Species Management Report and Plan ADF&G/DWC/SMR&P–2025–34

Moose Management Report and Plan, Game Management Unit 16:

Report Period 1 July 2015–30 June 2020, and

Plan Period 1 July 2020–30 June 2025

Tim C. Peltier

2025

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 A. Rinaldi, Management Coordinator for the Division of Wildlife Conservation.

Species management reports and plans are available via the Alaska Department of Fish and Game's public website (www.adfg.alaska.gov) or by contacting Alaska Department of Fish and Game's 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). To subscribe to email announcements regarding new technical publications from the Alaska Department of Fish and Game, Division of Wildlife Conservation please use the following link: http://list.state.ak.us/mailman/listinfo/adfgwildlifereport.

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Cover Photo: Creekside bull in fall. ©2018 ADF&G. Photo by Tim C. Peltier.

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose in Unit 16 for the 5 regulatory years 2015–2019 and plans for survey and inventory management activities in the following 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 (ADF&G, the department) Division of Wildlife Conservation (DWC) launched this 5-year report to more efficiently report on trends and to 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 16 is located in Southcentral Alaska, west of Anchorage. Unit 16 consists of the drainages into western Cook Inlet from Redoubt Creek and the Susitna River including the drainages of Redoubt Creek and the drainages on the west side of the Susitna River upstream from its junction with the Chulitna River and the drainages into the west side of the Chulitna River upstream of the Tokositna River including the river and drainages on the south side of the river up to the Tokositna Glacier. It is subdivided into Unit 16A which is east of the east bank of the Yentna River from its mouth upstream to the Kahiltna River, east of the east bank of the Kahiltna River and east of the Kahiltna Glacier, and Unit 16B which covers all portions south and west of Unit 16A (Fig. 1). During the first year of RY15–RY19, Unit 16B included Kalgin Island, a 23 mi^2 island approximately 7 miles east of the mainland at the southern end of the unit. Kalgin Island became part of Unit 15B in RY16. Unit 16A is 1,850 mi,^{2} however, the area of suitable moose habitat below the mean elevation of 3,500 feet is approximately 1,654 mi^2. Unit 16B is 10,405 mi^2 with approximately 6,795 mi^2 of suitable moose habitat.

Due to the size and variable weather conditions in Unit 16B, it has been subdivided for the purpose of survey work. This strategy allows managers to assess a proportion of the population when a unitwide effort may not be feasible. Unit 16B–North consists of all portions of the unit north of the Yentna River to its confluence with the Skwentna River, following the Skwentna River upstream to its confluence with the Happy River, and upstream along the Happy River to the unit boundary. Unit 16B–Middle contains the area between the border of Unit 16B–North to the mouth of the Beluga River, upstream along the Beluga River to Beluga Lake, along the north shore of Beluga Lake to the base of the Triumvirate Glacier, along the northern edge of the Triumvirate Glacier and the South Twin Glacier to the western border of the unit. Unit 16B–South encompasses the remainder of Unit 16B (Fig. 2).

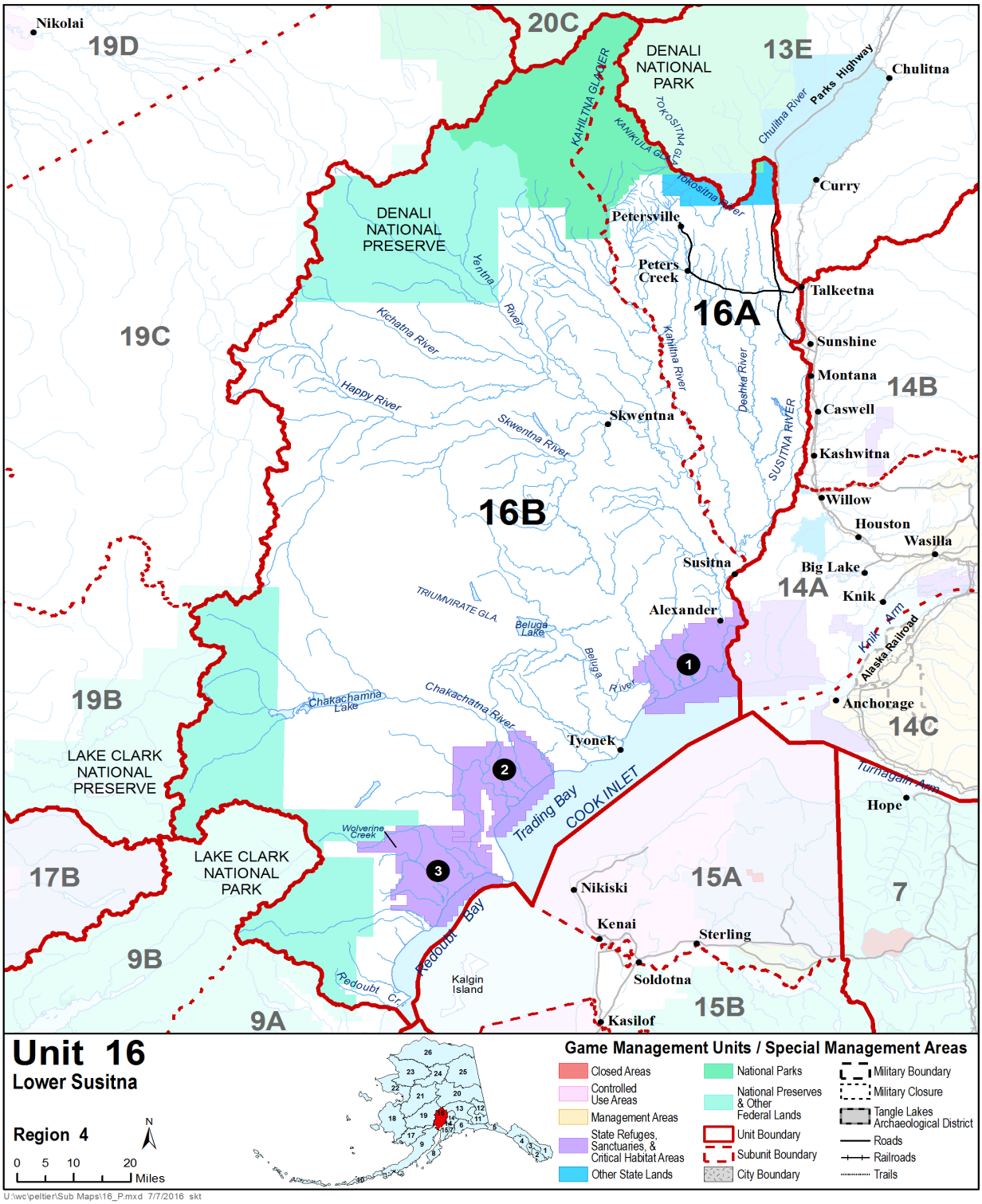

Figure 1. Units 16A and 16B in Southcentral Alaska as shown in the Alaska Hunting Regulations. The areas with the black circles are (1) Susitna Flats and (2) Trading Bay state game refuges, and (3) Redoubt Bay Critical Habitat Area.

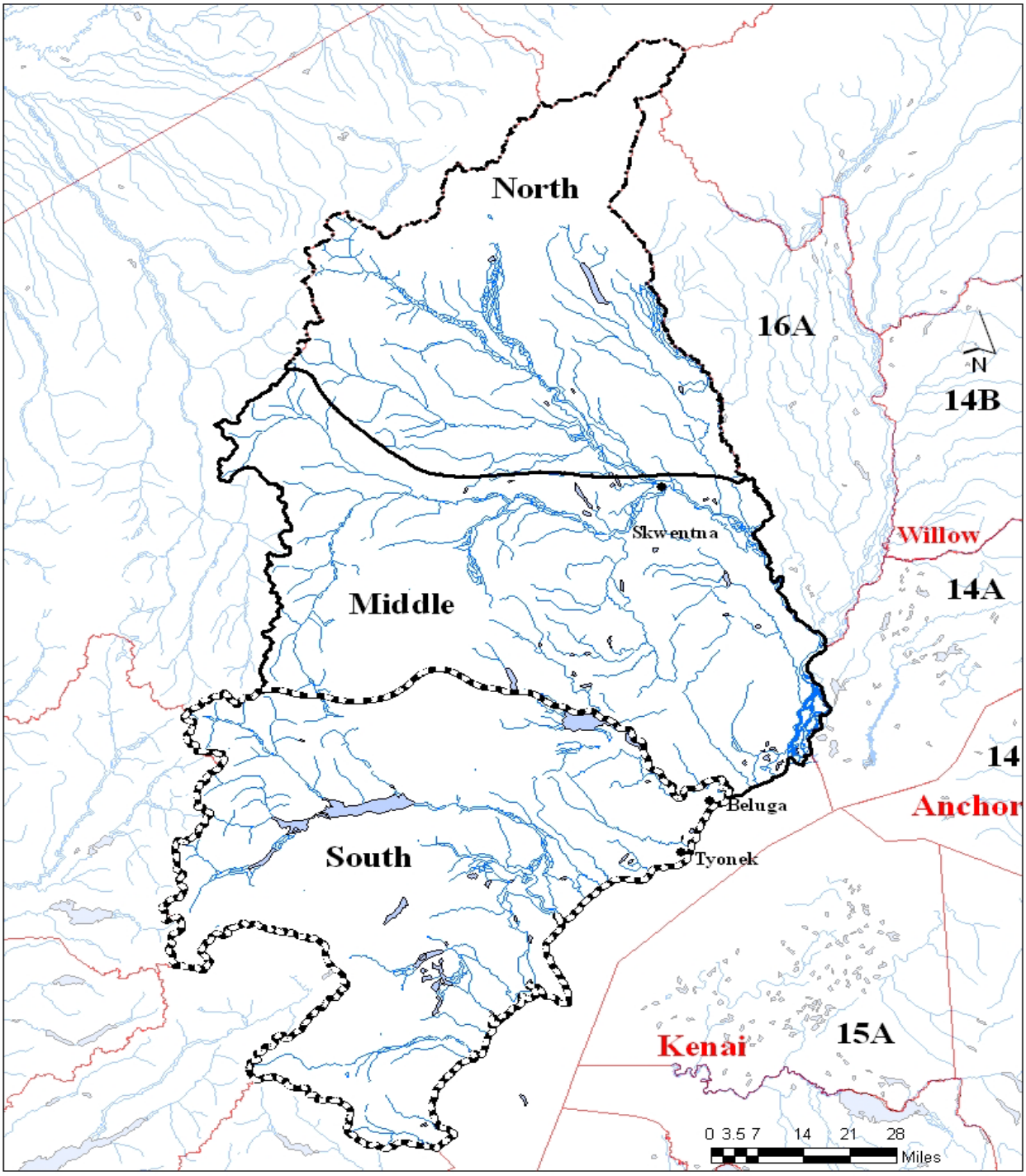

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Figure 2. Unit 16B moose survey unit boundaries, Southcentral Alaska. Unit 16B–Middle has a solid bolded black border; Unit 16B–North and Unit 16B–South have patterned black borders.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 16

UNIT 16A

Before 1940, moose persisted at low densities in Unit 16A (Griese 1995a). Thereafter the moose population experienced large fluctuations in population size as a result of die-offs during severe winters. These have occurred at least once every decade (Griese 1995b). A population high was noted in 1997 of 3,636 moose and a low of 1,619 was recorded in 2005. Recovery of the moose population after a severe winter can be hampered by predation (Peltier 2010a).

An intensive management law was passed in 1994. Under this law the Alaska Board of Game (BOG) was required to identify moose, caribou, and deer populations that are important to harvest by humans and to manage predator and prey populations for sustained harvest (Alaska Department of Fish and Game [ADF&G] 2016). In 2004 BOG developed a predator control program for Unit 16B. The program aimed to increase the moose population in Unit 16B by reducing the wolf population. This program was expanded in 2006 to include the roadless portions of Unit 16A to target wolves travelling between units and provide additional protection for moose on the border of the 2 units. In 2007 a black bear control program began on the same lands which included provisions for an unlimited take of black bears, the taking of sows with cubs, and the taking of cubs, among others (Peltier 2008). While the initial control efforts were designed to improve the moose population in Unit 16B, it was believed that predator reductions in the unit would benefit calf recruitment and the moose population in Unit 16A as well.

Unit 16A is mostly a roadless area. Access is limited to a few points from the Parks Highway, Petersville Road, and Oil Well Road. Boats, airboats, all-terrain vehicles, and airplanes are used to access more remote portions of the unit for moose hunting. Annual harvest by hunters has fluctuated because of variable moose densities, availability of cow moose hunts, and improved hunter access (Griese 1996a). Harvest numbers have ranged from a high of 309 (1984) to a low of 37 (1990) (Del Frate 2004).

UNIT 16B

Before 1940, moose were uncommon in Unit 16B. Since then, habitat changes and federal predator control allowed the population to increase (Griese 1995b). Moose populations fluctuate greatly in Unit 16B due to heavy snow years that seem to occur once or twice every decade. Moose in this unit likely numbered more than 10,000 during the early 1980s (Griese 1996b). Before the severe winter of 1989–1990, there likely were 8,500–9,500 moose (Harkness 1993). Following a 15–20% decline after winter 1989–1990, moose numbers in the unit continued to decline in response to deep snow winters and increasing predation (Griese 2000).

Prior to 1989, moose hunting seasons in Unit 16B were by harvest ticket and registration permit, and had long openings with any-moose or antlerless moose bag limits. To address a declining population, Tier II permits were issued beginning in RY90 to ensure local residents an opportunity to meet subsistence needs. Beginning in RY93, the bull harvest (during the general season) was restricted to moose with antlers having a spike or fork on at least one side, or a

minimum of 3 brow tines (bt) on at least one side, or a minimum total width of 50 inches. This selective harvest strategy is referred to as "spike-fork 50-inch" (SF-50-3bt) (Schwartz et al. 1992). The general season was closed in both RY01 and RY02 and then again during RY06–RY08 due to the reduced population size, few surplus bulls, and poor calf recruitment. The permit levels for the existing Tier II hunts were increased to provide for subsistence. These Tier II hunts were divided into 3 areas: TM565, TM567, and TM569 (Del Frate 2004).

For most of the post-statehood history of the unit, predation was not considered a significant factor limiting the moose population until around 1992, when an increase in the wolf population was first noticed. The minimum population estimate in 1993 was 39–42 wolves. A subsequent survey in fall 1998 estimated a population of 120–140 wolves (Masteller 2000), and Del Frate (2003) reported an estimate of 160–245 wolves for all Unit 16 in winter 2001. As a result of increased wolf numbers and a decrease in the moose population, the influence of wolf predation on the moose population is believed to have increased over time. Intensive management, a control program to reduce wolf predation on moose, began in 2004. At that time, the population was estimated at 175–180 wolves (ADF&G 2015). Additionally, studies in Unit 16B suggest that bear predation also has a strong influence on calf recruitment (Faro 1989; Peltier 2012). Black and brown bear surveys were conducted in spring 2007 and indicated a very high density of black bears (182 bears/386 mi^2) and brown bears (63 bears/386 mi^2) in the unit (Peltier 2008). Brown bear season and bag limits were liberalized, and a black bear control program began in fall 2007 (Peltier 2008, 2010b). A separate brown bear control program on a 960 mi^2 portion of the unit between the Beluga and McArthur rivers began in RY10 (Peltier 2013).

Moose were transplanted on Kalgin Island in the 1950s. By 1981 the population was over 140 moose and hunting was allowed on the island, first as a draw hunt and later as a registration hunt. The island became part of Unit 15B in RY16.

Management Direction

EXISTING WILDLIFE MANAGEMENT PLANS

- Direction in the Peters-Dutch Hills, Chelatna Lake-Yenlo Hills, and Skwentna moose management plans (ADF&G 1976) has been reviewed and modified through public comments, DWC staff recommendations, and BOG 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 16.
- Presently moose are managed under the "Operational Plan for Intensive Management of Moose in Game Management Unit 16 during regulatory years 2015–2017" (ADF&G 2015).
- "Alaska Interagency Wildland Fire Management Plan 2010" (Alaska Wildland Fire Coordinating Group 2010).

GOALS

- Protect, maintain, or enhance the moose population and its habitat in concert with other components of the ecosystem to provide maximum sustained opportunity to participate in hunting moose.
- Provide and enhance wildlife viewing opportunities with special consideration for state and national parks.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Harvest

The Unit 16B moose population has a positive customary and traditional use determination. The unitwide amount reasonably necessary for subsistence is 201–229 moose. It is allocated across the unit as follows:

- Unit 16B, Kalgin Island: 2 moose.
- Unit 16B, Redoubt Bay drainages: 10 moose.
- Unit 16B, south of the Beluga River and north of Redoubt Bay: 29–37 moose.
- Unit 16B, north of the Beluga River: 160–180 moose.

Intensive Management

In 2001 the Alaska Board of Game adopted a positive finding for intensive management of moose in Unit 16. Current intensive management objectives are as follows:

UNIT 16A

- Population objective: 3,500–4,000 moose.
- Harvest objective: 190–360 moose.

UNIT 16B

- Population objective: 6,500–7,500 moose.
- Harvest objective: 310–600 moose.

MANAGEMENT OBJECTIVES

- Manage moose populations at the following levels:
    - Unit 16A: Maintain a population of 3,500–4,000 moose.
    - Unit 16B: Maintain a population of 6,500–7,500 moose.
- Manage for a posthunt (fall) sex ratio of 20–25 bulls:100 cows in each unit.

MANAGEMENT ACTIVITIES

Assessing population status and trends, monitoring harvest and mortality, and assessing habitat conditions are integral components of moose management in Unit 16. Survey and inventory management activities used to monitor populations in Unit 16 are described below.

1. Population Status and Trend

ACTIVITY 1.1. Conduct aerial inventory, and a sex and age composition survey in the unit to determine population size, composition, productivity, and trends.

Data Needs

Moose abundance is a basis from which sustainable harvest may be estimated and provides a density context for interpreting nutritional condition relative to habitat conditions. Sex and age composition information can be used to determine appropriate harvest levels and recruitment into the populations. Sex and age ratio data may also be used to model population structure and trends.

Methods

Geospatial population estimator (GSPE; Kellie and DeLong 2006) surveys are conducted on all available moose habitat in the unit below 3,500 feet. Surveys are conducted between 1 November and 6 December on a triennial basis for Units 16A, 16B–North, and 16B–South, and biennially for Unit 16B–Middle as weather and snow conditions permit. This procedure produces population estimates and statistically bound sex and age composition estimates by using a random sampling design and geostatistical models of spatial autocorrelation. It is designed for high intensity surveys of moose (8–12 min/mi^2) from a PA-18 Super Cub or equivalent aircraft to obtain a relatively unbiased estimate of moose numbers. In addition, a subset of selected sample units are flown to develop a sightability correction factor that accounts for variations in animal detectability that may occur within or between surveys. Pilot and observer teams may fly 7 or 8 units per day collecting moose sex, age, and location data, as well as conditions at the time of the survey (Appendix A). When appropriate survey conditions do not exist in the fall for multiple years, GSPE surveys may be completed in February and March. Information collected at that time of the year does not provide sex and age class data but does provide information on moose abundance and density.

In Unit 16, real-time sample unit (SU) stratification is generally employed with a 4-person crew at approximately 1,000 feet above ground level (AGL) from a Cessna 185 prior to conducting the survey; however, desktop stratification can also provide guidance using past surveys, habitat information, and *a priori* knowledge. Stratification into high and low moose density is based on observed moose, moose tracks, and available moose habitat. Using only 2 strata minimizes the impacts of moose movements among strata for the spatial estimate and allows continuity of GSPE surveys across weather breaks that do not adversely affect moose distribution during the survey. For stratification purposes, SUs that are likely to have fewer than 5 moose in the unit are considered "low" stratum and sample units that are likely to contain ≥5 moose are considered "high" stratum units. Sightability correction factors (SCF) are developed for each stratum by randomly selecting a subset of the selected units and intensively searching a quarter of the unit at

10–12 min/mi^2 and comparing the difference between the number of moose seen during the regular and intensive surveys.

In years where weather conditions, logistics, or budget limitations prevent the ability to complete a GSPE survey in Unit 16B–Middle, smaller-scale sex and age composition surveys have been completed to assess population trends. In a manner similar to the GSPE survey, pilot-observer teams flying at approximately 500 feet AGL count moose of each sex and age class in areas of known winter concentrations.

Results and Discussion

The moose population in both Units 16A and 16B are within or slightly above their population objectives (Table 1). All results are reported as a point estimate ±1 standard error. A GSPE survey of Unit 16A was completed in RY17 for the first time since 2009. During the 2009 survey, an SCF was not included in the estimate of 2,574 ±230 moose, with 853 moose observed (Peltier 2017). In the RY17 survey, DWC staff sampled 50 of 89 high-strata and 30 of 172 low-strata units, which represented 31% of the unit. The resulting population estimate for Unit 16A was 5,968 ±579 moose or 8,654 ±1,097 with an SCF. During this survey 1,975 moose were observed. These results were highly questionable given what was understood about the area and moose population increase potential. As a result, staff conducted another GSPE in February 2019. Winter surveys do not provide as much information, as composition and ratio information are not available in late winter. In addition, seasonal movements to lower elevations as the result of heavy snows can prevent the direct comparison of results between fall and winter surveys. We sampled 53 high strata and 30 low strata of 261 available units resulting in a coverage of 32% of the unit. The population estimate was 3,447 ±461 moose, or 4,190 ±448 with an SCF. During this survey 1,248 moose were observed.

A winter GSPE survey of the northern section of Unit 16B (16B–North) was completed in RY18. During the survey, 56 of 97 high-strata units and 39 of 190 low-strata units were sampled for the survey for a total of 33% of the total survey area. The resulting population estimate was 1,405 ±155 moose or 1,671 ±153 with an SCF. We observed 672 moose during the survey. This is similar to the 2014 estimate of 1,587 ±151.

A winter GSPE survey of the middle portion of Unit 16B (16B–Middle) was completed in RY17. During the survey, 70 of 119 high-strata and 49 of 294 low-strata units were sampled for a total of 29% of the survey area. The resulting population estimate was 3,811 ±280 moose, or 5,339 ±734 with an SCF. We observed 1,875 moose during the survey. As this was a winter survey, sex and age composition information were not available. We completed a composition survey in fall RY19. During that survey we determined that the bull:100 cow ratio was 38 ±2, and a calf:100 cow ratio was 22 ±1. The previous survey for which composition information was available occurred in RY11. At that time, the bull:100 cow ratio was 42, indicating that the increased any-bull permits opportunity afforded through the DM540 and YM541 permits that began in RY14 may have slightly reduced the bull segment of the population. Nonetheless, the bull-to-cow ratio remains well-above the management objective of 20–25 bulls:100 cows.

A winter GSPE survey of the southern portion of Unit 16B (16B–South) was also completed in RY17. During that survey, 39 of 85 high-strata and 50 of 167 low-strata units were sampled for a total of 35% of the survey area. The resulting population estimate was 2,408 ±379 moose, or

Table 1. Unit 16 moose fall composition and estimated population from geospatial population estimates, regulatory years 2017–2019, Southcentral Alaska.

Regulatory year	Area	Bulls:100 cows[a]		Yearling bulls:100 cows[a]		Calves:100 cows[a]		Percent calves	Adults	Moose observed	Estimated population (90% confidence interval)[b]		Estimated population w/ SCF[c]	Moose/ mi^2 with SCF[d]
2017	16A	33	(29–37)	9	(8–10)	35	(33–37)	20	4,717	1,975	5,968	(5,252–6,684)	8,654	5.3
	16B–Middle[e]	–	–	–	–	–	–	14	3,373	1,875	3,811	(3,430–4,192)	5,339	2.0
	16B–South[e]	–	–	–	–	–	–	13	2,087	1,106	2,408	(2,167–2,649)	3,074	1.9
2018	16A[e]	–	–	–	–	–	–	12	3,027	1,248	3,450	(2,864–4,037)	4,190	2.6
	16B–North[e]	–	–	–	–	–	–	9	1,282	672	1,405	(1,208–1,601)	1,671	0.9
2019	16B–Middle[f]	38	(36–40)	8	(7–9)	22	(21–23)	14	–	1,009	–	–	–	–
	16B–South[f]	32	(30–34)	10	(9–11)	11	(10–12)	8	–	894	–	–	–	–

Note: An en dash (–) denotes there is no applicable data.
[a] Ninety percent confidence interval is in parentheses.
[b] Geospatial population estimation (GSPE) method.
[c] SCF represents sightability correction factor.
[d] Based on habitat available as determined by the total area of the GSPE grid for each area.
[e] Survey conducted in winter. Sex and age ratio information unavailable.
[f] Sex and age composition survey.

3,074 ± 409 with an SCF. We observed 1,106 moose during the survey. This is an increase from the 2010 survey of 2,372 moose. We completed a composition survey in the fall of RY19 and determined a bull:100 cow ratio of 32 ±2 and a calf:100 cow ratio of 11 ± 1. The bull:100 cow ratio decreased from 2010 when it was 50 ± 3, indicating a decrease in the number of bulls available for harvest. The calf-to-cow ratio of 11:100 cows was the lowest recorded since 1999.

Recommendations for Activity 1.1

Continue.

The moose population in Unit 16B encompasses a large area that does not have uniform snow conditions that allow for a unitwide population survey. As such, separate population objectives were recommended for each of the 3 units based on the size of each area. Achieving the midpoint of the objective for the units based on the whole intensive management objective would require populations of 1,960 moose in Unit 16B–North, 3,360 moose in Unit 16B–Middle, and 1,680 moose in Unit 16B–South (Table 2). The survey protocol for Unit 16B requires a biennial survey of Unit 16B–Middle, and a triennial survey of Unit 16B–North and Unit 16B–South. Given that Unit 16B–South seldom receives conditions that allow for a GSPE, this unit should be considered for surveys in any year that favorable conditions are present.

Table 2. Unit 16B moose population objectives for the 3 moose assessment areas, regulatory years 2015–2019, Southcentral Alaska.

	Moose population objective per area	
Survey unit	Range	Midpoint
Unit 16B–North	1,820–2,100	1,960
Unit 16B–Middle	3,120–3,600	3,360
Unit 16B–South	1,560–1,800	1,680
Unit 16B	6,500–7,500	7,000

Note: The Unit 16B objective is subdivided proportionately by the size of the assessment area.

ACTIVITY 1.2. Spring parturition, twinning, and recruitment surveys in Unit 16B.

Data Needs

Determining pregnancy rates and twinning rates provides an indication of maternal condition and productivity. Trends in these indicators are very important to determining the nutritional condition of the moose population and habitat quality. Fall recruitment of calves can indicate the level of predation on newborn calves and directly relates to the rate of growth of the moose population. Understanding these parameters is integral to management on a sustained yield basis.

Methods

Beginning in winter RY04 adult cows and short-yearlings were captured via helicopter darting. Weights and other health parameters were recorded, and the animals were fit with radio collars. Beginning in spring 2005, radiocollared cows were relocated on a daily or every other day basis during the calving season to determine pregnancy and the number of calves produced. Cows were relocated in the fall (November) to determine the survival rate of calves produced through the first 6 months of life, and in late March to determine overwinter survival.

Results and Discussion

Pregnancy and twinning rates have been high throughout the length of the project (Table 3). Calf recruitment into fall (6 months of age) peaked in 2015 with 54% of the calves born that spring alive 6 months later. It has decreased over the past 5 years. While it was initially believed that the moose appeared to have escaped what is known as a "low density dynamic equilibrium" or "predator pit" (Messier 1994; National Research Council 1997), this may not be the case.

Table 3. Unit 16B moose parturition, twinning, and survival rates from collared cows, 2005–2019, Southcentral Alaska.

Year	Cows observed	Single calves	Twins	Percent twinning[a]		Percent cows parturient[a]		Calves alive in fall	Percent recruitment to fall[a]	
2005	56	20	21	51	(36–66)	73	(61–85)	5	8	(1–15)
2006	66	32	24	43	(30–56)	85	(76–94)	13	16	(8–24)
2007	89	34	37	52	(40–64)	80	(72–88)	26	24	(16–32)
2008	89	32	31	49	(37–61)	71	(62–80)	12	13	(6–20)
2009	38	10	20	67	(50–84)	79	(66–92)	8	15	(6–24)
2010	43	19	17	47	(31–65)	84	(73–95)	6	11	(2–20)
2011	88	30	35	54	(42–66)	74	(65–83)	20	20	(12–28)
2012	89	36	36	50	(38–62)	81	(72–89)	28	27	(18–36)
2013	80	22	49	69	(58–80)	89	(82–96)	54	45	(36–54)
2014	70	34	30	47	(35–59)	91	(84–98)	40	44	(34–54)
2015	80	34	34	50	(38–62)	85	(77–92)	49	51	(41–61)
2016	77	37	27	42	(30–54)	83	(75–91)	29	34	(24–44)
2017	70	21	34	62	(49–75)	79	(69–89)	22	30	(20–40)
2018	51	18	18	50	(34–66)	71	(58–84)	14	28	(17–39)
2019	59	25	20	44	(29–59)	76	(65–87)	9	15	(6–24)

[a] Ninety-five percent confidence interval, plus and minus the estimate, in parentheses.

Recommendations for Activity 1.2

Continue.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor moose mortality through field observations, hunter harvest reports, contact with hunters, and reports of other sources of mortality.

Data Needs

Monitoring, collecting, and analyzing harvest data are critical for sustained yield management. Annual summaries of harvest are needed to establish quotas and to understand harvest in relation to moose population assessments (Activities 1.1 and 1.2). Analysis of harvest data will facilitate department recommendations for future BOG proposals.

Methods

Moose hunting in Unit 16 is recorded by the general-season moose harvest report, the draw hunt report, or the Tier II harvest report submitted by hunters who participate in the different hunting

opportunities in the unit. These reports note the number of days hunted, location, methods of take and transportation, commercial services used, and the results of the hunter effort. Reports from the Alaska Department of Public Safety provide information on additional forms of mortality.

Season and Bag Limit

During RY15–RY19, the general-season moose hunt (SF-50-3bt) in Unit 16A for residents and nonresidents was 10–17 August (archery only) and 25 August–25 September (archery, firearm, and muzzleloader).

In Unit 16B the general harvest (SF-50-3bt) for residents and nonresidents was 20 August–25 September (archery, firearm, and muzzleloader). Tier II moose season for any bull was 15 December–31 March. Draw hunts, which were available residents for any bull DM540, were 20 August–25 September. The any-bull draw hunts for youth ages 10–17 were 20 August–25 September and 15 November–15 December during RY15. The YM541 late season was extended to 31 January beginning in RY16 to allow for hunting during improved travelling conditions after local rivers have frozen and snow is available for snowmachine access. The season for the RM572 registration hunt on Kalgin Island was 20 August–20 September. Beginning in RY16 the management responsibilities for Kalgin Island came under the purview of Unit 15B and will no longer be reported in this document.

Current season and bag limit information is available on the ADF&G website:

http://www.adfg.alaska.gov/index.cfm?adfg=wildliferegulations.hunting

Results and Discussion

Accurate harvest reporting is necessary for understanding patterns and levels of harvest and assisting hunt managers with their understanding of sustainable harvest rates used to manage hunts. Lack of harvest reports for moose generally stems from hunter confusion or cultural values regarding hunting. Hunt results, an estimate of unreported and illegal take, and accidental death are summarized in Tables 4A and 4B. The average annual human-caused mortality was 274 moose in Unit 16A and 464 moose in Unit 16B. These estimates are both significantly higher than those reported for units 16A and 16B in the last report (176, and 274, respectively) are well within the management objectives.

Harvest by Hunters

Reported harvest averaged 216 moose in Unit 16A and 410 moose in Unit 16B. The harvests were higher than the previous reporting period, RY09–RY14, for both units. There were several changes to the harvest structure in Unit 16B that could explain the increase in harvest with an increase in the number of permits available for the DM540 and YM541 permits and the expanded opportunity for nonresidents made available by aligning their season with the resident season. However, the harvest also increased in Unit 16A where no changes from RY09–RY14 occurred.

Permit Hunts

The results of the Tier II and draw hunts are summarized in Table 5. During RY15–RY19, 260 permits were issued annually for the Tier II hunts except for RY18 when an application scoring error omitted hunters who received permits in previous years. As a result, additional permits were issued. From RY15 through RY17 there were 300 DM540 permits and 100 YM541 permits available. Beginning in RY18 the number of permits available was increased to 450 DM540 and 150 YM541 permits.

Hunter Residency and Success

Average hunter success in Unit 16A was 21% during RY15–RY19. The average general harvest season success in Unit 16B was 24% (Tables 6A and 6B). Most hunters in Unit 16 are from Anchorage and the Matanuska-Susitna (Mat-Su) Valley. Nonresident participation was minimal with an average of 24 moose harvested annually in Unit 16A. The 5-year average harvest for nonresident hunting in Unit 16B was 58 moose. The percentage of nonresident hunters in Unit 16B increased during RY15–RY19 and accounted for 31% of all successful hunters.

Harvest Chronology

Most moose are taken in the last 2 weeks of the general harvest season when they become more vulnerable to scraping and calling as the season gets closer to the rut (Tables 7A and 7B).

Transport Methods

In Unit 16A hunters access the unit through a variety of means. The area has few roads but several points of access for all-terrain vehicles (ATV; Table 8A). Unit 16B is not connected to the road system and most hunters access the area through fixed-wing aircraft and boats (Table 8B).

Alaska Board of Game Actions and Emergency Orders

At the spring 2016 BOG meeting, the board extended the youth hunt from 15 December to 31 January to make access to Unit 16B easier once travel conditions were improved. The board added a registration hunt in Unit 16B with a bag limit of any-bull and season dates of 15 December to the last day in February and added a drawing hunt with the same season dates and bag limits. This hunt structure allows the department to manage by registration permit in areas where the population can sustain the additional harvest of bulls without concern, and to manage by drawing permit in areas where there is concern of over harvest.

At the spring 2018 meeting, the board increased the number of permits available for the Unit 16B any-bull draw hunt (DM540) from 300 to 450 permits and for the youth any-bull hunt (YM541) from 100 to 150 permits.

During the spring 2019 BOG meeting, the board created 2 new drawing hunts in Unit 16A, one with a bag limit of any-bull, with season dates of 20 August–25 September and up to 50 permits available. The other drawing hunt is for antlerless moose, with season dates of 20 August–25 September, and up to 200 permits would be available. Both hunts would be advertised

Table 4A. Unit 16A moose harvest and accidental death, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Reported				Estimated			Accidental deaths[a]			Grand total
	M	F	Unk	Total	Unreported[b]	Illegal[c]	Total	Road	Other	Total	
2015	234	0	0	234	16	20	36	19	0	19	289
2016	234	0	1	235	16	20	36	22	0	22	293
2017	231	0	1	232	16	20	36	24	0	24	292
2018	203	0	0	203	14	20	34	30	0	30	267
2019	176	0	1	177	12	20	32	19	0	19	228

[a] Roadkill is minimum number and does not reflect moose hit and lost or not salvaged.
[b] Derived by taking 7% of the reported harvest.
[c] Includes moose taken in defense of life or property.

Table 4B. Unit 16B moose harvest and accidental deaths, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Reported				Estimated			Accidental deaths			Grand total[d]
	M	F	Unk	Total[a]	Unreported[b]	Illegal[c]	Total	Road	Other	Total	
2015	355	2	0	357	25	25	50	0	0	0	407
2016	353	0	0	353	25	25	50	0	0	0	403
2017	411	1	0	412	29	25	54	0	0	0	466
2018	457	0	0	457	32	25	57	0	0	0	514
2019	473	0	0	473	33	25	58	0	0	0	531

[a] Includes all reported harvest including federal subsistence.
[b] Derived by taking 7% of the reported harvest.
[c] Includes moose taken in defense of life or property.
[d] Does not include moose taken on Kalgin Island.

Table 5. Unit 16B moose harvest data by permit hunt, regulatory years 2015–2019, Southcentral Alaska.

Hunt number[a]	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unknown	Total
TM565	2015	100	18	42	58	48	0	0	48
	2016	100	25	51	49	37	0	0	37
	2017	100	21	42	58	46	0	0	46
	2018	129	29	53	47	43	0	0	43
	2019	100	22	44	56	44	0	0	44
TM567	2015	80	31	53	47	26	0	0	26
	2016	80	20	42	58	37	0	0	37
	2017	80	29	32	68	39	0	0	39
	2018	108	27	25	75	59	0	0	59
	2019	80	28	31	69	40	0	0	40
TM569	2015	80	48	67	33	14	0	0	14
	2016	80	44	69	31	14	0	0	14
	2017	80	49	73	27	11	0	0	11
	2018	80	56	60	40	14	0	0	14
	2019	80	48	60	40	17	0	0	17
DM540	2015	300	35	63	37	72	0	0	72
	2016	300	32	62	38	77	0	0	77
	2017	300	34	56	44	86	0	0	86
	2018	448	35	57	43	126	0	0	126
	2019	450	30	59	41	130	0	0	130

[a] TM represents Tier II permit; DM represents drawing permit; RM represents registration permit; and YM represents youth drawing permit.

– Continued –

Table 5. Page 2 of 2.

Hunt number[a]	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Harvest			
						Bulls	Cows	Unknown	Total
DM/YM541	2015	100	51	67	33	16	0	0	16
	2016	100	50	66	34	17	0	0	17
	2017	100	40	60	40	24	0	0	24
	2018	149	44	59	41	32	0	0	32
	2019	150	58	49	51	32	0	0	32
RM572[b]	2015[c]	130	22	55	45	23	22	0	45

[a] TM represents Tier II permit; DM represents drawing permit; RM represents registration permit; and YM represents youth drawing permit.
[b] RM572 represents Kalgin Island registration permit.
[c] After RY15, RM572 was moved to Unit 15B.

Table 6A. Unit 16A moose hunter residency and success, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Successful						Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	Percent	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	
2015	12	197	24	1	234	23	45	744	44	6	794	1,028
2016	10	205	20	0	235	22	35	758	50	4	812	1,047
2017	11	192	27	1	231	21	43	790	57	2	849	1,080
2018	8	171	24	0	203	19	35	801	37	1	839	1,042
2019	9	144	24	0	177	19	41	700	46	3	749	926

[a] Unit 16 residents.

Table 6B. Unit 16B moose hunter residency and success, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Successful						Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	Percent	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	
2015	8	130	43	0	181	25	19	471	62	1	553	734
2016	5	133	33	0	171	23	28	489	59	4	580	751
2017	4	132	69	1	206	25	25	491	100	7	623	829
2018	4	108	69	2	183	23	13	501	97	1	612	795
2019	5	124	78	3	210	24	13	559	101	4	677	887

Note: This table does not include individuals participating in permit hunts.
[a] Unit 16 residents.

in the 2019 November/December application period and the hunts would first be held in the fall of 2020.

Recommendations for Activity 2.1

Continue.

Table 7A. Unit 16A moose harvest chronology, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	August			September				Unknown	Total
	10–17	20–26	27–31	1–7	8–14	15–20	21–25		
2015	1	20	10	7	42	89	64	1	234
2016	2	20	8	21	31	81	67	5	235
2017	2	20	5	24	40	75	61	4	231
2018	0	10	10	14	35	80	50	4	203
2019	0	7	4	16	33	65	48	4	177

Note: This table does not include harvest from permit hunts.

Table 7B. Unit 16B moose harvest chronology, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	August		September				Unknown	Total
	20–26	27–31	1–7	8–14	15–20	21–25		
2015	11	2	14	32	70	49	3	181
2016	7	9	9	35	67	43	1	171
2017	12	7	15	38	87	41	6	206
2018	3	1	10	35	79	50	5	183
2019	6	4	9	38	79	71	3	210

Note: This table does not include harvest from permit hunts.

3. Habitat Assessment/Enhancement

ACTIVITY 3.1. Assess habitat quality and availability.

Data Needs

Monitoring browse utilization characteristics by moose enables an evaluation of the impact of increasing moose density on the available habitat and can serve as a signal to liberalize harvest in order to avert habitat degradation and a subsequent crash in the moose population.

Methods

Staff developed a browse survey scheme based on the work of Paragi and Kellie (2011), and Seaton et al. (2011; Appendix B). Due to differences in snowfall, and browse species composition and quantity, we divided Unit 16B into a northern and southern portion based on existing moose survey maps, knowledge of the area, and differences between where the 2 subareas may be distinct. Determinations of plot locations in the 2 areas were accomplished based on known areas of moose concentrations in fall and winter as determined by the GSPE

Table 8A. Unit 16A percent transport methods of successful moose hunters, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Transport method percent									Total
	Airplane	Horse	Boat	ATV	Snow-machine	ORV[a]	Highway vehicle	Unk	Airboat	
2015	9	18	46	12	10	2	0	3	0	233
2016	6	20	41	15	13	2	0	3	0	234
2017	8	17	37	19	11	3	1	3	1	231
2018	10	16	37	22	12	1	1	1	0	202
2019	8	16	42	21	8	2	1	1	1	177

Note: This table does not include harvest from permit hunts.
[a] ORV represents off-road vehicle.

Table 8B. Unit 16B percent transport methods of successful moose hunters, regulatory years 2015–2019, Southcentral Alaska.

Regulatory year	Transport method percent									Total
	Airplane	Horse	Boat	ATV	Snow-machine	ORV[a]	Highway vehicle	Unk	Airboat	
2015	62	2	21	4	1	1	4	4	1	179
2016	58	2	26	4	0	2	5	1	2	170
2017	56	3	25	5	0	4	4	3	0	204
2018	59	3	19	8	1	4	4	1	1	181
2019	59	2	22	6	0	6	3	2	0	209

Note: This table does not include harvest from permit hunts.
[a] ORV represents off-road vehicle.

sampling scheme, which entails subdividing suitable habitat in the unit into 2 strata of high and low density based on relative density in late fall. In Unit 16B, moose surveys are subdivided into 3 separate areas demarcated by boundaries at the Skwentna and Yentna rivers, and the Beluga River, Beluga Lake and the Triumvirate Glacier (Fig. 1). Initial analysis began by selecting 30 units in a 2:1 ratio with high and low strata, respectively, for each survey. These 30 plots per survey were supplemented with an additional 10 alternate plots that were selected to account for plots that may have been rejected due to no available habitat in accordance with the protocol set out in Paragi et al (2014). Sampling of the selected plots also follows the procedures cited above.

Results and Discussion

We sampled 30 units in the northern half of Unit 16B during 16–19 March, and 28 units in the southern half during 19–24 March. Covid-19 protocols initiated after 24 March prevented the completion of 2 sample plots. Nevertheless, we believe our coverage of the area was adequate. Surveys completed in the Alaska Interior demonstrated that 30 samples per unit is sufficient to determine the extent of moose grazing independent of the unit's size, however, we decided that the differences in snowfall patterns and species composition between the northern and southern portions of Unit 16B were potentially large enough that they warranted splitting the unit and treating each as a separate survey. The results showed similar amounts of browse offtake in both units. Browse removal rates for the northern portion of Unit 16B were 36.39, 95% CI = 28.7–44.1, and in the southern portion were 36.02, 95% CI = 31.0–41.0. The proportion of offtake on a kilogram per hectare basis was also similar with 3.62 ±2.74 kg/ha in the north versus 4.32 ±1.85 kg/ha in the south. Species composition was also similar between the 2 surveys with a few exceptions (Fig. 3). We encountered much more Cottonwood (*Populus balsamifera*) in the northern survey unit compared to the south, and much more Bebb willow (*Salix bebbiana*) in the south as compared to the north. While it appears from the graph below that there was a difference in the amount of Alaska birch (*Betula neoalaskana*) in the south compared to the north, birch was present in 19 plots in the south compared to 17 plots with birch in the north. The differences in production and offtake may have more to do with the maturity of the birch encountered in the 2 areas. If northern survey birch are older, they may not have had as much browse available to moose as the younger birch encountered in the south. One indication that this may be the case is that 14 plots in the northern survey were late-stage growth, compared to 9 in the southern survey unit.

There is a well-documented inverse relationship between the severity of browsing an area receives and the percentage of cow moose that twin in that area in Interior Alaska (Boertje et al. 2007, Seaton et al. 2011). Biomass removal >35% is indicative of a moose population that may be experiencing a nutritional limitation, and this is often followed by decreasing twinning rates. Boertje et al. (2007) suggested that multi-year twinning rates < 10%, as well as short-yearling mass <175kg, and/or <50% of 36-month-old cows parturient may signal the need for more liberal harvest of moose, and in particular, the need to harvest antler-less moose as a means of arresting further population growth. Both surveys in Unit 16B showed a similar amount of biomass removal in excess of 36% (Fig. 4).

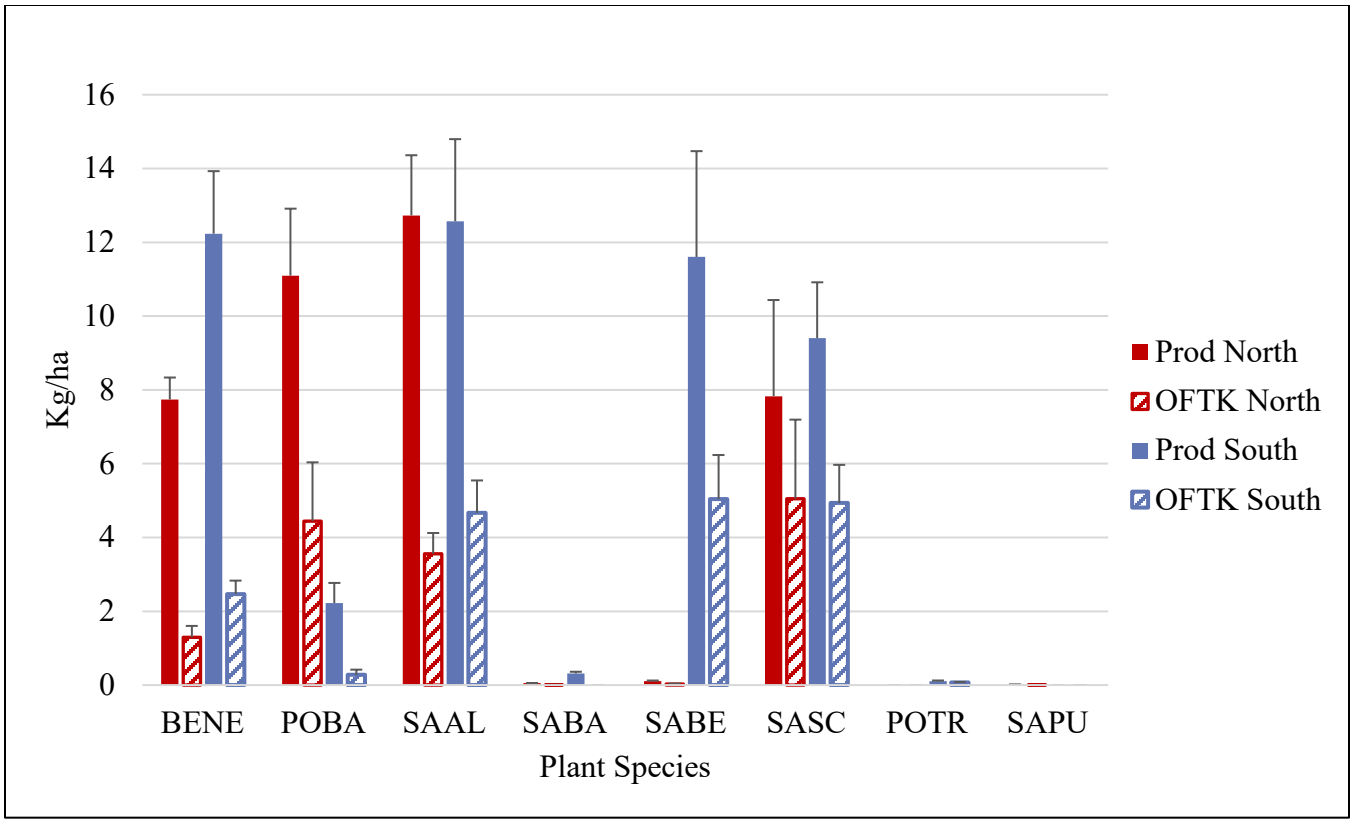

Figure 3. Comparisons of preferred moose browse and offtake in Unit 16B browse surveys, regulatory year 2019, Southcentral Alaska.

Note: Prod in the legend denotes production, which is how much browse per hectare was produced the previous year in kilograms. OFTK is the amount of browse offtake, or the amount eaten over the winter, in kilograms per hectare. The plant species are BENE for *Betula neoalaskana*, POBA for *Populus balsamifera*, SAAL for *Salix alaxensis*, SABA for *Salix Barclayi*, SABE for *Salix bebbiana*, SASC for *Salix Scouleriana*, POTR for *Populus tricocarpa*, and SAPU for *Salix pulchra*.

Recommendations for Activity 3.1

Continue. Further analyses are needed to determine if the habitat requirements of moose in Southcentral Alaska are similar to previous work conducted in Interior Alaska.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

RECORDING

GSPE moose survey form (Appendix A).

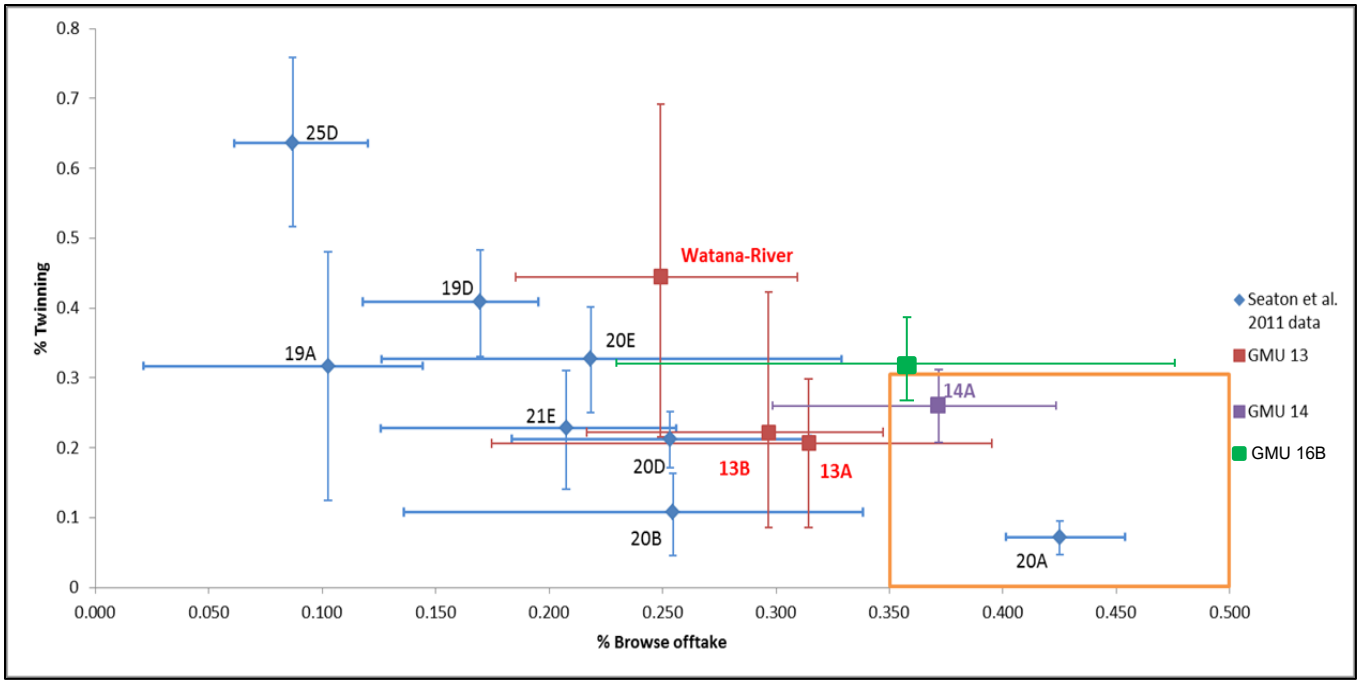

Figure 4. Comparison of browse offtake and twinning rates, Units 13, 14, and 16B, Southcentral Alaska.

Note: The box denotes the amount of browse offtake that could indicate nutritional limitations for moose. The Watana River is within Unit 13E.

ARCHIVING

- GSPE and harvest data are stored on an internal database housed on a server (http://winfonet.alaska.gov/index.cfm). Digitized field data sheets are stored in file folders located in the Palmer Assistant Area Biologist's office.

- Field data sheets are scanned and housed on the computer server in the Palmer Area Biologist's office (O:\WC\Palmer Area Office Folder\Species\Moose\Moose Population Estimation\16A or 16B Moose Survey Data\Archived Survey Sheets) and stored in file folders located in the Palmer Assistant Area Biologist's office.

- All other electronic data and files such as copies of field data sheets, survey memos, maps, and reports are located on the in-house server (O:\\WC\Palmer Area Office Folder\).

Agreements

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

Permitting

No permits were needed to conduct moose management activities in Units 16A and 16B during RY15–RY19.

Conclusions and Management Recommendations

The current population and harvest objectives for Unit 16A are adequate at this time. The harvest has been within objective 4 of the previous 5 years. The moose population appears to be at the population objective, if not slightly over. Additional browse surveys in the unit would help determine if the population objective is appropriate for the density of moose that reside in the unit currently. Moose population surveys should be conducted on a triennial basis preferably in the fall to closely monitor this population.

The moose population was estimated to be over 10,000 in Unit 16B during RY15–RY19. The population objective is for between 6,500 and 7,500 moose. The results of the browse survey and the decreasing twinning rate indicate that the population may be at the upper end, or beyond its carrying capacity. The harvest has been within the harvest objective of 310–600 moose, however, additional steps including antlerless harvest should be available to prevent the population from growing beyond what the habitat can support.

Both Units 16A and 16B are subject to deep snow winters on a decadal basis that can have a significant impact on the moose population. Unit 16B and a portion of Unit 16A are currently under an intensive management plan that requires closely monitoring the moose population as well as black bears, brown bears, and wolves. Additional measures to determine the size of black bear, brown bear, and wolf populations should be taken to help determine their impact on the moose population, and to prevent that population from reaching a low-density dynamic equilibrium should heavy snows reduce the population in the future.

II. Project Review and RY20–RY24 Plan

Review of Management Direction

Management Direction

There are no changes in the management direction for Unit 16. However, in an effort to develop a more effective management strategy within the existing framework, area staff are expanding and documenting potential improvements to the current program.

Goals

The goals for Unit 16 moose management remain unchanged. Specifically, they are to:

- Protect, maintain, or enhance the moose population and its habitat in concert with other components of the ecosystem to optimize opportunity to participate in hunting moose.
- Provide and enhance wildlife viewing opportunities with special consideration for state and national parks.

CODIFIED OBJECTIVES

Amount Reasonably Necessary for Subsistence Uses

- Unit 16B, Redoubt Bay drainages TM569: 10 moose.
- Unit 16B, south of the Beluga River and north of Redoubt Bay: 29–37 moose.
- Unit 16B, north of the Beluga River: 160–180 moose.

Intensive Management

In 2001 BOG adopted a positive finding for intensive management of moose in Unit 16. As per intensive management law, maintain:

UNIT 16A

- Attain a population of 3,500–4,000 moose.
- Achieve an annual harvest of 190–360 moose.

UNIT 16B

- Maintain a moose population of 6,500–7,500 moose.
- Achieve an annual harvest of 310–600 moose.

MANAGEMENT OBJECTIVES

1. Manage moose populations at the following levels:
    a. Unit 16A: Maintain a population of 3,500–4,000 moose.
    b. Unit 16B: Maintain a population of 6,500–7,500 moose.
2. Manage for a posthunt (fall) sex ratio of 20–25 bulls:100 cows in each unit.
    a. Manage population levels based on mean spring twinning rates over a 3-year period in accordance with the recommendations of Boertje et al. (2007) <10% twinning rate (manage for population reduction).
    b. 10–20% twinning rate (manage for population stability).
    c. >20% twinning rate (manage for population growth).

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct aerial inventory, and a sex and age composition survey in the unit to determine population size, composition, productivity, and trends.

Conduct a GSPE survey to inventory and determine sex and age composition in the unit to determine population size, productivity, and trends. The survey should be conducted with an SCF and designed to ensure that the interval proportion of the mean is ≤20% at the 90% confidence interval.

Data Needs

Area staff will continue to consult with biometric staff to ensure that methods have the necessary statistical power required to adequately sample the population.

Methods

Due to the importance of the Unit 16 moose population, surveys should be conducted on a biennial basis in Unit 16B–Middle, and triennially in Unit 16A, 16B–North, and 16B–South. When conditions prohibit fall surveys for several years, winter GSPE surveys should be conducted.

Variance in the population estimate and specifically in the SCF suggest that the total area surveyed, and the number of units selected for intensive surveys should be increased to gain precision in the estimate. Area staff will consult with a biometrician to determine the most effective methods to accomplish this goal.

In years where a complete GSPE survey is not completed, sex and age composition surveys should be completed in Unit 16B–Middle to detect any changes in the sex and age ratios that may augment existing data to determine trends and inform management decisions.

ACTIVITY 1.2. Spring parturition, twinning, and recruitment surveys in Unit 16B.

Manage population levels based on multi-year mean spring twinning rates over a 3-year period such that if the twinning rate is <10%, additional steps will be taken. These steps will substantiate low twinning-based nutritional status and may include determining if 1) <50% of 36-month-old moose are parturient, 2) a multi-year short-yearling mass <385 lbs. (175 kg), and/or >35% of annual biomass is removed by moose (Boertje et al. 2007).

Data Needs

No change from RY15–RY19.

Methods

To have an adequate sample size to continue monitoring the population with the existing approach, area staff will need to maintain a number of radio collars on the air. This will require capturing and radio-collaring cows to replace radio collars that are no longer functioning or cows

that have died. We recommend focusing capture efforts on short-yearlings (~10 months) to provide moose of known ages and prevent instances of animals that may have become too old to provide relevant reproduction information. Short-yearling captures will also inform decisions regarding the nutritional status of the population.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor moose mortality through field observations, hunter harvest reports, contact with hunters, and other causes of mortality.

Data Needs

No change from RY15–RY19.

Methods

No change from RY15–RY19.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Habitat assessment.

Data Needs

Monitoring forage utilization and forage plant condition enables an evaluation of the impact of increasing moose density on the available habitat and can serve as a signal to liberalize harvest in order to ward off the potential for severe habitat degradation and a subsequent crash in the moose population.

Methods

Staff should develop a browse survey protocol based on the work of Paragi and Kellie (2011), and Seaton et al. (2011) with a modification allowing for sampling in the roaded areas of Unit 16A.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

No new issues have been identified for the RY20–RY24 plan period.

Data Recording and Archiving

- GSPE and harvest data are stored on an internal database housed on a server (http://winfonet.alaska.gov/index.cfm). Digitized field data sheets are stored in file folders located in the Palmer Assistant Area Biologist's office.

- Field data sheets are scanned and housed on the computer server in the Palmer Area Biologist's office (O:\WC\Palmer Area Office Folder\Species\Moose\Moose Population Estimation\16A or 16B Moose Survey Data\Archived Survey Sheets) and stored in file folders located in the Palmer Assistant Area Biologist's office.

- All other electronic data and files such as copies of field data sheets, survey memos, maps, and reports are located on the in-house server (O:\\WC\Palmer Area Office Folder\).

- Historical (1990–2016) survey notes and data sheets should continue to be scanned for a more secure data archive.

Agreements

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

Permitting

No permits are expected in this period.

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Appendix A. Moose survey form used in stratified surveys such as the geospatial population estimator and for composition surveys.

MOOSE SURVEY FORM

Date ____/____/____ Page ____ of ____

GMU ____ Count Area ____ Mi² in count area ____

Aircraft Type ____ Pilot/Observer ____/____ Cost/hr ____

WEATHER:

Cloudcover (%) ____ Precipitation ____ Temp ____

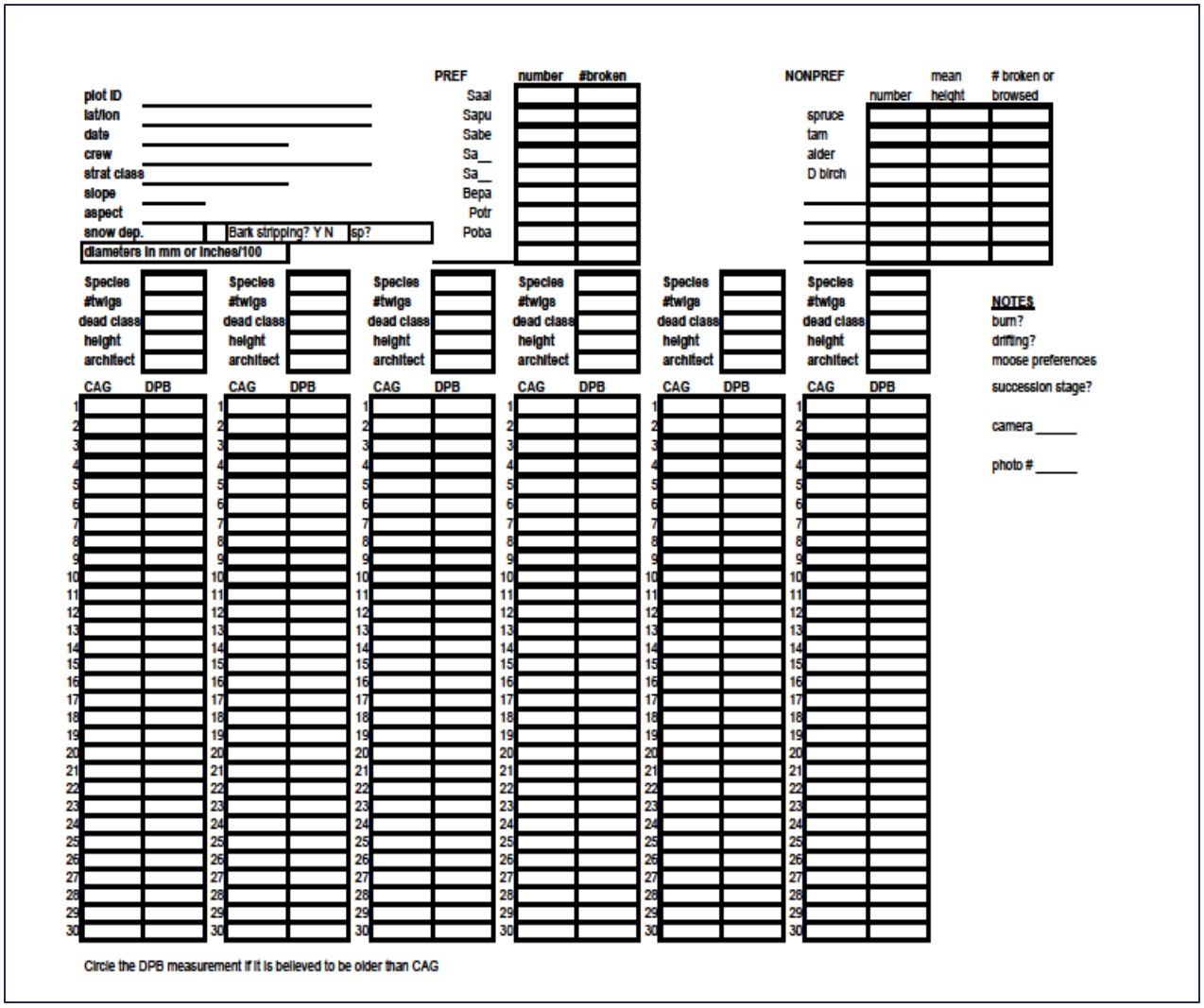
Wind Speed and Direction ____ Turbulence ____

CONDITIONS:

Light				**Snow age and cover**				**Flight Time**
Type		Intensity		Age		Cover		Depart
Bright	☐	High	☐	Fresh	☐	Complete	☐	Start Count
Flat	☐	Medium	☐	Moderate	☐	Low vegetation showing	☐	Stop Count
		Low	☐	Old	☐	Bare ground showing	☐	Return
								Flight Time
General Survey Conditions		☐ Excellent		☐ Good		☐ Fair	☐ Poor	Survey Time

	BULLS				COWS				Unk	
Group No.	Yearlings S/F I 3 pt.		Med < 50"	Large ≥ 50"	w/o calf	w/1 calf	w/2 calf	Lone Calf	sex/ age	Remarks
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										
Total Page 1										
Total Page 2										
Totals										

Appendix B. Browse survey data sheet.



plot ID
lat/lon
date
crew
strat class
slope
aspect
snow dep.
Bark stripping? Y N
sp?
diameters in mm or inches/100

PREF	number	#broken
Saal		
Sapu		
Sabe		
Sa__		
Sa__		
Bepa		
Potr		
Poba		

NONPREF	number	mean height	# broken or browsed
spruce			
tam			
alder			
D birch			

Species
#twigs
dead class
height
architect

	CAG	DPB
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Circle the DPB measurement if it is believed to be older than CAG

NOTES
burn?
drifting?
moose preferences
succession stage?
camera _____
photo # _____

Architecture classes (browsing history of the plant, includes this year, and all visible evidence of past years)
broomed- more than half of the CAG twigs rise from lateral twigs that are the result of browsing
unbrowsed- no evidence of past browsing
browsed- less than half of the CAG twigs rise from lateral twigs that are the result of browsing

Species	Species	Species	Species	Species	Species
#twigs	#twigs	#twigs	#twigs	#twigs	#twigs
dead class	dead class	dead class	dead class	dead class	dead class
height	height	height	height	height	height
arch/dfect	arch/dfect	arch/dfect	arch/dfect	arch/dfect	arch/dfect

	CAG	DPB	CAG	DPB	CAG	DPB	CAG	DPB	CAG	DPB	CAG	DPB
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
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28												
29												
30												

Dead classes (amount of dead material that comprises a plant)
X= no dead
L= less dead than live material
M= more dead than live material

STEPS IN SURVEY
1. Locate center of plot
2. Locate boundary of plot
3. If no pref plants, pick alt
4. Snow depth
5. Choose random distance and direction from center to start measuring closest plant of each pref species
6. Turn head and grab stem on plant
7. Measure 10 twigs starting at terminal end of that stem
8. height, # twigs, spp, arch.
stems only between 0.5m and 3.0m
9. Choose next random distance and direction from center for other plants to measure
9.5. Goal is 30 twigs/ spp
10. Estimate # of all woody browse plants by species in plot

TIPS
*Pref plant has CAG twigs between 0.5m and 3m
*Bepa, Sasi, Sabe, etc., can be nonpref plants if they are too tall
*measure plant height from ground


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