were a combination of population estimation survey data, trend count survey data, and extrapolation data to varying degrees.
[c] The range on the estimate is not a statistically derived confidence interval. It was an approximated range of (±15%) based on my experience at being able to estimate moose numbers for this area.

Table 9. Unit 21D moose aerial twinning surveys in the Three Day Slough trend count area, regulatory years[a] 2002–2011.

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[b]	Yearlings	Dates in May
2002	18	37	14	27	21	27,28
2003	44	35	25	42	31	26,27
2004[c]	77	27	16[d]	37	25	24–27
2005	118	26	24	48	62	25–27
2006	65	33	12	27	33	25–27
2007	49	40	23	37	43	25–27
2008	119	39	10	20	29	26–28
2009	69	32	19	37	26	26–28,30
2010	59	33	17	34	34	25–27
2011	74	39	19	33	28	26–28

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Percent of cows with calves that had 2 or more calves.
[c] Extensive flooding and early leaf-out, survey conditions difficult.
[d] Including 1 cow with 3 calves.

Table 10. Unit 21D moose aerial twinning surveys in the Pilot Mountain Slough to Kaiyuh Slough trend count areas, regulatory years[a] 2003–2011[b].

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[c]	Yearlings	Dates in May
2003	52	32	18	36	28	24,25
2004	63	26	31	54	12	24–26
2005	86	32	20	38	29	25,26
2006	69	29	18	38	35	22–26
2007	76	30	22	42[d]	7	23,24,29
2008	69	27	20	43	14	26–28
2009	60	34	19	36	18	28,29
2010	50	39	17	30	13	27
2011	94	30	21	41	13	24–26, 29

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2003 = 1 July 2003–30 June 2004).
[b] U.S. Fish and Wildlife Service data.
[c] Percent of cows with calves that had twins.
[d] Including 1 cow with 3 calves.

Table 11. Unit 21D moose harvest, regulatory years[a] 2002–2013.

Regulatory	Harvest by hunters				Unreported	Potlatch/	
year	Bull	Cow	Unk	Total	harvest[b]	Stickdance[c]	Total
2002	316	10	0	326	150	13	489
2003	310	9	1	320	150	14	484
2004	227	0	0	227	150	12	389
2005	218	0	0	218	150	13	381
2006	211	0	0	211	150	17	378
2007	204	1	0	205	150	25	380
2008	263	0	0	263	150	9	422
2009	244	0	0	244	150	17	411
2010	286	0	0	286	125	12	423
2011	285	0	2	287	125	15	427
2012	267	0	0	267	125	14	406
2013[d]	274	0	1	275	125	13	413

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Unreported harvest based on ADF&G-Division of Subsistence door-to-door survey and other sources.
[c] Includes all potlatch, stickdance, ceremonial and cultural permit harvest.
[d] Preliminary data.

Table 12. Koyukuk River checkstation moose harvest, regulatory years[a] 2002–2013[b].

Regulatory year	Bull	Cow	% Cow	Total
2002	217	0	0	217
2003	248	0	0	248
2004	153	0	0	153
2005	147	0	0	147
2006	164	1	1	167[c]
2007	157	1	1	158
2008	201	0	0	201
2009	223	0	0	223
2010	237	0	0	238[c]
2011	242	0	0	242
2012	230	0	0	230
2013	261	0	0	261

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Moose harvested in Units 21D and 24.
[c] Includes moose of unknown sex.

Table 13. Koyukuk River checkstation[a,b] moose hunter residency and success, regulatory years[c] 2002–2013.

Regulatory	Local resident[d]		Nonlocal resident[e]		Nonresident		Total	
year	Hunter	Moose	Hunter	Moose	Hunter	Moose	Hunter	Moose
2002	215	70	219	130	24	18	458	218
2003	230	80	274	148	40	20	544	248
2004	255	74	158	75	7	4	420	153
2005	261	73	174	68	7	6	442	147
2006	265	92	139	67	9	8	413	167
2007	212	78	122	70	8	8	342	156
2008	209	98	138	92	14	11	361	201
2009	247	110	181	104	14	9	442	223
2010	255	100	203	120	26	13	484	233
2011	204	95	211	134	21	13	436	242
2012	249	110	199	104	22	16	470	230
2013	276	101	227	144	18	16	521	261

[a] Includes hunters reporting in both Units 21D and 24.
[b] Includes hunters reporting at Huslia.
[c] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[d] Local residents of Units 21B, 21D and 24
[e] Other than local residents.

Table 14. Unit 21D distribution of reported moose harvest, north of the Yukon River and in the Koyukuk River drainage compared to remainder of southern Unit 21D, regulatory years[a] 2002–2013.

Regulatory year	Percent harvest		Total harvest
	Northern Unit 21D	Southern Unit 21D	
2002	68	32	318
2003	79	21	313
2004	70	30	192
2005	59	41	218
2006	53	47	211
2007	63	37	201
2008	66	34	258
2009	71	29	238
2010	69	31	283
2011	70	30	283
2012	68	32	260
2013[b]	72	28	274

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Preliminary data.

Table 15. Unit 21D large bull[a] moose percent harvested and number measured during the hunting season from the Koyukuk CUA hunts and percent counted during aerial surveys in the Koyukuk "Core-5" trend count areas, regulatory years[b] 2002–2013.

Regulatory year	% Harvested (Sep)	Number measured (Sep)	% Counted (Nov)[c]	Number counted (Nov)[c]
2002	46	97	–[d]	–[d]
2003	58	108	25	513
2004	42	138	19	589
2005	46	120	33	478
2006	53	125	27	647
2007	47	115	30	628
2008	41	156	25	671
2009	38	180	28	761
2010	50	205	36	657
2011	54	204	40	628
2012	52	190	–[d]	–[d]
2013	51	208	42	450

[a] Fifty-inch or greater antler spread.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[c] Data includes Huslia Flats and Treat Island trend count areas (Stout 2012b).
[d] No survey.

Table 16. Overall scores for meat evaluation at Koyukuk River checkstation, regulatory years[a] 2002–2013.

Regulatory year	Avg no. days hanging	Avg clean score[b]	Avg dry score[b]	Avg smell score[b]	Avg overall score[b]	% Hunters scoring <3	Sample size (*n*)
2002	3.3	4.3	4.3	n/a	4.3	4.4	184
2003	3.3	4.2	4.4	4.8	4.2	4.5	199
2004	2.6	4.3	4.8	4.8	4.6	1.1	96
2005	2.7	4.8	4.8	4.8	4.8	0.0	95
2006	2.6	4.8	4.8	4.8	4.8	0.0	90
2007	2.4	4.4	4.5	4.8	4.6	0.0	84
2008	2.6	4.6	4.9	5.0	4.9	0.0	118
2009	2.6	4.6	4.8	4.9	4.8	0.7	140
2010	2.7	4.6	4.8	4.8	4.7	2.0	148
2011	2.6	4.4	4.8	4.9	4.7	0.0	158
2012	3.0	4.5	4.6	4.8	4.7	0.7	140
2013	2.9	4.6	4.8	4.9	4.9	0.0	164

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Subjective ranking scale of 1–5, with a score of 1 being lowest.

Table 17. Units 21D and 24 Koyukuk controlled use area moose harvest by permit hunt, regulatory years[a] 2002–2013[b].

Hunt	Regulatory year	Permits issued	Percent successful hunters[c]	Percent unsuccessful hunters[c]	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
RM832	2002	359	49	51	17	145 (100)	0 (0)	0	145
	2003	401	45	55	12	155 (99)	0 (0)	2	157
	2004	399	38	62	8	141 (100)	0 (0)	0	141
	2005	411	37	63	9	132 (100)	0 (0)	0	132
	2006	382	42	58	7	142 (99)	0 (0)	1	143
	2007	349	41	59	8	131 (100)	0 (0)	0	131
	2008	341	53	47	6	168 (99)	1 (1)	0	169
	2009	429	48	52	9	187 (100)	0 (0)	0	187
	2010	418	47	53	7	181 (100)	0 (0)	1	182
	2011	405	47	53	9	174 (100)	0 (0)	0	174
	2012	394	48	52	7	174 (100)	0 (0)	1	175
	2013[d]	469	46	54	6	204 (100)	0 (0)	0	204
DM823	2005	2	100	0	0	2 (100)	0 (0)	0	2
	2006	2	50	50	0	1 (100)	0 (0)	0	1
	2007	2	100	0	0	2 (100)	0 (0)	0	2
	2008	4	75	25	0	3 (100)	0 (0)	0	3
	2009	4	100	0	0	4 (100)	0 (0)	0	4
	2010	7	29	71	0	2 (100)	0 (0)	0	2
	2011	7	43	57	0	3 (100)	0 (0)	0	3
	2012	6	100	0	17	5 (100)	0 (0)	0	5
	2013[d]	6	83	17	0	5 (100)	0 (0)	0	5
DM825	2005	3	100	0	33	2 (100)	0 (0)	0	2
	2006	4	100	0	0	4 (100)	0 (0)	0	4
	2007	4	100	0	0	4 (100)	0 (0)	0	4
	2008	6	100	0	33	4 (100)	0 (0)	0	4
	2009	4	50	50	0	2 (100)	0 (0)	0	2
	2010	7	86	14	0	6 (100)	0 (0)	0	6
	2011	7	83	17	0	5 (100)	0 (0)	0	5
	2012	6	100	0	0	6 (100)	0 (0)	0	6
	2013[d]	6	100	0	17	5 (100)	0 (0)	0	5

Hunt	Regulatory year	Permits issued	Percent successful hunters[c]	Percent unsuccessful hunters[c]	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
DM827	2002	20	69	31	35	9 (100)	0 (0)	0	9
	2003	26	37	63	19	7 (100)	0 (0)	0	7
	2004	5	75	25	20	3 (100)	0 (0)	0	3
	2005	3	100	0	33	2 (100)	0 (0)	0	2
	2006	3	100	0	66	1 (100)	0 (0)	0	1
	2007	3	100	0	66	1 (100)	0 (0)	0	1
	2008	4	50	50	50	1 (100)	0 (0)	0	1
	2009	4	50	50	50	1 (100)	0 (0)	0	1
	2010	7	17	83	14	1 (100)	0 (0)	0	1
	2011	7	75	25	43	3 (100)	0 (0)	0	3
	2012	6	17	83	0	1 (100)	0 (0)	0	1
	2013[d]	6	75	25	33	3 (100)	0 (0)	0	3
DM828	2002	79	55	45	56	17 (100)	0 (0)	0	17
	2003	103	60	40	48	27 (100)	0 (0)	0	27
	2004	20	57	43	55	4 (100)	0 (0)	0	4
	2005	20	44	56	55	4 (100)	0 (0)	0	4
	2006	20	60	40	50	6 (100)	0 (0)	0	6
	2007	20	80	20	75	3 (75)	1 25)	0	4
	2008	32	56	44	50	9 (100)	0 (0)	0	9
	2009	32	69	31	50	11 (100)	0 (0)	0	11
	2010	54	65	35	43	20 (100)	0 (0)	0	20
	2011	54	75	25	48	21 (100)	0 (0)	0	21
	2012	47	60	40	36	18 (100)	0 (0)	0	18
	2013[d]	48	52	48	52	12 (100)	0 (0)	0	12
DM829	2002	20	100	0	45	11 (100)	0 (0)	0	11
	2003	26	62	38	12	13 (100)	0 (0)	0	13
	2004	5	33	67	40	1 (100)	0 (0)	0	1
	2005	2	0	100	50	0 (0)	0 (0)	0	0
	2006	2	100	0	0	2 (100)	0 (0)	0	2
	2007	2	100	0	0	2 (100)	0 (0)	0	2
	2008	4	75	25	0	3 (100)	0 (0)	0	3
	2009	4	50	50	0	2 (100)	0 (0)	0	2
	2010	7	67	33	14	4 (100)	0 (0)	0	4

Hunt	Regulatory year	Permits issued	Percent successful hunters[c]	Percent unsuccessful hunters[c]	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
	2011	7	50	50	43	2 (100)	0 (0)	0	2
	2012	6	75	25	33	3 (100)	0 (0)	0	3
	2013[d]	6	100	0	50	3 (100)	0 (0)	0	3
DM830	2002	79	84	16	38	41 (100)	0 (0)	0	41
	2003	103	76	24	36	44 (100)	0 (0)	0	44
	2004	20	57	43	60	4 (100)	0 (0)	0	4
	2005	20	73	27	45	8 (100)	0 (0)	0	8
	2006	20	47	53	32	9 (100)	0 (0)	0	9
	2007	20	100	0	30	14 (100)	0 (0)	0	14
	2008	32	86	14	56	12 (100)	0 (0)	0	12
	2009	32	70	30	25	16 (100)	0 (0)	0	16
	2010	54	73	27	39	24 (100)	0 (0)	0	24
	2011	54	89	11	31	33 (100)	0 (0)	0	33
	2012	47	78	22	43	21 (100)	0 (0)	0	21
	2013[d]	47	88	12	32	28 (100)	0 (0)	0	28
Total	2002	557	54	46	27	223 (100)	0 (0)	0	223
	2003	659	50	50	22	246 (100)	0 (0)	2	248
	2004	449	38	62	13	153 (100)	0 (0)	0	153
	2005	461	40	60	15	150 (100)	0 (0)	0	150
	2006	433	44	56	12	165 (100)	0 (0)	1	166
	2007	400	46	54	13	157 (99)	1 (1)	0	158
	2008	423	56	44	14	200 (99)	1 (1)	0	201
	2009	511	51	49	13	223 (100)	0 (0)	0	223
	2010	557	50	50	14	238 (100)	0 (0)	1	239
	2011	541	53	47	16	241 (100)	0 (0)	0	241
	2012	512	51	49	13	228 (100)	0 (0)	1	229
	2013[d]	588	51	49	13	260 (100)	0 (0)	0	260

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).

[b] RM830 ended in regulatory year 2000 and was replaced by drawing hunts DM827, 828, 829, and 830.

[c] 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.

[d] Preliminary data.

Table 18. Unit 21D outside Koyukuk controlled use area moose harvest by permit hunt, regulatory years[a] 2004–2013.

Hunt	Regulatory year	Permits issued	Percent successful hunters	Percent unsuccessful hunters	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
DM814	2004	15	33	67	13	4 (100)	0 (0)	0	4
	2005	15	33	67	53	2 (100)	0 (0)	0	2
	2006	15	67	33	40	6 (100)	0 (0)	0	6
	2007	16	21	79	13	3 (100)	0 (0)	0	3
	2008	16	56	44	44	5 (100)	0 (0)	0	5
	2009	16	57	43	56	4 (100)	0 (0)	0	4
	2010	15	75	25	20	9 (100)	0 (0)	0	9
	2011	9	83	17	33	5 (100)	0 (0)	0	5
	2012	16	50	50	25	6 (100)	0 (0)	0	6
	2013[b]	18	63	38	55	5 (100)	0 (0)	0	5
DM815	2004	3	50	50	33	1 (100)	0 (0)	0	1
	2005	3	50	50	33	1 (100)	0 (0)	0	1
	2006	3	67	33	0	2 (100)	0 (0)	0	2
	2007	2	0	100	0	0 (0)	0 (0)	0	0
	2008	2	50	50	0	1 (100)	0 (0)	0	1
	2009	2	100	0	0	2 (100)	0 (0)	0	2
	2010	2	100	0	0	1 (100)	0 (0)	0	1
	2011	2	100	0	50	1 (100)	0 (0)	0	1
	2012	2	0	0	100	0 (100)	0 (0)	0	0
	2013[b]	2	100	0	0	2 (100)	0 (0)	0	2
DM816	2006	25	50	50	12	11 (100)	0 (0)	0	11
	2007	25	64	36	36	9 (100)	0 (0)	0	9
	2008	25	62	38	48	8 (100)	0 (0)	0	8
	2009	25	39	61	28	7 (100)	0 (0)	0	7
	2010	25	47	53	32	8 (100)	0 (0)	0	8
	2011	25	73	27	40	11 (100)	0 (0)	0	11
	2012	25	54	46	48	7 (100)	0 (0)	0	7
	2013[b]	25	64	36	44	9 (100)	0 (0)	0	9

Hunt	Regulatory year	Permits issued	Percent successful hunters	Percent unsuccessful hunters	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
DM817	2006	16	75	25	25	9 (100)	0 (0)	0	9
	2007	31	25	75	36	5 (100)	0 (0)	0	5
	2008	31	50	50	55	7 (100)	0 (0)	0	7
	2009	28	42	58	57	5 (100)	0 (0)	0	5
	2010	31	39	61	40	7 (100)	0 (0)	0	7
	2011	26	60	40	81	3 (100)	0 (0)	0	3
	2012	25	50	50	52	6 (100)	0 (0)	0	6
	2013[b]	15	17	83	60	1 (100)	0 (0)	0	1
DM818	2006	4	50	50	25	1 (100)	0 (0)	0	1
	2007	18	0	100	89	0 (0)	0 (0)	0	0
	2008	25	40	60	80	2 (100)	0 (0)	0	2
	2009	17	0	100	35	0 (0)	0 (0)	0	0
	2010	9	50	50	56	2 (100)	0 (0)	0	2
	2011	5	0	0	100	0 (0)	0 (0)	0	0
	2012	14	43	57	50	3 (0)	0 (0)	0	3
	2013[b]	8	75	25	0	6 (0)	0 (0)	0	6
DM819	2007	1	0	100	0	0 (0)	0 (0)	0	0
	2008	1	0	0	100	0 (0)	0 (0)	0	0
	2009	0	0	0	0	0 (0)	0 (0)	0	0
	2010	1	0	0	100	0 (0)	0 (0)	0	0
	2011	0	0	0	0	0 (0)	0 (0)	0	0
	2012	0	0	0	0	0 (0)	0 (0)	0	0
	2013[b]	0	0	0	0	0 (0)	0 (0)	0	0
DM820	2004	22	0	100	55	0 (0)	0 (0)	0	0
	2005	22	88	13	59	7 (100)	0 (0)	0	7
	2006	22	40	60	73	2 (100)	0 (0)	0	2
	2007	34	53	47	44	10 (100)	0 (0)	0	10
	2008	34	18	82	50	3 (100)	0 (0)	0	3
	2009	34	29	71	59	4 (100)	0 (0)	0	4
	2010	34	50	50	59	7 (100)	0 (0)	0	7
	2011	34	32	68	35	7 (100)	0 (0)	0	7

Hunt	Regulatory year	Permits issued	Percent successful hunters	Percent unsuccessful hunters	Percent did not hunt	Bulls (%)	Cows (%)	Unk	Total harvest
	2012	34	32	68	26	8 (100)	0 (0)	0	8
	2013[b]	34	41	59	50	7 (100)	0 (0)	0	7

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2004 = 1 July 2004–30 June 2005).
[b] Preliminary data.

Table 19. Unit 21D moose hunter residency and success, regulatory years[a] 2002–2013.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total	
2002	108	171	47	0	326	133	171	19	1	324	650
2003	115	159	45	3	322	222	169	49	5	445	767
2004	127	88	11	1	227	334	166	44	1	545	772
2005	109	92	15	2	218	288	170	29	9	496	714
2006	114	82	15	0	211	252	129	10	1	392	603
2007	112	79	13	1	205	274	126	22	0	422	627
2008	141	112	10	0	263	268	106	18	1	393	656
2009	121	114	9	0	244	315	156	30	0	501	745
2010	126	143	17	0	286	297	146	24	0	467	754[c]
2011	117	155	16	0	288	256	180	14	1	451	740[c]
2012	116	137	20	0	273	239	181	28	0	448	721
2013[d]	99	161	17	0	277	288	163	7	2	460	739[c]

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Unit 21D and Ruby residents only.
[c] Includes unknown success hunters.
[d] Preliminary data.

Table 20. Unit 21D moose harvest chronology percent by month/day, regulatory years[a] 2002–2013.

Regulatory	Harvest chronology percent by month/day				
year	8/22–8/31	9/1–9/14	9/15–9/25	2/1–2/10	*n*
2002	4	30	61	5	313
2003	4	43	47	6	313
2004	2	40	58	0	212
2005	1	37	61	0	209
2006	10	32	58	0	204
2007	7	37	56	0	199
2008	7	36	58	0	259
2009	3	45	52	0	242
2010	4	31	65	0	279
2011	3	35	62	0	285
2012	1	46	52	0	271
2013[b]	1	35	63	0	267

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Preliminary data.

Table 21. Unit 21D moose harvest percent by transport method, regulatory years[a] 2002–2013.

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
2002	5	0	87	0	4	1	1	2	326
2003	4	0	88	0	6	0	1	1	322
2004	3	0	81	2	3	2	6	3	227
2005	1	1	92	1	1	2	1	1	209
2006	5	0	90	2	0	1	1	1	211
2007	6	0	88	4	0	1	2	1	201
2008	3	0	92	4	0	1	1	0	261
2009	4	0	90	4	0	1	1	0	239
2010	4	0	90	3	0	0	2	0	284
2011	4	0	89	4	0	1	1	0	285
2012	3	0	91	3	0	0	2	1	266
2013[b]	2	0	90	1	0	2	1	4	275

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2002 = 1 July 2002–30 June 2003).
[b] Preliminary data.