**Alaska Department of Fish and Game**
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# CHAPTER 21: MOOSE MANAGEMENT REPORT

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

## LOCATION

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

**GEOGRAPHIC DESCRIPTION:** All Kuskokwim River drainages upstream from Lower Kalskag

## BACKGROUND

According to oral history, moose initially arrived in western Interior Alaska sometime after the turn of the 20th century, and by the 1970s moose populations were at record highs. Currently, moose are found throughout this area, with the exception of the rugged peaks of the Alaska Range. Predation by wolves, black bears, and grizzly bears is a major factor influencing moose abundance in Unit 19 with weather, habitat, and hunting also playing important roles.

Unit 19 can be conveniently divided into 2 regions with distinct differences in moose habitat, user access, and hunting practices. Units 19A and 19D are generally lower elevation areas accessible by boat. Hunters in these units generally live in Unit 19 or downriver in Unit 18 and hunt primarily for food. Units 19B and 19C are generally higher elevation areas where access is largely by aircraft. Few people live in these areas, and those who travel there to hunt often seek large bulls for their trophy quality, although meat also is an important consideration.

Prior to moose population density estimates such as those conducted in Unit 19A and eastern Unit 19D (Tables 1a–1d), aerial composition and trend surveys were the primary means of assessing population status and trend for several decades (Tables 2a–2c). Unfortunately, some of the older data and relevant survey information (i.e., snow conditions, weather and light conditions, survey dates, observers, techniques used, etc.) that help to interpret these data were lost during a fire that consumed the McGrath office in December 2006.

Regulations, including controlled use areas (CUA) and management areas (MA), and other requirements to manage moose hunting and reduce conflicts between user groups, exist throughout the area. For example, the Holitna–Hoholitna CUA imposes a boat motor horsepower restriction; the upper Holitna–Hoholitna MA requires hunters to stop at a checkstation if one is established, and hunters entering the Holitna–Hoholitna MA by aircraft must exit the area by the same means. Nonresident closed areas established within 2 miles of most major rivers in

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

Units 19A and 19B prohibit nonresidents from hunting moose and caribou. Aircraft restrictions apply in the upper Kuskokwim CUA in Unit 19D; and moose hunting is allowed by Tier II permit only in parts of Unit 19A, including the Lime Village MA. Additionally, there are meat care education requirements for nonresidents and meat-on-the-bone requirements in various areas.

Moose populations in Units 19A and 19B declined beginning in the early 1990s; conflicts between users intensified, and moose hunting regulations became more complicated. These conflicts lead to the creation of the Central Kuskokwim Working Group, made up of representatives of multiple user groups, and the development the *Central Kuskokwim Moose Management Plan* (CKMMP), which was finalized in June 2004 and still guides moose management decisions in Units 19A and 19B. Similar public input has been accomplished in Unit 19D, largely through the McGrath Fish and Game Advisory Committee, and since 1995 much of this input focused on predator control.

Wolf and bear predation plays a significant role in the population dynamics of moose (Gasaway et al. 1992, Boertje et al. 2009). In Unit 19D, wolves, black bears, and grizzly bears were all identified as significant predators (Keech et al. 2011). With this understanding we began managing to reduce predation in eastern Unit 19D (Unit 19D East); an 8,513 $mi^2$ area of Unit 19D upriver of the Black and Selatna River drainages. In 2001, the experimental micromanagement area (EMMA), a 528 $mi^2$ area of eastern Unit 19D, was established within an approximately 20 mile radius of McGrath. This area, renamed the bear control area (BCA) in 2009 and the bear control focus area (BCFA) in 2014, encompasses the highest density of moose in Unit 19D East and was established as a treatment area to test and implement predator population manipulations and other management actions (Fig. 1).

In 1995 the Alaska Board of Game (BOG) adopted a wolf control implementation plan for Unit 19D East. BOG updated and/or reauthorized the plan in January 2000, March 2001, March 2003, January 2006, May 2006, and March 2009 when the upper Kuskokwim villages moose management area was established (UKVMMA; Fig. 2).

Similarly, in Unit 19A, BOG adopted a wolf predation control implementation plan in March 2004 with updates and/or reauthorizations in January 2006, May 2006, and March 2009, when the central Kuskokwim villages moose management area (CKVMMA) was established (Fig. 3).

Wolf, black bear, and grizzly bear predation control programs in Units 19A and 19D are critical for compliance with intensive management regulations 5 AAC 92.106 and 5 AAC 92.108, which identify the Unit 19 moose populations as important for providing high levels of harvest for human consumptive use and set moose population and harvest objectives. As moose numbers declined, public planning efforts increased; predation control plans were implemented; research efforts undertaken; and despite wide local support for predator control, legal challenges to these programs remain. Efforts to increase the moose populations in Unit 19 characterize the most important management responsibilities in the McGrath office.

# MANAGEMENT DIRECTION

## MANAGEMENT GOALS

- Work toward achieving the intensive management moose population and harvest objectives for Units 19A, 19B and 19D.
- Maintain population indices in Unit 19C consistent with stable or increasing moose numbers.
- In Unit 19A and Unit 19D East, reduce predation on moose through predation control activities.

## MANAGEMENT OBJECTIVES

The Units 19A and 19B intensive management population and harvest objectives, as listed in regulation 5 AAC 92.108, were:

- Achieve a moose population of 13,500–16,500 moose (7,600–9,300 in Unit 19A) with a harvest of 750–950.

Objectives for Units 19A and 19B recommended in CKMMP:

- Maintain a minimum fall posthunt bull:cow ratio of 20–30 bulls:100 cows.
- Maintain a minimum fall posthunt calf:cow ratio of 30–40 calves:100 cows.
- Maintain no fewer than 20% calves in late winter surveys. These were described as short yearlings in CKMMP and are approximately 10-month-old calves.

Unit 19C:

- Maintain a fall posthunt bull:cow ratio of at least 30 bulls:100 cows.

Unit 19D intensive management population and harvest objectives:

- Achieve a moose population of 6,000–8,000 moose with a harvest of 400–600 moose in Unit 19D East.
- Achieve a moose population of 4,000–6,000 with a harvest of 250–600 in the remainder of Unit 19D (that portion of Unit 19D downriver of the Selatna and Black River drainages).
- Achieve a population of 2,500 moose with a harvest of 100 moose within UKVMMA.

## ACTIVITIES

Throughout Unit 19:

- Conduct composition–trend surveys, particularly in portions of the unit where harvest levels make significant impacts on moose populations.
- Assess population size through population density estimation surveys.

- Assess moose movements through regular radiotelemetry surveys.

- Assess moose habitat directly through browse surveys, and indirectly through population indices such as twinning rates and body weights, when possible.

- Encourage landowners and land managers to reduce fire suppression on wildfires that do not threaten human life, property, or valuable resources, thereby allowing fire to maintain young, productive, and diverse habitats.

- Monitor harvest through Tier II permits, registration permits, and general hunt harvest reports; analyze harvest data; and assess the accuracy of this data in selected areas when possible.

- Monitor natural mortality and analyze mortality data.

- Provide moose management information to state and federal regulatory bodies.

In Units 19A and 19B additional activities, as recommended in CKMMP:

- Assemble moose biology and management educational curricula and distribute through newsletters, school materials, posters, and other mechanisms to a variety of audiences, including students, teachers, hunters, and others.

## METHODS

To estimate moose population size and density in Unit 19A, we conducted aerial surveys using the geospatial population estimator method (GSPE; Ver Hoef 2001, 2008; Kellie and DeLong 2006). We conducted surveys during March 2005 in approximately 7,156 $mi^2$ south of and along the Kuskokwim River (south of the Kuskokwim); during March 2006 and 2010 in the western 3,444 $mi^2$ of this area (Unit 19A West [Aniak]); and during March 2008 and 2011 in the eastern 3,874 $mi^2$ of this area (Unit 19A East [Holitna]; Fig. 4). All survey units (SU) were stratified as high or low density moose habitat at the start of each survey. A simple random sample of survey units was selected from each stratum and additional SUs were selected to fill gaps in the randomized coverage. Sightability correction factors (SCF) were not obtained for these surveys except during the March 2011 survey in Unit 19A East (Holitna) (Paragi and Kellie 2011a). To estimate sightability for the March 2011 survey, we randomly selected north or south halves of sample units and intensively searched those portions with the most experienced pilot–observer crew using methods described by Gasaway et al. (1986). Overall and strata-specific densities calculated from these surveys were extrapolated to similar areas where no population estimation surveys were conducted.

Since 2001, early winter moose numbers have been estimated in 3 overlapping survey areas in Unit 19D. These areas are 1) the 528 $mi^2$ BCFA; 2) the 1,118 $mi^2$ UKVMMA; and 3) the 5,313 $mi^2$ moose survey area (Fig. 2). With the exception of the 2003 EMMA (now called BCFA) estimate, all estimates of moose numbers in Unit 19D are based upon GSPE techniques. The 2-strata Gasaway method (Gasaway et al. 1986) was used for estimating moose numbers in the EMMA during 2003. Estimates of total numbers of moose in Unit 19D generally include yearly SCFs based upon observations of radiocollared moose during surveys in 2001, 2003, and

2005–2008. Because yearly SCFs were not obtained during 2004 and 2009–2011, an average SCF value was used for those years.

We determined bull:cow, calf:cow, and yearling bull:cow ratios using population survey data in Unit 19D. We used data from fall trend and composition surveys in central Unit 19A in the Holitna River drainage, including the BCFA, which overlaps this drainage (Holitna trend count area [TCA]); in western Unit 19A in the Aniak River drainage, including the Aniak River downstream of the Buckstock River and the Kuskokwim River from Lower Kalskag to Aniak (Aniak TCA); and in Unit 19C in the Farewell area, generally from the Farewell airport east to the South Fork Kuskokwim River then northerly approximately 12 miles to the second moraine, then back to the Farewell airport (Farewell TCA). For fall trend and composition surveys, PA-18 aircraft were flown along 3–10 mile long transects generally at ½-mile intervals perpendicular to riparian moose habitats. Aircraft maintained altitudes of ≤500 feet above ground level. Pilots used a Global Positioning System to maintain the aircraft on transect. Most habitats in these areas are roughly linear and parallel to rivers and transect direction was selected to run perpendicular to habitat types to ensure that all habitat types in the area were sampled. We recorded the number of moose and classified them as cows, calves, and small, medium, or large bulls.

To determine twinning rates in Unit 19D, radiocollared cows were located using PA-18 and Bellanca Scout aircraft during May and early June. These cows, as well as uncollared cows observed during these flights or observed during specific twinning rate flights, were enumerated and classified as being accompanied by single calves or multiple calves. Specific twinning rate flights were conducted with a systematic search for uncollared cows along transects generally at ½-mile intervals perpendicular to riparian moose habitats. The twinning rate was calculated as the proportion of cows with twins or triplets from the sample of all cows with calves.

To determine twinning rates in Unit 19A in May 2013, we recorded opportunistic sightings of cows with calves on one day during our bear control effort within BCFA in Unit 19A (Fig. 3). This included a systematic search similar to that described above but involved 4 PA-18 type aircraft and over 25 aircraft hours of search time.

We estimated annual harvest using data from mandatory harvest report cards. This included data from report cards from general season harvest tickets, and registration, federal permits, and Tier II permits. Hunters received 1 or 2 reminder letters and usually an e-mail and telephone calls if we did not receive timely reports. We summarized data on hunter residency, hunter success, harvest chronology, and transport methods. Population and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY12 = 1 July 2012–30 June 2013). We also received notification of mortuary moose requests consistent with regulation 5 AAC 92.019, coordinated these hunts with enforcement personnel, and recorded harvests.

We conducted aerial snow depth surveys in Units 19A and 19D since 2008 (Paragi et al. 2008) and provided regular educational moose management newsletters to area residents, articles to local newspapers, and other educational materials to media sources when possible.

## RESULTS AND DISCUSSION

### POPULATION STATUS AND TREND

*Population Size and Trend*

Units 19A and 19B. Moose population estimation surveys using GSPE techniques have been conducted in portions of Unit 19A 5 times since February 2005 (Table 1a). In March 2011, we calculated 0.25 observable moose/mi$^2$ (±18%, 90% CI; Table 1a) with 15% calves. Analysis of the March 2011 survey data including SCFs of 1.24 in low density strata and 1.89 in high density strata produced a density of 0.43 total moose/mi$^2$ (±36%, 90% CI; Table 1a). A subanalysis of data from the within Unit 19A East (Holitna) portion of the March 2005 survey produced a density of 0.28 observable moose/mi$^2$ (±17%, 90% CI). Confidence intervals overlap for these surveys and no trend is detected.

Moose population abundance has not been measured in Unit 19B, but densities are likely at or below those found in Unit 19A.

Unit 19D. Moose numbers were estimated using GSPE techniques in November 2011 and 2012 within BCFA and UKVMMA (Tables 1b and 1c). Within BCFA, we estimated 835 (±21%; 90% CI) moose in 2011 and 612 (±19%; 90% CI) in 2012 and within UKVMMA, we estimated 1,647 (±18%; 90% CI) in 2011 and 1,337 (±15%; 90% CI) in 2012. Confidence intervals overlap and no trend between these years is detected.

Unit 19C. GSPE moose population estimation surveys have not been conducted in Unit 19C. However, moose numbers in Unit 19C are likely similar to those of the late 1980s and early 1990s. Trend count data indicate 134 moose/hour were detected in 2009 and 110 moose/hour were detected in 2010. These detection rates are similar to those during 1987–1997 when an average of 150 moose/hour were detected (range 100–194 moose/hour; Table 2a).

*Population Composition*

Units 19A and 19B. In November 2013 during a composition survey in the Aniak TCA we classified 147 moose including 82 cows, 31 bulls, and 34 calves (Table 2b).

In the November 2013 moose composition surveys in the Holitna TCA we observed 244 moose; ratios were 55 bulls:100 cows; 25 yearling bulls:100 cows; and 50 calves:100 cows (Table 2c). The ratio of 50 calves:100 cows in 2013 is the highest ratio recorded since 1996. We speculate that the higher calf:cow ratio is a result of reduced bear numbers following our bear control effort in May 3013.

Unit 19C. No composition surveys were conducted in the Farewell TCA during 2011 or 2012 due to unfavorable weather and other priorities. Results from previous surveys are in Table 2a.

Unit 19D. Within BCFA in 2011 among 335 moose classified, there were 31 bulls:100 cows; 12 yearling bulls:100 cows; and 49 calves:100 cows and in 2012 among 308 moose classified, there were 28 bulls:100 cows; 6 yearling bull:100 cows; and 47 calves:100 cows. These ratios are similar to those observed since 2001 (Table 1b). Similar composition data were obtained in the UKVMMA (Table 1c) except that in 2012, among 650 moose classified, there were 38 bulls:100 cows which was higher than the 28 bulls:100 cows ratio in BCFA and there were 35 calves:100

cows which was lower than the 47 calves:100 cows in BCFA. Moose population composition in moose survey area during 2008 indicated 55 bulls:100 cows; 17 yearling bulls:100 cows; and 41 calves:100 cows (Table 1d).

Table 3 shows twinning rates for moose in Unit 19D East during spring 2001–2013. Twinning rates of radiocollared cows are reported separately from randomly observed cows because our radiocollared sample is biased toward higher reproductive age classes. The twinning rate in – was 34% and in RY12 it was 22% with a 2-year average of 28% suggesting that the habitat is capable of supporting higher moose populations (Boertje et al. 2007). However, the 22% twinning rate observed in RY12 was the lowest observed.

*Moose Movements*

Radiotelemetry locations during 2003–2005 in Units 19A and 19B showed that most moose did not move great distances from their capture locations. The few moose that moved considerable distances moved south and wintered in Unit 17. In Unit 19C fewer moose are found in the Farewell TCA during spring bison surveys than during fall trend and composition surveys, suggesting that this population includes a large migratory component. In Unit 19D moose radiocollared in and around BCFA as part of mortality research generally remained within 25–30 miles of their capture location and were nonmigratory.

Cow moose radiocollared in the spring 2013 within or near BCFA in Unit 19A generally remained within this area. However, of 22 cows with calves that were relocated in late October through early November, 9 were found as far as 10 miles outside this area, including 5 of 6 moose radiocollared along the main stem of the Kuskokwim between Sleetmute and Stony River which were relocated in the fall in burned areas of the hills north of the Kuskokwim River.

**MORTALITY**

*Harvest*

Seasons and Bag Limits. Seasons and bag limits in Unit 19 for RY12 through RY13 were:

| Units and Bag Limits | Open Seasons |
|---|---|
| Unit 19A, Lime Village management area, that portion drained by the Stony River from the mouth of the Stink River, including the Stink River drainage upstream to, but not including the Can Creek drainage. | |
| RESIDENT HUNTERS: 2 antlered bulls by Tier II permit TM684; | 10 Aug–25 Sep |
| or | |
| 2 antlered bulls by Tier II permit TM684. | 20 Nov–31 Mar |
| NONRESIDENT HUNTERS: | No open season |
| Unit 19A, Kuskokwim River drainage downstream of and including the George River drainage and downstream of and excluding the Downey Creek drainage. | |
| RESIDENT HUNTERS: 1 antlered bull by Tier II permit TM680 | 1 Sep–20 Sep |
| NONRESIDENT HUNTERS: | No open season |

| Units and Bag Limits | Open Seasons |
|---|---|
| Remainder of Unit 19A | |
| RESIDENT AND NONRESIDENT HUNTERS: | No open season |
| Unit 19B within the nonresident closed area | |
| RESIDENT HUNTERS: 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least one side. | 1 Sep–20 Sep |
| NONRESIDENT HUNTERS: | No open season |
| Remainder of Unit 19B | |
| RESIDENT HUNTERS: 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least one side. | 1 Sep–20 Sep |
| NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side. Hunter orientation required. | 5 Sep–20 Sep |
| Unit 19C | |
| RESIDENT HUNTERS: 1 bull with spike-fork or 50-inch antlers, or antlers with 4 or more brow tines on at least one side; or | 1 Sep–20 Sep |
| 1 bull by registration permit RM655. | 1 Feb–28 Feb |
| NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or with 4 or more brow tines on at least one side. | 1 Sep–20 Sep |
| Unit 19D, that portion within the upper Kuskokwim controlled use area | |
| RESIDENT HUNTERS: 1 antlered bull by registration permit RM650; or | 1 Sep–25 Sep |
| 1 moose by registration permit; during a period 1 Feb–28 Feb, a season may be announced by emergency order. | (to be announced) |
| NONRESIDENT HUNTERS: | No open season |
| Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River | |
| RESIDENT HUNTERS: 1 antlered bull; or | 1 Sep–20 Sep |
| 1 antlered bull by registration permit RM650; or | 1 Sep–25 Sep |
| 1 moose by registration permit; during a period 1 Feb–28 Feb, a season may be announced by emergency order. | (to be announced) |
| NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least one side. | 1 Sep–20 Sep |
| Remainder of Unit 19D | |
| RESIDENT HUNTERS: 1 antlered bull; or | 1 Sep–20 Sep |
| 1 antlered bull by registration permit RM650; or | 1 Sep–25 Sep |
| 1 moose by registration permit; during a period Feb. 1–Feb. 28, a season may be announced by emergency order. | (to be announced) |
| NONRESIDENT HUNTERS: | No open season |

Alaska Board of Game Actions and Emergency Orders. Moose hunting regulations did not change during RY11 and RY12. However, in RY13, after discussions with the McGrath Fish and Game Advisory Committee, we chose not to request reauthorization of the winter registration permit moose hunt which could have been announced if the need for additional harvest were to arise.

In February 2014 the wolf control implementation plan for Unit 19D East was updated and adopted as the operational plan for intensive management of moose in Unit 19D East (RY14–RY19) as BOG established a moose density objective for BCFA of 2.0 moose/mi$^2$ and a harvest objective of 180 for the wolf control focus area (WCFA; Fig. 1). They also eliminated UKVMMA (Fig. 2) and reauthorized the plan through June 2020.

Also in February 2014 the wolf predation control implementation plan for Unit 19A was updated and adopted as the operational plan for intensive management of moose in Unit 19A (RY14–RY19) as BOG established a moose density objective for BCFA of 2.0 moose/mi$^2$ and a harvest objective of 120 moose for WCFA (Fig. 3). CKVMMA was eliminated as a management area but retained as WCFA where aerial wolf control was permitted, and the plan was reauthorized through June 2020.

Harvest by Hunters. The overall reported harvests in Unit 19 were 321 and 357 moose in RY11 and RY12, respectively (Table 4a). Moose harvest increased (49%) from RY11 to RY12 in Unit 19A. In Unit 19B harvest was steady, but remained low. Harvest increased by 28% in Unit 19C but fell by 20% in Unit 19D (Tables 4b–4e). A few moose were reported taken in Unit 19, but reported location information is missing or does not allow identification of subunit (Table 4f). Nearly all moose reported taken were bulls, consistent with bulls-only bag limits. Some cows were likely taken illegally, but the number is difficult to estimate.

Permit Hunts. The number of moose reported taken using Tier II permit hunt TM684 in the Lime Village MA in Unit 19A and registration permit RM655 in Unit 19C is typically low (Table 5). During RY11 and RY12, a total of 4 moose were taken under TM684 and 5 bulls were taken under RM655.

In western Unit 19A, TM680 permittees reported taking 65 moose in RY11 and 93 in RY12. A federal permit hunt (FM019) for local rural resident hunters is also held on federal public lands within the TM680 hunt area. Harvest federal data are taken partly from a database using ADF&G's Wildlife Information Network, and partly from personal communication with refuge staff; harvest reporting for FM019 is incomplete and these data should be considered minimums. 12 bulls were reported on this federal permit in RY11 and 22 in RY12 (Table 5).

In Unit 19D during RY08–RY12, an annual average of 303 permittees took an average of 107 bulls using the RM650 permit (Table 5). Hunters reported taking 128 moose in RY11 and 103 in RY12.

Hunter Residency and Success. Hunter residency and success during RY08–RY12 were subdivided by local resident, nonlocal resident, and nonresident hunters (Tables 6a–6e). Hunter success in Unit 19 was 45% in RY11 and 46% in RY12, up from 35% in RY08 and RY09 (Table 6a).

Hunter success in Unit 19A improved from a low of 25% in RY08 and RY09, to 34% in RY11 and 50% in RY12 (Table 6b). Increased hunter success, especially in RY12 may be due to an increase in moose numbers, but speculation should be reserved pending additional survey data.

In Unit 19B, success rates were 31% in RY11 and 41% in RY12 compared with 27% in RY08 (Table 6c). Also, the number of hunters declined from 107 in RY08 to 48 in RY11 and 44 in RY12. Moose antler restrictions and a much smaller caribou herd, which drew fewer hunters seeking combination moose and caribou hunts, may explain much of this decline.

In Unit 19C, success rates improved from 43% in RY08 to 59% in RY12 and 73% in RY12. Total number of moose taken also increased from 53 in RY08 to 76 in RY11 and 97 in RY12. The number of hunters also increased from 120 hunters in RY08 to 128 in RY11 and 171 in RY12 (Table 6d).

Success rates in Unit 19D varied within the last 5 years from a low of 38% in RY12 to a high of 49% in RY11. Total moose taken was at its highest during this period in RY11 with 149 moose reported (Table 6e).

In Units 19A and 19D, residency restrictions eliminated or reduced nonresident hunting. In Unit 19A, nonresidents reported taking 1 moose in RY12 even though nonresident seasons were closed and this report, as well as reports from RY09 and RY10, are likely misreported (Table 6b). In Unit 19D, 6 nonresidents reported taking moose in RY11 and 4 in RY12 (Table 6e).

Nonresidents continued to take a substantial portion of the harvest in Units 19B and 19C. In Unit 19B, 22 of 33 moose reported taken during RY11 and RY12 were taken by nonresidents (Table 6c). In Unit 19C, 69 of 173 moose taken during RY11 and RY12 were taken by nonresidents (Table 6d).

Transport Methods. In Units 19B and 19C, hunters primarily used aircraft, while in Units 19A and 19D, boats were the most common method of transport (Tables 7a–7e). These methods have historically been dominant and remained so throughout RY11 and RY12.

*Other Mortality*

Under regulation 5 AAC 92.019, hunters were permitted to take moose for customary and traditional Alaska Native funerary or mortuary religious ceremonies. During RY11, 6 bulls and 8 cows were taken and 7 unsuccessful hunts were reported in Unit 19A, and 1 cow was taken in 1 reported hunt in Unit 19D. During RY12, 10 bulls and 6 cows were taken and 5 unsuccessful hunts were reported in Unit 19A, and 2 cows and 1 unsuccessful hunt were reported in Unit 19D.

Keech et al. (2011) found that the primary cause of moose calf mortality was predation by black bears, grizzly bears, and wolves. Deep snow also contributed to calf mortality.

Other known mortality includes an unusual report of a moose killed in defense of life and property as the homeowner was attempting to scare the moose away from his fish drying rack where the moose was eating the hanging fish. After other hazing attempts failed, the homeowner

shot at the moose with light shot from a small bore shotgun, which is typically not thought to be lethal but in this case, it was.

### HABITAT

*Assessment*

Snow can restrict moose movement when it reaches about 28 inches and can make movement very difficult at about 35 inches (Coady 1974). Unit 19 experiences snow depths of this magnitude more frequently than other units in Interior Alaska (Paragi and Kellie 2011b). Deep snow increases energetic requirements and restricts access to forage, thus may reduce the proportion of Unit 19A available to moose for winter range. Deep snow may also increase vulnerability to wolf predation, particularly if a crust forms in mid to late winter. Snow depth measured in McGrath was 41 inches in April 2012, and 26 inches in April 2013 (Fig. 5) and we observed many calf carcasses during late winter 2012.

High twinning rates indicate that habitat in Unit 19 was adequate to support an increasing moose population (Boertje et al. 2007). The 28% 2-year average twinning rate during RY11 and RY12 suggests that habitat is not limiting. However, the RY12 twinning rate was the lowest recorded but it followed the deep snow winter of RY11 (Fig. 5) and the deep snow explains the lower twinning rate better than changing habitat.

*Enhancement*

We continued cooperating with fire management personnel at the Alaska Department of Natural Resources-Division of Forestry to ensure that natural fires are allowed to burn wherever possible to enhance early successional stage habitats that moose prefer. Wildland fires occur regularly over large areas of diverse vegetation types in Unit 19.

Ice scouring events regularly reset habitat succession along rivers in Unit 19. Major flooding events have not widely occurred since the 1980s but significant flooding events occurred in 2002, 2009, and 2011. These events produced ice-scouring that helped rejuvenate some willow stands. Nevertheless, the quality and availability of the moose habitat along the rivers is not believed to be as high as during the previous decade. With the possible exception of Unit 19D near McGrath, the available browse is generally underutilized, particularly in Unit 19A.

## CONCLUSIONS AND RECOMMENDATIONS

The combined Units 19A and 19B population and harvest objectives (13,500–16,500 moose and harvest of 750–950) were not achieved. This intensive management population objective would require a moose density within the entire area of approximately 0.75–0.93 moose/mi$^2$. Our recent moose density estimate of 0.43 moose/mi$^2$ in eastern Unit 19A (Holitna) during March 2011, was well below this objective. The harvest of 96 moose in RY11 and 139 in RY12 in Units 19A and 19B (Tables 4b and 4c) are well below the intensive management harvest objective of 750–950 moose.

We could not detect a change in moose numbers in Unit 19A West (Aniak) (Table 1a). The March 2006 density estimate of 0.39 observable moose/mi$^2$ ±15% (90% CI) was not significantly different from the March 2010 estimate of 0.33 observable moose/mi$^2$ ±15% (90% CI). However,

harvest in western Unit 19A has increased (Table 5) and our population data is becoming outdated. We recommend obtaining an estimate of moose numbers within this area as soon as resources become available.

We also could not detect a change in moose numbers in Unit 19A East (Holitna). We found no significant difference between our subanalysis of the Holitna portion of the March 2005 survey (0.28 observable moose/mi$^2$ ±17% [90% CI]), the March 2008 estimate (0.44 observable moose/mi$^2$ ±28% [90% CI]), and the March 2011 estimate (0.25 observable moose moose/mi$^2$ ±18% [90% CI]; 0.43 moose/mi$^2$ ±36% [90% CI] with SCF). Confidence intervals of all surveys overlapped and no trend is evident. Further, 2 of the 3 estimates are of observable moose and variations in sightability complicate interpretation of these data.

Persistent low moose densities in Unit 19A East (Holitna), even though aerial wolf control is being applied, prompted BOG to authorize lethal removal of black and grizzly bears during May 2013 and 2014. Documenting a numerical response to predator removal is a priority and we recommend maintaining radio collars on moose within the Holitna River drainage to obtain sightability estimates to better evaluate moose numbers.

We met our objective of at least 20–30 bulls:100 cows in Unit 19A. The November 2013 bull:cow ratio was 38 bulls:100 cows in the Aniak TCA (Table 2b) and 55 bulls:100 cows within the Holitna TCA (Table 2c).

We achieved our fall calf composition objective of a minimum of 30–40 calves:100 cows in Unit 19A in November 2013 with 41 calves:100 cows in the Aniak TCA (Table 2b) and 50 calves:100 cows in the Holitna TCA (Table 2c).

We did not complete late winter surveys in Unit 19A during RY11 and RY12; therefore we do not know whether we achieved our objective of no fewer than 20% calves. During our most recent survey in March 2011, we did not achieve this objective in the Unit 19A East (Holitna) survey area where we estimated 15% calves.

No composition data have been collected in Unit 19B since 2005. Therefore, we are unable to determine whether we have achieved our composition objectives in Unit 19B.

The objective in Unit 19C to maintain a fall posthunt bull:cow ratio of at least 30 bulls:100 cows was not achieved in RY10 (29 bulls:100 cows), which was the last time we conducted a composition survey. Even though we did not achieve this objective, the difference is small. Additionally, harvest and success rates have increased (Table 6d) suggesting higher moose numbers and we do not recommend any regulatory changes.

We estimate the population in Unit 19D East to be about 5,400 moose, which is below our objective of 6,000–8,000. The moose population is likely below the objective of 4,000–6,000 within the remainder of Unit 19D, as well. Reported harvests of 149 and 119 moose in Unit 19D during RY11 and RY12 (Tables 4e, 6e, and 7e) did not meet the Unit 19D East harvest objective of 400–600 or the harvest objective of 250–600 in the remainder of Unit 19D.

BOG is on record stating that the local need for moose in Unit 19D is 130–150. The hunt that best provides for this harvest is the RM650 registration permit hunt. The harvest from this hunt was 128 in RY11 and 103 in RY12 (Table 5) and we harvested slightly below the amount of moose needed locally.

UKVMMA has a population objective of 2,500 moose (2.2 moose/mi$^2$) and a harvest objective of a least 100 moose. The midpoint of the fall 2012 population estimate for this area is 1,337 moose which is below this objective. Harvest is difficult to assess from within this area because the boundaries do not follow our uniform coding unit boundaries which are used to record harvest. However, we believe harvest from within this area is below this objective.

For the next reporting period, consistent with BOG action on the Unit 19A and 19D East operational plans, we will eliminate CKVMMA and UKVMMA as management areas because the management area designations did not provide additional management benefits, and within UKVMMA, harvest is difficult to assess because the boundaries do not follow our uniform coding unit boundaries which are used to record harvest. We will also establish moose population density objectives within the Unit 19A and Unit 19D East BCFAs of 2.0 moose/mi$^2$ and harvest objectives of 120 moose from within WCFA in Unit 19A and 180 moose from within WCFA in Unit 19D (Figs. 2 and 3). Department resources are inadequate to conduct multiple GSPE surveys in Unit 19 each year. Generally, we have sufficient resources to conduct one population estimate (or a subset of one) per year; 3–6 fall composition surveys, dependent upon weather; and 1–5 spring twinning surveys. Therefore, we conduct a single moose population estimate each year and rotate these surveys on a 3-year cycle, recognizing that we will occasionally be unable to conduct surveys due to weather. We conduct GSPE surveys in Unit 19A East (Holitna), the eastern two-thirds of Unit 21E (not included in this report), and the moose survey area in Unit 19D, with an emphasis on the 1,118 mi$^2$ area surrounding BCFA that made up UKVMMA, as this area remains valuable for assessing moose numbers. If the opportunity presents itself to conduct a survey in Unit 19A West (Aniak), we take advantage of it, but this is not part of the normal cycle. When population estimates are necessary beyond these areas, we extrapolate from these surveys to obtain those estimates.

For the next reporting period we will establish an area within WCFA in Unit 19A, where moose numbers can be more intensively evaluated similar to those conducted in Unit 19D. The Unit 19A BCFA (Fig. 3) was recently established by BOG and is a logical choice.

To summarize, management objectives for the next reporting period, including these changes, are as follows below.

**MANAGEMENT OBJECTIVES**

The Units 19A and 19B intensive management population and harvest objectives, as listed in regulation 5 AAC 92.108, were:

- Achieve a moose population of 13,500–16,500 moose (7,600–9,300 in Unit 19A) with a harvest of 750–950.

Objectives for Units 19A and 19B recommended in CKMMP:

- Maintain a minimum fall posthunt bull:cow ratio of 20–30 bulls:100 cows.

- Maintain a minimum fall posthunt calf:cow ratio of 30–40 calves:100 cows.

- Maintain no fewer than 20% calves in late winter surveys. These were described as short yearlings in CKMMP and are approximately 10-month-old calves.

Objectives for Units 19A defined in the operational plan:

- Achieve a moose density of 2.0 moose/mi$^2$ within BCFA.

- Achieve a harvest of 120 moose from within WCFA.

Unit 19C:

- Maintain a fall posthunt bull:cow ratio of at least 30 bulls:100 cows.

Unit 19D intensive management population and harvest objectives:

- Achieve a moose population of 6,000–8,000 moose with a harvest of 400–600 moose in Unit 19D East.

- Achieve a moose population of 4,000–6,000 with a harvest of 250–600 in the remainder of Unit 19D (that portion of Unit 19D downriver of the Selatna and Black River drainages).

Objectives for Units 19D East defined in the operational plan:

- Achieve a moose density of 2.0 moose/mi$^2$ within BCFA.

- Achieve a harvest of 180 moose from within WCFA.

When evaluating populations, survey–specific sightability estimates are important because sightability correction values can vary from survey to survey. We recommend obtaining these using radiocollared moose for each GSPE survey when resources are available.

To augment the GSPE population estimates, we should continue fall composition and trend surveys and spring twinning surveys throughout the McGrath area. We should make areas that have not been recently surveyed, such as the Farewell TCA, a high priority during the next reporting period.

Twinning rates are a sensitive indicator of moose nutritional status (Boertje et al. 2009). We recommend monitoring twinning rates within BCFAs in Units 19A and 19D and using them as follows: If the 2-year average twinning rate is >20% we will continue to promote growth. At a rate of 15–20% the number will be stabilized through harvest. If the 2-year average twinning rate is <15% number of moose will be reduced through harvest. Predator control will be suspended if harvest alone is insufficient to reduce moose numbers. Our current 2-year average twinning rate is 28% and we will continue to promote growth.

We recommend continued support for information and education programs, license vendors, and delivery of materials. We also recommend working closely with advisory committees to develop hunting regulations as moose populations respond to predation management.

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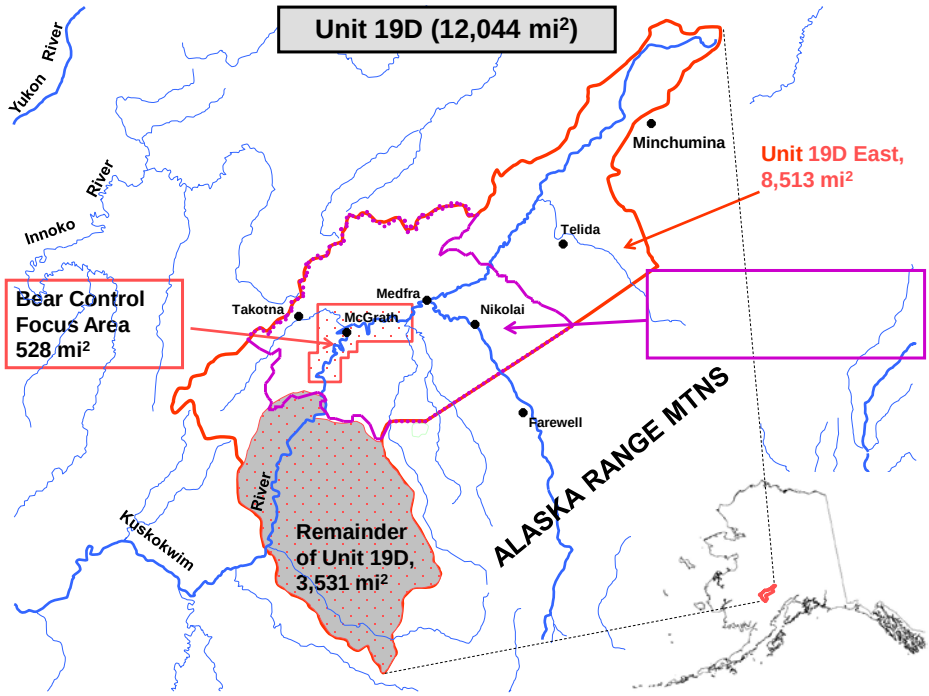


Figure 1. Unit 19D East (8,513 mi$^2$), the Unit 19D East wolf control focus area (4,484 mi$^2$), and the bear control focus area (528 mi$^2$) in effect during RY11 and RY12.

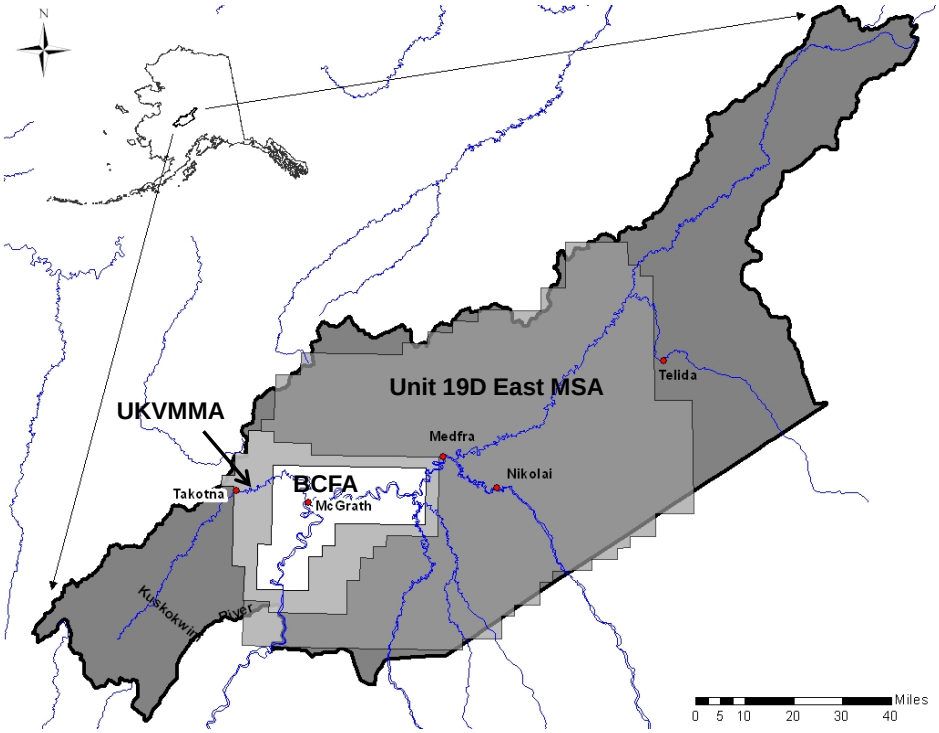


Figure 2. Unit 19D East (8,513 $mi^2$) showing the 3 Unit 19D moose survey areas (MSA) that have been surveyed since 2001 including the bear control focus area (BCFA; 528 $mi^2$); the upper Kuskokwim villages moose management area (UKVMMA; 1,118 $mi^2$); and the Unit 19D East moose survey area (5,313 $mi^2$).

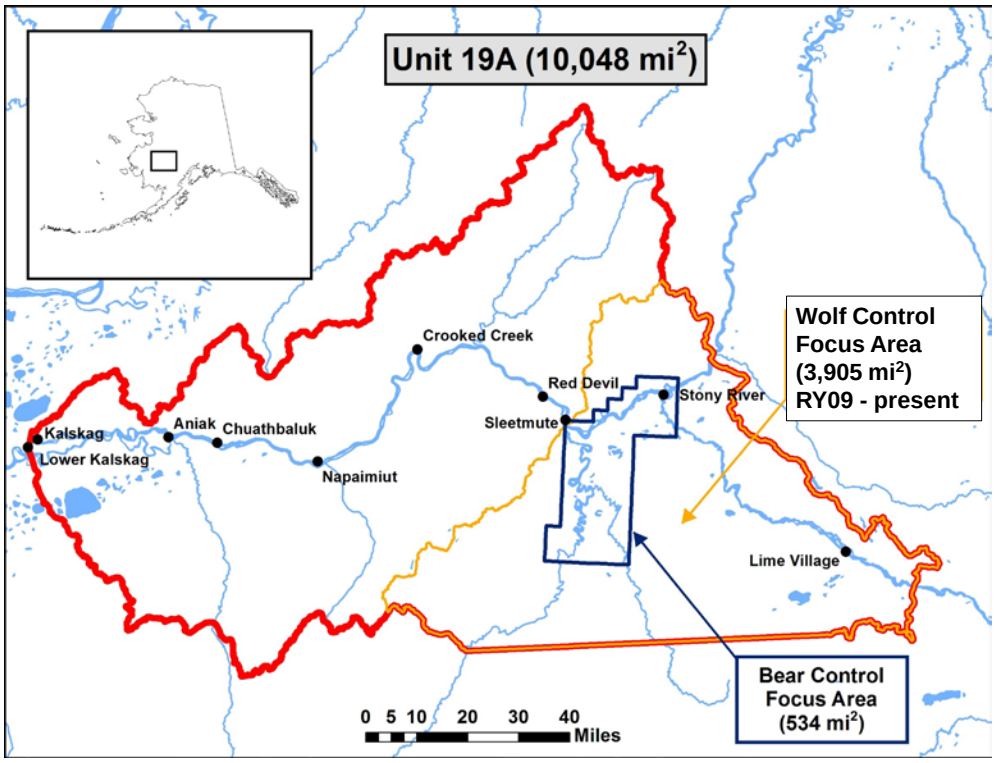


Figure 3. Unit 19A aerial wolf control area permitted throughout Unit 19A during RY04–RY08. Beginning in RY09, aerial wolf control was limited to the wolf control focus area. Both areas are defined as those portions of Unit 19A within those drainages upriver of Sleetmute. The bear control focus area is also shown.

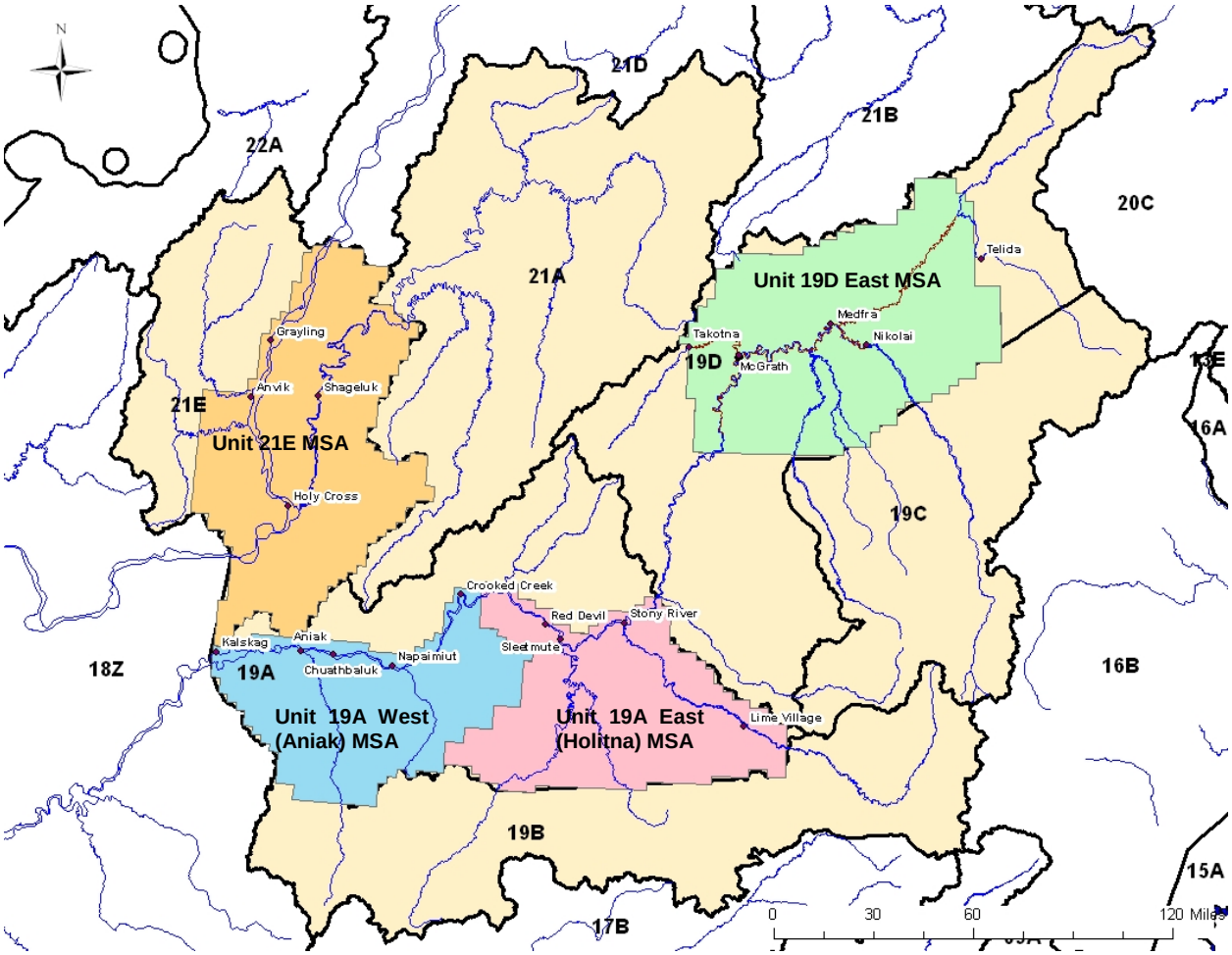


Figure 4. Units 19, 21A, and 21E showing the 3 scheduled moose survey areas (MSA): Unit 19D East moose survey area, Unit 19A East (Holitna), and Unit 21E moose survey area. Also shown is the Unit 19A West (Aniak) moose survey area which is surveyed opportunistically. The area south of the Kuskokwim River includes both the Unit 19A East (Holitna) and Unit 19A West (Aniak) survey areas.

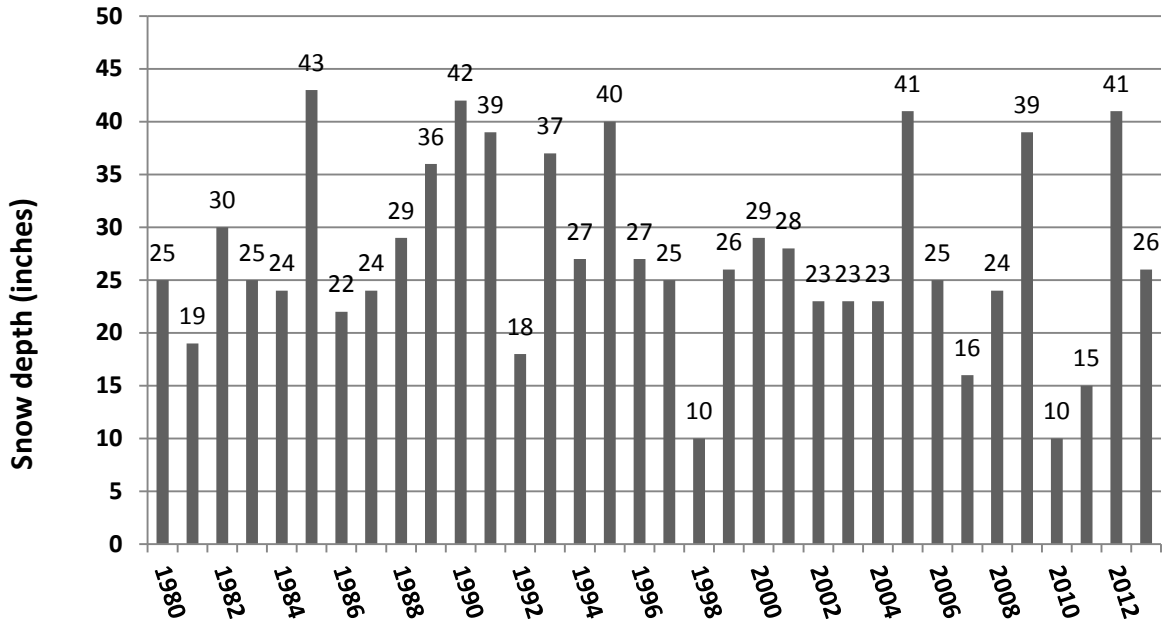


Figure 5. Snow depth in inches at McGrath as reported on 1 April from 1980 through 2013.

Table 1a. Summary of geospatial population estimates[a] for moose in Unit 19A, 2005–2011.

| Location and survey year | Survey area (mi²) | Strata size (mi²) Low | Strata size (mi²) High | Area searched (mi²) Low | Area searched (mi²) High | Total search area (mi²) | No. of moose estimated by strata and density (moose/mi²) Low | No. of moose estimated by strata and density (moose/mi²) High | Total estimate @ 90% CI | Average density moose/mi² | No. of survey units counted |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Unit 19A* | | | | | | | | | | | |
| South of Kuskokwim | | | | | | | | | | | |
| February 2005 | 7,156 | 5,709 | 1,446 | 306 | 719 | 1,025 | 623 (0.11) | 1,330 (0.92) | 1,953±16% | 0.27 | 161 |
| Unit 19A West (Aniak) | | | | | | | | | | | |
| March 2006 | 3,444 | 2,404 | 1,040 | 192 | 408 | 600 | –[b] | –[b] | 1,329±15% | 0.39 | 94 |
| March 2010 | 3,444 | 2,404 | 1,040 | 441 | 498 | 939 | 466 (0.19) | 663 (0.64) | 1,130±15% | 0.33 | 147 |
| Unit 19A East (Holitna) | | | | | | | | | | | |
| March 2008 | 3,874 | 2,833 | 1,041 | 223 | 255 | 478 | 339 (0.12) | 1,364 (1.31) | 1,703±28% | 0.44 | 75 |
| March 2011 | 3,874 | 2,833 | 1,041 | 345 | 632 | 977 | 235 (0.08) | 727 (0.70) | 962±18% | 0.25 | 135 |
| March 2011[c] | 3,874 | 2,833 | 1,041 | 345 | 632 | 977 | 291 (0.10)[c] | 1,374 (1.32)[c] | 1,666±36%[c,d] | 0.43[c] | 135 |

[a] Population estimates are of observable moose and do not include a sightability correction factor.
[b] Data lost in December 2006 office fire.
[c] Estimate includes a sightability correction factor of 1.24 in low density strata and 1.89 in high density strata.
[d] Total is greater than sum of strata due to rounding error.

Table 1b. Unit 19D, aerial moose fall composition counts and estimated population size within the bear control focus area, 2001–2012.

| Year | Moose observed | Estimated population (90% CI)[b] | SCF[a] ($n_{observed}$, $n_{available}$)[c] | Estimated population w/SCF | Bulls:100 cows[d] | Yearlings:100 cows[d,e] | Calves:100 cows[d] | Moose/mi$^2$ w/SCF[f] |
|---|---|---|---|---|---|---|---|---|
| 2001 | 440 | 440 (±0) | 1.19 (32,38) | 525 (±12%) | 18 | 16 | 34 | 1.0 |
| 2003 | 237 | 424 (±19) | 1.35 (21,28) | 573 (±24%) | 18 | 10 | 56 | 1.1 |
| 2004 | 531 | 531 (±0) | 1.27[g] | 674 (±15%) | 13 | 12 | 63 | 1.3 |
| 2005 | 479 | 479 (±0) | 1.30 (38,49) | 621 (±13%) | 18 | 18 | 51 | 1.2 |
| 2006 | 591 | 591 (±0) | 1.17 (42,49) | 692 (±10%) | 25 | 28 | 58 | 1.3 |
| 2007 | 662 | 662 (±0) | 1.33 (31,41) | 883 (±15%) | 39 | 32 | 56 | 1.7 |
| 2008 | 296 | 599 (±17) | 1.27 (16,20) | 758 (±25%) | 33 | 28 | 43 | 1.4 |
| 2009 | 331 | 654 (±14) | 1.27[g] | 830 (±21%) | 31 | 14 | 44 | 1.6 |
| 2010 | 311 | 625 (±12) | 1.27[g] | 793 (±19%) | 38 | 30 | 43 | 1.5 |
| 2011 | 335 | 658 (±14) | 1.27[g] | 835 (±21%) | 31 | 24 | 49 | 1.6 |
| 2012[h] | 308 | 474 (±10) | 1.29 (23,30) | 612 (±19%) | 28 | 12 | 47 | 1.2 |

[a] Sightability correction factor.
[b] All survey units were sampled during 2001 and 2004–2007, estimates/counts of observable moose have no variance or confidence intervals.
[c] Radiocollared moose.
[d] Ratios based on estimates rather than counts of sex and age classes.
[e] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[f] Based on an estimated 528 mi$^2$ of moose habitat in the bear control area.
[g] No SCF data collected, an average based on 2001, 2003–2008 SCFs was applied. Variability of SCF was based upon the largest observed SCF variation (Keech 2012).
[h] Preliminary data.

Table 1c. Unit 19D, aerial moose fall composition counts and estimated population size within the upper Kuskokwim villages moose management area, 2001–2012.

| Year | Moose observed | Estimated population (90% CI) | SCF ($n_{observed}$, $n_{available}$)[a] | Estimated population w/SCF | Bulls:100 cows[b] | Yearlings:100 cows[b,c] | Calves:100 cows[b] | Moose/mi$^2$ w/SCF[d] |
|---|---|---|---|---|---|---|---|---|
| 2001 | 455 | 727 (±12) | 1.19 (32,38) | 868 (±17%) | 21 | 16 | 36 | 0.8 |
| 2004 | 578 | 940 (±11) | 1.27[e] | 1,192 (±19%) | 18 | 16 | 66 | 1.1 |
| 2006 | 762 | 1,117 (±9) | 1.17 (42,49) | 1,308 (±13%) | 30 | 24 | 55 | 1.2 |
| 2007 | 844 | 1,290 (±10) | 1.33 (31,41) | 1,720 (±20%) | 36 | 30 | 53 | 1.5 |
| 2008 | 678 | 1,356 (±9) | 1.27 (16,20) | 1,718 (±20%) | 40 | 28 | 44 | 1.5 |
| 2009 | 711 | 1,435 (±9) | 1.27[e] | 1,820 (±18%) | 40 | 22 | 38 | 1.6 |
| 2010 | 712 | 1,416 (±8) | 1.27[e] | 1,796 (±17%) | 49 | 32 | 43 | 1.6 |
| 2011 | 639 | 1,298 (±9) | 1.27[e] | 1,647 (±18%) | 33 | 20 | 42 | 1.5 |
| 2012[f] | 650 | 1,036 (±9) | 1.29 (23,30) | 1,337 (±15%) | 38 | 14 | 35 | 1.2 |

[a] Radiocollared moose.
[b] Ratios based on estimates rather than counts of sex and age classes.
[c] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[d] Based on an estimated 1,118 mi$^2$ of moose habitat in the upper Kuskokwim villages moose management area.
[e] No SCF data collected, an average based on 2001, 2003–2008 SCFs was applied. Variability of SCF was based upon the largest observed SCF variation (Keech 2012).
[f] Preliminary data.

Table 1d. Unit 19D aerial moose fall composition counts and estimated population size within the moose survey area, 2001–2008.

| Year | Moose observed | Estimated population (90% CI) | SCF ($n_{observed}$, $n_{available}$)[a] | Estimated population w/SCF | Bulls:100 cows[b] | Yearlings:100 cows[b,c] | Calves:100 cows[b] | Moose/mi$^2$ w/SCF[d] |
|---|---|---|---|---|---|---|---|---|
| 2001 | 743 | 2,148 (±26) | 1.19 (32,38) | 2,564 (±28%) | 34 | 14 | 25 | 0.5 |
| 2004 | 764 | 2,163 (±19) | 1.27 | 2,744 (±24%) | 31 | 24 | 54 | 0.5 |
| 2008 | 982 | 3,071 (±16) | 1.27 (16,20) | 3,889 (±25%) | 55 | 34 | 41 | 0.7 |

[a] Radiocollared moose.
[b] Ratios based on estimates rather than counts of sex and age classes.
[c] Yearlings:100 cows = Yearling bulls:100 cows × 2.
[d] Based on an estimated 5,313 mi$^2$ of moose habitat in the Unit 19D East moose survey area.

Table 2a. Unit 19C Farewell Burn trend count area fall aerial moose composition counts, regulatory years[a] 1987–2010.

| Regulatory year | Bulls:100 Cows | Yearling bulls:100 Cows | Calves:100 Cows | Calves | Percent calves | Adults | Total moose | Moose/hr |
|---|---|---|---|---|---|---|---|---|
| 1987 | 53 | 10 | 19 | 32 | 13 | 207 | 242[b] | 115 |
| 1988 | 58 | 20 | 34 | 47 | 18 | 218 | 265 | 126 |
| 1989 | 47 | 15 | 22 | 55 | 13 | 361 | 416 | 194 |
| 1990 | 43 | 8 | 26 | 58 | 16 | 315 | 373 | 159 |
| 1991 | 44 | 8 | 29 | 59 | 17 | 293 | 352 | 156 |
| 1992 | 46 | 8 | 38 | 58 | 21 | 220 | 278 | 100 |
| 1994 | 52 | 10 | 19 | 45 | 11 | 353 | 404[b] | 170 |
| 1996 | 46 | 11 | 15 | 43 | 9 | 411 | 454 | 158 |
| 1997 | 30 | 10 | 27 | 75 | 17 | 368 | 443 | 174 |
| 1999[c] | 33 | 11 | 27 | 42 | 17 | 206 | 248 | 86 |
| 2001 | 25 | 3 | 25 | 76 | 17 | 377 | 454[b] | 81 |
| 2003 | 25 | 8 | 34 | 65 | 21 | 240 | 305 | 110 |
| 2006[d] | 46 | | 41 | | | | 279 | 85 |
| 2007[e] | 105[e] | 42[e] | 68 | 26 | 25 | 78 | 104 | 83 |
| 2009 | 53 | 23 | 25 | 34 | 14 | 211 | 245 | 134 |
| 2010 | 29 | 20 | 27 | 54 | 17 | 258 | 312 | 110 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1987 = 1 July 1987–30 June 1988).
[b] Calves plus adults do not add to match the total, which probably includes unknown moose, but records were lost in office fire.
[c] Only 77.5% of the survey area flown.
[d] Additional data lost in McGrath office fire December 2006.
[e] Weather influenced survey, likely resulting in inflated bull:cow and yearling bull:cow ratios.

Table 2b. Unit 19A Aniak trend count area fall aerial moose composition counts, regulatory years[a] 2004–2013.

| Regulatory year | Bulls:100 cows | Yearling bulls:100 cows | Calves:100 cows | Calves | Percent calves | Adults | Total moose | Moose/ hr |
|---|---|---|---|---|---|---|---|---|
| 2004 | 20 | 6 | 23 | 66 | 16 | 344 | 410 | 18 |
| 2007 | 28 | 9 | 52 | 35 | 29 | 87 | 122 | 41 |
| 2008 | 42 | 6 | 23 | 7 | 14 | 44 | 51 | 26 |
| 2013 | 38 | 10 | 41 | 34 | 23 | 113 | 147 | 28 |

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

Table 2c. Unit 19A Holitna trend count area fall aerial moose composition counts, regulatory years[a] 1987–2013.

| Regulatory year | Bulls:100 cows | Yearling bulls:100 cows | Calves:100 cows | Calves | Percent calves | Adults | Total moose | Moose/hr |
|---|---|---|---|---|---|---|---|---|
| 1987 | 22 | 4 | 72 | 50 | 36 | 84 | 140[b] | 85 |
| 1988 | 31 | 16 | 56 | 103 | 30 | 240 | 343 | 95 |
| 1989 | 24 | 13 | 55 | 160 | 30 | 361 | 528[b] | 163 |
| 1990 | 26 | 10 | 52 | 139 | 29 | 336 | 475 | 162 |
| 1992 | 31 | 15 | 63 | 172 | 32 | 360 | 542[b] | 169 |
| 1994 | 14 | 2 | 42 | 209 | 27 | 568 | 778[b] | 251 |
| 1996 | 22 | 10 | 50 | 146 | 29 | 355 | 502[b] | 152 |
| 1997 | 14 | 11 | 34 | 85 | 23 | 286 | 371 | 169 |
| 2001 | 6 | 3 | 8 | 13 | 7 | 183 | 196 | 59 |
| 2007 | 35 | 21 | 45 | 50 | 25 | 150 | 200 | 65 |
| 2008 | 34 | 12 | 27 | 21 | 18 | 103 | 124 | 35 |
| 2009 | 51 | 6 | 36 | 25 | 19 | 104 | 129 | 20 |
| 2010 | 61 | 10 | 19 | 24 | 11 | 188 | 212 | 55 |
| 2013 | 55 | 25 | 50 | 59 | 24 | 185 | 244 | 54 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 1987 = 1 July 1987–30 June 1988).
[b] Calves plus adults do not add to total which probably includes unknown moose, but records were lost in office fire.

Table 3. Twinning rates for moose in Unit 19D East, regulatory years[a] 2000–2012.

| Regulatory year | Percent observed rate of twinning for radiocollared cows >2 yr old (*n*) | Percent observed rate of twinning for uncollared cows (*n*) |
|---|---|---|
| 2000 | 25 (16) | |
| 2001 | 59 (22) | 39 (46) |
| 2002 | 24 (25) | 36 (39) |
| 2003 | 32 (31) | 39 (31) |
| 2004 | 44 (45) | 50 (40) |
| 2005 | 40 (60) | 35 (29) |
| 2006 | 52 (56) | 50 (30) |
| 2007 | 55 (51) | |
| 2008 | 33 (43) | 26 (87) |
| 2009 | 33 (40) | 29 (45) |
| 2010 | | 37 (38) |
| 2011 | | 34 (47) |
| 2012 | | 22 (55) |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2000 = 1 July 2000–30 June 2001).

Table 4a. Unit 19 reported moose harvest, regulatory years[a] 2008–2012.

| Regulatory year | Reported harvest | | | | | |
|---|---|---|---|---|---|---|
| | M | (%) | F | (%) | Unk | Total |
| 2008 | 277 | (100) | 0 | (0) | 1 | 278 |
| 2009 | 268 | (100) | 0 | (0) | 0 | 268 |
| 2010 | 302 | (100) | 0 | (0) | 0 | 302 |
| 2011 | 318 | (100) | 0 | (0) | 3 | 321 |
| 2012 | 355 | (100) | 0 | (0) | 2 | 357 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

Table 4b. Unit 19A moose harvest, regulatory years[a] 2008–2012.

| Regulatory year | Moose harvest | | | | Hunt type | | | |
|---|---|---|---|---|---|---|---|---|
| | M | F | Unk | Total | General[b] | TM684 | TM680 | FM019[c] |
| 2008 | 76 | 0 | 0 | 76 | 8 | 1 | 56 | 11 |
| 2009 | 70 | 0 | 0 | 70 | 4 | 1 | 52 | 13 |
| 2010 | 84 | 0 | 0 | 84 | 9 | 3 | 72 | 0[d] |
| 2011 | 79 | 0 | 2 | 81 | 2 | 2 | 65 | 12 |
| 2012 | 120 | 0 | 1 | 121 | 4 | 2 | 93 | 22 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Incorrect permit for this hunt area.
[c] Federal permits were issued to federally qualified subsistence users to hunt on federal public lands within the hunt area. One hundred permits are issued every regulatory year beginning in regulatory year 2006.
[d] FM019 data unavailable.

Table 4c. Unit 19B moose harvest, regulatory years[a] 2008–2012.

| Regulatory year | Moose harvest | | | |
|---|---|---|---|---|
| | M | F | Unk | Total |
| 2008 | 26 | 0 | 0 | 26 |
| 2009 | 20 | 0 | 0 | 20 |
| 2010 | 20 | 0 | 0 | 20 |
| 2011 | 15 | 0 | 0 | 15 |
| 2012 | 18 | 0 | 0 | 18 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

Table 4d. Unit 19C moose harvest, regulatory years[a] 2008–2012.

| Regulatory year | Moose harvest | | | | Hunt type | |
|---|---|---|---|---|---|---|
| | M | F | Unk | Total | General | RM655 |
| 2008 | 54 | 0 | 0 | 54 | 51 | 3 |
| 2009 | 57 | 0 | 0 | 57 | 56 | 1 |
| 2010 | 70 | 0 | 0 | 70 | 68 | 2 |
| 2011 | 76 | 0 | 0 | 76 | 73 | 3 |
| 2012 | 96 | 0 | 1 | 97 | 95 | 2 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

Table 4e. Unit 19D moose harvest, regulatory years[a] 2008–2012.

| Regulatory year | Moose harvest | | | | Hunt type | |
|---|---|---|---|---|---|---|
| | M | F | Unk | Total | General | RM650 |
| 2008 | 120 | 0 | 1 | 121 | 18 | 103 |
| 2009 | 119 | 0 | 0 | 119 | 27 | 92 |
| 2010 | 126 | 0 | 0 | 126 | 19 | 107 |
| 2011 | 148 | 0 | 1 | 149 | 21 | 128 |
| 2012 | 119 | 0 | 0 | 119 | 16 | 103 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

Table 4f. Moose harvest from Unit 19 where specific harvest location was not reported, regulatory years[a] 2008–2012.

| Regulatory year | Moose harvest | | | |
|---|---|---|---|---|
| | M | F | Unk | Total |
| 2008 | 1 | 0 | 0 | 1 |
| 2009 | 2 | 0 | 0 | 2 |
| 2010 | 2 | 0 | 0 | 2 |
| 2011 | 0 | 0 | 0 | 0 |
| 2012 | 2 | 0 | 0 | 2 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

Table 5. Permit hunt results from Unit 19A Lime Village management area Tier II (TM684), Unit 19A TM680 and FM019[a], Unit 19C (RM655) and Unit 19D (RM650), regulatory years[b] 2008–2012.

| Permit hunt | Regulatory year | Permits issued | Successful hunters (%) | Unsuccessful hunters (%) | Did not hunt (%) | Male (%) | Female (%) | Unk | Total harvest |
|---|---|---|---|---|---|---|---|---|---|
| Unit 19A, TM684[c] | 2008 | 14 | 1 (7) | 8 (57) | 5 (36) | 1 (100) | 0 (0) | 0 | 1 |
| | 2009 | 14 | 1 (7) | 6 (43) | 7 (50) | 1 (100) | 0 (0) | 0 | 2 |
| | 2010 | 15 | 3 (20) | 6 (40) | 6 (40) | 3 (100) | 0 (0) | 0 | 3 |
| | 2011 | 16 | 2 (13) | 7 (44) | 7 (44) | 0 (0) | 0 (0) | 2 | 2 |
| | 2012 | 14 | 2 (14) | 3 (21) | 9 (64) | 2 (100) | 0 (0) | 0 | 2 |
| Unit 19A, TM680 | 2008 | 230 | 56 (24) | 141 (61) | 33 (14) | 56 (100) | 0 (0) | 0 | 56 |
| | 2009 | 231 | 52 (23) | 132 (57) | 47 (20) | 52 (100) | 0 (0) | 0 | 52 |
| | 2010 | 200 | 72 (36) | 105 (53) | 23 (11) | 72 (100) | 0 (0) | 0 | 72 |
| | 2011 | 200 | 65 (33) | 102 (51) | 33 (17) | 65 (100) | 0 (0) | 0 | 65 |
| | 2012 | 200 | 93 (47) | 72 (36) | 35 (18) | 92 (100) | 0 (0) | 1 | 93 |
| Unit 19A, FM019[a] | 2008 | | 11 | 66 | | 11 (100) | 0 (0) | 0 | 11 |
| | 2009 | | 13 | 1 | | 13 (100) | 0 (0) | 0 | 13 |
| | 2010 | | 0 | | | 0 (0) | 0 (0) | 0 | 0 |
| | 2011 | 72 | 12 (17) | 30 (42) | 30 (42) | 12 (100) | 0 (0) | 0 | 12 |
| | 2012 | 82 | 22 (27) | 29 (35) | 31 (38) | 22 (100) | 0 (0) | 0 | 22 |
| Unit 19C, RM655 | 2008 | 10 | 3 (30) | 2 (20) | 5 (50) | 3 (100) | 0 (0) | 0 | 3 |
| | 2009 | 14 | 1 (7) | 8 (57) | 5 (36) | 1 (100) | 0 (0) | 0 | 1 |
| | 2010 | 2 | 2 (100) | 0 (0) | 0 (0) | 2 (100) | 0 (0) | 0 | 2 |
| | 2011 | 9 | 3 (33) | 0 (0) | 6 (67) | 3 (100) | 0 (0) | 0 | 3 |
| | 2012 | 8 | 2 (25) | 2 (25) | 4 (50) | 2 (100) | 0 (0) | 0 | 2 |
| Unit19D, RM650 | 2008 | 291 | 103 (35) | 114 (39) | 74 (25) | 103 (100) | 0 (0) | 0 | 103 |
| | 2009 | 294 | 92 (31) | 130 (44) | 72 (24) | 92 (100) | 0 (0) | 0 | 92 |
| | 2010 | 300 | 107 (36) | 116 (39) | 77 (26) | 107 (100) | 0 (0) | 0 | 107 |
| | 2011 | 303 | 128 (43) | 112 (37) | 63 (21) | 128 (100) | 0 (0) | 0 | 128 |
| | 2012 | 328 | 103 (31) | 148 (45) | 77 (23) | 103 (100) | 0 (0) | 0 | 103 |

[a] Includes data not available using ADF&G's Wildlife Information Network.

[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).

[c] Successful hunters for TM684 may not equal the number of moose taken. The bag limit is 2 antlered bulls.

Table 6a. Unit 19 moose hunter residency and success, regulatory years[a] 2008–2012.

| Regulatory year | Successful | | | | | Unsuccessful | | | | | Total hunters[c] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | |
| 2008 | 136 | 80 | 43 | 0 | 259 (35) | 237 | 187 | 67 | 0 | 491 (65) | 750 |
| 2009 | 112 | 97 | 36 | 10 | 255 (35) | 240 | 178 | 44 | 13 | 475 (65) | 730 |
| 2010 | 140 | 110 | 48 | 4 | 302 (42) | 210 | 149 | 50 | 2 | 411 (58) | 713 |
| 2011 | 166 | 106 | 49 | 0 | 321 (45) | 213 | 145 | 37 | 5 | 400 (55) | 721 |
| 2012 | 168 | 130 | 55 | 4 | 357 (46) | 227 | 155 | 39 | 5 | 426 (54) | 783 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Local residents reside in Unit 19.
[c] Total hunters for Unit 19 may not equal sum of hunters from all subunits due to hunters not reporting locations or unidentifiable reported locations. Includes federal data from FM019 not available using ADF&G's Wildlife Information Network.

Table 6b. Unit 19A moose hunter residency and success, regulatory years[a] 2008–2012.

| Regulatory year | Successful | | | | | Unsuccessful | | | | | Total hunters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | |
| 2008 | 43 | 18 | 0 | 0 | 61 (25) | 113 | 65 | 5[c] | 0 | 183 (75) | 244 |
| 2009 | 33 | 22 | 1[c] | 1 | 57 (25) | 98 | 64 | 3[c] | 4 | 169 (75) | 226 |
| 2010 | 50 | 32 | 2[c] | 0 | 84 (38) | 88 | 50 | 0 | 0 | 138 (62) | 222 |
| 2011 | 62 | 17 | 0 | 0 | 79 (34) | 109 | 40 | 0 | 4 | 153 (66) | 232 |
| 2012 | 85 | 35 | 1[c] | 0 | 121 (50) | 99 | 18 | 1[c] | 2 | 120 (50) | 241 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Local residents reside in Unit 19A. Includes federal data from FM019 not available using ADF&G's Wildlife Information Network.
[c] Incorrect permit for this hunt area.

Table 6c Unit 19B moose hunter residency and success, regulatory years[a] 2008–2012.

| Regulatory year | Successful | | | | | Unsuccessful | | | | | Total hunters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | |
| 2008 | 1 | 8 | 14 | 0 | 23 (27) | 1 | 32 | 29 | 0 | 62 (73) | 85 |
| 2009 | 0 | 3 | 16 | 1 | 20 (31) | 2 | 21 | 17 | 5 | 45 (69) | 65 |
| 2010 | 1 | 6 | 11 | 2 | 20 (33) | 4 | 15 | 18 | 3 | 40 (67) | 60 |
| 2011 | 1 | 4 | 10 | 0 | 15 (31) | 4 | 13 | 16 | 0 | 33 (69) | 48 |
| 2012 | 0 | 6 | 12 | 0 | 18 (41) | 6 | 9 | 10 | 1 | 26 (59) | 44 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Local residents reside in Units 19A or 19B.

Table 6d. Unit 19C moose hunter residency and success, regulatory years[a] 2008–2012.

| Regulatory year | Successful | | | | | Unsuccessful | | | | | Total hunters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | |
| 2008 | 3 | 26 | 24 | 0 | 53 (43) | 5 | 39 | 26 | 0 | 70 (57) | 123 |
| 2009 | 1 | 36 | 13 | 7 | 57 (45) | 7 | 46 | 15 | 1 | 69 (55) | 126 |
| 2010 | 2 | 36 | 32 | 0 | 70 (53) | 0 | 37 | 26 | 0 | 63 (47) | 133 |
| 2011 | 3 | 41 | 32 | 0 | 76 (59) | 1 | 37 | 14 | 0 | 52 (41) | 128 |
| 2012 | 4 | 52 | 37 | 4 | 97 (73) | 1 | 50 | 22 | 1 | 74 (27) | 171 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Local residents reside in Units 19C or 19D.

Table 6e. Unit 19D moose hunter residency and success, regulatory years[a] 2008–2012.

| Regulatory year | Successful | | | | | Unsuccessful | | | | | Total hunters |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | Local[b] resident | Nonlocal resident | Nonresident | Unk | Total (%) | |
| 2008 | 87 | 29 | 5 | 0 | 121 (42) | 104 | 56 | 7 | 0 | 167 (58) | 288 |
| 2009 | 76 | 37 | 5 | 1 | 119 (39) | 126 | 49 | 6 | 2 | 183 (61) | 302 |
| 2010 | 86 | 36 | 3 | 1 | 126 (44) | 99 | 58 | 3 | 0 | 160 (56) | 286 |
| 2011 | 101 | 42 | 6 | 0 | 149 (49) | 101 | 51 | 4 | 2 | 158 (51) | 307 |
| 2012 | 78 | 36 | 4 | 1 | 119 (38) | 120 | 65 | 7 | 2 | 194 (62) | 313 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Local residents reside in Unit 19D.

Table 7a. Unit 19[a] moose harvest percent by transport method, regulatory years[b] 2008–2012.

| Regulatory year | Harvest percent by transport method[c] | | | | | | | | | *n* |
|---|---|---|---|---|---|---|---|---|---|---|
| | Airplane | Dog Team/ Horse | Boat | 3- or 4-Wheeler | Snowmachine | Other ORV | Highway vehicle | Unk[d] | Airboat | |
| 2008 | 23 | 1 | 66 | 5 | 2 | <1 | 2 | 1 | 0 | 189 |
| 2009 | 26 | 3 | 58 | 9 | <1 | 1 | 2 | 1 | 0 | 263 |
| 2010 | 22 | 1 | 66 | 9 | 1 | 0 | 1 | <1 | 0 | 277 |
| 2011 | 21 | <1 | 65 | 9 | 2 | <1 | 1 | 1 | 0 | 309 |
| 2112 | 22 | <1 | 61 | 12 | <1 | <1 | <1 | 2 | 0 | 335 |

[a] Total for Unit 19 may not equal sum of hunters from all subunits due to hunters not reporting errors or omissions.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[c] Successful hunters only. Unit 19A federal hunt transport data is not available, though most use boats.
[d] Includes transportation method "on foot."

Table 7b. Unit 19A moose harvest percent by transport method, regulatory years[a] 2008–2012.

| Regulatory year | Harvest percent by transport method[b] | | | | | | | | | *n* |
|---|---|---|---|---|---|---|---|---|---|---|
| | Airplane | Dog Team/ Horse | Boat | 3- or 4-Wheeler | Snowmachine | Other ORV | Highway vehicle | Unk[c] | Airboat | |
| 2008 | 0 | 0 | 95 | 5 | 0 | 0 | 0 | 0 | 0 | 76 |
| 2009 | 2 | 0 | 84 | 12 | 0 | 0 | 0 | 2 | 0 | 57 |
| 2010 | 5 | 0 | 94 | 1 | 0 | 0 | 0 | 0 | 0 | 84 |
| 2011 | 0 | 1 | 96 | 0 | 3 | 0 | 0 | 0 | 0 | 69 |
| 2012 | 1 | 0 | 92 | 4 | 1 | 0 | 0 | 2 | 0 | 99 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Successful hunters only. Unit 19A federal hunt transport data is not available, though most use boats.
[c] Includes transportation method "on foot."

Table 7c. Unit 19B moose harvest percent by transport method, regulatory years[a] 2008–2012.

| Regulatory year | Harvest percent by transport method[b] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Airplane | Dog Team/ Horse | Boat | 3- or 4-Wheeler | Snowmachine | Other ORV | Highway vehicle | Unk | Airboat | *n* |
| 2008 | 76 | 0 | 12 | 4 | 8 | 0 | 0 | 0 | 0 | 28 |
| 2009 | 80 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 2010 | 80 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 2011 | 53 | 0 | 33 | 7 | 0 | 0 | 0 | 7 | 0 | 15 |
| 2012 | 78 | 0 | 17 | 0 | 0 | 0 | 0 | 6 | 0 | 18 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Successful hunters only.

Table 7d. Unit 19C moose harvest percent by transport method, regulatory years[a] 2008–2012.

| Regulatory year | Harvest percent by transport method[b] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Airplane | Dog Team/ Horse | Boat | 3- or 4-Wheeler | Snowmachine | Other ORV | Highway vehicle | Unk | Airboat | *n* |
| 2008 | 74 | 4 | 0 | 9 | 6 | 0 | 0 | 7 | 0 | 54 |
| 2009 | 68 | 11 | 0 | 18 | 2 | 2 | 0 | 0 | 0 | 57 |
| 2010 | 60 | 3 | 0 | 34 | 3 | 0 | 0 | 0 | 0 | 70 |
| 2011 | 63 | 1 | 0 | 32 | 4 | 0 | 0 | 0 | 0 | 76 |
| 2012 | 56 | 1 | 1 | 36 | 2 | 0 | 0 | 4 | 0 | 97 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Successful hunters only.

Table 7e. Unit 19D moose harvest percent by transport method, regulatory years[a] 2008–2012.

| Regulatory year | Harvest percent by transport method[b] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Airplane | Dog Team/ Horse | Boat | 3- or 4-Wheeler | Snowmachine | Other ORV | Highway vehicle | Unk[c] | Airboat | *n* |
| 2008 | 4 | 0 | 88 | 2 | 0 | <1 | 4 | 0 | 0 | 82 |
| 2009 | 8 | 1 | 80 | 4 | 0 | 2 | 5 | 1 | 0 | 114 |
| 2010 | 3 | 0 | 90 | 2 | 0 | 0 | 3 | 1 | 0 | 121 |
| 2011 | 6 | 0 | 87 | 2 | 0 | <1 | 3 | 2 | 0 | 149 |
| 2012 | 3 | 0 | 92 | <1 | 0 | <1 | 2 | <1 | 0 | 119 |

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2008 = 1 July 2008–30 June 2009).
[b] Successful hunters only.
[c] Includes transportation method "on foot."