Species Management Report and Plan ADF&G/DWC/SMR&P–2025–22

Moose Management Report and Plan, Game Management Unit 13:

Report Period 1 July 2015–30 June 2020, and

Plan Period 1 July 2020–30 June 2025

Joelle D. Hepler

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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 public website.

This species management report and plan was reviewed and approved for publication by Todd Rinaldi, Management Coordinator for Region IV for the Division of Wildlife Conservation.

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Cover Photo: Cow moose with newborn calf. ©2007 ADF&G. Photo by Mark Emery.

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose in Unit 13 for the 5 regulatory years 2015–2019 and plans for survey and inventory management activities in the next 5 regulatory years, 2020–2024. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY15 = 1 July 2015–30 June 2016). This report is produced primarily to provide agency staff with data and analysis to help guide and record agency efforts but is also provided to the public to inform it of wildlife management activities. In 2016 the Alaska Department of Fish and Game's Division of Wildlife Conservation (DWC) launched this 5-year report to report more efficiently on trends and describe potential changes in data collection activities over the next 5 years. It replaces the moose management report of survey and inventory activities that was previously produced every 2 years.

I. RY15–RY19 Management Report

Management Area

Unit 13 encompasses 23,368 mi^2 (Fig. 1) and consists of the area west of the east bank of the Copper River. The area is drained by all tributaries into the west bank of the Copper River from Miles Glacier. These drainages include the Slana River drainages north of Suslota Creek, the drainages into the Delta River upstream from Falls Creek and Black Rapids Glacier, the drainages into the Nenana River upstream from the southeast corner of Denali National Park, the drainage into the Susitna River upstream from its junction with the Chulitna River, the drainage into the east bank of the Chulitna River upstream to its confluence with the Tokositna River, the drainages of the Chulitna River (south of Denali National Park) upstream from its confluence with the Tokositna River, the drainages into the north bank of the Tokositna River upstream to the base of the Tokositna Glacier, the drainages into the Tokositna Glacier, and the drainages into the east bank of the Susitna River between its confluences with the Talkeetna and Chulitna rivers. The area also includes drainages into the north and east bank of the Talkeetna River, including the river's confluence with Clear Creek; the eastside drainages of a line up the south bank of Clear Creek to the first unnamed creek on the south; and then up that unnamed creek to lake 4408. Unit 13 extends along the northeast shore of lake 4408, then southeast to the northernmost fork of the Chickaloon River. The area also includes the drainages into the east bank of the Chickaloon River below the line from lake 4408 and the drainages of the Matanuska River above its confluence with the Chickaloon River. Additional maps for Unit 13 boundaries and special management areas are found on the ADF&G website.[1]

Summary of Status, Trend, Management Activities, and History of Moose in Unit 13

Unit 13 has long been an important area for moose hunting in Alaska. During the late 1960s and early 1970s, annual harvests were large, averaging more than 1,200 bulls and 200 cows. Hunting seasons were long, with both fall and winter hunts. Through the 1970s and the 1980s, the moose population increased at an average annual rate of 5%, until the population peaked in 1987 with a

[1] Additional maps: http://www.adfg.alaska.gov/index.cfm?adfg=maps.main.

high of 6,892 moose observed in established trend count areas (CAs). Harvest peaked 1 year later when 1,259 moose were taken.

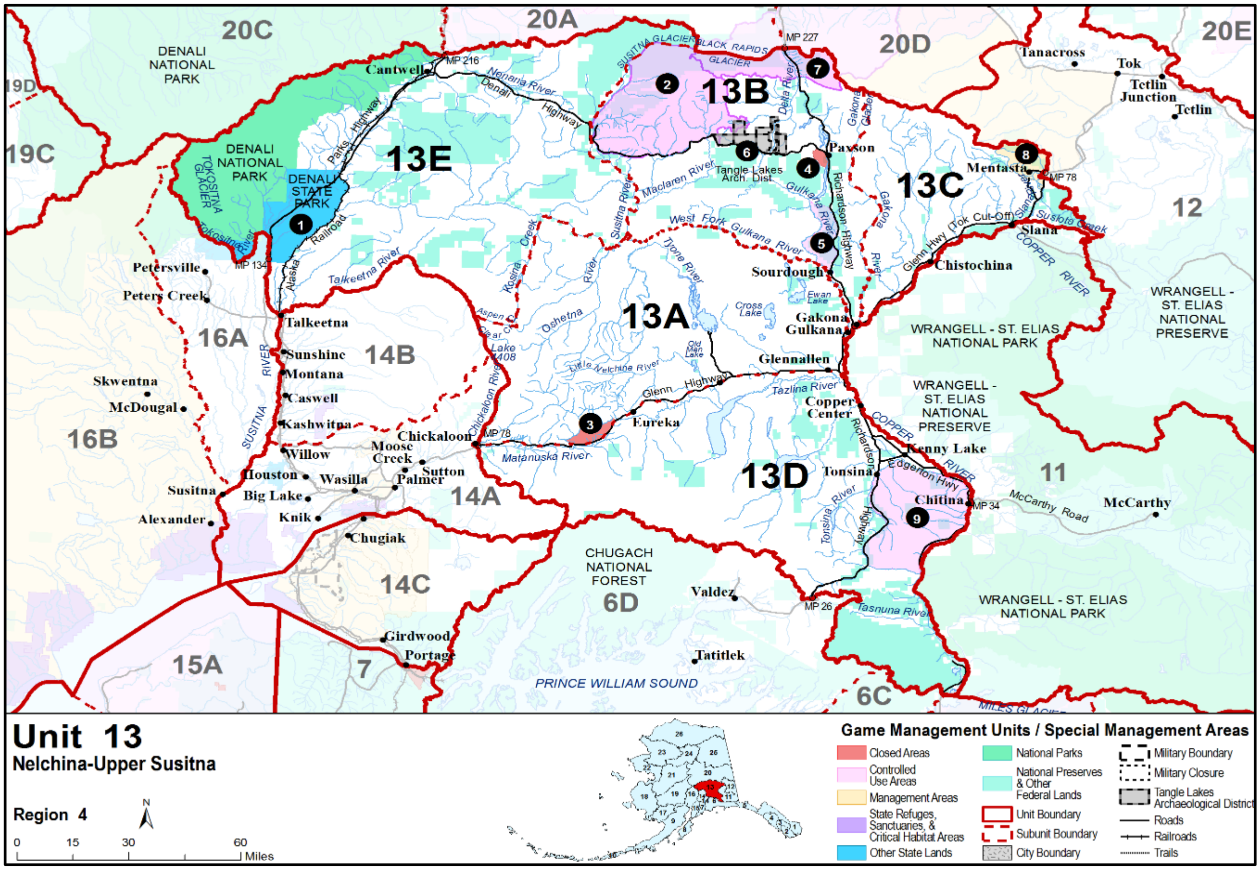

Figure 1. Unit 13 in Southcentral Alaska, regulatory years 2015–2019.

The population soon began to decline during 1988–1994, seemingly precipitated by harsh winters with deep snow. Moose harvest regulations were restricted beginning in RY90, though the population continued to decline. During fall of 1999 and 2000, unitwide wolf estimates peaked at more than 500 wolves (>3 wolves/100 mi^2 or >12 wolves/1,000 km^2), the highest in more than 25 years. Snow depths during the winters of 1999–2000 and 2000–2001 were considered severe by ADF&G biologists. Moose harvests also declined, reaching a low of 468 in RY01. From the peak population in 1988, the number of moose observed had declined by 47%.

In January 2000, an intensive management (IM) plan was initiated in Unit 13 for the benefit of moose. An increased take of wolves occurred by hunters with the new use of snowmachines, though land-and-shoot control was not activated until January 2004. The wolf population has reduced and has been held at or near objective levels since spring 2006. The moose population grew steadily until it peaked around 2015; it has since leveled off, though a slight decline started in 2017.

Management Direction

Existing Wildlife Management Plans

- Operational plan for IM of moose in Unit 13 during RY16–RY21, established in March 2016. This operational plan complements the moose IM plan in regulation (5 AAC 92.121).
- The direction in the Paxson, Nelchina Basin, Talkeetna River, Matanuska Glacier, Tonsina, and Klutina management plans (ADF&G 1976) has been reviewed and modified through public comments, staff recommendations, and Alaska Board of Game (BOG) actions over the years. A record of these changes can be found in DWC's management report series. The plan portion of this report contains the current management plan for moose in Unit 13.

Goals

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide the greatest sustained opportunity for moose harvest.
- Provide the opportunity to view and photograph moose.

Codified Objectives

Amounts Reasonably Necessary for Subsistence Uses

The Unit 13 moose population has a positive customary and traditional use determination. The unitwide amount reasonably necessary for subsistence is 300–600 moose.

Intensive Management

In 2000, BOG adopted a positive finding for IM of moose in Unit 13. Current IM objectives are as follows:

- Population objective: 17,000–21,400 moose (Table 1).
- Harvest objective: 1,050–2,180 moose (Table 1).

Table 1. Population and harvest objectives for moose in Unit 13, regulatory years 2015–2019, Alaska.

Unit	Population objective	Harvest objective
13A	3,500–4,200	210–420
13B	5,300–6,300	310–620
13C	2,000–3,000	155–350
13D	1,200–1,900	75–190
13E	5,000–6,000	300–600

There is an IM plan under 5 AAC 92.121 to benefit moose in Unit 13 which includes wolf predation control.

MANAGEMENT OBJECTIVES

In addition to the codified IM objectives above, ADF&G maintains the following population objectives for moose:

- Manage for post-hunt (fall) bull-to-cow sex ratio of 25:100, with a yearling bull-to-cow sex ratio of 10:100.
- Maintain a fall calf-to-cow ratio of 25:100 in Unit 13A.
- Maintain a fall calf-to-cow ratio of 30:100 in Units 13B, 13C, 13D, and 13E.

MANAGEMENT ACTIVITIES

Assessing population status and trends, monitoring harvest and mortality, and assessing habitat conditions are integral components of management programs in Unit 13. Survey and inventory management activities used to monitor moose populations in Unit 13 are described below.

1. Population Status and Trend

ACTIVITY 1.1. Monitor and evaluate moose abundance.

Data Needs

The geostatistical population estimation survey (GSPE) uses fixed or random sampling designs and geostatistical models of autocorrelation. This procedure provides a statistically-bound population estimate and, secondarily, population composition data if the survey is to be conducted in late fall.

Resources and weather conditions often preclude successful GSPE surveys in Unit 13. Furthermore, abundance objectives in Unit 13 were based upon abundance estimates derived from extrapolating density information from minimum trend counts conducted in established CAs in Unit 13 to comparable surrounding portions of each subunit. Total moose counts for each CA in Unit 13 were used to calculate an index of the moose population relative to moose abundance objectives for each subunit. GSPE results, when available, were compared with abundance indices to validate estimates or identify subunits for which abundance objectives or index calculations may need to be modified, or areas where adequate GSPE stratification may be difficult to achieve (Testa 2001).

Methods

During RY15–RY19, a GSPE was conducted in Unit 13B in RY15 and 13A in RY19, according to the GSPE protocol (Kellie and DeLong 2006). Minimum counts were flown in trend CAs annually, if conditions allowed, and abundance indices were derived from CA data.

Results and Discussion

For the RY15 Unit 13B survey, both a desktop stratification and a stratification flight were completed to classify 526 GSPE grid cells (a different survey type that is described in Kellie and DeLong 2006) in the unit as high or low density. The GSPE survey began in November 2015 and continued into December. The unit was broken down into 2 main areas, one northern and one southern, divided by the Denali Highway. While all 101 cells of the southern portion were fully surveyed, only 44 cells (60%) of the northern portion were surveyed. Combining the northern and southern survey areas, a total of 4,762 moose (80% confidence interval [CI] = 4,232–5,293) with an 8.5% coefficient of variation, or 1.5 moose/mi^2 (80% CI = 1.3–1.7), were estimated. When comparing the results of the Unit 13B GSPE to the composition surveys, which traditionally occurred in November, the CIs included the Unit 13B abundance index of 5,115 moose for RY15 (Table 2).

Table 2. Moose abundance indices for Units 13A–13E, regulatory years 2015–2019, Alaska.

Regulatory year	Unit 13A	Unit 13B	Unit 13C	Unit 13D	Unit 13E	Total
2015	4,653	5,115	3,978	1,063	6,281	21,090
2016	4,156	4,973	3,833	1,404	6,036	20,402
2017	3,445	4,237	2,390	1,350	6,324	17,746
2018	4,121	3,643	3,106	1,350	6,413	18,633
2019	3,968	3,845	3,588	1,201	6,394	18,997

For the RY19 GSPE survey in Unit 13A, a presurvey stratification flight was attempted but could not be completed due to weather conditions. A desktop stratification was conducted instead, which took into consideration local knowledge of moose movements and distribution in the fall and early winter to classify all 613 cells. Unfortunately, weather conditions also prevented survey activities in early winter; as such, the survey was conducted from the end of January into February 2020, and 115 cells were surveyed, representing 19% of the survey area. Due to the difficulties in stratification and the difference between moose distribution in early winter (relative to objectives) versus late winter, results suggested that the estimated moose abundance in Unit 13A is higher in the late winter than in the fall or early winter, as Unit 13A is bordered by the Glenn Highway and the Gulkana River. Both areas provide winter habitat which attracts higher densities of moose in late winter than observed in the fall or early winter. Therefore, late-winter GSPE results were not comparable to the abundance objectives for Unit 13A.

Moose abundance indices for RY15–RY19 in each subunit have been listed in Table 2. Unit 13A has remained stable over the report period, although a composition survey was not completed in this subunit in 2019 due to conducting the GSPE. Abundance indices are derived using the most recent 3-year average for an area if trend surveys are not completed in a given year. Unit 13B has experienced a slow decline in moose abundance, while the remaining subunits hold relatively stable populations. Overall, in Unit 13, the abundance index has dropped from a high of 21,090 moose in RY15 to 18,997 in RY19; however, this was well within the objectives for this area (17,000–21,400 moose).

Recommendations for Activity 1.1.

Continue.

ACTIVITY 1.2. Monitor moose sex and age composition.

Data Needs

Moose composition data are necessary to determine population status in relation to management objectives. Composition data are more informative for hunt management in maintaining bull-to-cow ratios than moose abundance data. For more than 50 years, an established group of 8 CAs have been surveyed with minimum trend counts annually, as budget and conditions allow (CAs 3, 5, 6, 10, 13, 14, 15, and 16; Fig. 2). In addition to the 8 annual CAs, 6 others are periodically flown when time and budget allow (CAs 7, 12, 17, 21, 22, and 23; Fig. 2).

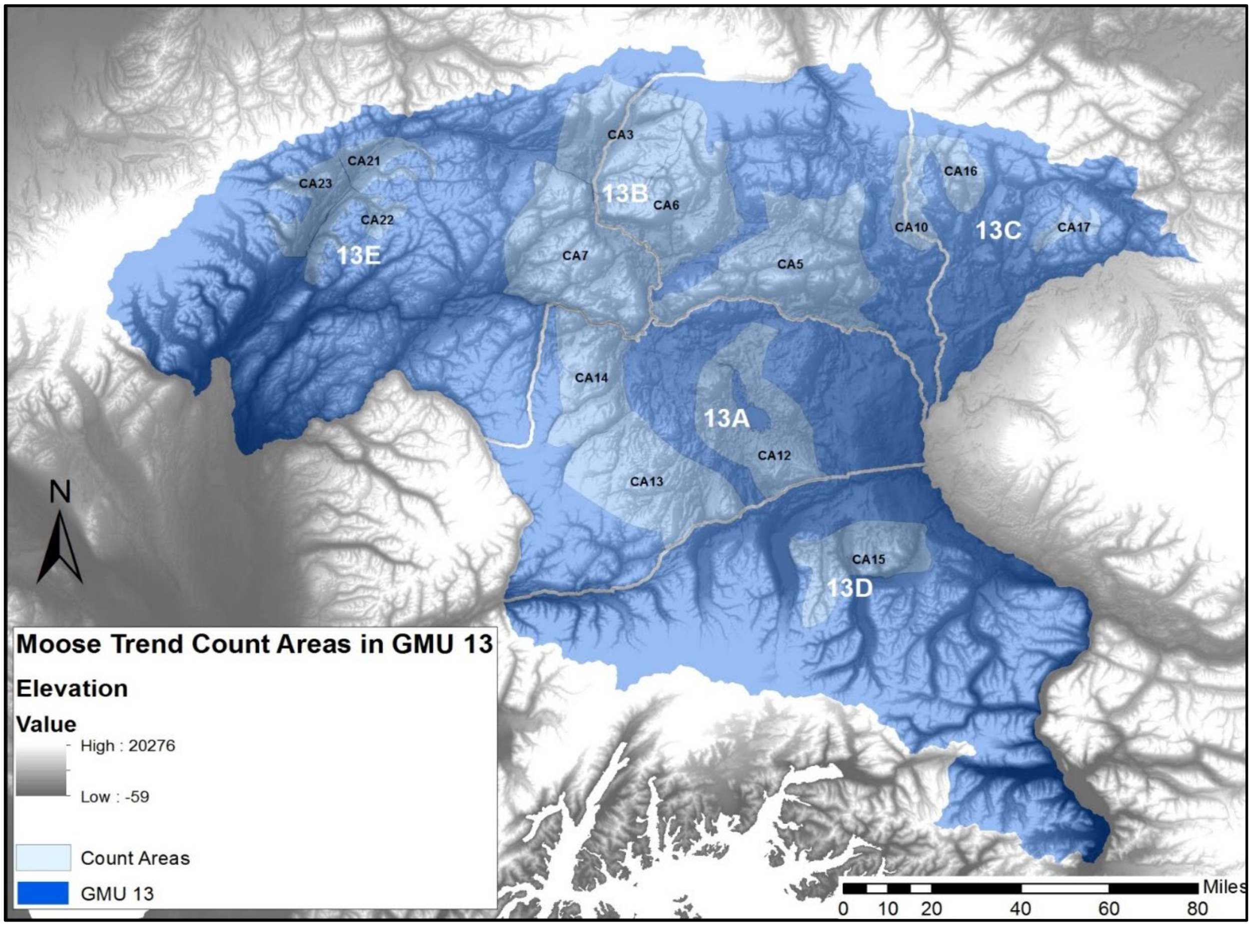

Figure 2. Moose trend count area map for Unit 13, regulatory years 2015–2019, Alaska.

CA surveys provide population composition data across large contiguous areas for each subunit, resulting in relatively high sample sizes which were more representative of population composition than observations obtained in random cells sampled during GSPE surveys.

Methods

Aerial moose surveys were conducted with fixed-wing aircraft (Piper PA-18 Super Cubs) during the fall, following sufficient snowfall and before bulls had dropped antlers, to document sex and age composition and population trends in large CAs distributed throughout Unit 13 (Fig. 2).

These surveys were repeated annually with an effort to use consistent pilots, timing, and conditions. Each moose observation was recorded on a trend count data sheet, along with age (calf, yearling bull, or adult), antler observations (spike-fork, estimated antler width, and number of brow tines), survey flight times, and survey condition data. Flight paths and waypoints for each moose observation were recorded on GPS (global positioning system) devices and saved in electronic files for each survey.

Results and Discussion

Unit 13A

Annual moose population composition ratios for Unit 13A were developed from trend count surveys flown in the western portion of the unit (CAs 13 and 14), which represented the areas of highest moose densities as well as those of highest hunting pressure for Unit 13A. During RY15–RY19, CA 13 was surveyed annually from 2015 to 2018, and CA 14 was surveyed in 2015 and 2017. Between 2015 and 2018, the bull-to-cow ratio averaged 24:100, which was similar to the previous 5-year average of 25:100 (Table 3). In 2016, there was a low bull-to-cow ratio of 19:100, but the number of bulls increased again in following years. During the report period, the calf-to-cow ratio averaged 23:100, similar to the previous 5-year average of 22:100. The average yearling bull-to-cow ratio, however, has dropped since RY10–RY14 from 8 to 5, with the lowest ratios since the early 2000s, suggesting that either the extended hunting season dates or the spike-fork antler allowance in this area does not allow an adequate number of yearling bulls to survive though the hunting season with the current level of pressure. This trend of the yearling bull proportion in the population suggests that there may be fewer bulls available for harvest in coming years.

Table 3. Unit 13A fall composition of moose, regulatory years 2015–2019, Alaska.

Regulatory year	Bull-to-cow[a]	Yearling bull-to-cow[a]	Calf-to-cow[a]	Percent calves	Adults observed	Total moose observed
2015	25	6	29	19	1,452	1,788
2016	19	5	23	16	980	1,165
2017	27	6	24	16	1,075	1,280
2018	24	3	16	11	1,019	1,150
2019	–	–	–	–	–	–

Note: En dashes indicate no data available.
[a] Ratio is per 100 cows.

Unit 13B

In Unit 13B, CAs 5, 6, and the eastern portion of CA 3 (CA 3E) were surveyed throughout RY15–RY19 for composition data. In 2016, only a partial survey was completed in CAs 5 and 3E, and in 2018, there was no survey in CA 3E. There have been declining trends in the ratios of bulls, yearling bulls, and calves per 100 cows over time (Table 4). These trends suggest that there may be factors affecting productivity within the population or affecting early survival or the recruitment of calves. Additionally, the decline in yearling bulls per 100 cows (from 8 in 2015 to 3 in 2019) may be reflective of poor survival and recruitment of calves or may indicate that the moose population is not able to support the extended season dates or spike-fork allowance under the report period's hunting pressure. The overall decline of bulls per 100 cows over time also indicates that the population cannot indefinitely support the report period's any-bull harvest that occurred in Unit 13B.

Table 4. Unit 13B fall composition of moose, regulatory years 2015–2019, Alaska.

Regulatory year	Bull-to- cow[a]	Yearling bull-to-cow[a]	Calf-to-cow[a]	Percent calves	Adults observed	Total moose observed
2015	37	8	26	16	2,261	2,683
2016	34	8	21	13	900	1,040
2017	33	7	19	13	1,971	2,255
2018	34	5	10	7	1,616	1,741
2019	29	3	17	12	1,808	2,047

[a] Ratio is per 100 cows.

<u>Unit 13C</u>

CA 10 was surveyed every year except 2016, and CA 16 was surveyed in 2015 and 2019 to classify the animals in Unit 13C during RY15–RY19. The average bulls (26), yearling bulls (5), and calves (11) per 100 cows all declined in this report period compared to RY10–RY14 (34 bulls, 8 yearling bulls, and 17 calves; Table 5).

Table 5. Unit 13C fall composition of moose, regulatory years 2015–2019, Alaska.

Regulatory year	Bull-to-cow[a]	Yearling bull-to-cow[a]	Calf-to-cow[a]	Percent calves	Adults observed	Total moose observed
2015	30	5	15	10	619	689
2016	34	7	15	10	560	624
2017	16	6	4	3	142	147
2018	21	3	11	8	231	251
2019	26	4	11	8	568	617

[a] Ratio is per 100 cows.

The continued decline of bulls to cows indicates that the level of any-bull harvest may not be sustainable over time. The decline of yearling bulls to cows may be a result of declining calves per 100 cows or may suggest that the extended season dates or spike-fork antler allowance in Unit 13C does not allow an adequate number of yearling bulls to survive through the hunting season with the report period's level of hunting pressure. The decline in calf and yearling bull metrics in this area, in combination with the relatively high moose abundance following a period of relatively low predator abundance, suggests that the population may be less productive and nutritional availability in Unit 13C should be investigated.

<u>Unit 13D</u>

CA 15 was flown every year during RY15–RY19, except for 2017 and 2018, to classify moose in Unit 13D (Table 6). The average bull-to-cow ratio was 72:100 and the average calf-to-cow ratio was 16:100, both of which were similar to RY10–RY14 (72:100 bull-to-cow ratio and 15:100 calf-to-cow ratio). The yearling bull-to-cow ratio fluctuated greatly not only during the report period but throughout the prior decade; however, it has shown an increasing trend since 2011. The seasonal nature of moose presence in the Unit 13D CA and the relatively low sample size compared to other subunits has made it difficult to definitively assess trends comparable to other subunits, although long-term trends were still helpful to suggest management direction.

Table 6. Unit 13D fall composition of moose, regulatory years 2015–2019, Alaska.

Regulatory year	Bull-to-cow[a]	Yearling bull-to-cow[a]	Calf-to-cow[a]	Percent calves	Adults observed	Total moose observed
2015	58	7	8	5	95	100
2016	89	18	21	10	119	132
2017	–	–	–	–	–	–
2018	–	–	–	–	–	–
2019	70	3	18	10	102	113

Note: En dashes indicate no survey was conducted.
[a] Ratio is per 100 cows.

Unit 13E

In Unit 13E, CA 3W was flown in RY15, RY17, and RY19; and CA 7 was flown in RY18 and RY19. The average bull-to-cow ratio throughout RY15–RY19 was 28:100, which is lower than the RY10–RY14 average of 36:100. The yearling bull-to-cow average was 8:100, which was a decline from the RY10–RY14 average of 11:100. The calf-to-cow average was 18:100 with a high of 31:100 in RY15 (Table 7).

Table 7. Unit 13E fall composition of moose, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Bull-to-cow[a]	Yearling bull-to-cow[a]	Calf-to-cow[a]	Percent calves	Adults observed	Total moose observed
2015	25	8	31	20	238	298
2016	40	14	15	10	802	887
2017	24	5	14	10	279	310
2018	27	8	15	11	961	1077
2019	24	6	16	11	1220	1376

[a] Ratio is per 100 cows.

This average was an increase from the RY10–RY14 average of 16:100, despite less frequent activation of wolf control in Unit 13E during the report period. Declines in bull-to-cow and yearling bull-to-cow ratios may suggest that the extended season dates or the spike-fork allowance in Unit 13E did not allow for an adequate number of yearling bulls to survive through hunting season, given that calf-to-cow ratios have not shown a similar declining trend. The declining bull-to-cow ratio also suggested that the report period's level of any-bull harvest in Unit 13E may not be sustainable in the long term.

Recommendations for Activity 1.2

Continue.

ACTIVITY 1.3. Conduct spring twinning surveys.

Data Needs

Estimates of moose nutritional condition are important to maintain management on a sustained yield basis and to help managers protect the population from causing damage to habitat or from experiencing density-precipitated declines in productivity and survival. Twinning rates provide an index of nutritional health of cows, assuming that abundant nutrition on the landscape correlates with healthy, fecund cows and higher twinning rates. This assumption, however, may be violated in situations where early calf survival rates are low.

Methods

Capture efforts were conducted in 2012 and 2017–2019 to collar adult cow moose with either very high frequency or satellite collars (enabled with GPS). Animals were collared in the Alphabet Hills in Units 13A, 13B, and 13E, in association with the Susitna-Watana Hydroelectric Project (ADF&G and Alaska Biological Research 2014). To estimate parturition rates, twinning rates, and neonate mortality, check flights of collared cows were conducted daily during calving season from mid-May to early June. Small fixed-wing airplanes were used for radiotracking flights to record location and timing of parturition events, number of calves, and the survival of those calves through the end of the survey period. Twinning rate was calculated as the percentage of collared cows with twins, which were detected among all collared cows observed with calves.

Results and Discussion

While the number of collared Alphabet Hills cows in Units 13A and 13B changed over RY15–RY19, the parturition rate remained stable between 79% and 87% (Table 8). The twinning rate fluctuated more, with a peak of 57% in 2017 and a low of 21% in 2019, suggesting there may be some nutritional limitations within the population. Survival through early June also fluctuated, with a high of 74% in 2017 to a low of 37% in 2016. Low calf survival through late June in 2019 may have allowed for the increased twinning rate observed in 2020, as most cows were not lactating through the summer and were thus able to devote more nutritional resources to improving body condition.

In Unit 13E, there was no survey from 2016 through 2018; however, parturition and twinning rates in 2019 and 2020 suggested that there were no nutritional concerns for this population if early calf survival was high. Based on calf survival rates observed in 2019 and 2020, however, that may not have been the case.

Wolf control was active in all control subunits for Unit 13 in the winter of 2018 and 2019. In the spring of 2019, neonate survival was slightly higher in Units 13A and 13B than it had been in the previous year but was relatively low in Unit 13E. Wolf control was active only in Unit 13B for the winter of 2019 and 2020; however, there was lower neonate survival in Units 13A and 13B in the spring of 2020 than in the previous spring. Neonate survival in Unit 13E, where wolf control was not active, increased in the spring of 2020.

Table 8. Moose parturition and twinning data, Units 13A, 13B, and 13E, regulatory years 2015–2019, Alaska.

	Units 13A and 13B Alphabet Hills collars					Unit 13E Susitna-Watana collars				
Calendar year	Cows collared	Parturition	Twinning	Survival through early June	Survival through late June	Cows collared	Parturition	Twinning	Survival through early June	Survival through late June
2016	25	84%	29%	37%	–	No survey	–	–	–	–
2017	37	81%	57%	74%	–	No survey	–	–	–	–
2018	30	87%	50%	40%	–	No survey	–	–	–	–
2019	57	82%	21%	46%	21%	30	83%	56%	33%	23%
2020	53	79%	41%	38%	25%	25	88%	74%	64%	31%

Note: En dashes indicate no data available.

Recommendations for Activity 1.3

Continue.

2. Mortality-Harvest Monitoring and Regulations

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

Data Needs

BOG has identified the Unit 13 moose population as important for providing high levels of harvest for human consumptive use and established an annual harvest objective of 1,050–2,180 moose for all subunits combined. BOG also established an amount necessary for subsistence of 300–600 moose. Annual summaries are needed to examine harvest relative to objectives, to help direct future harvest strategies, and to ensure sustained yield. Monitoring harvest is also essential to inform the regulatory process. In Unit 13, the timely tracking of harvest during the hunting season is imperative to successfully administer the Community Subsistence Harvest (CSH) hunt. Monitoring and analyzing harvest data annually is also important to understand hunter effort and success in Unit 13.

Methods

There are 4 types of harvest opportunities for moose hunts in the Nelchina Basin: the general season hunt using a harvest ticket, the CSH hunt, drawing permits issued by lottery, and a federal subsistence hunt opportunity administered by the Bureau of Land Management (BLM). Individuals who obtain a moose permit from ADF&G are required to report on their permit after a successful harvest or, if unsuccessful, after the end of the season. Failure to report results in 2 reminders and an eventual penalty. Hunt reports are recorded in ADF&G's Wildlife Information Network (WinfoNet) moose harvest database and include information regarding hunter residency, success, effort, hunt location, date of kill, transportation, and antler size. The harvest reporting requirement for the CSH hunt is 24 hours, and reports are received by telephone and online. Harvest information is summarized daily for the CSH hunt and annually for all other hunts. Federal hunters report to BLM, and ADF&G staff retrieve the federal harvest information from the BLM annually.

Season and Bag Limit

Current Unit 13 moose season dates and bag limits are available on the ADF&G website[2].

Results and Discussion

Harvest by Hunters

During RY15–RY19, the total Unit 13 reported bull harvest (Table 9) hit the highest numbers since the 1990s, with a peak in 2016 of 1,089 total moose reported harvested (Tobey 1996). The low for the report period was in RY18, with 801 total moose reported harvested.

[2]Information is available at http://www.adfg.alaska.gov/index.cfm?adfg=wildliferegulations.hunting.

Unreported harvest was not accounted for.

Table 9. Unit 13 moose reported harvest, regulatory years 2015–2019, Alaska.

Regulatory year	Male	Female	Unknown	Total[a]
2015	1,050	8	0	1,058
2016	1,080	7	3	1,090
2017	981	8	15	1,004
2018	791	7	3	801
2019	901	10	5	916

[a] Total includes federal harvest.

<u>Permit Hunts</u>

There were 10 resident antlerless permits (DM325) issued each year of RY15–RY19 (Table 10). Although there was high participation in this hunt, success throughout the report period varied greatly, from a low of 63% in RY16 to a high of 100% in RY19. In RY17 and RY19, 2 bulls were harvested during the late season, after antler drop, but the remaining harvests were cows.

A resident any-bull permit (DM324) was issued starting in RY16 with 5 permits issued annually (Table 10). This permit varied in success each year from 2 to 5 bulls being taken; however, it typically had high participation.

There were 5 nonresident antler-restricted drawing hunts (DM335-339) offered every year during the report period, with a combined total of 115 permits issued annually (Table 10). These permits had a lower success rate, with the highest being 39% in RY17 and the lowest being 23% in RY19, while 31–48% of permit winners did not hunt. The average harvest was 22 bulls between all 5 hunts combined.

The CSH program continued to be a popular hunt among residents of Unit 13, with the number of participants increasing from an average of 1,388 permits issued in RY10–RY14 to an average of 2,523 permits issued this period. After RY15, the number of permits increased drastically. Following some changes to the hunt structure implemented by BOG in 2017 and 2018, there appeared to have been a slight downward trend in the number of permits each year after RY17. This hunt has also had the highest percentage of permit holders who did not hunt, averaging at 71%. Of those who did hunt, the percentage of successful hunters remained relatively low, between 21–28%.

<u>Hunter Residency and Success</u>

Local residents (residents of Unit 13) did not receive any of the resident antlerless or any-bull permits during RY15–RY19 (Table 11). Nonlocal residents on average had an 81% success rate, spent 3.5 days in the field on successful hunts, and spent 5.4 days in the field for unsuccessful hunts. Nonresident draw hunters for the 5 different draw permits spent 5.7 days in the field for a successful hunt and 8.4 days in the field for an unsuccessful hunt on average.

For the CSH hunt, local residents harvested an average of 18% of the total CSH harvest and had a success rate of 81%, whereas nonlocal hunters had a much lower success rate of 32%.

Table 10. Unit 13 moose harvest data for state permit hunts, regulatory years 2015–2019, Alaska.

Hunt number(s)	Regulatory year	Permits issued	Successful hunters (%)	Bulls	Cows	Unknown	Harvest
Resident antlerless (DM325)	2015	10	78	0	7	0	7
	2016	10	63	0	5	0	5
	2017	10	89	2	6	0	8
	2018	10	70	0	7	0	7
	2019	10	100	2	8	0	10
Resident any-bull (DM324)	2016	5	100	5	0	0	5
	2017	5	60	3	0	0	3
	2018	5	67	2	0	0	2
	2019	5	100	4	0	0	4
Nonresident antler-restricted (DM335–DM339)	2015	115	38	23	0	0	23
	2016	115	34	21	0	0	21
	2017	115	39	28	0	0	28
	2018	115	30	20	0	0	20
	2019	115	23	18	0	0	18
Community subsistence harvest hunt (CM300)	2015	1,984	28	171	0	0	171
	2016	3,023	21	201	0	0	201
	2017	3,136	21	187	1	0	188
	2018	2,331	23	154	0	1	155
	2019	2,143	27	159	1	0	160

Successful CSH hunters spent an average of 4.3 days in the field during this report period, whereas unsuccessful hunters spent 7 days in the field on average.

Local residents harvested an average of 7% of the moose taken under the general season during this report period, whereas nonlocal residents harvested an average of 94% (Table 11). The success rates were very similar, at 15% for local residents and 16% for nonlocal residents. For all general season hunters, successful hunters averaged 6.1 days in the field during this report period, which is a decrease from the RY10–RY14 average of 6.9 days. Unsuccessful hunters averaged 6.7 days in the field, which is a decrease from the previous report period's average of 7.4 days.

Harvest Chronology

Harvest chronology data for the general moose hunt are presented in Table 12. For most years during RY15–RY19, there was a pulse of harvest the first and second days of moose season, 1–2 September, followed by more steady harvest until the end of September.

For the resident any-bull drawing hunt, harvest was steady throughout the season, with 64% of the total harvest happening in the first 2 weeks of the season.

Table 11. Unit 13 moose hunter residency and success, regulatory years 2015–2019, Alaska.

		Local resident[a]			Nonlocal resident[b]			Total[c]		
Hunt number(s)	Regulatory year	Harvested	Hunted	Percent success	Harvested	Hunted	Percent success	Harvested	Hunted	Percent success
Resident	2015	0	0	–	7	9	78	7	9	78
antlerless	2016	0	0	–	10	13	77	10	13	77
and any bull	2017	0	0	–	11	14	79	11	14	79
(DM325,	2018	0	0	–	9	13	69	9	13	69
DM324)	2019	0	0	–	14	14	100	14	14	100
Community	2015	36	132	27	135	489	28	171	621	28
Subsistence	2016	29	160	18	172	781	22	201	941	21
Harvest hunt	2017	24	157	15	164	722	23	188	879	21
(CM300)	2018	33	165	20	122	199	61	155	664	23
	2019	36	134	27	124	456	27	160	590	27
General	2015	41	275	15	719	4,027	18	772	4,358	18
season	2016	42	264	16	712	4,555	16	758	4,867	16
harvest	2017	30	246	12	653	4,069	16	690	4,361	16
ticket	2018	27	225	12	522	3,810	14	557	4,069	14
(GM000)	2019	42	238	18	599	3,257	18	649	3,530	18

Note: En dashes indicate no data available.
[a] Local residents include hunters who are residents of Unit 13 communities.
[b] Nonlocal residents include hunters who are residents of Alaska but who are not residents of Unit 13 communities.
[c] Total includes hunters of unspecified residency and hunters who are U.S. citizens but are not residents of Alaska.

The majority of harvest for the resident antlerless tag occurred in October, with 65% of animals being harvested then and only 35% of animals being harvested in March. For the nonresident draw permits, most harvest happened in the second week of the season, at 41%.

Table 12. Unit 13 percent moose harvest chronology by seasonal weeks for general state harvest ticket hunt only, regulatory years 2015–2019, Alaska.

	Week of harvest[a]		
Regulatory year	1–7 Sep	8–14 Sep	15–20 Sep
2015	37	32	31
2016	37	33	30
2017	33	34	33
2018	30	31	39
2019	35	30	35

[a] Percentage only derived from total moose harvested within legal season dates (1–20 September).

In RY15, the CSH hunt opened on 10 August, which was earlier than any other moose hunt in the unit. Starting in RY16, it opened on 20 August. Most (62%) of the harvest occurred before September, with a large pulse of harvest on opening day.

Transport Methods

Unit 13 general season moose hunters typically use all-terrain vehicles (ATVs), off-road vehicles (ORVs), or highway vehicles to reach hunting areas, but the most popular method of transportation for moose hunters since RY93 has been ATVs (Table 13). Hunters using ATVs and ORVs took 77% of the total moose harvest during RY15–RY19.

Table 13. Unit 13 successful moose hunter percent transport methods for general state harvest ticket hunt only, regulatory years 2015–2019, Alaska.

	Percent transport method									
Regulatory year	Airplane	Horse	Boat	ATV[a]	ORV[b]	Highway vehicle	None	Other	Airboat	Unknown
2015	5	1	4	57	21	10	1	1	1	1
2016	5	1	4	56	22	10	2	1	1	1
2017	4	0	7	53	24	9	2	0	0	0
2018	5	0	8	51	25	7	1	2	1	1
2019	6	0	5	55	22	9	1	1	0	0

[a] ATV refers to all-terrain vehicles.
[b] ORV refers to off-road vehicles.

This pattern held true with the CSH hunters, who used mainly ATVs and ORVs; however, these hunters demonstrated a much larger use of highway vehicles (18%) compared to general season hunters (9%).

For the resident draw hunts, ATVs were still the most utilized (50%), with the addition of snowmachines for the antlerless hunt in March. The nonresident draw hunters used planes more than any other mode of transport, at 47%, with ATVs and ORVs being used 42% of the time.

Other Mortality

Brown bears are abundant in Unit 13 and are important predators of neonatal moose calves. Research in the 1970s indicated that, during that time, brown bears killed up to 50% of calves within the first 6 weeks of life (Ballard et al. 1981). Although brown bears killed adult moose, the rate was much lower than for calves. A substantial reduction in bear numbers (1,979 bears removed from the Upper Susitna) increased calf survival significantly in this unit (Ballard et al. 1987). Based on this research, liberalized hunting regulations have been in effect for brown bears in Unit 13 since the mid-1990s to reduce the brown bear population, with the goal of increasing moose calf survival unitwide.

Unit 13 has 4 highways which run throughout. On average, 50 moose were killed in motor vehicle collisions during RY15–RY19 (Table 14). Additionally, the Alaska Railroad runs through Unit 13E and kills an average of 60 moose per year. During years of deep snow, moose tend to use the railroad and roadways for easier travel, making them more susceptible to collisions, as shown in RY19 (NRCS).

Table 14. Sources of accidental moose mortality, regulatory years 2015–2019, Unit 13, Alaska.

Regulatory year	Road	Train	Total
2015	47	59	106
2016	59	11	70
2017	65	48	113
2018	29	32	61
2019	47	151	198

During Unit 13B twinning surveys in RY18, a collared cow was observed with twins. The twins were observed dead 4 days after birth with no obvious clues as to cause of mortality. During surveys in RY19, the same cow gave birth to twins on 17 May, which were standing and walking shortly after birth. On 18 May, these calves were dead with the living cow lying near them and no signs of predation or obvious clues as to the cause of death. These twins were retrieved by Glennallen staff on 19 May and sent to Fairbanks the following day for necropsies. Wildlife disease and surveillance staff performed the necropsies and sent several samples for lab work. Cause of death was considered secondary to starvation with serous atrophy of fat, supported by histologic evidence and reported clinical findings of no gastrointestinal milk or other feed material outside of adult moose hair. These results indicated agalactia in the cow, and no other red flags arose from lab work or trace mineral results. Agalactia may be caused by several different factors, including bacterial infections such as the one identified in a Unit 13B Dall sheep ewe in the summer of 2019. Swabs were cultured and a polymerase chain reaction was conducted in an attempt to detect any such bacterial infection that may have existed within the cow, but results were inconclusive. Further deaths such as these should be investigated if the opportunity arises to determine whether other cows are experiencing agalactia, and further research may be necessary to determine if the underlying cause is specific to individual cows or may be a herdwide issue such as a contagious agent.

Alaska Board of Game Actions and Emergency Orders

In March 2009, BOG created the CSH program for moose to allow for greater harvest opportunity. Residents of the 8 Ahtna communities were eligible: Chitina, Kluti-Kaah, Tazlina, Gakona, Gulkana, Chistochina, Mentasta Lake, and Cantwell. Other Alaskan residents were allowed to participate if they had ties to one of these communities. Participants were allowed to hunt in Units 11, 13, and a small portion of Unit 12. The CSH program included an aspect which allowed a designated hunter to fill the bag limit of another member of the group. The hunt also included an any-bull quota of 100, allowing the take of bulls not meeting the general season antler restrictions. In addition to the any-bull option, CSH hunters were allowed an unlimited number of bulls meeting the state general hunt antler restrictions (spike, fork, 50-inch or larger width, or 4 brow tines on at least one side). CSH season dates were 10 August–20 September. Due to a court ruling, BOG eliminated the CSH hunt for the RY10 season.

In March 2011, BOG adopted a new version of the CSH hunt using previously established boundaries and season dates. For 2011, any community or group of Alaskan hunters numbering 25 or more could apply for the hunt. Up to 70 bulls not meeting general season antler restrictions could be taken (additional spike, fork, 50-inch or larger width, or 4 brow tines on at least one side). A 24-hour reporting requirement was implemented to allow for effective administration of the any-bull portion of the hunt. Moose harvested in the CSH hunt had additional salvage requirements.

BOG increased the CSH quota of any-bulls from 70 to 100 in 2013. For RY14, BOG added a winter CSH hunt (1–31 December) and limited any-bull take for the fall season dates by issuing 1 any-bull locking tag per every 3 households in a group. Beginning in RY16, a 2-year commitment was implemented for any group wishing to participate in the CSH hunt.

During a special BOG meeting in Glennallen in March 2017, as well as the regular BOG meeting in Dillingham in February 2018, BOG made several changes to the CSH hunt which became effective in RY18. To allow for longer any-bull seasons, the number of any-bull locking tags for the CSH hunt was limited to 350, and those locking tags were allocated within the CSH hunt through existing regulatory scoring criteria. The CSH moose season was changed to 20 August–20 September and additional salvage requirements were implemented.

BOG summary information is available on the ADF&G website[3].

Emergency orders were issued to manage the CSH hunt during RY15–RY19. While the CSH program already included a 24-hour reporting requirement to ensure an acceptable level of hunt management, the bag limit was changed by emergency order to match general season antler restrictions (spike, fork, 50-inch or larger width, or 4 brow tines on at least one side in Unit 13) when the any-bull harvest met the quota for a subunit. These emergency orders are not presented in this report but are available from ADF&G staff. Current and previous emergency orders, and extensive CSH hunt conditions, can be found on the ADF&G website[4].

[3] BOG summary information is available at http://www.adfg.alaska.gov/index.cfm?adfg=gameboard.meetinginfo.
[4] Current and previous emergency orders: http://www.adfg.alaska.gov/index.cfm?adfg=wcnews.main.
Extensive CSH hunt conditions: http://www.adfg.alaska.gov/index.cfm?adfg=huntlicense.cultural.

Recommendations for Activity 2.1

Continue.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor and evaluate moose browse utilization.

Data Needs

Information necessary to determine if moose density was impacting browse adversely was collected through browse surveys. Monitoring of browse plants provided information about how much of available browse was being removed by the existing moose population and the degree of browsing pressure during the life of a given plant (Seaton 2002). Browse biomass removal has been suggested as an indicator of moose nutritional condition (Seaton 2002, Boertje et al. 2007, Seaton et al. 2011). Monitoring browse plant architecture may provide additional information on the effects of moose browse on vegetation condition as a function of moose density (Seaton 2002, Paragi et al. 2015).

Methods

The late-winter survey developed by Seaton (2002) was used to measure randomly sampled twigs of browse plants for diameter of current annual growth which occurred the prior summer, and the diameter at the point of browsing over winter by moose. Regression equations of the dry mass to diameter relationship for each browse species were used to estimate biomass and, ultimately, proportion of browse removal (offtake), which reflects moose density (Seaton et al. 2011) and change in moose density (Paragi et al. 2015). The technique was developed in the boreal forest of Interior Alaska for game management purposes and appears to also represent moose density in shrub communities of northern and western Alaska sufficiently. Proportional offtake did not presently incorporate the nutritional quality or digestible energy of forage plants and has not yet been validated for Unit 13.

Results and Discussion

In March and April of 2017, browse data were collected from snowmachines in and around the Alphabet Hills in Unit 13B. Only 18 plots, 98 ft (30 m) in diameter, were sampled, resulting in an incomplete survey. The data collected suggested that the area was not heavily browsed.

Recommendations for Activity 3.1

Continue to conduct browse surveys in subunits which appear to have shifts in animal abundance, body condition, or twinning rates. Use winter distributions of moose populations to design and complete the surveys.

Nonregulatory Management Problems or Needs

Data Recording and Archiving

State moose harvest data are stored on WinfoNet. Federal moose harvest data must be collected from BLM and are stored electronically on the Glennallen wildlife conservation shared network (O:\DWC\BGDIF\Moose\MooseHarvest\Unit13).

Field data sheets are stored in file folders located in the Glennallen assistant area biologist's office. Additional field data are electronically stored on the Glennallen wildlife conservation shared network (O:\DWC\BGDIF\Moose).

Agreements

Currently there are no agreements with other agencies pertaining to moose management.

Permitting

No permits were needed to conduct moose management activities in Unit 13 during RY15–RY19.

Conclusions and Management Recommendations

Overall, in Unit 13 as a whole, the moose population appears to be experiencing a declining trend in RY15–RY19, after stabilizing at a high abundance in RY10–RY14.

Snow conditions throughout the report period varied across Unit 13, with RY17 and RY19 exhibiting deep snow in some areas of Unit 13. These conditions made it more energetically costly for moose to move across the landscape for browse, may have made some browse difficult to access, and in some cases may have resulted in moose becoming more susceptible to predation and/or vehicle collisions. These conditions typically result in higher-than-normal adult mortality and may impact neonate mortality in the spring as well.

A reduction in yearling bulls throughout the unit could have been a combined result of low neonate survival or recruitment and substantial hunting pressure on this age class, with the extended season dates as well as the spike or fork allowance. Brown bear predation has historically been an important factor in neonatal calf survival in Unit 13. Liberalized hunting regulations since 1994 have resulted in an increase in brown bear harvests, and recent surveys have documented a decline in brown bears between 1998 and 2011 in a portion of Unit 13 (Brockman et al. 2020). While there had been research to show that a reduction in brown bear density could increase moose calf survival, no study recent to the report period had been conducted to analyze the association between brown bear densities and neonate mortality in moose (Ballard and Miller 1990). A brown bear density survey will be conducted in 2022 to compare with the 1998 and 2011 densities, and that data will be analyzed in conjunction with moose neonate survival data in search of relevant trends or correlation. The level of hunting pressure during the report period could also be a factor in decreased yearling abundance as an increase in hunting competition can result in more spike or fork animals being harvested. As a result, fewer bulls may be aging into the 50-inch spread or 4 or more brow tines on at least one side category for general season harvest in Unit 13.

Unit 13 has several areas where habitat improvement could produce more favorable browse conditions for moose. Due to the size and remoteness of much of the unit, fire has been considered the only option for extensive habitat improvement. Wildfires occurred throughout much of Unit 13 before 1950, at which point fire suppression activities began. Since then, negligible acreage has burned. Current fire suppression policies detailed in the "Copper Basin Fire Management Plan" set aside large portions of the unit as limited suppression (let-it-burn) areas in order to mimic natural disturbance. Despite this, some wildfires have been suppressed, even in these areas. The current level of fire suppression has resulted in fewer fires and reduced seral habitat available as moose browse.

The use of prescribed fires to replace wildfire as a method of improving moose habitat has had limited application in Unit 13. The climate prevents the use of prescribed fire, except in the driest years. Additionally, scattered cabins and private landownership have increased since statehood, similarly increasing the liability associated with the use of prescribed fire. Despite problems associated with controlled burns, work with BLM and the Alaska Department of Natural Resources has been ongoing, and a prescribed fire was completed in 2004. The Alphabet Hills controlled burn was ignited in August 2004, and approximately 41,000 acres[2] burned around Kelly Lake on the south slopes of the Alphabet Hills in Unit 13B. The updated burn plan includes additional prescribed burning in the area for RY20–RY25.

ADF&G recommends reevaluating current hunt structures to determine if it may be necessary to reduce the number of yearling bulls being harvested. Additionally, reducing any-bull harvest in Unit 13 may be necessary in the coming years to keep the bull-to-cow ratios within objectives. Limited cow harvests should be used to stabilize populations at levels of highest productivity to provide additional harvest opportunity and decrease the potential for cyclical declines related to density-dependent factors as specific populations rise above the midpoint of abundance objectives. Given the controversial nature of antlerless hunts, a limited number of permits should be made available, and only for clearly identified hunting areas where moose are abundant.

II. Project Review and RY20–RY24 Plan

Review of Management Direction

Management Direction

There are no planned changes in the management direction for Unit 13 for RY20–RY24.

Goals

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide the greatest sustained opportunity for moose harvest.
- Provide an opportunity to view and photograph moose.

Codified Objectives

Amounts Reasonably Necessary for Subsistence Uses

The Unit 13 amount reasonably necessary for subsistence is 300–600 moose.

Intensive Management

- Population objective: 17,000–21,400 moose (Table 1).
- Harvest objective: 1,050–2,180 moose (Table 1).

Management Objectives

Manage moose populations at the following levels:

- Manage for post-hunt (fall) bull-to-cow sex ratio of 25:100, with a yearling bull-to-cow ratio of 10:100 throughout the unit.
- Maintain a fall calf-to-cow ratio of 25:100 in Unit 13A.
- Maintain a fall calf-to-cow ratio of 30:100 in Units 13B, 13C, 13D, and 13E.

Review of Management Activities

1. Population Status and Trend

ACTIVITY 1.1. Monitor and evaluate moose abundance.

Data Needs

No change from RY15–RY19.

Methods

Conduct GSPE surveys with the goal of completing each subunit on a 5-year cycle to compare and evaluate assessment of abundance trends derived from minimum count surveys.

Continue to conduct minimum count surveys in established CAs annually for each subunit in which a GSPE cannot be conducted.

ACTIVITY 1.2. Monitor moose sex and age composition data needs.

Data Needs

Moose composition data will be necessary to determine population status in relation to codified and management objectives. Although GSPE provides unbiased estimates of population abundance, composition data may not be as robust. Composition data is the most important population metric to be acquired on an annual basis to effectively manage bull harvest and maintain bull-to-cow ratios.

Methods

No change from RY15–RY19.

ACTIVITY 1.3. Conduct spring twinning surveys.

Data Needs

No change from RY15–RY19.

Methods

No change from RY15–RY19.

2. Mortality-Harvest Monitoring and Regulations

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

Data Needs

No change from RY15–RY19.

Methods

No change from RY15–RY19.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor and evaluate moose browse utilization.

Data Needs

No change from RY15–RY19.

Methods

ADF&G will follow the methods from RY15–RY19 and earlier, with the addition of using winter densities of moose instead of fall densities to create the sampling grid.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

State moose harvest data are stored on WinfoNet. Federal moose harvest data must be collected from BLM and are stored electronically on the Glennallen wildlife conservation shared network (O:\DWC\BGDIF\Moose\MooseHarvest\Unit13).

Field data sheets are stored in file folders located in the Glennallen assistant area biologist's office. Additional field data are electronically stored on the Glennallen wildlife conservation shared network (O:\DWC\BGDIF\Moose).

Agreements

Currently there are no agreements with other agencies pertaining to moose management.

Permitting

No permits are expected for RY20–RY24.

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