Moose Management Report and Plan, Game Management Unit 6:

Report Period 1 July 2015–30 June 2020, and

Plan Period 1 July 2020–30 June 2025

Charlotte Westing

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Alaska Department of Fish and Game   Division of Wildlife Conservation

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PREPARED BY:

Charlotte Westing
Area Wildlife Biologist

APPROVED BY:

Jeff Selinger
Management Coordinator

REVIEWED BY:

Dr. Thomas Lohuis
Research Coordinator

PUBLISHED BY:

Sky Guritz
Technical Reports Editor

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose (*Alces alces*) in Unit 6 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., RY18 = 1 July 2018–30 June 2019). 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 6 covers approximately 10,140 mi^2 of land including Prince William Sound, the Copper River Delta, and the North Gulf Coast of Alaska (Fig. 1). Unit 6 is divided into 4 administrative units (6A, 6B, 6C, and 6D.) Moose did not occur in meaningful numbers prior to their introduction, likely due to physical barriers (converging glaciers) to migration. Terrain includes rugged mountains, old-growth forest, coastal wetlands, and muskeg meadows.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 6

Moose populations in most of Unit 6 originated from translocations of calves from the Kenai Peninsula, Anchorage, and the Matanuska-Susitna area (Paul 2009). The only moose endemic to this unit are small populations in the Lowe River drainage in Unit 6D, which probably number about 40 animals total. Until sometime within the last 70 years, glaciers isolated the Copper River Delta (CRD) from moose populations in other parts of the state. Many people recognized the CRD contained good moose habitat.

During 1949–1958, Cordova residents successfully raised 24 captive moose calves and released them on the western CRD (Unit 6C). This small population grew rapidly and expanded eastward across the Copper River and into the Martin River Valley (Unit 6B) by the early 1960s. Eastward expansion continued into the Bering River area (Unit 6A) by the late 1960s and to Cape Yakataga by the mid-1970s. Meanwhile, the 1964 Good Friday Earthquake led to uplift by as much as 11.5 meters (38 feet) in areas of Unit 6. The CRD itself uplifted 1.8–3.4 meters (5.9–11.2 feet), effectively changing the habitat from a subtidal estuary to intertidal and supertidal wetlands that are gradually transitioning from willow to alder. These changes may be decreasing available moose habitat and habitat quality (Stephenson et al 1998). To reinitiate habitat succession, the U.S. Forest Service (USFS) and the Native Village of Eyak (NVE) have been mechanically cutting (via hydraulic ax) nearly annually since the 1990s.
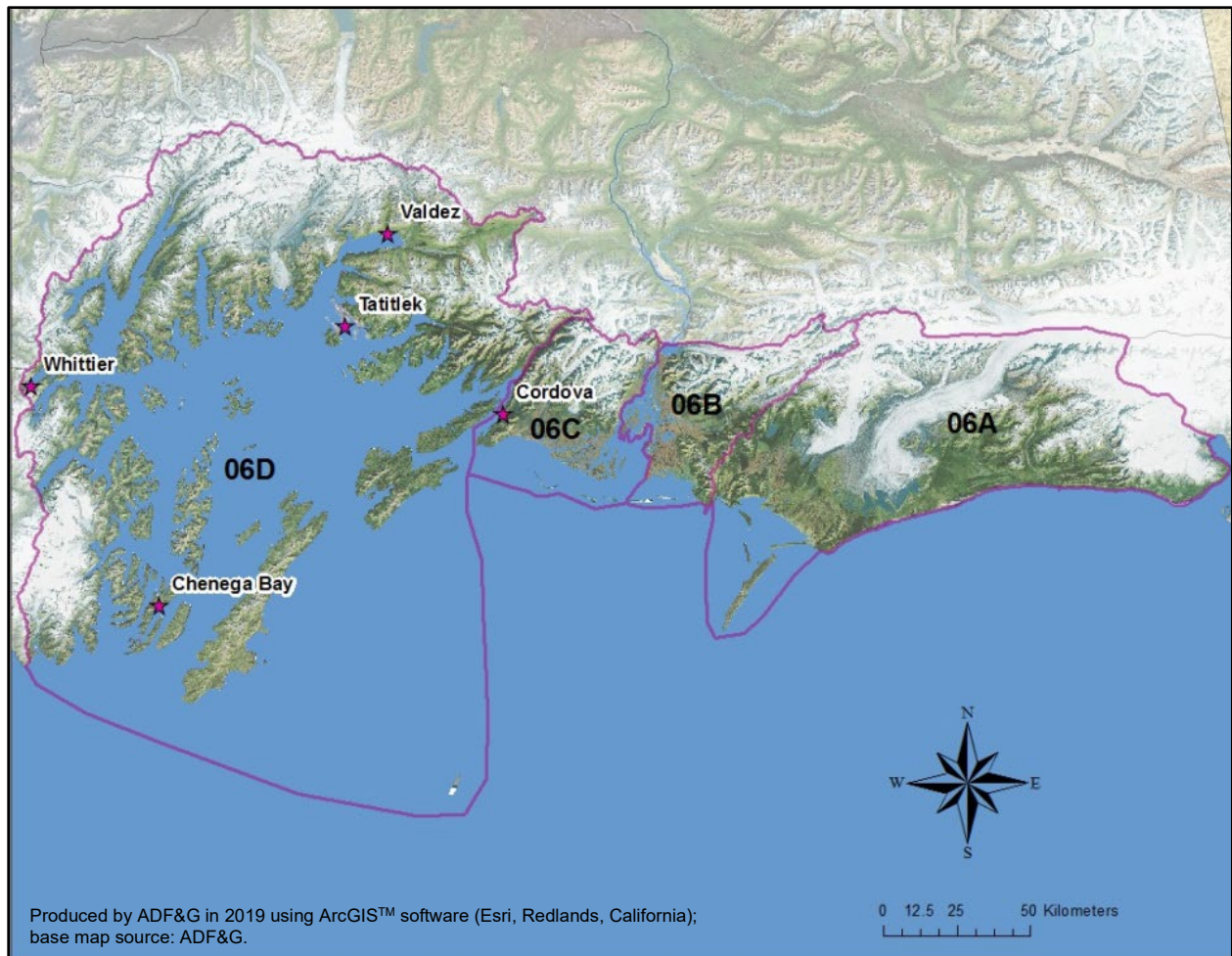
Figure 1. Game Management Unit 6 and its administrative units (subunits), Alaska.

CRD was evaluated for nutritional carrying capacity of moose in the early 1990s (MacCracken 1992, MacCracken et. al 1997). The carrying capacity estimate encompassed a wide range, 380–1,424 moose, depending on winter snow depths. In the early 1990s, population estimation techniques transitioned from minimum count techniques to the Gasaway estimation technique (Gasaway et al. 1986). Nowlin (1995) revised harvest objectives in 1994 using this new information about carrying capacity of the winter ranges and better estimates of population size.

The population reached a high of approximately 1,600 in 1988 as the population came out of its irruptive period (Griese 1990). Population objectives were relatively conservative in the 1970s and early 1980s because of concerns about mortality during severe winters. Objectives were established at 0.9–1.2 moose/mi^2 after a severe winter in 1971–1972 and remained conservative under management plans written in 1976 (ADF&G 1976).

Hunting of the introduced population in Unit 6C began with 25 bulls harvested in 1960. Harvest began in Unit 6B during 1965 and Unit 6A during 1971. In 1977, moose in Unit 6A were designated as 2 populations (east and west of Suckling Hills) and have been managed separately since then.

By 1994, harvest was liberalized to accommodate an interest in increased harvest opportunities (Nowlin 1998). Cow hunts were permitted to prevent postirruptive collapse. However, since that time, the populations in Units 6B and 6A have declined and stabilized at low numbers that are incompatible with cow harvest. The last year of cow harvest in Unit 6B was in 1998, and the last year in Unit 6A was in 2005. Now cow hunts are only used in Unit 6C, where productivity is high, and the population is within population objectives.

Hunters harvested more than 6,400 moose from 1965 to 2020 in Units 6A, 6B, and 6C. In contrast, total kill of the endemic moose population in Unit 6D during the same period was approximately 130 moose. The 10-year (RY05–RY14) and 20-year average (RY95–RY14) annual harvest in Unit 6 was 120 (standard deviation [SD] = 29) and 104 (SD = 29) moose, respectively.

The harvest allocation for cow moose in Unit 6C was moved into federally administrated subsistence hunting in 2000, followed by 75% of the bull harvest quota in 2002. These changes reflected a positive customary and traditional use finding by the Federal Subsistence Board (FSB) the same year. This increased rural harvest opportunity for Cordova residents from an average 75% under state regulations to more than 90% under combined state and federal regulations.

In 2017, the Prince William Sound/Copper River Delta Fish and Game Advisory Committee reviewed current information regarding the moose population and habitat in Unit 6C. A new carrying capacity study had been published that documented low browse utilization and moose potential habitat than had been previously considered (Smythe 2015). The committee voted unanimously to revise management objectives for this area to the following: 600–800 moose and a minimum bull-to-cow ratio of 25:100 to maintain a healthy distribution among age classes of bulls.

Management Direction

EXISTING WILDLIFE MANAGEMENT PLANS

A formal plan for moose management in Unit 6 does not exist. However, current management goals and objectives were formed with thorough consultation with the local Fish and Game Advisory Committee.

GOALS

Our goals in Unit 6A East are to focus harvest on large moose (>50-inch antler spread) and to provide for optimum harvest. For the remainder of Unit 6, the goals are to provide for optimum harvest and to provide for the greatest opportunity to hunt.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The Alaska Board of Game has not made a positive customary and traditional use determination for moose in Unit 6.

Intensive Management

Moose in Unit 6 have a negative intensive management finding.

MANAGEMENT OBJECTIVES

The management objective for Unit 6A East is to maintain a population of 300–350 moose and a minimum bull-to-cow ratio of 30:100. The objectives for Units 6A West and 6B are to maintain populations of 300–350 moose and minimum bull-to-cow ratios of 15:100 in each unit. In Unit 6C, our objective is to maintain a population of 600–800 moose and minimum bull-to-cow ratios of 25:100 to provide for improved viewing opportunities along the Cordova road system.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Estimate late winter abundance in at least 1 survey area annually. Estimate calf recruitment in at least 1 late winter survey area annually.

Data Needs

Population estimates are necessary to provide maximum harvest while meeting objectives. Estimating calf recruitment may help in anticipating population trajectory and guide setting appropriate harvest rates.

Methods

Population estimates were conducted between mid-January and mid-March. Surveys were dependent on adequate snow cover and an acceptable weather window for survey completion. Study design was based on stratified random sampling with the Geospatial Population Estimator (GSPE) technique. Sample units were flown at altitudes of 800–1,500 feet above ground level at an intensity of approximately 4–6 minutes per square mile. When possible, sightability correction factors (SCFs) were generated using more intensive surveys (9–12 minutes per square mile). SCFs, applied to the number of moose observed, give an estimate of total observable moose.

Data was analyzed using the geospatial population estimation (GSPE) analysis tool in ADF&G's Wildlife Information Network[1] (WinfoNet). In some surveys, GSPE is only used for the high strata and a standard Gasaway analysis for the low strata.

Recruitment of calves is estimated during spring surveys, usually in concert with a population estimate. Calves are identified based on body size, rostrum length, and proximity to a larger moose. GPS locations are recorded to assess distribution.

Results and Discussion

During RY15–RY19, GSPE surveys were conducted in RY16 for Unit 6A West, in RY17 for west of the CRD (Unit 6C) and east of the CRD including the Martin River Valley (Unit 6B), and in RY19 for Unit 6A West and Unit 6A East. No population estimation surveys were conducted in RY15 and RY18 due to weather (inadequate snow). Results from RY15–RY19 are summarized below.

Units 6B and 6C

The RY17 point estimate for Unit 6B, east of the Copper River Delta and including the Martin River Valley, is 420 (90% CI = 320–520; Table 1.) This is the highest population estimate ever generated for this area. For the first time since 1998, the estimate is within or above the population objective (300–350) for this area (Fig. 2). While this is a dramatic increase from the last population estimate, composition surveys in RY14 and RY16 foreshadowed this result. The 2014 fall composition noted the highest fall calf retention (36 calves:100 cows) observed since 1977 when the population was probably within its irruptive period. In 2016, the fall composition survey led to the observation of 245 moose, more than the last population estimate (227 moose in 2014) even though only selected units within the survey area were flown. This suggests that many of the calves observed in the 2014 survey recruited into the population. The total number of moose observed on the RY17 survey (195 moose) was almost double what was observed in 2014 (106 moose) despite lower survey intensity (45% of units surveyed in 2014 and 33% of units surveyed in RY17).

The RY17 point estimate for Unit 6C, west of the Copper River Delta is 677 (90% CI = 468–888; Table 1.) This is very close to the point estimates of the 2 previous population estimates (601 moose in RY11 and 609 moose in RY13; Fig. 3) The population appears to be stable despite high harvest.

Calf recruitment was good in the RY17 population estimate. Calf survival in Unit 6C was 32% of observed moose, compared with 16% calves in GMU 6B (east of the Copper River including Martin River drainages).

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[1] WinfoNet is the Division of Wildlife Conservation's intranet data system.
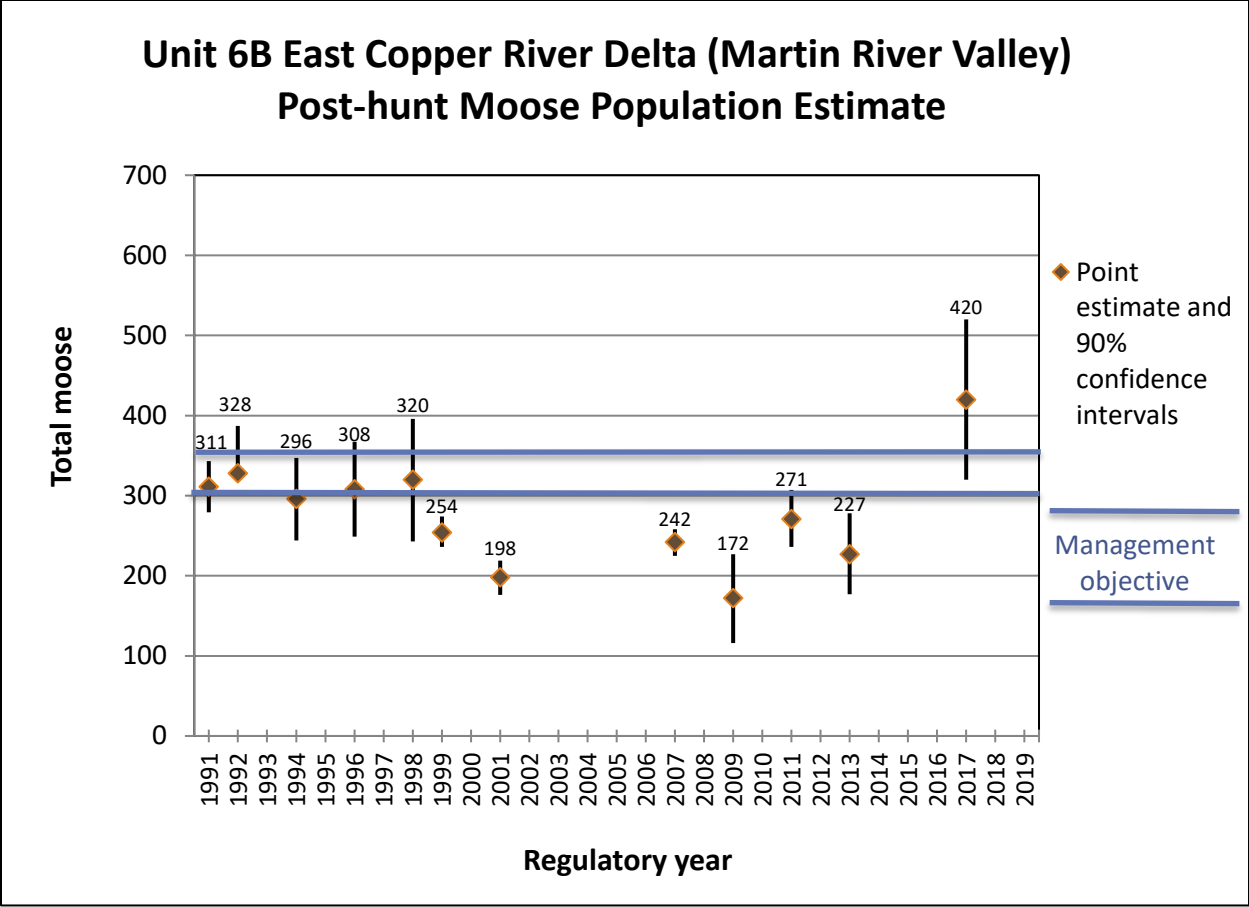
Figure 2. Post-hunt moose population estimates, Unit 6B, regulatory years 1991–2019.
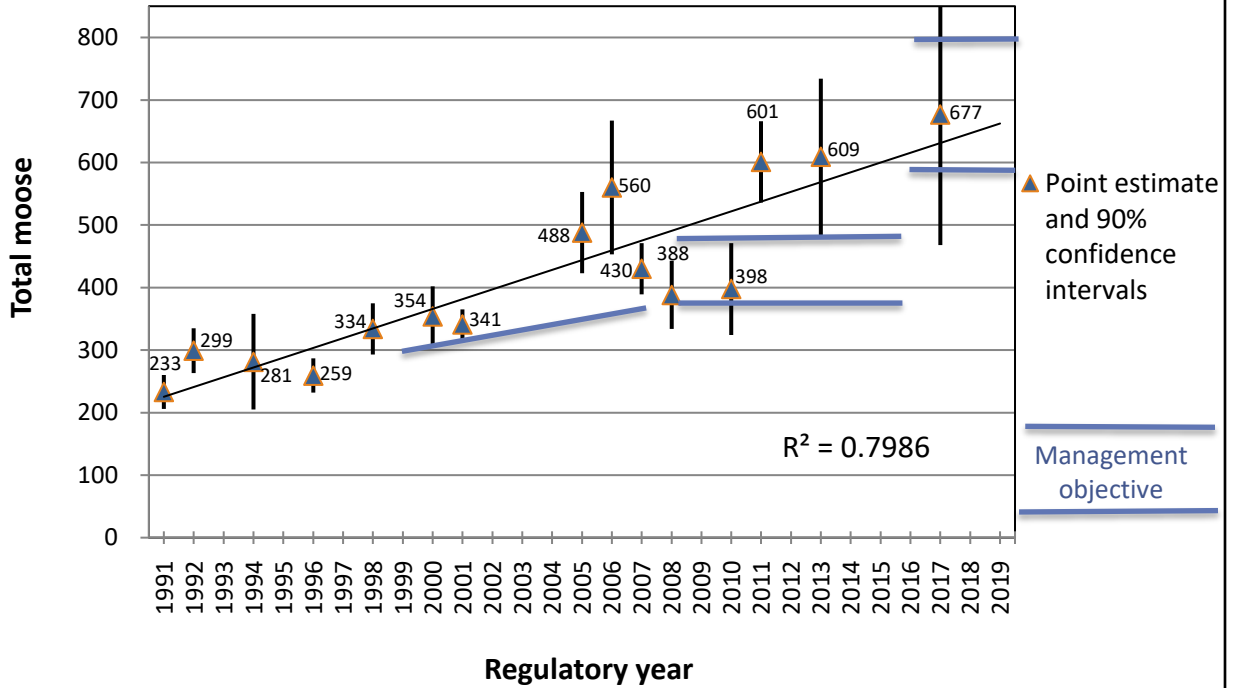
Figure 3. Post-hunt moose population estimates in Unit 6C, Alaska, regulatory years 1991–2019.

Table 1. Unit 6, Alaska moose population estimates, regulatory years 2005–2019.

Unit	Regulatory year	Survey date	Calves (%)	Adult estimate	Population estimate	90% Confidence interval	Moose observed
6A East	2007	29 Jan 2008	7	213	230	212–247	203
	2009[a]	2 Feb 2010	–	–	–	–	49
	2019	13 Mar 2020	13	273	316	289–342	294
6A West	2007	31 Jan 2008	7	257	276	249–301	232
	2008	14 Feb 2009	3	237	245	212–279	194
	2016	3 Mar 2017	14	231	269	207–331	140
	2019	14 Feb 2020	11	183	204	117–292	108
6B	2007	18 Jan 2007	6	220	242	225–258	195
	2009	17 Mar 2010	16	144	172	116–227	122
	2011	29 Jan 2012	16	227	272	236–307	174
	2013	19 Feb 2014	15	196	227	177–278	106
	2017	2 Mar 2018	16	351	420	320–520	195
6C	2006	18 Jan 2007	20	447	560	453–667	409
	2007	14 Jan 2008	15	367	430	389–471	347
	2008	14 Feb 2009	19	314	388	334–443	269
	2009	16 Mar 2010	17	245	296	164–426	183
	2010	23 Feb 2011	17	331	398	324–471	296
	2011	25 Jan 2012	21	472	601	536–666	535
	2013	19 Feb 2014	20	487	609	483–734	291
	2017	2 Mar 2018	32	464	677	468–888	314

[a] Brief survey between Cape Yakataga and Icy Bay east of established survey, colonized by moose and now hunted regularly.

Unit 6A West

The RY16 point estimate for Unit 6A West, Cape Suckling to Palm Point, is 269 moose (90% CI 207–331; Table 1). The RY19 point estimate for the same area is 204 moose (90% CI = 117–292; Table 1). The point estimates for 6 of the last 7 surveys are within the confidence intervals (CIs) for this survey. This population has not been observed within the management objective of 300–350 for at least 15 years (Fig. 4).

The percentage of calves observed (11%) in RY19 was less than the last survey (14% calves in RY16), but greater than the RY07 and RY08 surveys when 7% and 3% calves were observed, respectively. A minimum count survey was performed in RY14 which also found 13% calves (160 moose observed; Charlotte Westing, Area Wildlife Biologist, ADF&G, Cordova, Completion of moose recruitment surveys in GMU 6A West, Palm Point to Cape Suckling memorandum, 17 April 2015). None of these surveys documented calf abundance indicative of a growing population.

The RY19 point estimate for Unit 6A East, Cape Suckling to Icy Bay, is 316 moose (90% CI = 289–342; Table 1.) With 12 years between population estimates, there is not enough data to speculate on population trajectory. Additionally, this is the first year that the area from Cape Yakataga to Icy Bay has been included in the population estimate. Had this not been included, the estimate would have been very close to past estimates of about 275–285 moose. This population has not been observed within the management objective of 300–350 for at least 25 years (Fig. 5). While the population is now within range of the management objective, it is important to note that this is mostly due to the inclusion of the additional area. The percentage of calves observed (13%) has increased compared with the last surveys (7% calves in RY07, and 11% calves in RY09).

Recommendations for Activity 1.1

Continue.
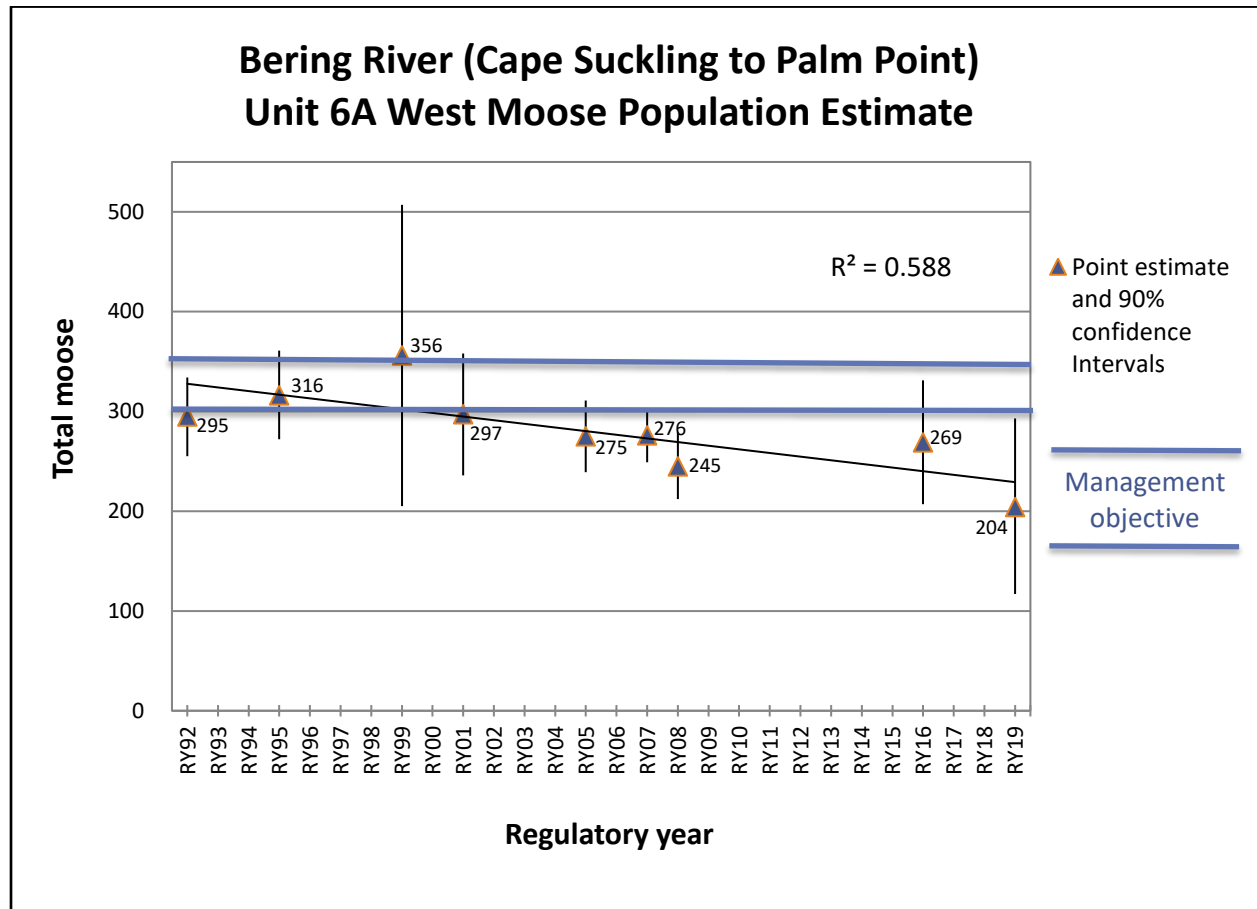
Figure 4. Post-hunt moose population estimates in Unit 6A West, Alaska, regulatory years (RY) 1992–2019.
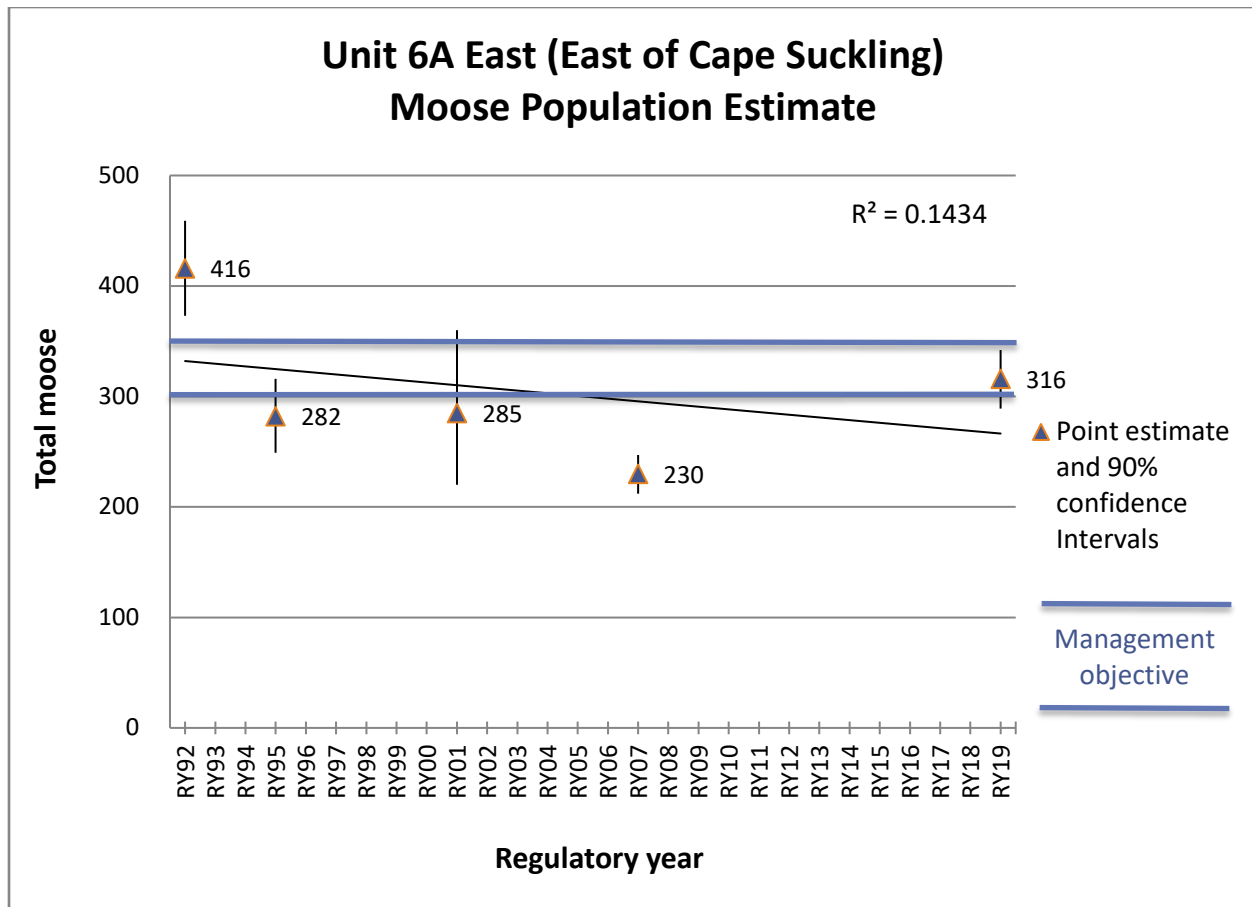
Figure 5. Post-hunt moose population estimates in Unit 6A East, Alaska, regulatory years (RY) 1992–2019.

ACTIVITY 1.2. Estimate fall composition in at least one area annually.

Data Needs

Composition surveys are an essential management tool to calculate appropriate bull harvest quotas and monitor the potential effects of harvest. In addition to the ratio of bulls:100 cows, the ratio of calves:100 cows is collected. This metric can be used to understand winter calf mortality when compared with a spring population estimate. Depressed bull-to-cow ratios have been found to affect the fecundity of primiparous moose (Solberg et al. 2002) and have been related to a delay in mean parturition date which may influence the winter survival of calves (Sæther et al. 2003).

Methods

We conduct aerial surveys to estimate fall moose population composition in November when snow increases sightability (Crowley 2010). In some years, requisite snow does not occur by the time antlers begin to shed in early December making bull identification inaccurate. Surveys are flown in Piper Super Cub aircraft at 300–800 feet above ground level. Survey techniques since RY13 used a stratified random sample of GSPE survey units (approximately 6 square miles). We

used the stratification from the spring population estimate survey to focus effort away from areas that are not expected to have moose. This technique is preferable to abundance-driven sampling, which can lead to bias toward sampling large groups of animals which are weighted toward more cows than other groups.

Sample units were selected using an 90/10 split between high and low strata, respectively, based on most recent spring survey stratification. Sample unit order was randomly generated order with modifications for weather when necessary. Moose seen in transit or outside of sampled units were also counted and classified but were indicated as such so they could be separated for analysis. Bulls were classified as yearling (either spiked or forked antlers), medium (<50-inch antler spread), and large (>50-inch antler spread.) Cows were classified as either a cow without calf, cow with 1 calf, or cow with 2 calves. Prior to 2009 bulls were classified only as either yearling or >2-year-old. Waypoints were taken for groups of animals to record distribution and determine inclusion in GSPE analysis if deemed appropriate. Observations of other wildlife, including coyotes and bears, were also recorded.

Results and Discussion

Fall composition surveys were completed in RY16 for Unit 6B. Fall composition surveys were attempted in RY16 and RY19 in Unit 6C but did not result in usable data. Snow conditions were inadequate in RY15, RY17, RY18, and RY19 in both areas.

Unit 6B

During the RY16 fall composition survey in Unit 6B, 245 moose were observed (Table 2; not counting 36 unclassified due to wind on Long Island), which was 108% of the 2014 spring estimate of 227 moose. The number of moose observed in RY16 is more than double the 2014 fall composition count of 102 moose (Table 2). Seventy-two of these moose were bulls, 150 were cows, and 23 were calves. Using these numbers, 48 bulls:100 cows and 15 calves:100 cows were observed.

Table 2. Unit 6, Alaska moose composition estimates, regulatory years 2005–2019.

Unit	Regulatory year	Survey date	Number observed			Bulls: 100 cows	Calves: 100 cows	Calves (%)	Moose observed
			Bulls	Cows	Calves				
6A West[a]	2005	5 Dec 2005	26	143	18	18	13	10	187
	2009	17 Nov 2009	26	129	19	20	15	11	174
6B	2005	2 Dec 2005	33	77	19	45	25	15	129
	2014	30 Nov 2014	12	66	24	18	36	24	102
	2016	10 Dec 2016	72	150	23	48	15	9	245
6C	2005	1 Dec 2005	45	151	44	30	29	18	240
	2007	30 Nov 2007	32	83	14	36	17	11	129
	2009	16 Nov 2009	34	230	34	14	15	11	298[b]
	2010	2 Dec 2010	40	183	35	22	19	14	258
	2013[a]	2 Dec 2013	63	129	63	49	49	25	255

[a] Composition data not collected in 6A East.
[b] Includes 1 unknown moose.

GSPE allows for the generation of measures of precision. For the GSPE analysis, 201 moose were considered and 44 were discarded because they were outside of the designated sample units. Using these numbers only, 42 bulls:100 cows (95% CI = 36–50) and 17 calves:100 cows (95% CI = 15–22) were observed. Therefore, regardless of whether all waypoints were considered or GSPE analysis was used, both produced similar ratios within confidence intervals.

While 75% of the bulls observed in RY14 (nearly all of those in the medium and large categories; Table 3) were one antlered (due to premature antler cast), only 11% were one antlered in RY16. This suggests that antler cast may have been premature in RY14, and there is the possibility that some antlerless bulls may have been classified as cows. If animals have been misclassified, the bull-to-cow ratio is likely biased low. Abnormal and early antler cast may vary annually and remains an observation of interest.

Table 3. Unit 6B, Alaska fall composition survey detail, regulatory years 2005, 2014, and 2016.

Survey date	Yearling bulls	Medium bulls	Large bulls	Bulls >2 years	Cows	Calves	Unk	No. bulls: 100 Cows	No. calves: 100 cows	Percent calves	Total
2 Dec 2005	9	10	16	26	77	17	0	45	22	13	129
30 Nov 2014	3	7	2	9	66	24	0	18	36	24	102
9 Dec 2016	16	39	15	72	150	23	0	48	15	9	245

The high number of calves observed in RY14 relative to cows (36 calves:100 cows) may have resulted in the large recruitment event observed in RY16. Both the total number of moose observed in RY16 as well as the ratio of bulls to 100 cows substantially improved compared to the RY14 survey. The 18:100 bull-to-cow ratio observed in 2014 may have been biased low. However, both the increased total number of moose, and to some extent, the improved ratio of bulls to 100 cows were likely also a product of exceptional calf retention and recruitment. The winters of 2013–2014, 2014–2015, and 2015–2016 have been some of the mildest on record and calf observations in the fall surveys of 2013 (49 calves:100 cows observed in Unit 6C) and 2014 (36 calves:100 cows observed in Unit 6B) were the highest since the population came out of its irruptive period in the late 1970s. During mild winters, animals may have unencumbered access to food and expend less energy. This may result in sustained fat reserves and higher productivity.

Recommendations for Activity 1.2

Continue with careful attention to observing and documenting bulls with premature antler cast on one or both sides.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor mortality and harvest in Unit 6 annually.

Data Needs

Annual summaries of harvest are needed to establish maximum allowable harvest (MAH) for sustained-yield management.

Methods

Harvest data was obtained from hunt reports, a mandatory condition of drawing and registration permits. These data are summarized by unit, except for Unit 6A, which was further divided into eastern and western portions. The eastern portion encompassed all drainages that flow into the Gulf of Alaska between Cape Suckling and the head of Icy Bay. The western portion encompassed all drainages into the gulf between Cape Suckling and Palm Point. Harvest data were summarized by regulatory year (RY).

We monitored harvest using the WinfoNet harvest database to track and store records on permit issuance and hunt reports.

Season and Bag Limit

The following regulations were in effect during regulatory years 2015 and 2020:

Unit, area, and bag limits	Resident open season (subsistence and general hunts)	Nonresident open season
Unit 6A, all drainages into the Gulf of Alaska from Cape Suckling to Palm Point		
1 bull moose	1 Sep–30 Nov (registration hunt)	1 Sep–30 Nov (drawing hunt)
Remainder of Unit 6A		
1 bull with spike-fork antlers, 50-inch antlers, or 3 or more brow tines on 1 side	1 Sep–30 Nov (general hunt)	–
1 bull with 50-inch antlers or antlers with 3 or more brow tines 1 side	–	1 Sep–30 Nov (general hunt)
Unit 6B		
1 antlered moose by registration permit only	1 Sept–31 Oct (registration hunt)	No open season
Unit 6C		
1 bull	1 Sep–31 Oct (drawing hunt)	No open season
Unit 6D		
1 bull moose	1 Sep–30 Sep	1 Sep–30 Sep

Unit 6B is a controlled use area. Moose hunters may not use motorized vehicles for transportation 15 August–4 September (changed to 25 August–4 September in 2019), except for highway vehicles on the maintained surface of the Copper River Highway. Therefore, the first 4 days of the season were open to nonmotorized hunting only. Like the "no same-day airborne" regulation, after 4 September moose cannot be taken until after 3:00 AM following the day in which a motorized vehicle was used for transportation off the highway. This required motorized hunters to camp out before harvesting a moose, which slowed harvest, extended the season, and allowed more hunters to participate. All airboats are required to display an Alaska Department of Fish and Game identification number.

Results and Discussion

Harvest by Hunters

The RY15–RY19 average reported moose harvest in Unit 6A East was above the 10-year average (RY05–RY14) of 16 moose. Harvests in RY16 and RY17 were 28 and 27 moose, respectively (Table 4). Harvest was substantially lower in RY18 with only 4 moose harvested. RY15 and RY19 had harvests of 18 and 19 moose, respectively. Volatility in this harvest is likely related to weather and commercial operator dynamics rather than population changes. Harvest in Unit 6A West was between 14 and 22 moose during all of RY15–RY19, averaging slightly higher than the 10-year average (RY04–RY14) of 15 moose. Harvest in Unit 6B during RY15–RY19 was slightly above the 10-year average of 23 moose, with between 19 and 28 moose taken each year (Table 4). In Unit 6C, the harvest during RY15–RY19 was 72–89 moose which was higher than the 10-year average of 62 moose and the 20-year average (RY94–RY14) of 44 moose. This increased harvest is due to an increase in the maximum allowable harvest (MAH) since RY13. Harvest in Unit 6D increased considerably during RY15–RY19 ranging from 3 to 11 moose each year. The 10-year average in Unit 6D was 5 moose. This is probably a result of mild winters that have allowed for the growth and expansion of the population near Thompson Pass.

Permit Hunts

During RY15–RY19, there was 1 registration (RM160) hunt and 1 drawing permit (DM160) hunt in Unit 6A West (Table 5). All moose harvested in Unit 6B were from the RM164 registration hunt. In Unit 6C 25% of the bull harvest was taken in a state drawing hunt (DM167). The remaining 75% of the bull quota, and all of the antlerless moose quota, was taken in federal subsistence hunts administered by the U.S. Forest Service (USFS). Additionally, USFS authorizes 1–2 potlatch bull permits each year (Table 5).

Hunter Residency and Success

Unitwide, hunter success ranged 48–58% during RY15–RY19 (Table 6). This success rate is higher than the 10-year average (RY05–RY14) of 42% and the 20-year average (RY95–RY14) of 40%. Local residents composed 68–87% of successful moose hunters in Unit 6 each year during RY15–RY19 (Table 6). Since 2001, all the cow permits and 75% of the bull permits in Unit 6C have been administered through the federal system by the U.S. Forest Service, Cordova Ranger District, which requires Cordova residency. During this reporting period, 43–52% of the total unit harvest took place with a federal permit. Local residents comprised 89–99% of the

Table 4. Unit 6, Alaska moose harvest, regulatory years 2015–2019.

Unit	Regulatory year	Reported harvest				
		Males	(%)	Females	(%)	Total[a]
6A East	2015	18	(100)	0	(0)	18
	2016	28	(100)	0	(0)	28
	2017	27	(100)	0	(0)	27
	2018	4	(100)	0	(0)	4
	2019	19	(100)	0	(0)	19
6A West	2015	18	(100)	0	(0)	18
	2016	18	(100)	0	(0)	18
	2017	22	(100)	0	(0)	22
	2018	15	(100)	0	(0)	15
	2019	14	(100)	0	(0)	14
6B	2015	19	(100)	0	(0)	19
	2016	21	(100)	0	(0)	21
	2017	22	(100)	0	(0)	22
	2018	28	(100)	0	(0)	28
	2019	25	(100)	0	(0)	25
6C	2015	46	(61)	29	(39)	75
	2016	41	(57)	31	(43)	72
	2017	55	(63)	33	(37)	88
	2018	54	(61)	35	(39)	89
	2019	45	(53)	40	(47)	85
6D	2015	3	(100)	0	(0)	3
	2016	4	(100)	0	(0)	4
	2017	8	(100)	0	(0)	8
	2018	7	(100)	0	(0)	7
	2019	11	(100)	0	(0)	11
Unit 6 total	2015	104	(78)	29	(22)	133
	2016	112	(78)	31	(22)	143
	2017	134	(80)	33	(20)	167
	2018	108	(76)	35	(24)	143
	2019	114	(74)	40	(26)	154

[a] Total includes reported harvest only; unreported, illegal, or accidental kill combined.

successful hunters in Unit 6C during RY15–RY19. Similarly, local residents comprised 86–100% of successful hunters in Unit 6B during RY15–RY19. All nonresident hunting occurs in Unit 6A East. Most nonlocal Alaska residents either successfully draw for a permit in Unit 6C or they hunt in the Unit 6B registration hunt. Unit 6A West has the most diverse participation due to the presence of a nonresident draw hunt (5 permits) and the overlap between the commercial coho fishing season and prime moose hunting time which has some participation by nonlocal Alaska residents.

Table 5. Unit 6, Alaska moose harvest data by permit hunt, regulatory years 2015–2019.

Unit/hunt number[a]	Regulatory year	Legal moose	Permits Issued	Percent did not hunt	Percent successful hunters	No. bulls	Bulls (%)	No. cows	Cows (%)	Total reported harvest
6A/RM160	2015	Bull	40	55	83	15	(100)	0	(0)	15
	2016	Bull	65	60	54	14	(100)	0	(0)	14
	2017	Bull	54	50	70	19	(100)	0	(0)	19
	2018	Bull	71	62	52	14	(100)	0	(0)	14
	2019	Bull	50	54	48	11	(100)	0	(0)	11
6A/DM160	2015	Bull	5	20	75	3	(100)	0	(0)	3
	2016	Bull	5	0	80	4	(100)	0	(0)	4
	2017	Bull	5	40	100	3	(100)	0	(0)	3
	2018	Bull	5	80	100	1	(100)	0	(0)	1
	2019	Bull	5	20	75	3	(100)	0	(0)	3
6B/RM164	2015	Bull	158	39	20	19	(100)	0	(0)	19
	2016	Bull	162	47	24	21	(100)	0	(0)	21
	2017	Bull	154	44	26	22	(100)	0	(0)	22
	2018	Bull	164	43	30	28	(100)	0	(0)	28
	2019	Bull	157	37	25	25	(100)	0	(0)	25
6C/DM167	2015	Bull	12	0	92	11	(100)	0	(0)	11
	2016	Bull	12	17	100	10	(100)	0	(0)	10
	2017	Bull	15	0	93	14	(100)	0	(0)	14
	2018	Bull	15	0	93	14	(100)	0	(0)	14
	2019	Bull	15	7	93	13	(100)	0	(0)	13
6C/ Federal subsistence[b]	2015	Both	71	1	90	35	(56)	28	(44)	63
	2016	Both	70	2	93	32	(51)	31	(49)	63
	2017	Both	82	3	94	41	(55)	33	(45)	74
	2018	Both	80	1	96	40	(53)	36	(47)	76
	2019	Both	81	2	87	36	(52)	33	(48)	69

[a] RM prefix indicates a registration hunt, DM prefix a drawing hunt.
[b] Federal subsistence hunts, including bull, antlerless, and potlatch bull.

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

Unit	Regulatory year	Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local resident	Nonlocal resident	Nonresident	Total	(%)	Total hunters
		Successful					Unsuccessful					
6A East	2015	0	3	15	18	(67)	1	2	6	9	(33)	27
	2016	0	0	28	28	(56)	0	5	16	22[b]	(44)	50
	2017	0	6	21	27	(63)	1	2	13	16	(37)	43
	2018	0	1	3	4	(20)	0	1	15	16	(80)	20
	2019	1	0	18	19	(51)	0	3	15	18	(49)	37
6A West	2015	12	3	3	18	(82)	3	0	1	4	(18)	22
	2016	10	4	4	18	(58)	6	6	1	13	(42)	31
	2017	18	1	3	22	(73)	7	1	0	8	(27)	30
	2018	10	4	1	15	(54)	8	5	0	13	(46)	28
	2019	8	3	3	14	(52)	7	5	1	13	(48)	27
6A total	2015	12	6	18	36	(73)	4	2	7	13	(27)	49
	2016	10	4	32	46	(57)	6	11	17	35[b]	(43)	81
	2017	18	7	24	49	(67)	8	3	13	24	(33)	73
	2018	10	5	4	19	(40)	8	6	15	29	(60)	48
	2019	9	3	21	33	(52)	7	8	16	31	(48)	64
6B	2015	17	2	–	19	(20)	74	3	–	77	(80)	96
	2016	21	0	–	21	(24)	57	8	–	65	(76)	86
	2017	19	3	–	22	(26)	62	2	–	64	(74)	86
	2018	27	1	–	28	(30)	55	11	–	66	(70)	94
	2019	22	3	–	25	(25)	66	8	–	74	(75)	99
6C	2015	72	2	–	74	(96)	2	1	–	3	(4)	77
	2016	65	8	–	73	(97)	2	0	–	2	(3)	75
	2017	83	5	–	88	(95)	5	0	–	5	(5)	93
	2018	83	7	–	90	(96)	3	1	–	4	(4)	94
	2019	81	1	–	82	(88)	10	1	–	11	(12)	93

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Table 6. Page 2 of 2.

Unit	Regulatory year	Successful					Unsuccessful					Total hunters
		Local[a] resident	Nonlocal resident	Nonresident	Total	(%)	Local resident	Nonlocal resident	Nonresident	Total	(%)	
6D	2015	0	2	1	3	(12)	18	4	1	23	(88)	26
	2016	2	1	1	4	(11)	28	3	3	34	(89)	38
	2017	7	1	0	8	(22)	23	3	2	28	(78)	36
	2018	5	1	1	7	(11)	42	10	4	56	(89)	63
	2019	10	1	0	11	(24)	33	2	0	35	(76)	46
Unit 6 total	2015	101	12	19	13	(53)	98	10	8	116	(47)	248
	2016	98	13	33	14	(51)	93	23	20	138[b]	(49)	282
	2017	127	16	24	16	(58)	98	8	15	121	(42)	288
	2018	125	14	5	14	(48)	108	28	19	155	(52)	299
	2019	122	8	21	15	(50)	116	19	16	151	(50)	302

[a] Residents of Unit 6.
[b] Includes 1 hunter with unknown residency.

Harvest Chronology

Harvest is protracted in Unit 6A and Unit 6C, occurring between September and mid-October. In Unit 6B, most harvest is concentrated in early September. In Unit 6D, moose are only taken in September due to the season dates (1–20 September). During RY15–RY19 approximately 40% of the harvest in Unit 6 occurred in the first 15 days of September (Table 7).

Table 7. Unit 6, Alaska moose harvest percent by time period, regulatory years 2015–2019.

Unit	Regulatory year	Sep 1–15	Sep 16–30	Oct 1–15	Oct 16–31	Nov 1–30	Dec 1–31	n
6A	2015	25	33	33	6	3	0	36
	2016	13	48	24	15	0	0	46
	2017	27	50	10	8	4	0	48
	2018	37	42	11	5	5	0	19
	2019	27	45	15	12	0	0	33
6B	2015	100	0	0	0	0	0	19
	2016	100	0	0	0	0	0	20
	2017	100	0	0	0	0	0	22
	2018	68	32	0	0	0	0	28
	2019	100	0	0	0	0	0	25
6C[a]	2015	46	23	16	8	4	3	74
	2016	39	22	18	17	4	0	72
	2017	28	18	27	14	7	6	88
	2018	29	25	17	18	6	6	89
	2019	18	28	13	28	7	5	82
6D[b]	2015	33	67	–	–	–	–	3
	2016	75	25	–	–	–	–	4
	2017	50	50	–	–	–	–	8
	2018	43	57	–	–	–	–	7
	2019	45	55	–	–	–	–	11
Unit 6 total	2015	48	23	18	6	3	2	132
	2016	40	27	17	13	2	0	142
	2017	39	27	17	10	5	3	166
	2018	38	30	12	12	4	3	143
	2019	36	29	11	18	4	3	151

Note: En dashes represent periods when hunting was not open.
[a] Number of moose harvested (*n*) in Unit 6C may not include all federal subsistence harvest because date of kill is not consistently reported. The federal season closes 31 October for antlerless moose and 31 December for bulls.
[b] Moose season dates in Unit 6D are 1–20 September.

Transport Methods

Unit 6A is the only area where a significant proportion of the harvest is airplane supported (Table 8). Airboats, boats, and ORVs (off-road vehicles, including 3- and 4-wheelers) are also used, particularly in the Bering River portion (Unit 6A West). Local hunters use larger boats (seiners or tenders) to transport smaller vessels for use in the hunt. Harvest in Unit 6B most

commonly occurred via airboat or a highway vehicle during RY15–RY19. Harvest using highway vehicles has been high since 2013 relative to previous years. In some years, boats (mainly using jet motors) are one of the most used transport methods. Unit 6C has good road access from Cordova, allowing both highway vehicle and airboat access to moose. Unit 6D harvest occurs by boat, highway vehicle, or 3- or 4-wheeler; however, with such a small number of participants these data are only summarizing the tendencies of a few individual hunters. This pattern of use is consistent with previous years.

Table 8. Unit 6, Alaska moose harvest percent by transport method, regulatory years 2015–2020.

Unit	Regulatory year	Airplane	Boat	Airboat	3- or 4-wheeler	Highway vehicle	*n*
6A	2015	56	18	26	0	0	34
	2016	58	16	24	2	0	45
	2017	657	20	20	0	4	46
	2018	21	37	42	0	0	19
	2019	53	13	19	13	3	32
6B	2015	0	13	40	0	47	15
	2016	0	19	38	0	44	16
	2017	0	37	47	0	16	19
	2018	0	32	27	5	36	22
	2019	9	13	39	0	39	23
6C[a]	2015	1	3	36	12	46	74
	2016	0	4	36	15	41	73
	2017	0	6	49	13	32	88
	2018	0	2	58	11	27	90
	2019	2	2	53	13	28	83
6D	2015	0	33	0	33	33	3
	2016	0	75	0	25	0	4
	2017	0	13	13	0	75	8
	2018	0	14	0	43	43	7
	2019	18	9	0	45	27	11
Unit 6 total	2015	16	9	34	8	34	125
	2016	19	12	32	10	27	135
	2017	16	14	39	7	24	160
	2018	3	13	49	10	26	136
	2019	16	7	40	14	24	148

[a] Number of moose harvested (*n*) in Unit 6C does not include all federal subsistence harvest because hunter transportation is not always recorded.

Other Mortality

Four moose were reported killed in accidents (mostly with vehicles) during RY15–RY19. This amount of mortality is normal compared with other years; however, reporting of moose-vehicle collisions has been variable over time.

Alaska Board of Game Actions and Emergency Orders

The MAH for Unit 6A West was up to 20 bulls shared between resident registration permit holders (RM160), and nonresident permit holders (5 bulls by drawing permit). In RY17, the season was closed by emergency order on 3 October for the first time since RY01.

The season in Unit 6B was closed by emergency order during every year of RY15–RY19. MAH for Unit 6B was 20 bulls in both RY15 and RY16. The season was closed 8 September in RY15 and 9 September in RY16. In RY17, MAH increased to 22 bulls in response to survey data, and the season closed 15 September. In RY18 and RY19, MAH increased to 28 bulls in response to additional survey data that confirmed a population increase. The season was closed 26 September in RY18 and 15 September in RY19.

The Board of Game reauthorized antlerless moose hunts in Unit 6C each year during the reporting period. The board also acted in 2019 to clarify the language of the Martin River Controlled use area to specifically pertain to moose hunters and not impact those pursuing other species. The start date for the Unit 6B Controlled Use Area was changed from 15 August to 25 August.

Recommendations for Activity 2.1

Continue to monitor harvest data and mortality data.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Conduct twinning surveys in one hunt area annually.

Data Needs

Twinning surveys were flown in RY17 and RY19 in Unit 6B to attempt to acquire a baseline assessment of twining rate. Unit 6C twinning surveys conducted in RY15, RY16, and RY19 sought to continue to assess habitat in a high-density population.

Methods

We conducted moose twinning surveys using a Piper Super Cub PA-18 airplane flown at low level (200–600 feet above ground level), searching brush lines bordering large meadows and stream braids. Each day, a unique portion of the area was surveyed. The objective of each survey was to see as many parturient cows as possible. Each moose observed was classified based on sex and parturition status, e.g., bull, yearling, and cow with 0, 1, or 2 calves. Moose observations, weather, visibility, and relevant moose activity were recorded on data forms. Survey tracks and locations of moose were marked and mapped using a GPS unit.

Twinning rates are calculated based on peak twinning which takes multiple flights to determine and were also calculated cumulatively. However, multiple surveys are not possible when leaf-out is advanced, budgets are restricted, or weather is bad. Surveys were flown in the morning (starting prior to 9 AM) with calm winds and limited precipitation, which were the most likely conditions for cows with calves to be active and visible. Our sample goal was 30 parturient cows in one survey. However, data can also be considered cumulatively since it is proportional. Twinning rates were calculated as 100 × (no. of cows with 2 calves/total no. of cows with calves).

Results and Discussion

Twinning surveys were unsuccessful in RY18 due to early leaf emergence and foggy conditions. In RY17 in Unit 6B, only 5 parturient cows were observed, 3 with twins and 2 with a single calf (Table 9). Although this sample size is inadequate to be considered representative, it constitutes a 60% twinning rate. A total of 132 moose were observed, which was 31% of the most recent population estimate (420 moose, March 2018; Table 1). Twinning surveys were attempted in RY18 but did not result in enough moose observations to be considered representative due to leaf emergence.

Table 9. Unit 6B, Alaska twinning survey results, regulatory years 2014 and 2017.

	Cows with			Total	Percent	Hours	Twinning
Date	0 calves[a]	1 calf	2 calves	moose[b]	calves	searched	rate
25–26 May 2015	31	2	4	68	15	7.00	66.7
1–4 June 2018	56	2	3	132	4	6.25	60.0

[a] Cows with 0 calves likely includes yearling bulls and cows that were likely misclassified.
[b] Total moose includes yearlings and bulls.

The survey on the west delta (Unit 6C) yielded a similar number of parturient cows (>25% of cows observed) in 2016 and 2017 relative to peak counts in other years. However, the survey in 2020 resulted in observations of only 16% parturient cows, suggesting that the survey was early (Table 10). The May 2017 survey had the highest total number of moose ever observed on a twinning survey in the unit (27% of the most recent population estimate, 677 moose, March 2018). It also represented the highest proportion of parturient cows (40%), and the twinning rate was 43.6%.

Recommendations for Activity 3.1

Continue. Twinning rates are an important index to track as the population grows, is maintained at high densities, and experiences aggressive harvest rates.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Federal records have not been updated in the WinfoNet system since 2010. Records in WinfoNet for 2001–2010 contain errors and omissions.

Table 10. Unit 6C, Alaska twinning survey results, regulatory years 2007–2019.

Date	Cows with 0 calves[a]	Cows with 1 calf	Cows with 2 calves	Total moose[b]	Percent calves	Hours searched	Twinning rate
26 May 2020	107	13	8	148	20	5.00	38.1
26 May 2017	59	22	17	183	31	6.50	43.6
24–25 May 2016	45	14	13	122	33	8.00	48.1
27 May 2015	55	5	16	134	28	7.00	76.2
21 May 2013	61	5	5	93	16	4.00	50.0
23 May 2013	102	5	6	146	12	7.00	54.5
29 May 2013	57	11	10	108	29	7.00	47.6
23 May 2012	46	7	5	78	22	6.50	41.7
28 May 2012	66	13	12	142	26	3.75	48.0
26 May 2009	21	2	4	45	22	2.50	66.7
28 May 2009	40	8	7	82	27	2.70	46.7
29 May 2008	46	8	11	103	29	3.75	57.9
07 June 2008	13	3	3	41	22	3.00	50.0
26 May 2007	41	4	8	91	22	3.50	66.7
12 June 2007	50	3	5	84	15	3.30	62.5

[a] Cows with 0 calves likely includes yearling bulls and cows that are likely to be misclassified.
[b] Total moose includes yearlings and bulls.

Data Recording and Archiving

- GSPE data are stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet, http://winfonet.alaska.gov/index.cfm).

- Data sheets are scanned and stored on the Cordova ADF&G server (O:\DWC\Moose).

- Original datasheets are stored in file folders located in the Cordova area biologist's office.

- Historical survey notes and data sheets are being digitized and scanned for permanent storage on the file server.

Agreements

Alaska Department of Fish and Game and USFS Chugach National Forest have a cooperative agreement that allows for financial support and the sharing of harvest data.

<u>Permitting</u>

None.

Conclusions and Management Recommendations

The moose population point estimate in Unit 6A West has been below management objectives for many years. This, in combination with consistently low calf abundance, may be an indication that the population is declining. MAH for Unit 6A West has been reduced to 15 bulls and the drawing hunt for DM160 will not be held until the potential trajectory of the population improves.

The moose population point estimate in Unit 6B has been observed within or above population objectives for the first time since 1998. Harvest opportunity has gradually increased since 2016.

The moose population point estimate in Unit 6C appears to be within objectives and stable. Bull harvest has been reduced to stabilize bull-to-cow ratios near objectives. Cow hunts will continue to be used to allow for harvest and maintain the population within objectives.

Twinning surveys should also continue in Unit 6C due to the high density of moose. Rump fat depth and/or short yearling weights may also be used to evaluate resource constraints. Moose per hour flown from these surveys may also be a helpful metric while budgets are low.

Fall composition surveys should continue to rotate between survey areas to monitor for the potential effects of high harvest. This may be the most effect tool for identifying and responding to changes in the population while budgets are low. Collecting information on variable timing of antler cast may help guide our strategy for survey timing.

II. Project Review and RY20–RY24 Plan

Review of Management Direction

MANAGEMENT DIRECTION

Regularly assess the population relative to management objectives and adjust harvest accordingly.

GOALS

Our goals in Unit 6A East are to focus harvest on large moose and to provide for optimum harvest. For the remainder of Unit 6, the goals are to provide for optimum harvest and to provide for the greatest opportunity to hunt.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Moose in Unit 6 have a negative customary and traditional use finding.

Intensive Management

Moose in Unit 6 have a negative intensive management finding.

MANAGEMENT OBJECTIVES

Our management objective for Unit 6A East is to maintain a population of 300–350 moose and a minimum bull-to-cow ratio of 30:100. Our objectives for Units 6A West and 6B are to maintain populations of 300–350 moose and minimum bull-to-cow ratios of 15:100 in each unit.

The Prince William Sound/Copper River Delta Fish and Game Advisory Committee reviewed current information regarding the moose population and habitat in Unit 6C. The committee voted unanimously to revise management objectives for this area to the following: In Unit 6C, our objective is to maintain a population of 600–800 moose and a minimum bull-to-cow ratio of 25:100 to maintain a healthy distribution among age classes of bulls.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Estimate late winter abundance in at least one survey area annually. Estimate calf recruitment in at least one late winter survey area annually.

Data Needs

No change from RY15–RY19.

Methods

Future surveys will apply similar methods to those described in the RY15–RY19 report. Snow during many winters of RY15–RY19 was inadequate for survey completion. Budget constraints and increased costs make the next survey opportunity uncertain. The next time adequate survey conditions exist, Units 6C and 6B should be surveyed. We will complete a GSPE survey using biometric support to prioritize sample size among strata and appropriate use of sightability correction factors (SCF) units. We will continue to seek new and less expensive survey techniques.

ACTIVITY 1.2. Estimate fall composition in at least one area annually.

Data Needs

No change from RY15–RY19.

Methods

Future surveys will apply similar methods to those described in the report. Continue with random sampling to address sampling bias. Record prevalence of dropped antlers. Recognizing the increase in snow-free conditions, helicopter surveys should be conducted when it is clear that snow coverage will be inadequate for fixed-wing surveys.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor mortality and harvest in Unit 6 annually.

Data Needs

No change from RY15–RY19.

Methods

We will continue to follow methods from the RY15–RY19 reporting period.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Conduct twinning surveys in one subunit annually.

Data Needs

No change from report.

Methods

Twinning surveys will continue to be conducted with caution (due to there being no collared animals) as a general indicator of habitat condition. We will continue to strive for higher sample size, especially in years where timing of parturition coincides with ideal sightability (prior to leaf out).

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Federal and state data sharing issues must be resolved at higher levels than the ADF&G, DWC area office. Federal records have not been updated in the WinfoNet system since 2010. Records that do exist in the system contain errors and omissions. More than 75% of the harvest in Unit 6C, the unit with the highest harvest, is on permits administered by the U.S. Forest Service (USFS). Currently, we have access to these harvest records by informally sharing a Microsoft Excel spreadsheet between the USFS subsistence biologist and the DWC Unit 6 area biologist. These data should be stored in a way that protects records from erroneous modification while documenting changes, and is password protected. Additionally, the current form of data sharing depends on positive relationships among parties and is not a viable long-term solution. Entering these data into a secure database would ensure that all parties can access secure information and that hunt records are collected consistently and accurately.

<u>Data Recording and Archiving</u>

- GSPE data will be stored on an internal database housed on ADF&G's Wildlife Information Network (http://winfonet.alaska.gov/index.cfm).

- Data sheets will be scanned and stored on the Cordova ADF&G server (O:\DWC\Moose)

- Original datasheets will be stored in file folders located in the Cordova area biologist's office.

- Historical survey notes and data sheets are being digitized and scanned for permanent storage on the file server.

<u>Agreements</u>

Alaska Department of Fish and Game and USFS Chugach National Forest have a cooperative agreement signed in 2014 that allows for financial support and the sharing of harvest data.

<u>Permitting</u>

None.

Acknowledgments

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