Moose Management Report and Plan, Game Management Unit 20B:

Report Period 1 July 2010–30 June 2015, and

Plan Period 1 July 2015–30 June 2020

Anthony L. Hollis

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Alaska Department of Fish and Game Division of Wildlife Conservation

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Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's website.

This species management report and plan was reviewed and approved for publication by Doreen I. Parker McNeill, Management Coordinator for the Division of Wildlife Conservation, Fairbanks.

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose (*Alces alces*) in Unit 20B for the previous 5 regulatory years (RY) and plans for survey and inventory management activities in the 5 years following the end of that period. A regulatory year begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). This report is produced primarily to provide agency staff with data and analysis to help guide and record its own efforts but is also provided to the public to inform them of wildlife management activities. In 2016 the Alaska Department of Fish and Game's (ADF&G) Division of Wildlife Conservation (DWC) launched this 5-year report to more efficiently report on trends and describe potential changes in data collection activities over the next 5 years. It replaces the moose management reports of survey and inventory activities that were previously produced every 2 years and supersedes the 1976 draft Alaska wildlife management plans (ADF&G 1976).

I. RY10–RY14 Management Report

Management Area

The study area, Unit 20B, is a 9,196 mi^2 game management unit that surrounds Fairbanks (Alaska, USA) (Fig. 1). The area encompasses all drainages that drain into the north bank of the Tanana River between Delta Creek and Manley Hot Springs. Elevation in Unit 20B ranges from 302 feet to 5,865 feet. Habitat types and terrain varies greatly in Unit 20B with areas that are flat with little topography, rolling hills, and mountainous terrain. Habitat types range from lowland riparian and grasslands, black spruce (*Picea mariana*) forest, deciduous forest, alpine and subalpine habitat, and burns of various ages. The climate in Unit 20B is typical of Interior Alaska where temperatures frequently reach 80°F during the summer months and −40°F during the winter months. Snow depths are generally low and rarely reach 32 inches, although snow depth varies greatly by elevation and generally is deeper in the higher elevations of the unit.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 20B

Moose numbers increased in Unit 20B throughout the 1950s and early 1960s after extensive wildfires improved moose habitat and federal predator reduction programs reduced wolf (*Canis lupus*) predation on moose (McNay 1992). Moose numbers declined following severe winters in 1965, 1970, 1971, and 1974. Increasing wolf predation and liberal either-sex hunting seasons contributed to the moose population decline. By 1976 moose densities were low, and the hunting season had been reduced to 10 days for bulls only in most of Unit 20B. Moose populations again increased following wolf reduction programs during 1980–1986. Moose hunting seasons were extended from 10 days in 1981 and 1982 to 20 days during 1983–1987. Subsequent increases in harvest along with declining bull:cow ratios and evidence of low recruitment in some areas resulted in hunting seasons being shortened to 15 days in 1988. Despite this 5-day reduction in the season, harvests increased further from nearly 400 bulls in 1988 to more than 700 bulls in 1998. Moose population trends from the late 1980s through the

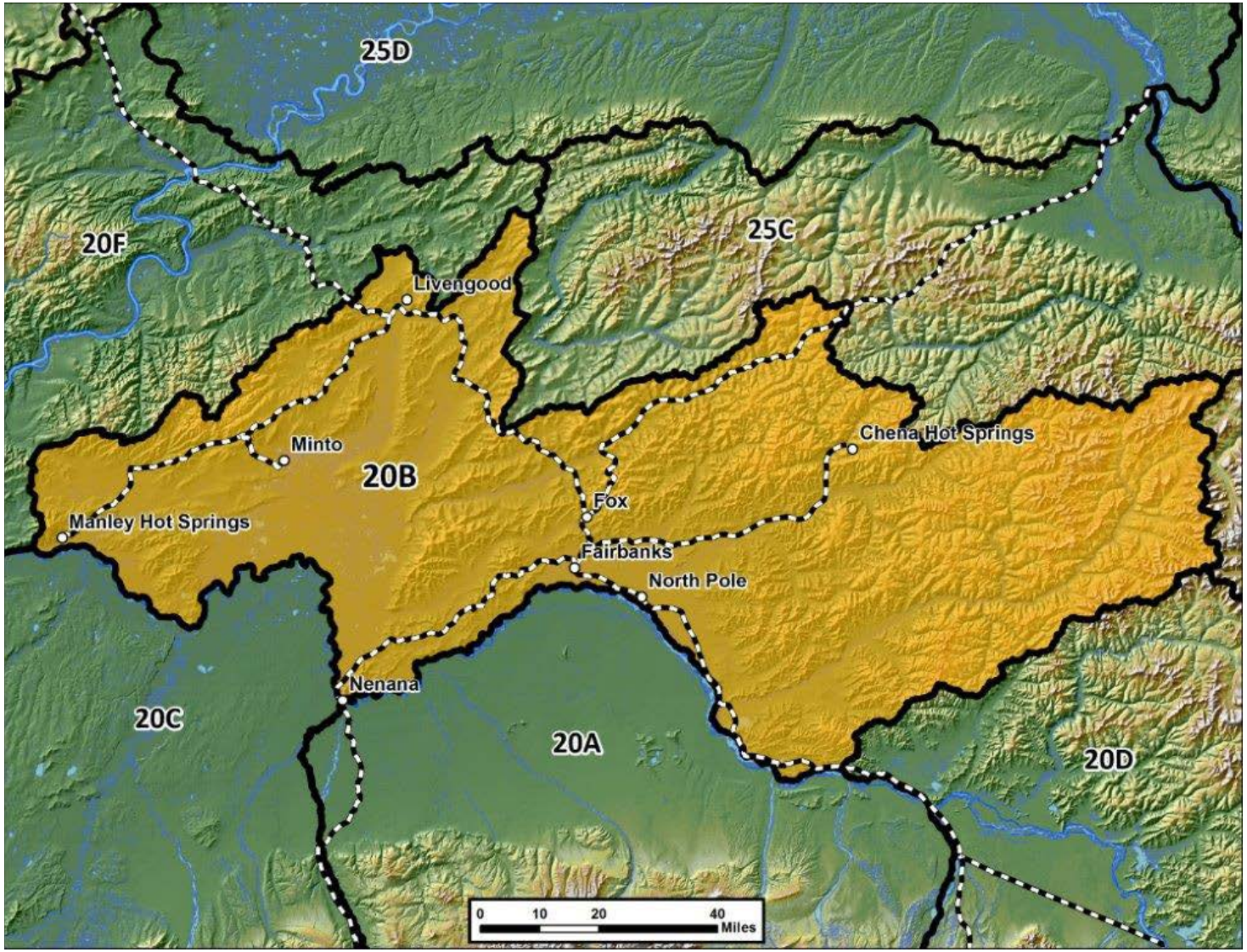

Figure 1. Game Management Unit 20B, Interior Alaska.

1990s were largely unknown because unitwide surveys were not conducted. However, unitwide surveys conducted in 2001, 2003–2006, 2008, and 2009 indicated that the moose population increased from an estimated 9,800 (about 1.1 moose/mi^2) in 1990 to a peak of about 20,000 (about 2.2 moose/mi^2) in 2009.

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

Both general season and permit hunts are available to meet the demand to harvest moose in Unit 20B. Many of the permit hunts are available only to resident hunters. Fifty-eight permit hunts were available to hunt moose in Unit 20B during RY10–RY14: 2 hunts for "any moose" and 56 hunts for "antlerless moose" (i.e., 1 in the Fairbanks management area [FMA] by bow and arrow, 1 in the Creamer's Field Migratory Waterfowl Refuge [Creamer's Refuge] within FMA by muzzleloader, and 56 in central and western Unit 20B outside FMA).

The Minto Flats management area (MFMA) was established in 1979 to restrict harvest in a low-density moose population. In 1988 the Alaska legislature established the Minto Flats State Game Refuge to ensure the protection and enhancement of habitat and the conservation of fish and wildlife; and to guarantee the continuation of hunting, fishing, trapping, and other compatible public uses within approximately 900 mi^2 of the Minto Flats area.

FMA was established in 1983 to provide moose hunting opportunities around the Fairbanks urban area by bow and arrow only. This area was closed to hunting in the late 1970s and early 1980s to prevent excessive harvest. FMA's boundaries changed numerous times. The most recent changes went into effect in July 2004. FMA currently encompasses about 300 mi^2, about 50 mi^2 of which have a relatively dense human population. Even though harvest is generally low, a permit hunt in this area for antlerless moose is popular.

For management purposes, Unit 20B is divided into 3 geographic zones: 1) western Unit 20B (2,942 mi^2), including the Minto Flats, Tatalina Creek drainage, Tolovana River drainage, and areas farther west; 2) eastern Unit 20B (2,425 mi^2) including the Little Salcha and Salcha river drainages; and 3) central Unit 20B (3,829 mi^2), the remainder.

Management Direction

Existing Wildlife Management Plans

Direction for moose management in Unit 20B has been reviewed and modified through public comments, staff recommendations, and Alaska Board of Game actions over the years. A record of these changes can be found in the division's moose management report series. The plan section of this document contains the current management plan for moose in Unit 20B.

Goals

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.

- Provide for continued subsistence use of moose by Alaska residents who have customarily and traditionally used the population.
- Provide the greatest sustained opportunity to participate in hunting moose.
- Provide an opportunity to view and photograph moose.
- Protect human life and property in human–moose interactions.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Outside the Fairbanks nonsubsistence area, Unit 20B has a customary and traditional use finding for moose, with amounts reasonably necessary for subsistence uses of the following:

- Unit 20B, that portion outside the MFMA: 75–100 moose.
- Unit 20B, that portion within the MFMA: 20–40 moose.

Intensive Management

- Population objective: 12,000–15,000.
- Harvest objective: 600–1,500.

MANAGEMENT OBJECTIVES

- Manage for a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each count area (i.e., eastern Unit 20B, central Unit 20B, western Unit 20B, and MFMA).

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Geospatial population estimation (GSPE) surveys.

Data Needs

Population status and trend data are important in determining whether Unit 20B meets the intensive management (IM) population objective of 12,000–15,000 moose. It is also important to help determine harvestable surplus (IM harvest objective), harvest rates, recruitment and age classes in the population.

Methods

Weather and snow conditions were not adequate in 2010, 2011, and 2014 to allow us to complete a unitwide survey. In November 2012 we completed the survey in eastern Unit 20B, but conditions deteriorated before the remainder of Unit 20B could be completed. We used the GSPE method to conduct the survey (Ver Hoef 2001, 2008; Kellie and DeLong 2006). Previous

analyses suggest survey effort and the precision of population estimates are optimized when the survey effort includes approximately 40% low-density and 60% high-density sample units (SU; Kellie and DeLong 2006). We selected a simple random sample of SUs (n = 164) from each stratum using Microsoft Excel® software. Additional SUs (n = 15) were selected to fill in gaps in the coverage. Preliminary studies suggest using a sightability correction factor (SCF) of 1.16–1.25 for moose that were present, but not observed, during the survey using the GSPE method (Boertje et al. 2009). Because an SCF has not been determined in Unit 20B, we used the midpoint of SCF data suggested by Boertje et al. (2009) and applied an SCF of 1.21 to GSPE estimates in Unit 20B to estimate total moose numbers.

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

Results and Discussion

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

Within the 3 geographic zones in Unit 20B, moose numbers in central and western Unit 20B (including MFMA) showed similar increasing trends through 2009 and then a decrease in 2012 and 2013 (Table 1). During 2001–2009, central Unit 20B moose population estimate increased from 4,794 (1.3 moose/mi^2) to 7,436 (1.8 moose/mi^2) and then decreased to 5,841 (1.5 moose/mi^2) in 2013. In western Unit 20B moose numbers increased from 4,562 (1.6 moose/mi^2) to 9,742 (3.3 moose/mi^2) during 2001–2009 and then decreased to 5,419 (1.8 moose/mi^2) in 2013. Population estimates in eastern Unit 20B, however, increased slightly during 2001–2006 and remained stable during 2006–2009 (Table 1). It appears that there might be a slight decrease in the eastern Unit 20B population from 2009 through 2012.

Table 1. Unit 20B aerial moose fall composition counts and estimated population size, Interior Alaska, 2001–2014.

Count area	Year	Bulls:100 Cows	Yearlings: 100 Cows[a]	Calves:100 Cows	Percent calves	Adults	Moose observed	Estimated population[b] (90% CI)	Estimated population w/SCF = 1.2[c]	Moose/mi^2 w/SCF = 1.2
Unit 20B	2001	33	15	30	18	751	914	12,499 (±19)[d]	12,499	1.3
Unit 20B	2003	33	23	39	22	399	514	16,214 (±24)[d]	16,214	1.7
Unit 20B	2004	32	18	42	25	551	730	16,710 (±30)[d]	16,710	1.7
Unit 20B	2006	29	22	43	26	838	1,127	16,118 (±23)[d]	16,118	1.6
Unit 20B	2008	28	20	36	24	1,177	1,558	17,954 (±18)[d]	17,954	1.9
Unit 20B	2009	37	16	36	21	891	1,128	20,173 (±22)[d]	20,173	2.2
Unit 20B[e]	2012 and 2013							14,057 (±14)[d]	14,057	1.5
Eastern[f]	2001	47	15	24	11	271	305	2,454 (±22)	2,945	1.2
Eastern[f]	2006	36	24	46	24	180	236	2,728 (±34)	3,274	1.4
Eastern[f]	2008	31	13	26	20	106	132	3,126 (±31)	3,751	1.5
Eastern[f]	2009	40	16	27	18	155	189	2,954 (±41)	3,574	1.5
Eastern[f]	2012	40	15	36	21	439	566	2,310 (±19)	2,795	1.2
Central[g]	2001	27	13	34	*26*	205	278	4,005 (±25)	4,806	1.3
Central[g]	2003	26	21	35	21	191	242	3,995 (±37)	4,794	1.3
Central[g]	2004	33	22	46	27	158	216	5,276 (±41)	6,331	1.7
Central[g]	2005	26	26	40	24	493	645	5,881 (±18)	7,057	1.8
Central[g]	2006	28	22	41	17	328	397	5,451 (±29)	6,541	1.7
Central[g]	2008	26	24	36	26	627	852	6,197 (±20)	7,436	1.9
Central[g]	2009	32	16	33	21	258	328	5,666 (±38)	6,856	1.8
Central[g]	2013	24	12	30	19	472	584	4,828 (±17)	5,841	1.5
Western[h]	2001	30	16	29	17	274	331	3,802 (±22)	4,562	1.6
Western[h]	2006	27	20	44	22	384	494	5,142 (±24)	6,170	2.1
Western[h]	2008	27	22	44	23	444	574	5,515 (±19)	6,618	2.2
Western[h]	2009	39	16	41	22	478	611	8,051 (±19)	9,742	3.3
Western[h]	2013	33	12	33	20	386	485	4,479 (±17)	5,419	1.8
MFMA[i,j]	2001	30	16	28	17	191	230	1,877 (±21)	2,252	2.4
MFMA[j]	2003	44	20	36	23	89	116	1,352 (±63)	1,622	1.7
MFMA[j]	2004	26	11	47	24	302	399	3,447 (±19)	4,136	4.3
MFMA[j]	2005	12	12	40	26	296	400	2,937 (±17)	3,524	3.7

Count area	Year	Bulls:100 Cows	Yearlings: 100 Cows[a]	Calves:100 Cows	Percent calves	Adults	Moose observed	Estimated population[b] (90% CI)	Estimated population w/SCF = 1.2[c]	Moose/mi^2 w/SCF = 1.2
MFMA[j]	2006	19	15	45	28	243	337	2,724 (±23)	3,269	3.4
MFMA[j]	2008	30	23	37	18	309	375	2,487 (±20)	2,984	3.1
MFMA[j]	2009	40	12	40	21	235	298	4,749 (±19)	5,746	6.0
MFMA[j]	2010	34	20	41	23	1,309	1,709	3,455 (±9)	4,181	4.4
MFMA[j]	2013	23	8	41	24	189	250	2,029 (±18)	2,455	2.6
FMA[k,l]	2001	12	13	39	29	70	99	461 (±34)	553	1.7
FMA[k,m]	2008	25	26	56	31	288	417	417[n]	500	1.7

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

During 2001–2010 the MFMA estimate increased from 1,622 (2.4 moose/mi^2) to 5,746 (4.4 moose/mi^2) and then decreased to 2,455 (2.6 moose/mi^2) in 2013. However, annual estimates of moose densities in MFMA during 2003–2013 were highly variable (Table 1), possibly the result of varying sampling effort, survey conditions and the small size of the area surveyed. The 2010 estimate was the best survey completed in regard to sampling effort. During that survey, 49% of all the sample units in MFMA were surveyed. Therefore, our estimate resulted in the lowest 90% CI (±9%) since 2001. However, surveys in MFMA may provide inconsistent results regardless of sampling effort if estimates are influenced by changes in moose distribution and the timing of the October or November migration (P. Valkenburg and R. Boertje, ADF&G, Wildlife Biologists, personal communication to J. Selinger, ADF&G, Wildlife Biologist, 2000).

Gasaway et al. (1992) reported that areas of Interior Alaska and Yukon Canada where predators were lightly harvested had densities of 0.1–1.1 moose/mi^2. Higher moose densities occurred where wolf and/or bear populations were below food-limited levels. Central Unit 20B and MFMA in western Unit 20B have had relatively intensive wolf trapping efforts compared with most of Interior Alaska, including eastern Unit 20B. Black bear harvest is also relatively high in roadside areas of Unit 20B and grizzly bears are rare relative to more remote areas of Alaska. This high predator harvest may have contributed to the increased moose densities in Unit 20B, however, we lack wolf and bear population estimates for this area.

Population Composition

Bull:Cow Ratios

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

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

Calf:Cow Ratios

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

Recommendations for Activity 1.1

- Continue, but conduct GSPE surveys annually in order to monitor and evaluate trends in abundance, productivity, survival, recruitment, and bull escapement.
- Incorporate SCF trials into all GSPEs to improve population estimate and trend.
- Evaluate trends in the moose population's productivity (calves:100 cows), survival–recruitment (yearlings:100 cows), and sustainable bull harvests (bulls:100 cows) with mixed-effect linear model using Akaike's information criterion and smoothed estimates over roughly 5-year periods.

ACTIVITY 1.2. Spring twinning surveys.

Data Needs

The Alaska Board of Game (BOG or board) identified Unit 20B as an IM area for moose. Data from twinning surveys are an important component to determining the nutritional condition and productivity of the population and to help manage on a sustainable yield basis over a long period of time.

Methods

Minto Flats Management Area

Twinning surveys were flown in MFMA using a fixed-winged aircraft with a pilot and an observer searching for parturient moose. Parallel transects are flown approximately 0.5–1.0 miles apart depending on the openness of the habitat. To increase statistical power, we established, a priori, a desired sample size of ≥50 cows with calves. Starting on lat 65°02.9′N we flew northwest–southeast transects as far north as lat 65°10′N between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east and working south to lat 64°53.0′N.

Central Unit 20B

Twinning surveys were flown in central Unit 20B using a fixed-winged aircraft with a pilot and an observer searching for parturient moose. The survey is flown from Fairbanks down Goldstream Valley to Standard Creek road, up over Luck Dome to Murphy Dome, up the Chatanika River to the Steese Highway, over Fort Knox to the Little Chena River, down the Little Chena River to the Chena River, up the Chena River to the flood control project, around the flood control project to the vicinity of Eielson Air Force Base (AFB) and then down the north side of the Tanana River to Fairbanks. The survey includes searching all of the likely moose habitat on this route and searching for as many parturient moose as can be located.

Results and Discussion

2010 Twinning Surveys

Minto Flats Management Area: Twinning surveys were flown in MFMA between 1:35 p.m. and 4:50 p.m. with pilot M. Webb in a PA-18 Super Cub and observer T. Hollis (ADF&G) on 25 May using the transect method described above. East–west transects were flown between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east between 64°55.00′N

and 65°02.9′N. Leaf-out was approximately 85%. Because of the 75°F temperatures weather may have been a factor that affected the survey. Many of the moose were lying in water and in shaded areas to keep cool. Turbulence and airsickness were not factors. We observed 2 black bear groups (4 bears total) and 1 grizzly bear sow. Total flight time (including ferry time) was 4.0 hours ($780) and actual survey time was 3.25 hours. We observed 162 adult/juvenile moose; 49.8 adult/juvenile moose/hour; 51 (31.5%) parturient moose; and 15.7 parturient moose/hour. The observed twinning rate was 17.6% (9/51; Table 2).

Central Unit 20B: We flew central Unit 20B twinning surveys on 28, 29, and 30 May. T. Seaton piloted the Bellanca Scout with observers D. Parker McNeill, N. Pamperin, and C. Roberts. Surveys were generally conducted 9:00 p.m. to midnight. Weather was hot and sunny during the days, but the surveys were directed toward the cooler evening hours. Total flight time was 9.9 hours ($473) and actual survey time was 9.6 hours. The concentrations of calving moose this year were along the Goldstream Valley from Ohio Creek to Fox, and within 5 miles north and east of Eielson. We spotted no calves at Luck Dome or Alder Creek this year compared to higher numbers in previous years. We observed 164 adult/juvenile moose; 17.1 adult/juvenile moose/hour; 29 (17.7%) parturient moose; and 3.0 parturient moose/hour. The observed twinning rate was 3.4% (1/29; Table 2).

2011 Twinning Surveys

Minto Flats Management Area: Twinning surveys were flown in MFMA with pilot M. Webb in a PA-18 Super Cub and observer T. Hollis on 25 May using the transect method described above. East–west transects were flown between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east between 64°55.0′N and 65°02.9′N. Leaf-out was approximately 70%. Weather, turbulence, and airsickness were not factors. Total flight time was 3.4 hours ($697) and actual survey time was 2.8 hours. We observed 171 moose ≥1 year (61 moose/hour); 50 (29%) parturient moose; and 18 parturient moose/hour. The observed twinning rate was 34% (17/50; Table 2).

Central Unit 20B: We flew central Unit 20B twinning surveys on 25 and 26 May. T. Seaton flew the Bellanca Scout with observer C. Carroll. One survey was a morning shift (6:00–10:00 a.m.) and 2 were evening shifts (9:00 p.m. to midnight). Weather was hot (80°F) and sunny during the days, so the surveys were directed toward the cooler evening hours to maximize the number of moose that were in the open and visible, since the dominant habitat in central Unit 20B is closed canopy forest. Survey time was about 7.55 hours. The concentration of calving moose this year was only the area east and southeast of the Eielson AFB runway. The Goldstream Valley from Ohio Creek to Fox has been a good place to find parturient moose in previous years, but not this year. We spotted 2 calves at Luck Dome compared to none the previous year. Other areas searched in this survey are all open fields around Creamer's refuge and Fort Wainwright army post. We observed 88 moose ≥1-year old and 138 total moose (18.3 moose/hour); 24 (27%) parturient moose; and 3.2 parturient moose/hour. The observed twinning rate was 8.3% (2/24; Table 2).

Table 2. Unit 20B observed moose twinning rates (Minto Flats management area and central Unit 20B), Interior Alaska, 2006–2014.

		Cows			
Year	Date	w/Single calf	w/Twins	Total	% Twins[a]
2006[b]	24 May	44	15	59	25
2006[c]	24–26 May	23	5	28	18
2007[b]	26 May	47	16	63	25
2007[c]	29–31 May	29	1	30	3
2008[b]	24 May	60	20	80	25
2008[c]	29–31 May	55	7	62	11
2009[b]	25 May	46	16	62	26
2009[c]	28–29 May	50	1	51	2
2010[b]	25 May	42	9	51	18
2010[c]	28–30 May	28	1	29	3
2011[b]	25 May	33	17	50	34
2011[c]	25–26 May	22	2	24	8
2012[b]	24 May	55	8	63	13
2012[c]	30 May	26	1	27	4
2013[b]	29 May	39	11	50	22
2013[c]	30 May	16	1	17	6
2014[b]	30 May	42	6	48	13

[a] Percentage of cows with calves that had twins or triplets.
[b] Minto Flats Management Area.
[c] Central Unit 20B.

2012 Twinning Surveys

Minto Flats Management Area: Twinning surveys were flown in MFMA with pilot M. Webb in a PA-18 Super Cub and observer T. Hollis on 24 May using the transect method described above. East–west transects were flown between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east starting on lat 65°02.9′N and ending on lat 64°55.0′N. Leaf-out was approximately 80%. Weather, turbulence and airsickness were not factors. Total survey time was 2.75 hours. We observed 186 moose ≥1 year (68 moose/hour); 63 (34%) parturient moose; and 23 parturient moose/hour. The observed twinning rate was 13% (8/63; Table 2).

Central Unit 20B: We flew central Unit 20B twinning surveys on 30 May. M. Keech flew the Bellanca Scout with observer T. Hollis. The survey was flown from Fairbanks down Goldstream Valley to Standard Creek road, up over Luck Dome to Murphy Dome, up the Chatanika River to the Steese Highway, over Fort Knox to the Little Chena River, down the Little Chena River to the Chena River, up the Chena River to and around the Chena River Flood Control Project, to the vicinity of Eielson AFB and then down the north side of the Tanana River to Fairbanks. Total flight time was 4.7 hours. Weather was 68°F and sunny. The main concentration of calving moose was in the Goldstream Valley, Luck Dome, the Chatanika River near the Elliot Highway and the area east and southeast of the Eielson AFB runway. We observed 81 moose ≥1-year old (17.2 moose/hour); 27 (33%) parturient moose; and 5.7 parturient moose/hour. The observed twinning rate was 4% (1/27; Table 2).

2013 Twinning Surveys

Minto Flats Management Area: Twinning surveys were flown in MFMA with pilot A. Greenblatt in a PA-18 Super Cub and observer T. Hollis on 24 May using the transect method described above. East–west transects were flown between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east starting on lat 65°02.9′N and working south until a sample of 50 parturient moose is found or we reach lat 64°55.0′N. Leaf-out was approximately 50%. Turbulence and airsickness were not factors, but unseasonable warm temperatures (75–89°F) made it harder to locate moose. Many of the moose were found in the more shaded and dense brush, likely escaping the heat, making them more difficult to see from the air. Total survey time was 4.91 hours. We observed 171 moose ≥1 year (35 moose/hour); 50 (29%) parturient moose; and 10 parturient moose/hour. The observed twinning rate was 22% (11/50; Table 2).

Central Unit 20B: We flew central Unit 20B twinning surveys on 30 May. The survey was flown in a PA-18 Super Cub piloted by A. Greenblatt with T. Hollis as an observer. The survey was flown from Fairbanks down Goldstream Valley to Standard Creek road, up over Luck Dome to Murphy Dome, up the Chatanika River to the Steese Highway, over Fort Knox to the Little Chena River, down the Little Chena River to the Chena River, up the Chena River to the flood control project, around the flood control project to the vicinity of Eielson AFB and then down the north side of the Tanana River to Fairbanks. Total flight time was 5.0 hours. Weather was 75–80°F and sunny. The main concentration of calving moose this year was in Goldstream Valley and the area east and southeast of the Eielson AFB runway. We observed 61 moose ≥1-year old (12.2 moose/hour); 17 (18%) parturient moose; and 3 parturient moose/hour. The observed twinning rate was 6% (1/17; Table 2).

2014 Twinning Surveys

Minto Flats Management Area: Twinning surveys were flown in MFMA with pilot M. Webb in a Bellanca Scout with observer M. Glaser (ADF&G) on 23 May using the transect method described above. East–west transects were flown between the Tolovana River–Swanneck Slough to the west and Dunbar Trail to the east starting on lat 65°02.9′N and working south until a sample of 50 parturient moose is found or we reach lat 64°55.0′N. Leaf-out was approximately 50%. Turbulence and airsickness were not factors, however early leaf-out may have made it harder to locate moose. Total flight time was 4.4 ($1,034) hours and actual survey time was 4.25 hours. We observed 210 moose ≥1 year (49 moose/hour); 48 (23%) parturient moose; and 11 parturient moose/hour. The observed twinning rate was 13% (6/48; Table 2).

Central Unit 20B: Surveys were not conducted in central Unit 20B due to the early leaf-out in the area. Finding an adequate sample in this area is difficult with normal spring conditions, therefore having early leaf-out would make this survey not possible.

Twinning rates averaged 20% during RY10–RY14 in MFMA. In RY10, RY12, and RY14 the twinning rate was below our threshold of 20% which causes us to manage for zero population growth. Until we see consistent twinning rates above 20%, we will continue to manage MFMA for zero growth. In central Unit 20B, twinning rates are chronically low. Though this survey is difficult to conduct because of problems finding enough parturient moose for an adequate sample size, it appears that twinning rates have not improved in this area and that managing for a stable moose population would be appropriate at this time.

Recommendation for Activity 1.b

- Continue spring twinning rate surveys in both MFMA and central Unit 20B.
- Explore better central Unit 20B options for conducting twinning rate surveys with higher success of finding parturient cow moose.
- Manage for zero population growth.

2. Mortality–Harvest Monitoring and Regulations

ACTIVITY 2.A. Monitor and analyze harvest data.

Data Needs

Unit 20B was identified by BOG for IM of moose with a harvest objective of 600–1,500 moose available for harvest annually. We estimate annual harvest through harvest report cards which are mandatory for all moose hunts.

Methods

We estimated harvest based on harvest reports. Moose harvested by hunters were reported on report cards. Data were archived in databases housed on ADF&G's Wildlife Information Network (WinfoNet) server and accessed (October 2016). This included report data from general season harvest tickets; the MFMA registration permit hunt; and FMA, Creamer's Field Migratory Waterfowl Refuge, and central and western Unit 20B antlerless drawing permit hunts.

Reminder letters were sent to nonreporting general season hunters, and up to 2 letters and an e-mail were sent to permit holders who failed to report. When antler size of bulls was reported, we considered bulls with antler spreads of <30 inches to be yearlings. Harvest data were summarized by regulatory year.

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

Results and Discussion

General Season

Reported harvest of 543 bulls in RY10, 605 bulls in RY11, 652 bulls in RY12, 457 in RY13 and 576 bulls in RY14 ($\bar{x}$ = 567) was higher than the average reported harvest of 546 bulls during RY03–RY10 (Table 3). Most harvest during RY10–RY14 was in central Unit 20B, followed by western Unit 20B, then eastern Unit 20B (Table 3).

Reported harvest in FMA was 36 moose in RY10, 30 moose in RY11, 25 in RY12, 20 in RY13, and 20 in RY14 ($\bar{x}$ = 26; Table 3), a decrease from the RY03–RY09 average of 34. Relatively high harvest in FMA is likely the result of high densities and survival rates of moose in FMA.

The reported bull harvest for the general season in MFMA was 56, 51, 69, 69, and 68 respectively during RY10–RY14. In RY12, a 7-day any bull season in August was added to the general season in MFMA and the harvest ranged from 12 to 28 bulls harvested during that early season in RY12–RY14.

Table 3. Unit 20B moose hunter[a] residency and success, Interior Alaska, regulatory years[b] 2003–2014.

Area/ Regulatory year	Successful						Unsuccessful					Total hunters
	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	
Eastern Unit 20B — Uniform Coding Units[d] (UCUs) 600, 601, 602, 603, 604, 605, 684)												
2003	58	1	10	0	69	20	235	22	15	0	272	341
2004	49	6	11	3	69	22	205	10	20	4	239	308
2005	77	11	8	0	96	25	243	13	24	1	281	377
2006	76	6	7	0	89	24	235	29	15	5	284	373
2007	60	14	8	4	86	24	222	24	22	2	270	356
2008	65	13	6	4	88	26	206	20	12	10	248	336
2009	54	15	6	1	76	23	208	36	7	4	255	331
2010	54	14	6	2	76	22	204	38	15	11	268	344
2011	68	7	9	2	86	25	200	39	11	9	259	345
2012	72	13	11	4	100	27	211	35	17	1	264	364
2013	40	5	15	2	62	18	210	46	18	8	282	344
2014	70	10	21	0	101	29	208	30	15	0	253	354
Central Unit 20B — (UCUs 207, 208, 209, 211, 212, 213, 301, 401, 402, 403, 404, 405, 406, 484, 485,486,487, 501, 583, 584)												
2003	232	33	23	0	288	19	1,099	94	55	5	1,253	1,541
2004	203	18	25	5	251	19	916	56	57	22	1,051	1,302
2005	211	21	29	0	261	17	1,070	97	70	8	1,245	1,506
2006	239	25	28	2	294	18	1,110	109	76	8	1,303	1,597
2007	216	31	33	0	280	18	1,072	118	63	14	1,267	1,547
2008	276	45	20	19	360	23	1,005	100	44	62	1,211	1,571
2009	261	42	25	1	329	21	1,093	106	48	26	1,273	1,602
2010	183	21	18	4	226	17	937	118	48	21	1,124	1,350
2011	227	37	23	4	291	21	838	130	48	27	1,043	1,334
2012	203	36	39	7	285	17	1,088	159	82	49	1,378	1,663
2013	167	36	35	10	248	12	1,463	210	90	57	1,820	2,068
2014	183	50	26	0	259	17	1,059	148	73	0	1,280	1,539
Western Unit 20B — (UCUs 101, 201, 202, 203, 204, 205, 206, 210)												
2003	65	19	3	0	87	21	244	69	17	1	331	418
2004	56	16	6	2	80	22	214	51	13	4	282	362
2005	53	15	8	0	76	20	233	47	15	1	296	372
2006	57	16	5	0	78	20	241	63	8	4	316	394
2007	67	20	8	1	96	23	247	62	12	1	322	418
2008	91	23	6	1	121	28	216	78	12	8	314	435
2009	83	35	11	1	130	29	245	58	15	5	323	453

Area/ Regulatory year	Successful						Unsuccessful					Total hunters
	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	
2010	80	29	4	3	116	25	246	98	7	5	356	472
2011	69	45	10	4	128	30	196	74	9	10	289	417
2012	107	48	4	4	163	28	295	111	10	4	420	583
2013	86	38	6	2	132	20	356	138	26	2	522	654
2014	88	43	14	2	147	23	331	139	10	0	480	627
FMA[e] — general archery hunt[f] (UCUs 0212, 0213, 0300, 0301, 0401, 0402, 0403, 0501; archery only)												
2003	54	5	1	0	60							
2004	31	0	2	0	33							
2005	18	2	1	0	21							
2006	21	1	1	0	23							
2007	21	2	0	0	23							
2008	26	1	0	0	27							
2009	48	2	0	0	50							
2010	33	1	2	0	36							
2011	28	2	0	0	30							
2012	24	1	0	0	25							
2013	17	1	2	0	20							
2014	18	1	1	0	20							
MFMA[g] — general hunt (UCUs 0201, 0205, 0210; Nonresident hunters and antlerless harvest censored)												
2003	39	10	0	0	49	30	96	19	0	0	115	164
2004	28	8	0	0	36	25	90	16	0	0	106	142
2005	28	10	0	0	38	25	100	17	0	0	117	155
2006	33	11	0	0	44	25	102	30	0	1	133	177
2007	43	8	0	0	51	28	108	25	0	0	133	184
2008	45	11	0	0	56	30	102	26	0	0	128	184
2009	36	14	0	1	51	29	107	16	0	3	126	177
2010	39	15	0	2	56	25	121	45	0	3	169	225
2011	36	13	0	2	51							
2012	51	15	0	3	69							
2013	53	14	1	1	69	24	152	52	5	1	220	289
2014	40	21	6	1	68	21	193	65	3	0	258	326

Area/ Regulatory year	Successful						Unsuccessful					Total hunters
	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	% Successful	Local[c] resident	Nonlocal resident	Nonresident	Unk	Total	
All general hunts												
2003	397	57	38	0	492	18	1,871	217	99	8	2,195	2,687
2004	352	49	45	13	459	20	1,569	145	101	35	1,850	2,309
2005	396	53	47	0	496	19	1,790	187	114	14	2,105	2,601
2006	427	56	42	2	527	19	1,886	233	109	18	2,246	2,773
2007	394	75	57	2	528	19	1,879	265	119	19	2,282	2,810
2008	486	104	33	25	648	23	1,755	247	82	91	2,175	2,823
2009	487	130	54	4	675	22	1,942	278	87	47	2,354	3,029
2010	403	86	44	10	543	19	1,805	346	84	50	2,285	2,828
2011	439	108	48	10	605	22	1,640	318	84	55	2,097	2,702
2012	461	114	58	19	652	20	2,025	401	134	76	2,636	3,288
2013	315	82	56	5	458	14	2,195	448	157	18	2,818	3,276
2014	399	118	69	2	588	19	2,045	394	125	5	2,569	3,157

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

Permit Hunts

Registration Hunts: The amount of participation and reported harvest for the MFMA registration hunt varied during RY10–RY14 due to a change in the hunt from a limited registration permit in RY10 and RY11 to an unlimited registration permit in RY12–RY14 (Table 4). In RY10 and RY11, 230 and 237 permits were issued respectively. This resulted in a harvest of 150 moose (78 males, 72 females) in RY10 and 132 moose (54 males, 78 females) in RY11. In RY12, RY13, and RY14 we issued 825, 624, and 725 permits respectively. This resulted in a harvest of 140 moose (18 males, 122 females) in RY12, 102 moose (14 males, 88 females) in RY13 and 55 moose (6 males, 49 females) in RY14. The harvest during this time decreased due to a decrease in the harvestable surplus in the area, therefore harvest quotas were set at lower levels.

Drawing Permit Hunts: During RY10–RY14, the number of drawing permits issued and harvest varied among hunt areas (Table 4). In RY10, a total of 162 permits were issued in FMA with a harvest of 42 moose (4 males, 38 females). In central and western Unit 20B, we issued a total of 673 permits and harvested 163 moose (161 females, 2 males). During RY11, a total of 160 permits were issued in FMA with a harvest of 40 moose (36 females, 4 males). In central and western Unit 20B, we issued 1,216 moose permits and harvested 289 moose (280 females, 9 males). We also issued 50 permits in eastern Unit 20B and harvested 20 moose (14 females, 6 males). During RY12, a total of 160 permits were issued in FMA which resulted in a harvest of 35 moose (32 females, 3 males). In central and western Unit 20B, a total of 1,039 permits were issued and 241 moose (230 females, 11 males) were harvested. In eastern Unit 20B, 51 permits were issued and 10 moose (9 females, 1 male) were harvested. During RY13, we issued 160 permits for the FMA, 1,037 permits in central and western Unit 20B and 51 permits in eastern Unit 20B. A total of 34 moose (26 females, 8 males) were harvested in FMA, 217 (209 females, 9 males) in central–western Unit 20B and 11 (9 females, 2 males) in eastern Unit 20B. In FY14, we issued a total of 160 permits in FMA, 432 permits in central–western Unit 20B and 50 permits in eastern Unit 20B. A total of 32 moose (31 females, 1 male) were harvested in FMA, 95 moose (89 females, 6 males) in central–western Unit 20B and 5 moose (4 females, 1 male) in eastern Unit 20B.

The number of permits issued in FMA remained constant during RY10–RY14, however we began issuing permits for a portion of eastern Unit 20B along the Richardson highway in RY11. We also began decreasing the number of antlerless permits each year during RY10–RY14 in response to our population estimates.

There were no apparent trends in harvest, effort, or success rates in permit hunts during RY03–RY14 (Table 4). Harvest of antlerless moose changes based on the number of drawing permit issued. Despite changes in the number of permits issued, success rates in those hunts remained relatively stable. Success rates drastically decreased in the registration hunts in RY12 because the hunt was changed to an unlimited registration permit and the number of permits issued drastically increased.

Table 4. Unit 20B moose harvest data by permit hunt, Interior Alaska, regulatory years[a] 2003–2014.

Hunt	Regulatory year	Permits issued	Successful hunters (%)	Unsuccessful hunters (%)	Did not hunt (%)	Did not report (%)	Bulls (%)	Cows (%)	Harvest
Drawing hunts	2003	100	28 (35)	53 (65)	17 (17)	2 (2)	0 (0)	28 (100)	28
	2004	160	50 (38)	80 (62)	24 (16)	6 (4)	1 (2)	49 (98)	50
	2005	159	38 (32)	81 (68)	39 (25)	1 (1)	2 (5)	39 (95)	41
	2006	360	158 (53)	142 (47)	55 (15)	5 (1)	11 (7)	147 (93)	158
	2007	361	127 (42)	169 (58)	65 (18)	0 (0)	8 (6)	119 (94)	127
	2008	185	63 (40)	93 (60)	29 (16)	0 (0)	0 (0)	63 (100)	63
	2009	867	254 (41)	362 (59)	247 (29)	4 (1)	1 (0)	253 (100)	254
	2010	851	209 (33)	422 (67)	216 (26)	4 (1)	8 (4)	201 (96)	209
	2011	1,276	309 (32)	645 (68)	318 (25)	4 (1)	15 (5)	294 (95)	309
	2012	1,250	286 (33)	593 (67)	369 (30)	2 (1)	15 (5)	271 (95)	286
	2013	1,248	263 (30)	614 (70)	371 (30)	2 (1)	18 (7)	244 (93)	263
	2014	642	132 (30)	311 (70)	198 (31)	1 (1)	8 (6)	124 (94)	132
Registration hunts	2003	0							
	2004	110	62 (76)	20 (24)	2 (2)	26 (24)	30 (48)	32 (52)	62
	2005	115	64 (65)	35 (35)	16 (14)	0 (0)	26 (41)	38 (60)	64
	2006	193	104 (64)	59 (36)	21 (11)	9 (5)	45 (43)	59 (57)	104
	2007	197	107 (64)	60 (36)	29 (15)	1 (1)	46 (43)	61 (57)	107
	2008	211	140 (77)	43 (23)	26 (12)	2 (1)	69 (49)	71 (51)	140
	2009	210	142 (77)	43 (23)	22 (11)	3 (1)	65 (46)	77 (54)	142
	2010	230	150 (75)	50 (25)	25 (11)	5 (2)	78 (52)	72 (48)	150
	2011	237	132 (71)	54 (29)	42 (18)	9 (4)	54 (41)	78 (59)	132
	2012	825	140 (39)	217 (61)	441 (55)	27 (3)	18 (13)	122 (87)	140
	2013	624	102 (31)	224 (69)	298 (48)	2 (1)	14 (14)	88 (86)	102
	2014	725	55 (15)	304 (85)	347 (49)	19 (3)	6 (11)	49 (89)	55
Total for all permit hunts	2003	200	74 (47)	83 (53)	38 (19)	5 (3)	23 (31)	51 (69)	74
	2004	270	112 (47)	100 (53)	26 (11)	32 (12)	31 (28)	81 (72)	112
	2005	274	105 (48)	113 (52)	55 (20)	1 (1)	28 (27)	77 (73)	105
	2006	553	262 (56)	201 (44)	76 (14)	14 (3)	56 (21)	206 (79)	262
	2007	558	234 (51)	229 (49)	94 (17)	1 (1)	54 (23)	180 (77)	234
	2008	396	203 (60)	136 (40)	55 (14)	2 (1)	69 (34)	134 (66)	203
	2009	1,077	396 (48)	405 (52)	269 (25)	7 (1)	66 (17)	330 (83)	396
	2010	1,081	359 (43)	472 (57)	241 (22)	9 (1)	86 (24)	273 (76)	359
	2011	1,513	441 (39)	699 (61)	360 (24)	13 (1)	69 (16)	372 (84)	441
	2012	2,075	426 (34)	810 (66)	810 (40)	29 (1)	33 (8)	393 (92)	426
	2013	1,872	365 (30)	838 (70)	669 (36)	4 (1)	32 (9)	332 (91)	365
	2014	1,367	187 (23)	615 (77)	545 (40)	20 (1)	14 (7)	173 (93)	187

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

Hunter Residency and Success

Primarily local residents hunted moose in Unit 20B (Table 3). Participation by nonlocal Alaska residents and nonresidents was relatively low but has increased most years since RY04. Nonlocal resident (n = 530) and nonresident (n = 213) hunters peaked in RY13.

The average success rate of 19% during RY10–RY14 was similar to the average (20%) reported during RY03–RY09. During RY10–RY14, central Unit 20B had the lowest success rates ($\bar{x}$ = 17%), followed by eastern Unit 20B ($\bar{x}$ = 24%) and then western Unit 20B ($\bar{x}$ = 25%). By comparison, success rates during RY03–RY09 were similar in central ($\bar{x}$ = 19%), eastern ($\bar{x}$ = 23%), and western Unit 20B ($\bar{x}$ = 23%). Typically, success rates are lower in areas with higher hunter densities and/or lower bull:cow ratios, such as central Unit 20B, and higher in areas with lower hunter densities and/or higher bull:cow ratios, such as eastern Unit 20B. Hunter success during the general season was typically lower in Unit 20B than elsewhere in Unit 20. For example, during RY03–RY14, 14–23% ($\bar{x}$ = 20%) of general season hunters in Unit 20B were successful (Table 3), whereas annual success rates in Units 20A and 20C typically exceed 35% (Hollis 2010; Young 2010).

Harvest Chronology

During RY10, most of the harvest occurred during 11–15 September ($\bar{x}$ = 35%) (Table 5). The season was lengthened for the RY11 season, therefore a good portion of the harvest now occurs during 16–20 September when the bull moose are more susceptible due to rutting activities. During RY10–RY14, at least 50% of the harvest occurs between 11 and 20 September. Beginning in RY13 a general season hunt in MFMA occurs during 21–27 August, therefore some harvest occurs at that time.

Transport Methods

Three- or 4-wheelers, followed by highway vehicles, then boats were the primary methods of transportation used by successful hunters (Table 6). Methods of transportation used by successful hunters have been relatively consistent during RY03–RY14.

Other Mortality

The number of moose killed in accidents with motor vehicles and trains has been substantial in some years (Hollis 2014). The number of moose reported killed on roads in FMA averaged 80 animals during RY05–RY09 compared to 61 animals during RY10–RY14 (Table 7). This is an indication that the increased antlerless hunts in FMA may be helping to reduce roadkill. An additional 30–59 moose were reported killed on roads in the remainder of Unit 20B during RY10– RY14. Generally, few moose are reported killed by trains in Unit 20B (Young 2006). This trend continued during RY10–RY14 with no data available for RY09–RY12 and a few reported in RY13 and RY14.

Table 5. Unit 20B moose harvest[a] chronology percent by month/day, Interior Alaska, regulatory years[b] 2003–2014.

Regulatory		Harvest chronology percent by month/day						
year	8/21–8/27	9/1–9/5	9/6–9/10	9/11–9/15	9/16–9/20	9/21–9/25	Unk/Other	*n*
2003		24	26	35	8	1	7	492
2004		33	27	29	6	2	4	459
2005		38	22	27	6	2	4	496
2006		35	20	31	5	2	6	527
2007		27	24	36	8	2	4	528
2008		37	25	29	5	2	3	648
2009		33	29	27	8	2	2	664
2010		29	22	35	8	3	3	543
2011		21	17	24	29	5	4	605
2012		22	20	25	25	4	4	652
2013	7	18	14	27	26	4	4	458
2014	4	17	19	24	28	5	3	588

[a] Excludes drawing, registration, and Tier II permit hunt harvest.

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

Table 6. Unit 20B moose harvest[a] percent by transport method, Interior Alaska, regulatory years[b] 2003–2014.

Regulatory year	Harvest percent by transport method									*n*
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Airboat	Other/ Unknown	
2003	4	0	20	28	0	4	36	3	5	492
2004	4	0	16	30	0	3	39	3	4	459
2005	4	0	21	31	2	5	34	2	3	496
2006	3	1	19	38	1	2	31	3	4	527
2007	3	1	17	35	0	4	33	3	2	528
2008	3	0	17	37	0	6	33	2	2	655
2009	2	0	20	40	0	4	28	1	2	675
2010	3	0	21	40	0	5	26	3	2	543
2011	3	0	19	39	0	5	26	3	5	605
2012	5	0	22	35	0	5	27	3	3	652
2013	4	0	27	37	0	4	23	2	2	458
2014	4	0	26	42	0	4	18	2	4	588

[a] Excludes drawing, registration, and Tier II permit hunt harvest.

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

Table 7. Estimate of Unit 20B moose harvest[a] and accidental death, Interior Alaska, regulatory years[b] 2001–2014.

	Harvest by hunters							Accidental death					
	Reported				Estimated			Road[c]					
Regulatory year	M	F	Unk	Total	Unreported[d]	Illegal/ Other	Total	FMA[e]	Unit 20B remainder	Total	Train[f]	Total	Combined total
2001	531	53	6	590	104	37[g]	141	72	50	122	9	131	862
2002	725	61	2	788	139	47[g]	186	118	71	189	12	201	1,175
2003	549	52	2	603	107	50[g]	157	87	64	151	13	164	924
2004	488	84	1	573	101	56[g]	157	95	62	157	30	187	917
2005	519	77	4	600	106	109[h]	215	79	57	136	6	142	957
2006	571	212	7	790	140	105[h]	245	88	68	156	8	164	1,199
2007	581	183	5	769	136	93[h]	229	73	56	129	12	141	1,139
2008	718	135	4	857	152	112[h]	264	79	67	146	6	152	1,273
2009	664	264	7	935	165	90	255	79	72	151	0[i]	151	1,341
2010	558	278	1	837	148	80	228	78	59	137	0[i]	137	1,202
2011	672	373	2	1,047	185	101	286	60	57	117	0[i]	117	1,450
2012	681	396	2	1,079	191	104	295	65	48	113	0[i]	113	1,487
2013	490	331	1	822	145	79	224	53	30	83	6	89	1,135
2014	595	176	5	776	137	74	211	51	55	106	1	107	1,094

[a] Includes general, registration and permit hunt harvest.
[b] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2001 = 1 July 2001–30 June 2002).
[c] Documented kills; actual number killed by vehicles is certainly greater.
[d] Based on 17.7% unreported harvest (including wounding loss) estimated by Gasaway et al. (1992).
[e] Fairbanks management area.
[f] Confirmed dead between Alaska Railroad mileposts 411.8 and 470.0; "Missing" (moose hit but not recovered) are not included. Data provided by the Alaska Railroad.
[g] Includes illegal, defense of life or property, dispatched, potlatch, stickdance, and other reported deaths.
[h] Includes illegal, defense of life or property, dispatched, potlatch, stickdance, and other reported deaths, plus an additional estimate of mortality caused by snaring calculated from annual estimates of the posthunt moose population × 0.005361 (estimated mortality rate caused by snares based on radiocollared sample of moose in Unit 20A).
[i] No data available for these years.

Alaska Board of Game Actions and Emergency Orders

At the spring 2012 meeting, the board authorized a 21–27 August general season hunt for any bull in MFMA and lengthened the September general season to begin 8 September instead of 11 September. The board also authorized a registration permit for a 15 October–28 February antlerless moose season in MFMA. These changes were in response to a proposal that sought to address the limited registration hunts and the process to obtain those permits. During the spring 2014 BOG meeting several changes were made to moose hunting in Unit 20B. The board authorized a nonresident drawing permit for moose in MFMA. They also changed the muzzleloader drawing permit hunt for bull moose in the upper Salcha River and middle fork of the Chena River to a registration permit hunt. The board also lengthened the general moose season 5 days in that portion of the Salcha River upstream of Goose Creek and in the middle fork of the Chena River. The board also approved a youth drawing permit for antlerless moose in central and western Unit 20B that will begin in RY15.

Recommendations for Activity 2.1

- Continue to monitor total harvest for comparison with the IM harvest objective.
- Modify comparisons of reported harvest to the lower threshold of the IM harvest objective using 3-year running means to account for annual variability.

3. Habitat Assessment–Enhancement

ACTIVITY 3.A. Browse removal surveys.

Data Needs

Because the Unit 20B population estimate in 2009 was well above the IM population objective of 12,000–15,000, a browse removal study was conducted in 2010 to determine if the high population was having a negative effect on the winter browse available to them.

Methods

The most recent browse removal surveys were conducted in March 2010 in MFMA. Data on browse production and removal were estimated using plant sampling methods described by Seaton (2002). No browse removal surveys were conducted during RY11–RY14.

Results and Discussion

The browse removal study in MFMA estimated browse biomass removal at 29.5% (27–32%, 95% CI), a moderately high removal rate (Paragi and Kellie, *In prep*). This was similar to the 2007 removal rate of 25.1% (20.6–29.6%, 95% CI; Paragi et al. 2008) in central Unit 20B. Short-yearling weights in both MFMA and central Unit 20B were below the threshold of 385 lb (175 kg) used as a signal to begin reducing moose density through liberal antlerless harvest (Boertje et al. 2007). This supported our recommendation to limit population growth through conservative antlerless harvests in portions of western and central Unit 20B during RY09–RY12.

Recommendations for Activity 3.1

- Conduct another browse removal study in MFMA after several years of meeting the IM population objective if we see a decrease in twinning rates below 20% for 3 consecutive years.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

During RY10–RY14 we continued to collect systematic information on nonhunting mortality of moose because of its potential influence on harvest quotas and population trends. Motor vehicle and railroad kills continue to be important sources of mortality (Table 7). Within the Fairbanks urban area, we also received many complaints about human–moose conflicts, such as moose in gardens or yards, moose attacking dogs in dog yards and along dogsled trails, and moose "trapped" within the confines of the urban area. Besides attempting to reduce moose densities through increased harvest, we continue to work with the public through direct interaction and through the media to reduce nonhunting mortality and human–moose conflicts.

Another problem that occurs in Unit 20B is the amount of unreported ceremonial, cultural education, and potlatch harvest. Permits for all 3 styles of these hunts are applied for and documented, but record of the actual harvest is poor. The number of permits issued is estimated at 40–60 per year and permits authorize 1–3 moose to be harvested. With the actual harvest unknown and the population estimate of moose in Unit 20B falling within the IM population objective, the number of female moose harvested with these permits may begin to cause a reduction in permits available for drawing permits to the general public. A better system for tracking the harvest of moose from these permits is needed for the department to provide maximum hunting opportunity for hunters.

Data Recording and Archiving

Harvest and GSPE data will be stored on an internal moose database housed on a server (http://winfonet.alaska.gov/index.cfm). Field data sheets will be stored in 3-ring binders located in the Fairbanks Assistant Area Biologist's office (Room 118).

Electronic copies of data, memos, and reports will be stored on WinfoNet – Data Archive. Project Title: 20B Moose. Project ID: 2016. Primary Region: Region III.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

Since no population estimates were available during RY10, RY11, and RY14, it is unknown if we met the IM population objective of 12,000–15,000 moose. However, the unitwide 2012–2013

estimate falls within the objective, so it was met during RY13. Reported harvests reached the IM objective's lower limit of 600 moose during RY05–RY14; therefore, we met this objective in RY10–RY14. Because the 2012–2013 population estimate is within our IM population objective, I recommend continuing a conservative antlerless moose harvest (1% of the prehunt moose population) in central Unit 20B and in MFMA in western Unit 20B to limit population growth, maintain the population within the IM population objective, and increase yield to meet the IM harvest objective. If unitwide surveys indicate population growth or decline, more aggressive or restrictive antlerless harvest may be necessary to maintain this population level.

During RY10, RY11 and RY14 it is unknown if we met our management objective of a posthunting ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each of the 3 geographic zones (i.e., eastern, central, and western Unit 20B), however we did meet this objective in 2013. This is consistent with surveys conducted during 2001–2009 that indicate we consistently met this management objective. Lower bull:cow ratios in MFMA and FMA (300 mi^2) are of less biological concern than in larger areas because these areas are small in relation to the annual home range of moose. If insufficient bulls are available for breeding, cows in estrus can easily move to the periphery or outside the management areas where bull:cow ratios are higher, and bulls seeking females can readily migrate into the management areas. This is particularly true of the smaller FMA. High calf:cow ratios indicate there have been sufficient bull moose in MFMA and FMA to breed estrous cows.

I concur with Dale (1998) that we need to continue to collect annual unitwide population data to assess the status of the moose population, particularly because we have antlerless hunts in most of western and central Unit 20B, as well as in MFMA and FMA. I recommend continued twinning rate surveys in MFMA and central Unit 20B to evaluate nutritional status of moose in those portions of Unit 20B. Twinning rates and annual population estimates will be necessary to annually reevaluate management objectives and to gain public approval of those management objectives. Also, I recommend an intensive survey of FMA or MFMA on alternating 4- to 6-year cycles to evaluate the effectiveness of increased antlerless harvests to reduce moose numbers and densities and moose–vehicle collisions.

II. Project Review and RY15–RY19 Plan

Review of Management Direction

MANAGEMENT DIRECTION

There are no changes in the management direction for Unit 20B. However, in an effort to continue an effective management strategy within the existing framework, area staff will continue exploring possible strategies that will improve the current program.

GOALS

G1. Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.

G2. Provide for continued subsistence use of moose by Alaska residents who have customarily and traditionally used the population.

G3. Provide the greatest sustained opportunity to participate in hunting moose.

G4. Provide an opportunity to view and photograph moose.

G5. Protect human life and property in human–moose interactions.

The above goals (from the prior report period) are applicable to the next 5 years, and so will be included in this plan.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Unit 20B has a customary and traditional use finding outside the Fairbanks nonsubsistence area, with amounts necessary for subsistence uses of the following:

C1. Unit 20B, that portion outside MFMA – 75–100 moose.

C2. Unit 20B, that portion within MFMA – 20–40 moose.

Intensive Management

C3. Population objective: 12,000–15,000.

C4. Harvest objective: 600–1,500 moose available for harvest.

MANAGEMENT OBJECTIVES

M1. Manage for a posthunting sex ratio of ≥30 bulls:100 cows unitwide and ≥20 bulls:100 cows in each count area (i.e., eastern Unit 20B, central Unit 20B, western Unit 20B, and MFMA).

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Geospatial population estimation (GSPE) surveys. (objectives C1, C2, C3, C4, and M1)

Data Needs

Population status and trends are important data to determine whether Unit 20B meets the IM population objective of 12,000–15,000. It is also important to help determine harvestable surplus (IM harvest objective), harvest rates, recruitment, sex and age ratios and age classes in the population. GSPE surveys are used to collect these data.

Methods

We will conduct GSPE surveys with SCF trials (see "I. RY10–RY14 Management Report | Management Activities | 1. Population Status and Trend | Methods" this document; Kellie and DeLong 2006). To ensure that high scientific standards are retained in methods and interpretation of results, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this activity.

- Maintain 70 high:30 low density SU ratio.
- Alternate high (≥100 SUs) and low intensity (≥60 SUs) GSPE surveys annually in Unit 20B, in order to also conduct GSPE surveys annually in Unit 20A.
- Compare abundance estimates to the lower limit of the ANS and IM population objective.
- Obtain composition estimates.
    - Evaluate bull:cow ratio estimates (90% CI) from GSPE data in relation to the bull:cow ratio management objective.
    - Evaluate trend in calf:cow, yearling bull:cow, and bull:cow ratios and construct 90% CI using GSPE data.

ACTIVITY 1.2. Spring twinning surveys. (objective C3)

Data Needs

BOG identified Unit 20B as an IM area for moose. Twinning surveys are an important component to determine the nutritional condition and productivity of a population and to help manage on a sustainable yield over a long period of time.

Methods

To ensure that high scientific standards are retained in methods and interpretation of results, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this activity.

- See "I. RY10–RY14 Management Report | Management Activities | Activity 1.2. Spring twinning surveys | Methods" this document.
- Compare multi-year mean of twinning rates (95% CI ± 5–8%).

ACTIVITY 1.3. Short-yearling mass estimation. (objective C3)

Data Needs

Unit 20B was identified by the board for IM of moose. Understanding the nutritional condition of the moose in Unit 20B is an important part of managing moose intensively. Short-yearling weights aids in assessing nutritional condition of moose.

Methods

To ensure that high scientific standards are retained in methods and interpretation of results, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this activity.

- Compare mean female short-yearling mass (95% CI) against the 385 lb threshold (Boertje et al. 2007).
- Compare mean female short-yearling mass to the mass of those weighed in 2010 in MFMA and central Unit 20B. Multi-year samples are desired to incorporate annual variation in short-yearling weights resulting from differences in environmental conditions (e.g., weather, snow conditions, etc.).

2. Mortality–Harvest Monitoring

ACTIVITY 2.1. Monitor and analyze harvest data. (objectives C1, C2, C4)

Data Needs

Unit 20B was identified by BOG for IM of moose with a harvest objective of 600–1,500 moose available for harvest annually.

Methods

To ensure that high scientific standards are retained in methods and interpretation of results, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this activity.

- Monitor harvest for comparison with the IM harvest objective. (see "I. RY10–RY14 Management Report | Management Activities | 2. Mortality-Harvest Monitoring and Regulations | Methods" this document).
- Compare reported harvest, using 3-year running means to account for annual variation in harvest, to the lower limit of the IM harvest objective.
  - Use linear regression models to evaluate harvest trends.
  - Use biometric review to evaluate harvest numbers.

3. Habitat Assessment–Enhancement

ACTIVITY 3.1. Browse removal survey. (objective C3)

Data Needs

Because the Unit 20B population estimate in 2009 was well above the IM population objective of 12,000–15,000, a browse removal study was conducted in 2010 to determine if the high moose population was having a negative effect on the winter browse available to them. However, we only need to conduct another browse removal study in MFMA after several years of meeting

the IM population objective if we see a decrease in twinning rates below 20% for 3 consecutive years.

Methods

See "I. RY10–RY14 Management Report | Management Activities | 3. Habitat Assessment–Enhancement | Methods" this document. To ensure that high scientific standards are retained in methods and interpretation of results, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this activity.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

- Continue collecting information from the Alaska Wildlife Troopers on moose mortality caused by motor vehicles, trains, and illegal hunting. This information will aid in determining the surplus of moose available to hunters.
- Continue to work on issues pertaining to the lack of reported harvest associated with educational, ceremonial, and potlatch moose permits. Having a better understanding of the harvest that occurs with these permits.

Data Recording and Archiving

Harvest data will be stored on an internal moose database housed on the WinfoNet server (http://winfonet.alaska.gov/index.cfm). Electronic copies of survey data, survey memos, and reports will be stored on the Fairbanks Assistant Area Biologist's computer at H: Fairbanks area\20B Moose and at WinfoNet – Data Archive. Project Title: Moose Management Program Unit 20B. Project ID: GMU 20B Moose. Primary Region III. Field data sheets will be stored in a 3-ring binder located in the Fairbanks Assistant Area Biologist office (Room 118).

Agreements

None.

Permitting

None.

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