Moose Management Report and Plan, Game Management Unit 12:

Report Period 1 July 2010–30 June 2015, and

Plan Period 1 July 2015–30 June 2020

Jeffrey J. Wells

2018

Alaska Department of Fish and Game Division of Wildlife Conservation

Moose Management Report and Plan, Game Management Unit 12:

Report Period 1 July 2010–30 June 2015, and

Plan Period 1 July 2015–30 June 2020

PREPARED BY:

Jeffrey J. Wells
Wildlife Biologist II

APPROVED BY:

Doreen I. Parker McNeill
Management Coordinator

REVIEWED BY:

Jackie J. Kephart
Assistant Management Coordinator

Laura A. McCarthy
Publications Specialist II

John W. Merickel
Biometrician II

Alyssa L. Crawford
Biometrician II

Alaska Department of Fish and Game
Division of Wildlife Conservation
PO Box 115526
Juneau, AK 99811-5526

Funding for survey and inventory project 1.0 was provided through the Federal Aid in Wildlife Restoration grant program. Hunters are important founders of the modern wildlife conservation movement. They, along with trappers and sport shooters, provided funding for this publication through payment of federal taxes on firearms, ammunition, and archery equipment, and through state hunting license and tag fees.

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 area, 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 Region III for the Division of Wildlife Conservation, Fairbanks.

Species management reports and plans are available via the Alaska Department of Fish and Game's website (www.adfg.alaska.gov) or by contacting Alaska Department of Fish and Game, Division of Wildlife Conservation, PO Box 115526, Juneau, AK 99811-5526; phone: (907) 465-4190; email: dfg.dwc.publications@alaska.gov. The report may also be accessed through most libraries, via interlibrary loan from the Alaska State Library or the Alaska Resources Library and Information Services (www.arlis.org).

This document, published as a PDF only, should be cited as follows:

Wells, J. J. 2018. Moose management report and plan, Game Management Unit 12: Report period 1 July 2010–30 June 2015, and plan period 1 July 2015–30 June 2020. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2018-17, Juneau.

Cover photo: The Tok River valley is important to both Unit 12 moose and moose hunters. ©2008 ADF&G. Photo by Jeffrey A. Gross.

Contents

Purpose of this Report....1
I. RY10–RY14 Management Report....1
Management Area....1
Summary of Status, Trend, Management Activities, and History of Moose in Unit 12....1
Management Direction....2
Existing Wildlife Management Plans....2
Goals....2
Codified Objectives....3
Amounts Reasonably Necessary for Subsistence Uses....3
Intensive Management....3
Management Objective....3
Management Activities....3
1. Population Status and Trend....3
2. Mortality–Harvest Monitoring and Regulations....10
3. Habitat Assessment–Enhancement....11
Nonregulatory Management Problems or Needs....15
Data Recording and Archiving....15
Agreements....16
Permitting....16
Conclusions and Management Recommendations....16
II. Project Review and RY15–RY19 Plan....17
Review of Management Direction....17
Management Direction and Goals....17
Codified Objectives....17
Amounts Reasonably Necessary for Subsistence Uses....17
Intensive Management....17
Management Objective....18
Review of Management Activities....18
1. Population Status and Trend....18
2. Mortality–Harvest Monitoring....21
3. Habitat Assessment–Enhancement....21
Nonregulatory Management Problems or Needs....22
Data Recording and Archiving....22
Agreements....23
Permitting....23
References Cited....23

List of Figures

Figure 1. Moose survey areas in Unit 12, Interior Alaska, regulatory years[a] 2010–2014. 5
Figure 2. Moose and grouse habitat enhancement project in the lower Tok river valley in Unit 12, Interior Alaska. Shown on the map are areas that were rollerchopped during regulatory years[a] 2014 and 2015 and areas that are planned to be rollerchopped during regulatory years 2016–2018. The rollerchopping is being conducted to promote aspen and willow regeneration within areas burned during the 1990 Tok River wildfire. 14

List of Tables

Table 1. Moose composition and population estimates in Unit 12 moose survey areas, Interior Alaska, fall 2008–2014[a]. 9
Table 2. Unit 12 reported moose harvest, Interior Alaska, regulatory years[a] 2010–2014. 12
Table 3. Unit 12 moose hunter residency and success, Interior Alaska, regulatory years[a] 2010–2014.....12

♦ ♦ ♦

Purpose of this Report

This report provides a record of survey and inventory management activities for moose (*Alces alces*) in Unit 12 for the previous 5 regulatory years (RY; RY10–RY14) and plans for survey and inventory management activities in the 5 years following the end of that period (RY15–RY19). 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 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

Unit 12 is in eastcentral Alaska bounded by the Canada border on the east and is centered on 62°34′N latitude and 142°7′W longitude. Major drainages within the unit include the Nabesna and Chisana drainages, which combine to form the Tanana River. Unit 12 encompasses 9,975 mi^2, of which approximately 6,000 mi^2, or that portion at or below 4,500 feet in elevation, is generally considered suitable moose habitat. Elevations within the unit range from 1,500 feet along the Tanana River to >12,000 feet in the Wrangell, Nutzotin, and Mentasta mountains. Much of the northeastern portion of the unit (e.g., Tetlin National Wildlife Refuge) is dominated by lowland shrub and sedge meadows, wetlands, mature black (*Picea mariana*) and white (*Picea glauca*) spruce forest, and recently burned areas dominated by shrubs and early successional forest species. The western and southern portions of the unit include more mountainous areas dominated by spruce forest in the lowland valleys transitioning to shrub communities, subalpine and alpine tundra, and glaciated areas at the higher elevations. The climate is typical of Interior Alaska, where temperatures frequently reach 80°F in summer and −40°F in winter.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 12

Similar to other areas within Alaska, the Unit 12 moose population experienced wide fluctuations in size from the 1950s to present time. Moose abundance was estimated to be high in Unit 12 during the 1950s through the mid-1960s and declined rapidly during the mid-1960s through mid-1970s (Kelleyhouse 1989). The moose population increased in portions of northwest Unit 12 during the 1980s and 1990s, likely partially a result of the 155 mi^2 Tok River wildlife fire in 1990 (Gardner 1998) and has remained relatively stable since then with 2008 observable moose densities estimated at 0.62 moose/mi^2 in the eastern portion of the unit and 1.2 moose/mi^2 in the western portion of the unit (Bentzen 2012).

In response to low population numbers and/or low bull:cow ratios, portions of Unit 12 were closed to moose hunting during the RY75–RY81 and RY86–RY90. All of Unit 12 was open to moose hunting beginning in RY91, when most of the unit was open for a 15-day any-bull resident season and a 10-day antler-restricted nonresident season. Since then, most of the unit has retained a 15-day season for residents, although it was split into a 5-day late August season and 10-day September season in RY01, and season dates were modified along the Nabesna Road in RY12. In addition, antler restrictions have been in place within portions of the Tok River since RY93 and in the Nabesna Road vicinity since RY12. The total number of hunters and harvest generally remained stable during RY00–RY09.

Since the early 1980s, ADF&G has initiated several efforts, including predator control and habitat enhancement, to increase portions of the Unit 12 moose population. The most recent of these efforts included wolf (*Canis lupus*) control in northern Unit 12 during RY04–RY13 as part of the upper Yukon-Tanana predator control program (ADF&G 2014) and habitat enhancement via scarification in timber harvest areas during RY09–RY12 (Wells 2014). In addition to potentially benefitting from these efforts, Unit 12 moose also likely benefitted from large wildfires during 2004 that burned approximately 434 mi^2 within northern portions of the unit.

Management Direction

Existing Wildlife Management Plans

- Direction in the Yukon–Tanana, Sixtymile Butte, and Little Tok moose management plans (ADF&G 1976) has been reviewed and modified through public comments, staff recommendations, and Board of Game actions over the years. A record of these changes can be found in the division's management report series. The plan portion of this report contains the current management plan for moose in Unit 12.
- Upper Yukon–Tanana intensive management plan (included moose during RY10–RY13; Alaska Fish and Game Laws and Regulations Annotated, 2013–2014: 5 AAC 92.113[b]).

Goals

During RY10–RY14 (and since RY89), the Unit 12 moose management goals were as follows:

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

G2. Continue sustained opportunity for subsistence use of moose.

G3. Maximize sustained opportunities to participate in hunting moose.

G4. Maximize opportunities for nonconsumptive use of moose.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The Unit 12 moose population has a positive customary and traditional use finding, as determined by BOG, with an amount necessary for subsistence uses of 60–70 moose.

Intensive Management

The Unit 12 moose population is identified by BOG as important for providing high levels of harvest for human consumptive use and has the following intensive management (IM) objectives:

- Maintain a population of 4,000–6,000 moose.
- Maintain a harvest of 250–450 moose annually.

MANAGEMENT OBJECTIVE

- Maintain a minimum posthunting sex ratio of 40 bulls:100 cows east of the Nabesna River and a minimum ratio of 20 bulls:100 cows in the remainder of the unit.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Population abundance and composition.

Data Needs

Estimates of population abundance and composition are important components of moose management. Population abundance estimates are necessary to determine whether IM population objectives are met, estimate sustainable yield, and monitor the population in response to different management actions. Composition estimates are used to assess the influence of harvest on the male component of the population (adult bull:cow ratio) and to compare to the bull:cow ratio management objectives. Furthermore, the composition data are used to assess recruitment (calf:adult cow ratio), which accounts for a combination of parturition and calf mortality during the first 5–6 months.

Methods

Composition was estimated within a 234 mi^2 trend count area within the upper Tok River in 2010. During 2011–2014, Unit 12 moose abundance and composition were estimated using the geospatial population estimator (GSPE) method (Ver Hoef 2001, 2008; Kellie and DeLong 2006). Areas surveyed included 1,602 mi^2 in the Nabesna Road vicinity (of which approximately 618 mi^2 was located within Unit 12) in 2011; the 2,701 mi^2 northwestern and 2,954 mi^2 southeastern Unit 12 survey areas in 2012; the Robertson river drainage in 2013 (portions within both Unit 12 and 20D; 275 mi^2); and 3,551 mi^2 within the range of the Chisana caribou (*Rangifer tarandus*) herd (of which approximately 1,640 mi^2 was located within Alaska in Unit 12) in 2014

(Fig. 1). It is important to note that although the total area surveyed sums to an amount greater than the total amount of estimated moose habitat in Unit 12 (~6,000 mi^2), portions of each survey area are located >4,500 feet in elevation (thereby not considered to be moose habitat), and portions of the southeastern Unit 12, Chisana, and Nabesna Road survey areas overlapped. This is likely the first report period in which virtually all moose habitat within the unit was surveyed using the GSPE technique.

Sample units (SU) in all survey areas were stratified as high density if they were likely to contain >3 moose, and survey conditions for each SU were rated as either poor, fair, good, or excellent based upon snow (age and cover), light (intensity and type), and wind (strength and turbulence). Unless noted otherwise, all surveys were completed using PA-18 Piper Super Cub aircraft. For the GSPE surveys, population and ratio estimates (along with 90% binomial confidence intervals [CI]) were calculated using the GSPE software (DeLong 2006), and all population estimates were reported as an "observed" estimate due to the lack of a survey-specific sightability correction factor.

RY10

Composition was estimated in a 234 mi^2 area in the Tok river drainage upstream of the Tok Cutoff Highway by surveying all high density GSPE SUs (n = 17; 103 mi^2) on 21 November. For the SUs in which survey conditions were recorded (10 of 17), 2 and 8 were recorded as excellent and fair, respectively. In general, snow cover was complete, snow age was >1-week old, and there was little to no snow or frost remaining on the spruce trees. Overall search time, when taking into account the estimated proportion of moose habitat in each SU (e.g., if a SU was estimated to have 80% moose habitat, it was assumed that 20% of the SU was not flown), averaged 6.0 min/mi^2. Total flight time (including ferry time) was 10.2 hours. Composition was estimated based upon the raw data collected (e.g., bull:cow ratio was estimated based upon the total number of bulls observed:total number of cows observed).

RY11

In conjunction with the National Park Service (NPS), the GSPE method was used to survey 81 (50 high density and 31 low density; 499 mi^2) of 260 SUs in the Nabesna Road vicinity in Units 11, 12, and 13C during 21 November–3 December. Stratification was completed during 21–25 November, and the survey took place during 28 November–3 December. The survey area, which included areas accessible to moose hunters along the Nabesna Road and adjacent trail system, was delineated by using moose distribution and movement patterns between the rut in October and survey season in late November from 22 adult moose (11 cows and 11 bulls) radiocollared in the Nabesna Road area in October 2011 (T. Bentzen, Wildlife Biologist, ADF&G, memorandum 15 March 2012, Tok). For the SUs in which survey conditions were recorded (54 of 81), 4, 48, and 2 were recorded as excellent, good, and fair, respectively. Snow cover was complete in all units.

Although search time was recorded for all 81 SUs surveyed, percent habitat was only recorded for 56 SUs. Search time per SU with 100% moose habitat averaged 4.8 min/mi^2 (n = 23), while overall search time, when taking into account the estimated proportion of moose habitat in each SU, averaged 5.3 min/mi^2. Total flight time, including stratification and ferry time, was 78 hours.

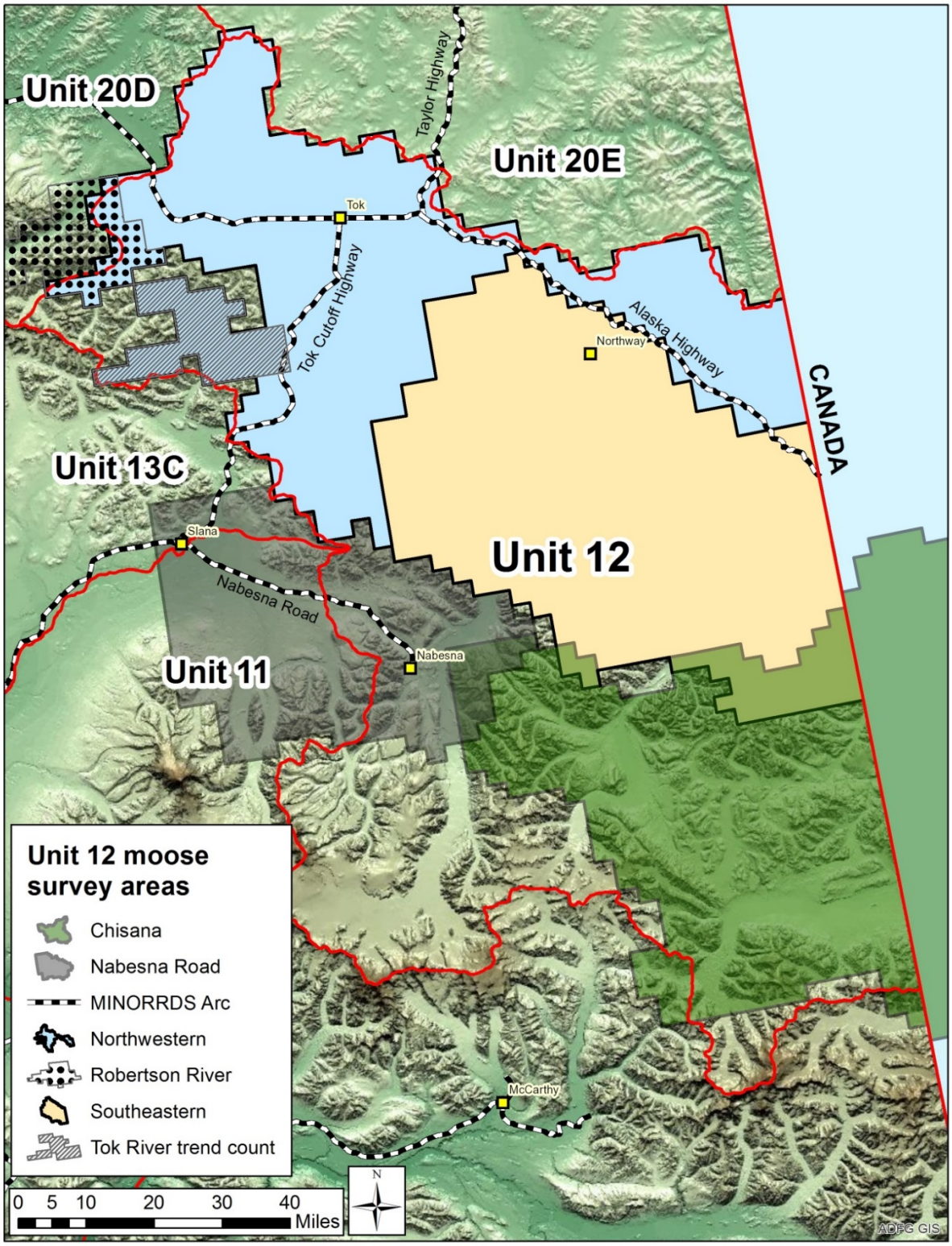

Figure 1. Moose survey areas in Unit 12, Interior Alaska, regulatory years[a] 2010–2014.

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).

RY12

The GSPE method was used to survey 80 (48 high density and 32 low density; 482 mi^2) of 449 SUs in the northwestern Unit 12 survey area during 6–9 November. For the SUs in which survey conditions were recorded (30 of 80), 13 and 17 were recorded as excellent and good, respectively, and snow cover was complete throughout the survey area. Search time per SU with 100% moose habitat averaged 6.7 min/mi^2 (n = 50), while overall search time, when taking into account the estimated proportion of moose habitat in each SU, averaged 7.4 min/mi^2. Total flight time, including ferry time, was 63.3 hours.

Tetlin National Wildlife Refuge (Tetlin NWR) staff also used the GSPE method to survey 80 (50 high density and 30 low density) of 482 SUs in the southeastern Unit 12 survey area during 31 October–16 November.

RY13

The GSPE method was used to survey 28 (24 high density and 4 low density; 168 mi^2) of 46 SUs within the Robertson river drainage upstream of the confluence of the east and west forks during 18–19 November. Eleven of the 28 SUs surveyed were in Unit 12, while the remaining SUs were in Unit 20D. The primary reason for conducting this survey was to estimate the bull:cow ratio within the drainage due to concerns by the public that the harvest in this area had increased above sustainable levels; therefore, all high SUs were surveyed (n = 24) along with a random sample of 4 of the low SUs. This allowed for composition, but not population abundance (due to an inadequate sample size of low SUs) to be estimated using the GSPE software. For the SUs in which survey conditions were recorded (27 of 28), 10, 14, and 3 were recorded as excellent, good, and fair, respectively. Overall search time, when taking into account the estimated proportion of moose habitat in each SU, averaged 9.9 min/mi^2 (no SUs had 100% moose habitat). Total flight time, including ferry time, for the Unit 12 portion of the survey was 8.4 hours.

RY14

The GSPE method was used to survey 160 (101 high density and 59 low density; 1,004 mi^2) of 566 SUs within the range of the Chisana caribou herd during 9–23 November. This survey was conducted in part to address objective 5, strategy 5.3 in the Chisana caribou herd management plan (Chisana Caribou Herd Working Group 2012; hereby referred to as "the plan"), which recommended conducting a moose survey within the life of the plan (2010–2015) in order to further the understanding of predator-prey relationships within the range of the caribou herd. All areas of moose habitat within the range were included in the survey, with the exception of the area east of Beaver Creek (and east of the White River), where radiocollared Chisana caribou had not been located since prior to 1995. The total survey area included 3,551 mi^2, of which 1,640 mi^2 was within Alaska in Unit 12, with the remaining portion in the Yukon Territory, Canada. Funding for the survey was provided by the NPS, ADF&G (through a cooperative agreement with funding provided by NPS through the Pacific Northwest Cooperative Ecosystem Studies Unit, Task Agreement #P14AC01344), and Environment Yukon.

Of 566 moose survey units (SUs) in the survey area, 308 had not been surveyed using the GSPE method. These SUs were stratified during 9–11 November with 2 Cessna 185s using 2 observers

in addition to the pilot in each aircraft. Additional SUs were stratified but were removed from the survey area due to lack of moose habitat within the unit. A simple random sample of 128 SUs (80 high density and 48 low density) were selected using Microsoft Excel® software, and an additional 32 SUs (20 high density and 12 low density) were selected to fill gaps in randomized coverage. Surveys were flown with 3 PA-18 Super Cubs and 1 CubCrafters Top Cub.

For the SUs in which survey conditions were recorded (155 of 160), 28, 69, 57, and 1 were recorded as excellent, good, fair, and poor, respectively. Suboptimal survey conditions were largely a result of snow cover and snow age. Although snow cover was complete in some areas, portions of the survey area, particularly those portions within the upper Beaver Creek and lower White river drainages, had poor snow cover. This was partially due to low snowfall prior to the survey. However, some of these areas are prone to strong winds and typically have poor snow cover even when surrounding areas have good snow conditions. Furthermore, warm temperatures during the survey, particularly at higher elevations, created patchy snow conditions on some south facing slopes. Lastly, with the exception of the final day of surveying, snow age was greater than 1-week old.

Search time per SU with 100% moose habitat averaged 6.1 min/mi^2 (n = 59), while overall search time, when taking into account the estimated proportion of moose habitat in each SU, averaged 7.05 min/mi^2. Total flight time for all flights was 141.4 hours, including 20.3 hours for stratification (including 10.5 hours with the NPS Cessna 185) and 121.1 hours of survey time (including 25.4 hours with the USFWS Top Cub).

Unitwide Population Estimate

In order to compare population estimates to the Unit 12 intensive management population objective, the following equation was used to estimate a probable population range for all of Unit 12 during this report period:

$$Pop_{12} = Pop_{NW–SE} + Pop_{Nabesna} + POP_{Chisana}$$

Where

Pop_{12} = Observable moose population estimate for Unit 12 during RY10–RY14.

$Pop_{NW–SE}$ = Upper or lower 90% CI of the observable moose population estimate for the combined northwestern and southeastern survey areas (5,560 mi^2) during 2012.

$Pop_{Nabesna}$ = Upper or lower 90% CI of the observable moose population estimate in the 642 mi^2 portion of the Nabesna Road survey area located within Unit 12 during 2011. Only that portion of the survey area that did not include any area of overlap with the northwestern or southeastern Unit 12 survey areas was used.

$POP_{Chisana}$ = Upper or lower 90% CI of the observable moose population estimate in the 1,311 mi^2 portion of the Chisana survey area located within Unit 12 during 2014. Only that portion of the survey area that did not include any area of overlap with the southeastern Unit 12 or Nabesna Road survey areas was used.

Although the sum of the total square mileage of all of these areas exceeds the estimated 6,000 mi^2 of moose habitat in Unit 12, portions of each survey area include non-moose habitat.

Results and Discussion

The Unit 12 moose population was likely within or greater than the IM population objective of 4,000–6,000 moose during RY10–RY14. The unitwide observable November moose population estimate during RY10–RY14 was 4,492–6,444. However, it is important to note, as described above, that this estimate includes information from several surveys spread out over multiple years. Furthermore, a Unit 12 sightability correction factor is not available. Therefore, this estimate should be considered a rough approximation of the Unit 12 moose population. However, considering that all available moose habitat in Unit 12 was included in these surveys, and a sightability correction factor would result in a higher estimate than the observable moose estimate, it is very likely the Unit 12 moose population was greater than the minimum IM population objective of 4,000 moose.

Since each survey area was only surveyed once during RY10–RY14, it is not possible to determine population trend specific to this reporting period. Even when the timeframe is expanded beyond this reporting period, population trend is difficult to assess since surveys have typically been conducted only every 3–4 years. However, based upon survey information from 2008, it is likely that the moose population within southeastern and northwestern Unit 12 has been relatively stable (Table 1). The observable moose population estimate between 2008 and 2012 was similar for both survey areas, and calf:cow ratios were at moderate levels ranging 18–35 calves:100 cows.

Bull:cow ratios during RY10–RY14 were greater than the management objectives of 40 bulls:100 cows east of the Nabesna River and 20 bulls:100 cows in the remainder of the unit (Table 1). The 2012 bull:cow ratio estimate for that portion of southeastern Unit 12 east of the Nabesna River was 46:100 (±10.1, 90% CI). Bull:cow ratios were highest within the Chisana and southeastern Unit 12 survey areas, both of which are relatively difficult to access and are lightly hunted. Conversely, bull:cow ratios were lower in areas more accessible to hunters (e.g., within northwestern Unit 12 and along the Nabesna Road), although bull:cow ratios in these areas remained above the management objective. The bull:cow ratio estimate within northwestern Unit 12 decreased from 46 bulls:100 cows in 2008 to 29 bulls:100 cows in 2012, although the decrease was not statistically significant (based on 90% CI). The northwestern Unit 12 population estimate and the unitwide harvest, hunters, and harvest distribution remained stable during RY08–RY12; therefore, if the bull:cow ratio truly declined, the mechanism for the decrease is unknown. The antler restrictions that have been in place in the upper Tok River since RY06 continue to be effective at maintaining the bull:cow ratio above the objective. However, since bull:cow ratio estimates within the upper Tok River during RY08–RY12 were greater than the management objective and ranged from 29 to 39:100, it may be possible to increase hunter opportunity (e.g., via a limited number of any-bull draw permits or extending the season) while still maintaining the ratio above the management objective.

Table 1. Moose composition and population estimates in Unit 12 moose survey areas, Interior Alaska, fall 2008–2014[a].

Survey area	Year	Size of survey area (mi^2)	Bulls:100 cows[b]		Calves:100 cows[b]		Yearling bulls:100 cows[b]		Total moose observed	Observable moose density estimate[b]		Observable moose population estimate[b]	
Chisana[c]	2014	3,551	49	(8.8)	14	(3.9)	7	(2.6)	410	0.32	(0.06)	1,137	(216)
Chisana – Alaska portion	2014	1,640	50	(10.0)	11	(3.3)	6	(2.7)	260	0.41	(0.09)	673	(155)
Nabesna Road[d]	2011	1,602	35	(9.5)	26	(7.1)	3	(1.3)	551	0.79	(0.13)	1,262	(216)
Northwestern Unit 12[e]	2008	2,702	46	(14.5)	35	(9.0)	15	(5.4)	1,117	1.19	(0.21)	3,225	(581)
	2012	2,702	29	(8.3)	27	(7.2)	6	(2.1)	818	1.13	(0.14)	3,058	(367)
Robertson River[f,g]	2013	275	33	(8.5)	24	(7.3)	8	(3.5)	240				
Southeastern Unit 12[h]	2008	2,954	62	(16.7)	24	(5.3)	14	(3.7)	633	0.62	(0.12)	1,843	(359)
	2012	2,954	52	(14.0)	18	(5.2)	9	(3.2)	699	0.55	(0.09)	1,613	(277)
Tok River[g]	2010	234	34	(7.5)	23.4	(5.9)			350				

[a] Sampled using the geospatial population estimator (GSPE) sampling method (Ver Hoef 2001, 2008; Kellie and DeLong 2006).
[b] Ninety percent confidence interval, plus and minus the estimate, in parentheses.
[c] Survey area includes portions in Alaska (Unit 12) and in Yukon Territory, Canada.
[d] Survey area includes portions of Units 11, 12, and 13C mostly within the Wrangell-St. Elias National Park and Preserve.
[e] Survey area includes state and private lands in northwestern Unit 12. Survey conducted by Alaska Department of Fish and Game.
[f] Survey area includes portions of Units 12 and 20D.
[g] Due to the small survey area, the GSPE method could not be used to estimate population abundance.
[h] Survey area includes federal and private lands in eastern and southern Unit 12. Survey conducted by U.S. Fish and Wildlife Service, Tetlin National Wildlife Refuge.

Since population and composition surveys in Unit 12 are typically conducted once every 3–4 years, determining and detecting trend is difficult. If this frequency of surveys is continued, it may be difficult to observe a change that necessitates management action and respond in a timely manner (e.g., bull:cow ratios falling below management objectives). Therefore, survey frequency, especially of lower-intensity surveys intended to estimate composition as opposed to population size, should be increased during the next report period.

Recommendations for Activity 1.1.

Continue and modify.

- Conduct high-intensity GSPE surveys within southeastern and northwestern Unit 12 every 3 years.
- During years in which a high-intensity GSPE survey is not conducted within northwestern Unit 12, conduct a low-intensity GSPE survey within a portion of the survey area to allow for more accurate and timely assessment of changes and trends in composition and population estimates.
- Utilize memos to archive details of future abundance and composition surveys to reduce detail in the methods and results of management reports.

2. Mortality–Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor and analyze harvest data and other mortality.

Data Needs

Harvest data are a necessary component to ensure harvest remains within sustainable yield and to determine whether the IM harvest objective has been achieved.

Methods

Annual harvest was estimated from mandatory harvest report cards and reported potlatch harvest. During RY10–RY14 this included data from the registration hunt RM291 in southern Unit 12 along the Nabesna Road and the general season hunt in the remainder of the unit. If timely harvest reports were not received, general season hunters received 1 reminder letter, and RM291 hunters received 2 reminder letters, an e-mail (if an email address was provided by the hunter), and in some situations, a telephone call. Potlatch permittees received 1 or more reminder telephone calls.

Results and Discussion

Harvest by Hunters

Total reported annual harvest during RY10–RY14 averaged 124 moose per year when reported potlatch harvest was not included and 133 moose per year when reported potlatch harvest was included (Table 2), both of which are well below the IM harvest objective of 250–450 moose per year. With the exception of RY13, annual moose harvest increased during this report period, and the reported general season and registration permit harvest of 169 moose during RY14 was the

highest reported harvest during the last 25 years. Similar to other areas of Interior Alaska, harvest was low during RY13, likely due at least in part to a very warm fall hunting season. Unreported and illegal harvest was not estimated during this report period.

Hunter Residency and Success

With the exception of RY13, when the reported success rate was 16%, success rates during RY10–RY14 were relatively stable and ranged 22–25% (Table 3). Overall, the total number of moose hunters who reported hunting in Unit 12 increased during RY10–RY14. The reported number of moose hunters in Unit 12 during RY13 and RY14 was the highest reported during the last 25 years.

Alaska Board of Game Actions and Emergency Orders

In March 2012 BOG replaced the general season hunt for the portion of Unit 12 within the Nabesna river drainage west of the east bank of the Nabesna River upstream from the southern boundary of the Tetlin NWR with a registration hunt (RM291) for residents and nonresidents. The change to a registration hunt also included that portion of Unit 11 east of the east bank of the Copper River upstream from and including the Slana river drainage; therefore, season dates and antler restrictions were aligned for Units 11 and 12 along the Nabesna Road.

Recommendations for Activity 2.1.

- Continue to monitor total harvest for comparison with the IM harvest objective.
- Recommend to BOG to lower the IM harvest objective from 250–500 to 120–300 (3–5% of the IM population objective).

3. Habitat Assessment–Enhancement

ACTIVITY 3.1. Habitat enhancement.

Data Needs

The Tok river drainage is an important area for the Unit 12 moose population, both in terms of habitat and harvest. First, past research has shown that the lower Tok river valley is an important wintering area for moose (Kelleyhouse 1983). Both migratory and nonmigratory moose winter within the lower Tok river valley, with the migratory portion typically traveling to areas south of the Alaska Range (Unit 13C) to calve and to areas within the upper Tok River to rut. Second, a considerable amount of the annual moose harvest in Unit 12 occurs within the Tok river drainage ($\bar{x}$ = 29% of the total harvest during RY11–RY12 whereas this area represents 9% of the total Unit 12 area). Therefore, attempts to maintain or increase the moose population within the Tok river valley are important in light of achieving the IM population and harvest objectives. One habitat enhancement project was continued and one project was initiated within the lower Tok river valley during RY10–RY14.

Table 2. Unit 12 reported moose harvest, Interior Alaska, regulatory years[a] 2010–2014.

Regulatory year	General season reported harvest		Registration permit (RM291) reported harvest[b]	Total general and registration reported harvest	Potlatch reported harvest			Total reported harvest
	Male	Unk	Male		Male	Female	Unk	
2010	109	0	n/a	109	0	0	0	109
2011	112	0	n/a	112	1	5	2	120
2012	119	1	7	127	2	4	0	133
2013	91	1	9	101	2	2	3	108
2014	160	0	9	169	19	6	0	194

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).
[b] RM291 initiated in RY12. Although RM291 includes portions in both Units 11 and 12, only that harvest from Unit 12 is included in this table.

Table 3. Unit 12 moose hunter residency and success, Interior Alaska, regulatory years[a] 2010–2014.

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
2010	44	47	18	0	109 (22)	206	162	27	2	397 (78)	506
2011	46	39	27	0	112 (23)	189	151	26	2	368 (77)	480
2012	33	59	34	1	127 (22)	213	199	39	2	453 (78)	580
2013	36	39	25	1	101 (16)	226	254	45	1	526 (84)	627
2014	58	73	38	0	169 (25)	218	222	54	3	497 (75)	666

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).
[b] Residents of Units 12, 20E, and eastern Unit 20D are considered local residents. Local residents mainly live at Eagle, Chicken, Boundary, Northway, Tetlin, Tok, Tanacross, Slana, and Dot Lake.

3.1.1 Beginning in 1998, ADF&G personnel worked in cooperation with the Alaska Department of Natural Resources-Division of Forestry (DNR-DOF) to determine suitable timber harvest sites ranging from 20 to 80 acres in size within an 880-acre timber sale area in the Tok river valley. Potential harvest areas were selected based on numbers of marketable trees, historic winter moose use, and the potential to regenerate quality moose browse species, while the intent following harvest was to scarify sites as warranted to encourage hardwood regeneration and leave some late-seral features to simulate natural disturbance and succession (DNR 2003).

3.1.2 In 1990, the Tok River fire burned approximately 155 mi^2 of primarily black spruce muskeg in the Tetlin Hills and lower Tok river valley. Subsequently, moose browse quality and availability improved, and the moose density within the burned area increased during the 1990s (Gardner 1998). The burn is now dominated by quaking aspen and although it is expected to continue to provide winter moose browse for the next 5–10 years, browse availability will decrease as the burn ages. Therefore, in cooperation with the Ruffed Grouse Society and DNR-DOF, efforts began in RY14 to create regenerating patches of aspen and willow within the burn for moose browse and grouse habitat.

Methods

3.1.1 The original intent of the project was to scarify timber harvest sites during spring–fall (when the ground was not frozen) using 1 of 3 methods: disk-trencher, dozer blade, or fire.

3.1.2 Efforts to create aspen and willow regeneration were focused within an approximately 8,000-acre area of state land southeast of Tok that burned in the 1990 Tok River fire (Fig. 2). Aspen-dominated stands were identified through a variety of methods, including satellite imagery, aerial photos taken by a drone, observations from the air via fixed-wing and rotor aircraft, and trips on the ground. Once aspen stands were identified, habitat enhancement sites ranging in size from 2 to 46 acres ($\bar{x}$ = 17 acres; n = 42 sites; total acres = 721 acres) with a maximum width of 300 meters were identified using ArcGIS™ software (Esri, Redlands, California). For sites ≥20 acres, islands of untreated forest ranging in size from 1 to 2 acres were identified within the approximate center of each site. The purpose of the islands was to both provide cover for wildlife and to reduce long shooting lanes. In addition, a minimum buffer of 100 meters was left between treatment sites. The treatment prescription was to rollerchop sites during the dormant season using a D5 or D6 dozer, and rollerchopping began in spring 2015. Prior to rollerchopping, photos were taken in the 4 cardinal directions from the center of the site at a predetermined GPS point to allow for photo documentation post-treatment.

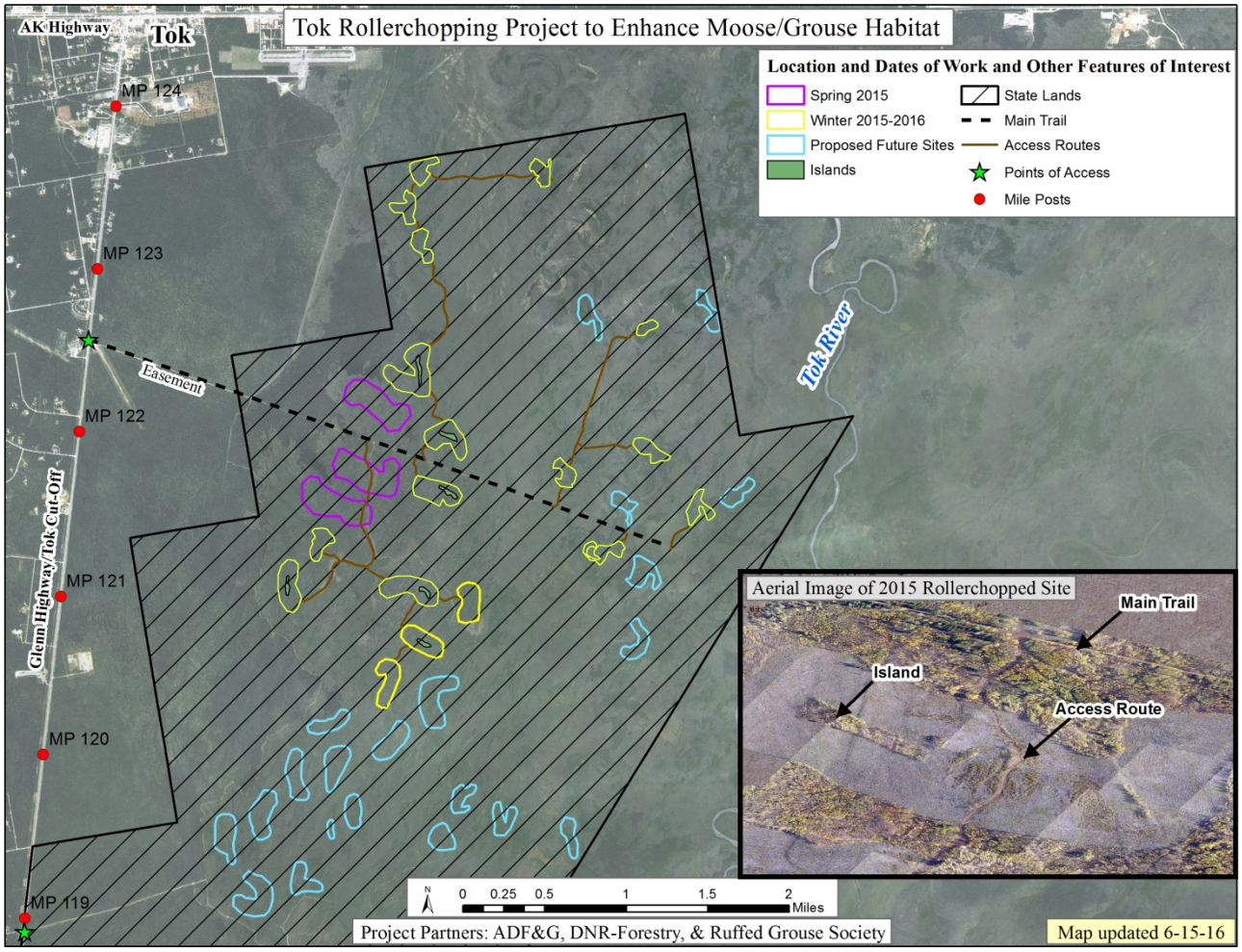

Figure 2. Moose and grouse habitat enhancement project in the lower Tok river valley in Unit 12, Interior Alaska. Shown on the map are areas that were rollerchopped during regulatory years[a] 2014 and 2015 and areas that are planned to be rollerchopped during regulatory years 2016–2018. The rollerchopping is being conducted to promote aspen and willow regeneration within areas burned during the 1990 Tok River wildfire.

[a] Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2014 = 1 July 2014–30 June 2015).

Results and Discussion

3.1.1 Timber harvest within the Tok River timber sale begin in winter 2008 and harvest was ongoing during RY10–RY14. Eighty-eight acres were scarified using a disk-trencher or blade during spring–summer 2010–2012, but several issues were encountered, including the inaccessibility of the harvest units during spring–fall. As a result, scarification attempts were abandoned following summer 2012.

3.1.2 Three sites ranging in size from 40 to 46 acres and totaling 130 acres were rollerchopped during March 2015 (Fig. 2). Snow levels ranged approximately 12–18 inches, and temperatures varied from −20°F to +40°F. Although the aspen and willow still broke at warmer temperatures (e.g., ≥20°F), overall breakage was poor and pieces several feet in length were often left sticking out of the ground. Results were excellent in the areas rollerchopped during subzero temperatures.

Recommendations for Activity 3.1.

3.1.1 Scarification in timber harvest sites in the Tok River timber sale: Discontinue. This project was discontinued following difficulties that arose during scarification attempts during spring–summer 2010–2012.

3.1.2 Rollerchopping to promote aspen and willow regeneration within the 1990 Tok River fire: Continue. Funding is available to complete the identified treatment sites during RY16–RY18.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Potlatches are culturally important and common in many of the communities in and near Unit 12, and moose are often the preferred species for the potlatches. Reported annual potlatch harvest of moose during RY10–RY14 accounted for 7% of the total reported harvest and 100% of the reported cow harvest (Table 2); however, potlatch reporting has historically been poor and each year a large portion of potlatch permits remained unreported. For example, 45% (24 of 53) and 68% (21 of 31) of permits during RY05–RY09 and RY10–RY12, respectively, remained unreported. Therefore, additional efforts to improve potlatch harvest reporting (e.g., additional phone calls to permittees following the potlatch if a report was not received) were initiated beginning in RY13, and only 26% (5 of 19) of permits remained unreported during RY13–RY14. Although potlatch harvest likely has little influence on unitwide population dynamics, localized harvest of cows near communities and along the road system might hinder population growth in these areas. Furthermore, since potlatch harvest accounts for a portion of the annual moose harvest in Unit 12, efforts should continue to improve reporting in order to obtain accurate harvest data for the unit.

Data Recording and Archiving

- All GSPE and harvest data are stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet) server (http://winfonet.alaska.gov/index.cfm).
- All other electronic files such as survey memos, reports, and maps are located on the Tok server (S:\Wells\moose, S:\Wells\MAPS, S:\Wells\Habitat, and S:\Wells\Forestry - habitat).

All hard copy data sheets, paper files, etc. are found in the file cabinet in the conference room in the Tok office.

- Electronic copies of survey memos, reports, and maps will be stored in the WinfoNet Data Archive. Project Title: Unit 12 Moose. Primary Region: Region III.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

Population estimates during RY10–RY14 indicate that the Unit 12 moose population was likely greater than the minimum IM population objective of 4,000 moose. Surveys during this reporting period likely resulted in one of the most accurate unitwide population estimates to date due to the fact that this was the first reporting period in which all moose habitat within Unit 12 was surveyed using the GSPE method. However, due to the relative infrequency of surveys within Unit 12, population trend is difficult to assess, although data since 2008 suggest a relatively stable trend.

Reported harvest during RY10–RY14 did not meet the IM harvest objective of 250–450 moose. Difficult hunter access to portions of the unit, especially on the Tetlin NWR and on private lands, makes it unlikely that the IM harvest objective will be achieved. In addition, harvest of 250–450 moose would represent a 4–11% harvest rate if the population was between 4,000 and 6,000 moose. Based upon research conducted in Unit 20A, where reproduction and predation (especially by bears) are relatively low compared to most of the rest of Interior Alaska, sustainable harvest rates were estimated at 5% during the late 1990s and early 2000s (Boertje et al. 2007). In addition, Gasaway et al. (1992) estimated that in low-density areas where bear and wolf predation is significant, sustainable harvest likely ranges from 2% to 5%. Therefore, harvest rates in excess of 5% in Unit 12 would likely be unsustainable unless there were significant reductions in predator populations. Furthermore, given the difficult access to portions of the unit and the fact that the majority of harvest occurs in areas accessible from the Alaska and Tok Cutoff highways, the unitwide sustainable harvest rate is likely less than 5%. Therefore, a proposal should be submitted to BOG to change the IM harvest objective to 120–300 moose, which would represent a 3–5% harvest rate (based upon a 3% harvest rate of the lower population objective and 5% harvest rate of the higher population objective).

Bull:cow ratios during RY10–RY14 were greater than the management objectives of 40 bulls:100 cows east of the Nabesna River and 20 bulls:100 cows in the remainder of the unit. Antler restrictions within the upper Tok river valley have been effective at keeping the bull:cow ratio above the objective within this area, although additional opportunity (e.g., via a limited number of any-bull draw permits or extending the season) may be possible during the next reporting period. However, since reported harvest in RY14 was the highest reported during the last 25 years, it will be important to closely track bull:cow ratios during the next reporting

period. After a discussion with the local advisory committee and an investigation into bull:cow ratios in adjacent units, it was determined that the bull:cow ratio objective of 20:100 west of the Nabesna River was likely lower than what the local public would consider acceptable before instituting restrictions. Therefore, the bull:cow ratio objective will be modified for the next reporting period.

Although habitat improvement efforts within the Tok River timber sale were abandoned during this reporting period, largely due to logistical difficulties, the ongoing habitat enhancement project within the lower Tok river valley near Tok has thus far been a success. Although it will likely take several years for the aspen and willow to fully respond to the rollerchopping treatment, the project will likely aid in maintaining the western Unit 12 moose population by creating new moose browse within the area burned during the 1990 Tok River wildfire as the current habitat ages. In turn, this will help in achieving the IM population and harvest objectives.

II. Project Review and RY15–RY19 Plan

Review of Management Direction

MANAGEMENT DIRECTION AND GOALS

The current management direction and goals for Unit 12 moose are appropriate and will remain unchanged. Specifically, the goals will remain as:

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

G2. Continue sustained opportunity for subsistence use of moose.

G3. Maximize sustained opportunities to participate in hunting moose.

G4. Maximize opportunities for nonconsumptive use of moose.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

C1. Unit 12 has a customary and traditional use determination for moose with amounts reasonably necessary for opportunity for subsistence uses of 60–70 moose. This objective will be considered to be met if 4% of the midpoint of the unitwide prehunt moose population estimate (estimated once during the 5-year report period: see this document "II. Project Review and RY15–RY19 Plan | Review of Management Activities | 1. Population Status and Trend | Methods") is greater than or equal to the lower threshold of the amounts reasonably necessary for subsistence (currently 60 moose).

Intensive Management

C2. Population objective: 4,000–6,000 moose. This objective will be considered to be met if the midpoint of the unitwide prehunt moose population estimate (estimated once during the 5-year report period: see this document "II. Project Review and RY15–RY19 Plan | Review

of Management Activities | 1. Population Status and Trend | Methods") is greater than or equal to the lower threshold of the IM population objective (currently 4,000 moose).

C3. Harvest objective: 250–450 moose available for harvest. This objective will be considered to be met if 4% of the midpoint of the unitwide prehunt moose population estimate (estimated once during the 5-year report period: see this document "II. Project Review and RY15–RY19 Plan | Review of Management Activities | 1. Population Status and Trend | Methods") is greater than or equal to lower threshold of the IM harvest objective (currently 250 moose). In addition, since unitwide GSPE surveys are not regularly conducted in Unit 12, the harvest objective will also be considered to be met if 3-year mean reported harvest (including reported potlatch harvest) is greater than or equal to lower threshold of the IM harvest objective. We will consider recommending to BOG to reduce the harvest objective to 120–300 moose (3–5% harvest rate), which is more likely attainable and sustainable.

MANAGEMENT OBJECTIVE

M1. Maintain a minimum posthunting sex ratio of ≥40 bulls:100 cows east of the Nabesna River and ≥25 bulls:100 cows in the remainder of the unit. This objective will be considered to be met if the midpoint bull:cow ratio estimate (determined annually for each area surveyed) falls above the objective.

- Management action will be considered if the midpoint estimate falls below the objective for 2 consecutive surveys, or conversely, if the midpoint estimate falls above the objective for 2 consecutive surveys. Examples of possible management actions, if the bull:cow ratio falls below the objective, include shortening the season or instituting an antler restriction. If the bull:cow ratio falls above the objective, possible management actions could include lengthening the season or relaxing an antler restriction.

The bull:cow ratio objective for the remainder of Unit 12 is revised for RY15–RY19 and is a change from the previous objective of a posthunting ratio of 20 bulls:100 cows. After a discussion with the Upper Tanana–Fortymile Fish and Game Advisory Committee in March 2016 and an investigation into bull:cow ratios in adjacent units, it was determined that the bull:cow ratio objective of 20:100 west of the Nabesna River was likely lower than what the local public would consider acceptable before instituting restrictions. In addition, surrounding units had bull:cow ratio objectives that were significantly higher that 20:100 (objectives in surrounding units currently range 30–40 bulls:100 cows).

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. GSPE surveys: Population abundance and composition (objectives C1, C2, C3, M1).

Data Needs

Data needs are the same as those described during the prior reporting period, with the addition that abundance and composition estimates are necessary on a more frequent basis to better

evaluate trend and/or detect change in response to changing harvest or other management actions. Furthermore, the desired relative precision (RP) for all survey areas for observable moose population estimates is within 15–20% of the mean at the 90% CI, and for composition estimates (calf:cow and bull:cow ratios) within 20–30% of the mean at the 90% CI.

Methods

The GSPE technique will be used to complete all population and composition surveys (see this document "I. RY10–RY14 Management Report | Management Activities | 1. Population Status and Trend | Methods"; Kellie and DeLong 2006).

RY15

Although the plan was to complete a GSPE survey within the northwestern Unit 12 survey area, poor snow cover persisted through November, and the survey was not completed. In addition, the Tetlin NWR had plans to complete the southeastern Unit 12 survey area, but this survey was also not completed.

RY16

Complete a GSPE survey within the northwestern Unit 12 survey area. To determine sample allocation for this survey, estimated sample variances from the RY08 and RY12 moose surveys were used to optimally allocate sampled SUs between strata and estimate a sample size sufficient for attaining an estimate of observable moose with an RP of 15% at the 90% CI. Using data from the RY08 survey, a sample size of 112 SUs was estimated as necessary with an optimal allocation of approximately 50% high:50% low SUs, while using data from the RY12 survey suggests a sample size of 97 SUs as necessary with an optimal allocation of approximately 50% high:50% low SUs. However, due to budgetary constraints and the overall precision goal to estimate observable moose with an RP of between 15% and 20% of the mean at the 90% CI, the sample size for the RY16 survey will likely be closer to 80 with an allocation of approximately 60% high:40% low SUs. The RY08 and RY12 surveys had relatively low precision due to inaccurate stratification in some of the SUs, especially in those SUs designated as low-density. Therefore, stratification flights within portions of the survey area prior to the initiation of the RY16 survey should help increase the precision of the survey, even with a lower sample size of SUs than was estimated as necessary based upon the RY08 and RY12 data. The Tetlin NWR is also planning to complete a GSPE survey within the southeastern Unit 12 survey area.

To ensure that high scientific standards are retained, input from biometric staff will be sought to interpret results of these surveys.

RY17 and RY18

We plan to complete a low-intensity GSPE survey within the condensed northwestern Unit 12 survey area. The condensed survey area includes approximately two-thirds of the entire northwestern Unit 12 survey area. This condensed survey is new and is being added to better assess composition and population trend within the most heavily hunted portion of the unit. The previous survey frequency of every 3–4 years was likely too infrequent to adequately detect and react to changes in the population. This is especially important given the increase in harvest and

hunters during recent years. In addition, more frequent surveys will aid in decreasing stratification errors, which in turn will increase precision. The condensed survey area will be surveyed 1 or both years depending on survey results and hunter and harvest trends.

Based on data from those portions of the RY08 and RY12 surveys that were within the condensed survey area, a sample size of approximately 50 SUs, with an allocation between 60–70% high:30–40% low, was estimated as necessary to estimate bull:cow ratios with an RP within 20–25% at the 90% CI. Therefore, the total number of SUs sampled and allocation will likely be close to 50 total SUs with a ratio of 60% high:40% low; however, the final sample size and allocation will be determined based upon biometric assistance using the most up-to-date survey and variance data. To ensure that high scientific standards are retained, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this survey.

RY19

We plan to complete a GSPE survey within the northwestern Unit 12 survey area. Similar to RY17–RY18, biometric assistance will be used to determine the sample size and allocation of SUs to ensure high scientific standards are retained. In addition, the Tetlin NWR will likely complete a GSPE survey within the southeastern Unit 12 survey area.

Unitwide Population Estimate

Similar to the previous reporting period, the unitwide population will not be estimated on an annual basis but will instead be estimated for the 5-year report period as a whole. This is because not all areas can be surveyed annually in Unit 12, making annual estimates infeasible and likely inaccurate. The unitwide population estimate will be determined using a formula similar to that used during the RY10–RY14, with the exception that the estimate will change from a posthunt to a prehunt estimate by adding the average annual reported harvest to the estimate. This change is being made to allow for more accurate estimates of moose available for harvest to evaluate whether the amounts reasonably necessary for subsistence and IM harvest objectives are met. In addition, the prehunt unitwide estimate will be compared to the IM population objective.

Analyze Population and Composition Trend

- With biometric assistance, population trend will be analyzed for the northwestern Unit 12 and condensed northwestern Unit 12 survey areas using mixed effects linear models (DeLong and Taras 2009).
- With biometric assistance, composition (specifically bull:cow ratios) trend will be analyzed for the northwestern Unit 12 and condensed northwestern Unit 12 survey areas using mixed-effects linear models.

2. Mortality–Harvest Monitoring

ACTIVITY 2.1. Monitor and analyze harvest data (objectives C3, M1).

Data Needs

No change from prior reporting period. Harvest data are a necessary component to ensure harvest remains within sustainable yield and to determine whether the IM harvest objective has been achieved.

Methods

No change from prior reporting period, other than:

- Total reported harvest (including reported potlatch harvest), using a 3-year running mean to account for annual variation, will be one method used to determine whether the IM harvest objective (C3) was met (the IM harvest objective will also be assessed using the unitwide population estimate – see this document "II. Project Review and RY15–RY19 Plan | Codified Objectives | Intensive Management").
- Harvest rate will be estimated by dividing the mean annual reported harvest (including reported potlatch harvest) for the 5-year report period by the midpoint unitwide population estimate.
- Linear regression models will be used to evaluate harvest trends. To ensure that high scientific standards are retained, input from biometric staff will be sought to verify and, if needed, refine the methods prior to conducting this portion of the activity.

3. Habitat Assessment–Enhancement

ACTIVITY 3.1. Habitat enhancement (goal to protect, maintain, and enhance the moose population in concert with other components of the ecosystem).

Data Needs

No change from prior reporting period. The Tok river drainage is an important area for the Unit 12 moose population, both in terms of habitat and harvest. First, past research has shown that the lower Tok river valley is an important wintering area for moose (Kelleyhouse 1983). Both migratory and nonmigratory moose winter within the lower Tok river valley, with the migratory portion typically traveling to areas south of the Alaska Range (Unit 13C) to calve and to areas within the upper Tok River to rut. Second, a considerable amount of the annual moose harvest in Unit 12 occurs within the Tok river drainage ($\bar{x}$ = 29% of the total harvest during RY11–RY12 whereas this area represents 9% of the total Unit 12 area). Therefore, attempts to maintain or increase the moose population within the Tok river valley are important in light of achieving the IM population and harvest objectives.

Methods

RY15

Eighteen sites ranging in size from 5 to 35 acres and totaling 287 acres were rollerchopped during October 2015–March 2016. Snow levels were low throughout the winter and ranged from virtually no snow at the beginning to approximately 12 inches at peak snow depth. Temperatures varied from −20 to +40°F, and based upon the results from spring 2015, attempts were made to avoid rollerchopping when temperatures >20°F. Low snow levels and the lack of prolonged cold snaps allowed for the project to continue through the entire winter.

RY16–RY19

Rollerchopping efforts will continue within the remaining 21 identified treatment sites (303 acres) during RY15–RY18 using the methods described in the prior reporting period. Attempts will be made to limit rollerchopping efforts to times when temperatures are ≤20°F.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Efforts will continue to further improve potlatch reporting. In addition to reminder phone calls to permittees, additional efforts might include communicating with local communities during village council meetings, traditional knowledge workshops, etc. about the importance of accurate harvest reports and the influence of cow harvest on the moose population.

Data Recording and Archiving

RECORDING

- GSPE Moose Survey Form (archived in WinfoNet under Data Archive [folder Unit 12 moose]).
- ArcGIS version 10.3 (store and analyze spatial data).

ARCHIVING

- Harvest data and GSPE survey data will be stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet) server (http://winfonet.alaska.gov/index.cfm) and archived in WinfoNet under Harvest Information and Survey and Inventory Tools.
- All other electronic files such as survey memos, reports, and maps will be located on the Tok server (S:\Wells\moose, S:\Wells\MAPS, S:\Wells\Habitat, and S:\Wells\Forestry - habitat). All hard copy data sheets, paper files, etc. are found in the file cabinet in the conference room in the Tok office.
- In addition, survey memos, reports, and other pertinent electronic survey information (e.g., survey maps) will be archived in WinfoNet – Data Archive. Project Title: Unit 12 Moose. Primary Region: Region III.

Agreements

None.

Permitting

None.

References Cited

ADF&G (Alaska Department of Fish and Game). 1976. Alaska wildlife management plans: Interior Alaska (draft proposal; subsequently adopted by Alaska Board of Game). Division of Game, Federal Aid in Wildlife Restoration Project W-17-R, Juneau.

ADF&G (Alaska Department of Fish and Game). 2014. Annual report to the Alaska Board of Game on intensive management for moose and caribou with wolf predation control in the upper Yukon–Tanana rivers. Division of Wildlife Conservation, Juneau. http://www.adfg.alaska.gov/static-f/research/programs/intensivemanagement/pdfs/2014_uytpcp_intensive_management_annual_report.pdf (Accessed 2 February 2018).

Bentzen, T. W. 2012. Unit 12 moose. Pages 125–142 [*In*] P. Harper, editor. Moose management report of survey-inventory activities 1 July 2009–30 June 2011. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2012-5, Juneau.

Boertje, R. D., M. A. Keech, D. D. Young, K. A. Kellie, and C. T. Seaton. 2007. Managing for elevated yield of moose in interior Alaska. Journal of Wildlife Management 73:314–327.

Chisana Caribou Herd Working Group. 2012. Management plan for the Chisana caribou herd: 2010–2015. Government of Yukon Department of Environment, Whitehorse, Yukon Territory, Canada.

DeLong, R. A. 2006. Geospatial population estimator software user's guide. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. https://winfonet.alaska.gov/sandi/moose/surveys/documents/GSPESoftwareUsersGuide.pdf (Accessed 1 February 2018).

DeLong, R. A., and B. D. Taras. 2009. Moose trend analysis user's guide. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. https://winfonet.alaska.gov/sandi/trend/pdf/moose_trend_analysis.pdf (Accessed 2 February 2018).

DNR (Alaska Department of Natural Resources). 2003. Forest land use plan (amended 6 February 2003), Tok River wildlife habitat timber sale, NC-837-T. Division of Forestry, Fairbanks.

Gardner, C. L. 1998. Unit 12 moose. Pages 96–109 [*In*] M. V. Hicks, editor. Moose management report of survey-inventory activities 1 July 1995–30 June 1997. Alaska Department of

Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Study 1.0, Juneau.

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

Kelleyhouse, D. G. 1983. Unit 12 moose. Pages 45–48 [*In*] J. A. Barnett, editor. Moose annual report of survey-inventory activities 1 July 1981–30 June 1982. Alaska Department of Fish and Game, Division of Game, Federal Aid in Wildlife Restoration Study 1.0, Juneau.

Kelleyhouse, D. G. 1989. Unit 12 moose. Pages 87–95 [*In*] S. O. Morgan, editor. Moose annual report of survey-inventory activities 1 July 1987–30 June 1988. Alaska Department of Fish and Game, Division of Game, Federal Aid in Wildlife Restoration Study 1.0, Juneau.

Kellie, K. A., and R. A. DeLong. 2006. Geospatial survey operations manual. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks. https://winfonet.alaska.gov/sandi/moose/surveys/documents/GSPEOperationsManual.pdf (Accessed 1 February 2018).

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

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

Wells, J. W. 2014. Unit 12 moose. Chapter 11, Pages 11-1 through 11-17 [*In*] P. Harper and L. A. McCarthy, editors. Moose management report of survey-inventory activities 1 July 2011–30 June 2013. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2014-6, Juneau.

♦ ♦ ♦


ALASKA
DEPARTMENT OF FISH AND GAME