Moose Management Report and Plan, Game Management Unit 15:

Report Period 1 July 2015–30 June 2020, and Plan Period 1 July 2020–30 June 2025

Jason Herreman



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Alaska Department of Fish and Game

Division of Wildlife Conservation

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Report Period 1 July 2015–30 June 2020, and Plan Period 1 July 2020–30 June 2025

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose (*Alces alces*) in Game Management Unit 15 for the 5 regulatory years 2015–2019 and plans for survey and inventory management activities in the next 5 regulatory years, 2020–2024. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY14 = 1 July 2014–30 June 2015). 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 report more efficiently 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 15 incorporates the western portion of the Kenai Peninsula and is subdivided into 3 administrative units: Units 15A (1,314 mi²), 15B (1,121 mi²), and 15C (2,441 mi²); hereinafter referred to as units. Each of these units are significantly different in topography, flora, and ecological history. Unit 15A is the most northern unit and is separated from Unit 15B by the Kenai River and Skilak Lake. Unit 15C is the most southerly unit and is separated from Unit 15B by the Tustumena Glacier, Tustumena Lake, and the Kasilof River (Fig. 1).

Unit 15A is relatively flat with many small lakes leading up to the foothills of the Kenai Mountains to the east. The dominant flora is a mixed spruce and hardwood climax community. The Kenai National Wildlife Refuge (KNWR) is the largest landholder in Unit 15A. KNWR actively participates in a variety of cooperative moose management programs including the Alaska Department of Fish and Game Moose Research Center near Sterling and cooperative management of Skilak Loop as a wildlife viewing area. Two significant habitat disturbances have occurred since a 1969 wildfire (85,306 acres): The 2015 Card Street Wildfire that burned more than 9,000 acres in the southeast corner of Unit 15A; and the 2019 Swan Lake Wildfire that burned approximately 167,182 acres in the eastern portion of Unit 15A and a small portion of Units 15B and 7.

KNWR is also the largest landholder in Unit 15B. The western portion of Unit 15B is similar to Unit 15A in topography and flora. As you go east, however, Unit 15B becomes more mountainous and transitions into an alpine ecosystem. Forests within Unit 15B succumbed to widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s. Until 2020 Unit 15B was managed as Units 15B East and 15B West. Unit 15B East was bounded by a line running from the mouth of Shantatlik Creek on Tustumena Lake, northward to the headwaters of the west fork of Funny River; then downstream along the west fork of Funny River to the Kenai National Wildlife Refuge boundary; then east along the refuge boundary to its junction with the Kenai River; then eastward along the north side of the Kenai River and Skilak



Figure 1. Map showing the Unit 15 boundaries with indicators of controlled use areas (numbered circles), administrative subunits, and federal lands as found in the *Alaska Hunting Regulations*.

Lake; then south along the western side of Skilak River, Skilak Glacier, and Harding Icefield; then west along the Unit 15B boundary to the mouth of Shantatlik Creek with the remainder of Unit 15B making up Unit 15B West. Unit 15B East was broken up into draw hunt units for moose and Unit 15B West was managed under a general harvest ticket. Unit 15B recently experienced significant habitat turnover in the form of large wildfires. The 2014 Funny River Fire burned approximately 196,610 acres, most of which was in Unit 15B. This fire burned in a mosaic pattern and should provide good moose habitat in the near future. Two other fires had previously burned within a portion of the Funny River Fire perimeter; the Shanta Creek Fire in 2009 burned approximately 13,212 acres, and the King County Fire (2005) burned an additional 10,135 acres. The Funny River Fire completely encompassed the area of the Shanta Creek Fire and a portion of the area of the King County Fire.

Unit 15C is significantly different from both Units 15A and 15B. Refuge lands make up only a small portion of the unit, in the northeast corner and a section south of Kachemak Bay. The rest of Unit 15C contains a mix of state, private, and municipal land ownership. The portion of Unit 15C north of Kachemak Bay and the Fox River peaks in the Caribou Hills and the Ninilchik Domes and slopes from there down to the lowlands. Very few small lakes are present but numerous riparian areas drain from the highlands. Dominant vegetation is a mosaic consisting of spruce (*Picea*), willow (*Salix*), bluejoint reedgrass (*Calamagrostis canadensis*, particularly in salvage logged areas), alder (*Alnus*), and some mixed hardwood stands containing birch (*Betula*), cottonwood (*Populous balsamifera*), and aspen (*Populous tremuloides*). The northern portion of Unit 15C has seen fairly consistent habitat disturbance over the past 2 decades in the form of wildfires, beetle kill, logging, and human development. The portion of Unit 15C south of Kachemak Bay and the Fox River consists of a very different ecotype compared to the northern portion of Unit 15C in the form of a hypermaritime forest (Nowacki et al. 2001), subalpine, and alpine habitats.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 15

Historical records and reports from residents indicate moose became abundant in Unit 15A following a 1947 wildfire. Increased forage following the approximately 280,000-acre fire is the major factor to which high moose densities can be attributed. Point population estimates using the Quadrat survey technique (Evans et al. 1966) for moose fluctuated between 4,436 and 3,197 moose from 1964 to 1974 (U.S Fish and Wildlife Service 1996). Although seasons were long and either-sex harvest was allowed, the moose population increased beyond carrying capacity and extensive overbrowsing occurred. A wildfire in 1969 initially reduced moose habitat, affecting approximately 85,306 acres, and harsh winters from 1971 to 1974 reduced the moose population over the entire Kenai Peninsula. Between 1974 and 1979, point estimates for moose showed a decline. By 1982, however, the 1969 burn had produced significant moose habitat and the Gasaway point estimate (Gasaway et al. 1986) for moose in Unit 15A had recovered to 4,352 (U.S. Fish and Wildlife Service 1996).

A selective harvest management strategy limiting harvest to a bull with either a spiked or forked antler and at least a 50-inch spread was initiated by the Alaska Board of Game on the Kenai Peninsula in 1987; this strategy was applied to general season areas in all of Unit 15. The

proportion of males in the population subsequently increased, and hunters seemed generally satisfied with the selective harvest strategy. A 5-year evaluation of selective harvest on the Kenai Peninsula was completed in 1992 (Schwartz et al. 1992), with a 10-year follow-up in 1999 (The Spike–Fork/50 Task Force 2000).

The Board of Game identified Unit 15A as an intensive management (IM) area in 1999. This area, however, was below objectives for both harvest and population levels upon establishment and has remained below objectives. The established objectives are not attainable without unitwide habitat turnover. Unfortunately, no significant habitat turnover occurred in Unit 15A from 1969 to 2019 due to land management policies, and population estimates since 1969 have shown a significant decline in the number of moose. In 2013, the geospatial population estimator (GSPE) population estimate for Unit 15A was 1,569 moose (95% confidence interval = 1,295–1,843) and general season harvest remained well below harvest objectives. As a token effort to increase harvest levels, the Board of Game instituted wolf control in a small portion of Unit 15A (49 mi² later expanded to 63 mi²) through ground trapping and permitted aerial gunning. This effort was not biologically justified as the limiting factor in this population is habitat not predators and the area in which control efforts could be conducted was too small to be effective.

Like Unit 15A, moose numbers in Unit 15B were relatively high following the 1947 burn and the good moose habitat it created. Point estimates using the quadrat survey technique from 1964 to 1971 ranged from 2,307 to 3,314 moose. By the mid-1970s, however, estimates for moose had dropped significantly, and by 1982 the point estimate for moose in Unit 15B had leveled off at about 1,000 animals (U.S. Fish and Wildlife Service 1996). Estimates hovered near 1,000 animals up through the last census conducted in 2001. No population estimate was produced from 2001 to 2017 due to lack of funding and poor survey conditions. Composition counts in Unit 15B West suggest a decline from 1994 to 2009. Because these counts were not censuses, it is difficult to determine the extent of the decline, but the total number of moose observed in 2009 composition counts was less than half of those observed in 1994.

Forests within Unit 15B succumbed to widespread spruce bark beetle infestations that began in the 1990s. More than 1.2 million acres of spruce forests were affected (Sink 2018). Since 2001, infestation rates have decreased as the number of unaffected trees became scarce (Wittwer 2003). Salvage logging efforts were limited in Unit 15B because most of the area is within the Kenai National Wildlife Refuge, which limits many motorized and mechanical activities.

From 2003 through 2013 several small wildfires burned about 33,949 acres in Unit 15B. Then in 2014, the Funny River Fire burned approximately 5 times the area consumed in the previous decade. The quality of moose habitat in Unit 15B is likely to dramatically increase as a result of this fire.

Available habitat in Unit 15C can be limiting in winters with heavy snow accumulations. Important winter habitat includes the drainages of the Ninilchik River, Stariski Creek, Anchor River, Fritz Creek, the lower reaches of Fox River and Sheep Creek, and the Homer Bench. Despite several winters of deep snow in the late 1990s, the point estimate for moose increased by about 30% between surveys in 1993 and 2002; different survey techniques were used, and statistical rigor was lacking in both surveys, so it is difficult to say that an actual increase occurred. Recent census numbers do support that a population increase occurred since the early 1990s.

Widespread spruce bark beetle infestations have also affected this region of the Kenai Peninsula. Portions of beetle kill spruce stands outside of designated wilderness have been salvage logged. Spruce mortality and salvage logging efforts have significantly altered moose habitat in this area. Moose browse species did regenerate in logged areas that were scarified after tree removal, but in areas that were not scarified, bluejoint reedgrass, which has poor nutritional value for moose, became the dominant ground cover. Moose browse species are just now beginning to develop in some areas were bluejoint reedgrass is dominant. Some logged areas were replanted with conifers rather than species beneficial for moose browse such as birch. Logged areas could have produced more high-quality moose browse if specific treatments were applied during the salvage operations.

Unit 15C has reasonable moose browse throughout much of the unit; however, in some areas browse is beginning to reach senescence, and winter moose habitat can also be limiting. The major concerns for moose management in Unit 15C are maintaining an adequate bull-to-cow ratio while trying to meet intensive management (IM) objectives and continuing habitat turnover while reducing habitat loss.

A few special areas and seasons exist within Unit 15. Harvest from the Skilak Loop Management Area (SLMA) in Unit 15A is by permit only. No permits have been issued for the SLMA in recent years due to population levels. An early bow season currently opens 8 days prior to the general season in Units 15A and 15B. A long established antlerless (cow) hunt persists in Unit 15C. It is intended to limit the number of animals wintering on the Homer Bench to prevent winter loss, habitat destruction, and human-moose conflicts. In 2015, an additional antlerless hunt was established in Unit 15C. The intention of this hunt was to limit moose numbers near the Sterling Highway and reduce the possibility of moose vehicle collisions in years of heavy snowfall. However, no permits have been issued for this hunt to date. Unit 15C also has the only state designated subsistence moose permit area within Unit 15, which is south of Kachemak Bay and a line running from Point Pogibshi and the point of land between Rocky and Windy bays.

Federal management of subsistence opportunities within the Kenai National Wildlife Refuge has complicated management in recent years. Federal subsistence hunts are open to qualified subsistence users and have different season dates and bag limits than state regulations. Current (RY15–RY19) regulations include an early hunt that begins before the state season, a late hunt that opens after the current state season, and a cow hunt. Bag limits are less restrictive allowing for the harvest of bulls with a forked antler on at least one side in addition to bulls that are legal under state regulations.

Management Direction

EXISTING WILDLIFE MANAGEMENT PLANS

The 1976 Alaska wildlife management plan (Alaska Department of Fish & Game 1976) contained 5 sections that applied to moose management within Unit 15 including the Kachemak Bay, Kenai Peninsula, Tustumena, Skilak, and the Kenai Moose Research Center management

plans. The primary goal of the Kachemak Bay and Kenai Peninsula plans was to provide the greatest opportunity to participate in moose hunting. The Tustumena plan focused on providing an opportunity to take large-antlered moose; while the Skilak plan was setup to provide viewing opportunities. The Kenai Moose Research Center Plan established the goals of conducting scientific and educational study of moose. While no specific management plan exists today for Unit 15, little has changed in the management direction of the areas specified above since the establishment of the 1976 plan. Periodic changes to management objectives and harvest management strategies based on public comment, staff recommendations, and Board of Game actions have been reported in the division's previous species management reports. The plan portion of this report contains the current management strategy for moose in Unit 15.

GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide the greatest sustained yield opportunity to participate in hunting moose.
- Provide an opportunity for nonconsumptive uses (e.g., to view and photograph moose).

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

The current state subsistence law was passed by the legislature in 1992, which provides a preference for the subsistence uses of all Alaskans regardless of where they reside in the state and prohibits the Board of Game from permitting subsistence hunting in areas identified by the board as nonsubsistence areas. Current subsistence harvest opportunities in Unit 15 as identified under 5AAC 99.025(8) are as follows:

- Units 15A and 15B have a negative customary and traditional use finding for moose.
- Unit 15C has a positive customary and traditional use finding of 5–6 moose in the portion southwest of a line from Point Pogibshi to the point of land between Rocky Bay and Windy Bay.

Intensive Management

The Intensive Management Law was passed by the Alaska Legislature in 1994. In 1999 the Board of Game adopted a positive finding for intensive management of moose in Units 15A and 15C under 5 AAC 92.108. Current intensive management objectives are as follows:

- Unit 15A
 - Population objective: 3,000–3,500 moose.
 - Harvest objective: 180–350 moose.

- Unit 15C
 - Population objective: 2,500–3,500 moose.
 - Harvest objective: 200–350 moose.

MANAGEMENT OBJECTIVES

- Unit 15
 - Maintain moose populations at a level to promote public safety through directed harvest.
 - Participate in land management decisions that affect moose movements in an effort to direct moose into areas with lower vehicle traffic.
- Unit 15A
 - Maintain a healthy population of moose with a post-hunting bull-to-cow ratio of at least 20–25:100 in Unit 15A, except for the Skilak Loop Wildlife Management Area (SLWMA; Fig. 1: numbered circle 1).

Primary moose management objectives in SLWMA are as follows:

- Provide opportunities to view moose in a natural setting throughout the year.
- Provide opportunities to view all components of the moose community, including their behavior and habitat.
- Provide opportunities to harvest moose when a reduction in numbers is desirable to achieve other objectives.
- Achieve and maintain the resident moose population at 130 animals or a density of 1.8 to 2.0 moose per mi². Resident moose in excess of 130 will be available for harvest.
- Maintain a bull-to-cow ratio of at least 40:100.

In addition to the resident population, moose from surrounding areas commonly winter in SLWMA. Winter populations can easily reach 300 animals when overall moose numbers are high. Habitat will be managed to provide for 130 resident and up to 170 additional wintering moose.

- Unit 15B
 - Maintain a bull-to-cow ratio of 20–25:100.
 - Maintain a healthy and productive population.

- Unit 15C
 - Maintain a bull-to-cow ratio of 20–25:100.
 - Maintain a healthy and productive population.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct annual composition counts in late November or early December in survey areas 2, 5, 8, 9, 10, and 13 in 15A; in survey areas 14–17 for 15B; and survey areas 20, 21, 24, and 26 for 15C.

Data Needs

Information on moose population health and status is needed to direct management action on a yearly basis. Composition counts provide a reliable metric that, with ideal weather conditions and snow cover, can be achieved yearly to provide trend data for comparisons.

Methods

Composition counts are conducted annually from a PA18 or equivalent aircraft if conditions allow in specific trend areas in all of Unit 15. Trend areas for Units 15A, 15B, and 15C include 2, 5, 8, 9, 10, and 13 for Unit 15A; 14–17 for Unit 15B; and 20, 21, 24, and 26 for Unit 15C. Each trend area is flown for optimal coverage and all moose sighted are categorized as cow, calf, or bull. Bulls are further classified by antler size into the categories "spike-fork" (bull with either 1 spike or 1 fork), greater than "spike-fork" (31"–40"), less than a 50-inch spread, or greater than or equal to a 50-inch spread. From these counts we calculate the following metrics: bull-to-cow ratio, calf-to-cow ratio, percent calves, total moose, and moose per hour flown. The actual number of moose seen during composition counts is not directly comparable from year to year, because survey intensity and conditions are inconsistent. However, large-scale trends are generally thought to be comparable between years. Composition counts are performed to achieve an adequate sample of moose to calculate ratios of bulls to cows and calves to cows.

Results and Discussion

<u>Unit 15A</u>

Composition counts were consistently completed in all years during RY15–RY19 except 2018 (Table 1). The bull-to-cow ratio has fluctuated between 32:100 and 53:100 in recent years, always remaining above our management objective of 20–25:100. We have been happy with the larger bull numbers due to the low density of moose currently in this unit. Larger bull numbers increase the likelihood of breeding all available cows in a timely manner. Calf-to-cow ratios have fluctuated between 12:100 and 17:100, which is much lower than the 30-year historical average (1962–1991) of 37:100.

<u>Unit 15B</u>

Composition survey units were restructured in 2019 and flown for the first time in 8 years (Table 1).

	Regulatory	Bulls:100	Calves:100	Percent		Total moose	95% CI estimated
Unit	year	cows	cows	calves	Adults	observed	population size ^a
15A	2015	33	18	12	204	232	_
	2016	32	24	15	230	272	_
	2017	52	28	15	258	304	_
	2018	—	—	_	—	_	_
	2019	53	32	17	185	224	612-809 ^b
15B	2015	—	—	_	—	—	_
	2016	_	—	_	_	—	_
	2017	—	—	_	—	—	669–1,004
	2018	—	—	_	_	—	_
	2019	48	24	14	_	555	_
15C	2015	46	23	14	—	519	_
	2016	34	25	16	_	1,265	_
	2017	52	22	13	959	1,098	2,769–4,289
	2018	40	30	18	651	791	_
	2019	39	32	19	1,432	1,769	_

Table 1. Aerial composition counts for moose	and estimated	population size,	, regulatory
years 2015–2019, Unit 15, Alaska.			

Note: Composition count surveys are conducted separately from population estimate surveys. En dash indicates that no survey was conducted.

^a Estimates from geostatistical census method, estimated population size shown = 95% confidence interval (CI).

^b Due to poor stratification and the lack of a correction factor for low density survey plots, the upper end of this estimate should be used.

<u>Unit 15C</u>

In 2010, composition count areas were standardized to provide a more representative sample of Unit 15C moose. Bull-to-cow ratios have fluctuated between 34:100 and 52:100 during RY15–RY19 (Table 1). Bull-to-cow ratios have been declining since 2017 and are expected to remain stable under current regulations that were implemented in 2019. With the introduction of any-bull permits on the Kenai Peninsula by board action in 2019, wildlife managers now have a more flexible system by which to make management decisions each year.

Recommendations for Activity 1.1

Continue composition surveys in current trend count areas in Units 15A, 15B, and 15C.

ACTIVITY 1.2. Conduct composition counts in trend area 30 for Unit 15C every 2 years.

Data Needs

Information on moose population health and status is needed to inform management actions for TM549, the Tier II subsistence moose hunt on the south side of Kachemak Bay. This management area is not conducive to a population estimate using current methods due to dense canopy cover. Composition counts provide a reliable metric that normally can be achieved on a semiannual basis to provide trend data for comparisons.

Methods

Composition counts are conducted biannually from a PA18 Super Cub or equivalent aircraft if conditions allow in trend area 30 in Unit 15C. Major drainages are flown for complete coverage and all moose sighted are categorized as cow, calf, or bull. Bulls are further classified by antler size into the categories "spike-fork" (bull with either 1 spike or 1 fork), greater than "spike-fork" (31"–40"), less than 50 inches (41"–49"), and greater than or equal to 50 inches. From these counts we calculate the following metrics bull-to-cow ratio, calves-to-cows ratio, percent calves, total moose, and moose per hour flown.

Results and Discussion

The most recent composition count outside of RY15–RY19 was done in 2011. The total number of moose observed during composition counts increased from 10 in 2011 to 48 in 2017. The number of moose per hour also increased from 7 to 14. The percent of calves in the population was identical in 2011 and 2015 but declined in 2017.

Regulatory			Percent		Total moose	Moose
year	Bulls:100 cows	Calves:100 cows	calves	Adults	observed	per hour
2015	41	35	19	24	31	8
2016	_	_	—	_	_	_
2017	48	17	10	43	48	14
2018	—	—	_	_	_	_
2019	_	_	_	_	_	_

Table 2. Trend area 30 moose aerial composition counts, regulatory years 2015–2019, Unit15C, Kenai Peninsula, Alaska.

Note: En dash indicates that no survey was conducted.

ACTIVITY 1.3. Conduct a census to estimate population levels once every 3 years.

Data Needs

Moose abundance is used to estimate sustainable harvest and provides a density context for interpreting nutritional condition relative to habitat conditions. Lack of consistent snow across units usually precludes census work in early winter but conditions commonly develop soon enough to complete composition surveys in critical areas. Abundance surveys can then be flown in late winter in Game Management Units that hold enough snow.

Methods

Geospatial population estimator (GSPE; Kellie and Delong 2006) surveys with an estimate of sightability correction are conducted when feasible during February and March in all units. This procedure produces population estimates and statistically bounded sex and age composition estimates by using fixed or random sampling designs and geostatistical models of autocorrelation. It is designed for high search intensity (8–12 min/mi²) from a Piper PA-18 Super Cub or equivalent aircraft to obtain a relatively unbiased estimate of moose numbers. If lower intensity is achieved, it is accounted for in the sightability correction factor (SCF; Kellie and Delong 2006). Validation of stratification classification of both high and low strata units through visual observation during surveys is necessary to ensure areas have not been misclassified.

The last survey conducted in February of 2020 for Unit 15A used 50 high and 30 low strata survey units out of a total of 263 survey units of which 188 were stratified as high and 75 as low. Surveys were last conducted in Units 15B and 15C in February 2017. In Unit 15B, 32 of 52 "high" survey units and 28 of 56 "low" survey units were sampled. In Unit 15C, 35 of 76 "high" survey units and 21 of 120 "low" survey units were sampled.

Results and Discussion

Unit 15A

The Unit 15A moose population is currently below its intensive management (IM) population size objective. The most recent population survey from 2020 produced a GSPE population estimate of 818 moose (95% CI = 612–818, SCF = 1.26), well below the intensive management (IM) objective of 3,000–3,500. The high end of the confidence interval is used as the point estimate due to poor stratification and the lack of a scientific correction factor for low density survey areas, biasing the estimate low. The most recent survey peak in 1991 provided a point estimate of 3,432 moose (95% CI = 2,921–3,943, SCF = 1.21), but all surveys since then have been outside the IM objectives (2001: 1,942 moose [95% CI = 1,555–2,329, assumed SCF = 1.25], 2008: 1,670 moose [95% CI = 1,405–1,934, assumed SCF = 1.25]). Moose numbers in SLWMA within Unit 15A are at an all-time low and well below the 130-animal objective required for permits to be issued (Table 1).

Unit 15B

The 2017 GSPE population estimate in Unit 15B of 837 moose (CI = 669-1,004, SCF = 1.38, Table 1) suggests a continued population decline from peak numbers seen in the 1960s when point estimates ranged from 2,307–3,314 moose. This population trend has likely reversed course as a result of recent habitat turnover and forage production from the 2014 Funny River Fire. It is expected that the next population estimate will show an increase in Unit 15B moose numbers. The low proportion of calves documented during the recent composition counts however, suggest that significant population increases may take some time.

<u>Unit 15C</u>

The Unit 15C moose population is currently within and possibly above the intensive management objective of 2,500–3,500 moose. The most recent GSPE census conducted in February 2017 produced a population estimate of 3,529 moose (95% CI = 2,769–4,289,

SCF = 1.56; Table 1). This is a slight increase from the point estimate produced in 2013 of 3,204 moose (95% CI = 2,554–3,855, SCF = 1.3). When taken together these population estimates suggest that the Unit 15C moose population is stable to increasing and within IM objectives.

Recommendations for Activity 1.3

Continue producing population estimates for Units 15A, 15B, and 15C every 3 years using current GSPE methods as possible and pursue new census methods that can be used during low snow years. Consult regional biometrician prior to conducting a GSPE to improve statistical validity of the survey.

ACTIVITY 1.4. Research the productivity, survival, and condition of cow and calf moose in Units 15A and 15C.

Data Needs

Baseline data on productivity of adult cows, annual survival of adult cows and their calves, and general health and nutritional measures can be used to assess the status of the moose population given its current density, habitat availability, and quality.

Methods

Division research projects are underway to identify factors affecting calf production and survival including survival of adult moose in Units 15A and 15C, identification of factors affecting reproduction and survival of moose on the northwestern Kenai Peninsula (Unit 15A), and identification of factors affecting reproduction and survival of moose on the southern Kenai Peninsula (Game Management Unit 15C, Principal Investigator DWC Wildlife Research Biologist Thomas McDonough). Research is also being done to evaluate the physiological and behavioral responses of moose to fluctuating environment temperatures and changing habitat conditions (Principal Investigator DWC Wildlife Research Biologist Dan Thompson).

These projects maintain about 50 radiocollared cow moose in Units 15A and 15C. A sample of radiocollared cows are captured each year, generally during fall when animals are near their peak of body condition and again during late winter when animals are approaching their low point in body reserves. During captures, total body fat percentage is estimated using ultrasound measures of rump fat thickness. Overall body condition, including lean mass, is assessed using the Franzmann body condition score (Franzmann 1977). Pregnancy, disease, and trace mineral status is determined by blood assays. Aerial monitoring of collared animals is conducted throughout the year to determine survival. Intensive aerial tracking during May and June is used to determine parturition date, twinning, and early calf survival.

Results and Discussion

Results from this work can be found in the annual research performance reports (McDonough 2015-2018) and the unpublished report; Productivity, nutritional condition, and survival of moose in Game Management Units 15A and $15C^{1}$.

¹ Thomas McDonough, Research Biologist, ADF&G, Homer, Alaska; Productivity, nutritional condition, and survival of moose in Game Management Units 15A and 15C; unpublished data summary, February 2012–June 2020.

Recommendations for Activity 1.4

Continue monitoring radiocollared moose in Unit 15C to assess age-specific fecundity and survival as individuals reach senescence. Work with ADF&G's Region II furbearer research biologist to evaluate the age and condition of moose killed by wolves and evaluate evidence for the type and strength of wolf limitation on moose in Units 15A, 15B, and 15C.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor moose harvest and mortality in Unit 15 by regulatory year.

Data Needs

Units 15A and 15C were identified by the Board of Game (BOG) for IM of moose with harvest objectives of 180–350 and 200–350, respectively. The BOG set the amounts necessary for subsistence uses (ANS) in the area southwest of the line from Point Pogibshi to the point of land between Rocky Bay and Windy Bay at 5–6 moose annually. Annual harvest summaries are needed to establish quotas to ensure we remain within sustained yield in all units. Monitoring and documentation of roadkill and illegal take will also help to ensure that harvest is maintained within sustained yield limits.

Methods

Harvest is monitored through mandatory sealing of antlers, reports from harvest tickets, and permit reports that are recorded in ADF&G's Wildlife Information Network (WinfoNet), the central ADF&G wildlife harvest database. Documentation of roadkills comes from trooper dispatch reports and illegal harvest is documented from sealing reports, trooper reports, and other incidental findings. Roadkill and illegal harvest data are maintained at the local level on the Homer ADF&G office network drive: (O:)DWC/ADF&G-Homer Files/Species Data/Moose.

Season and Bag Limit

The general season for Units 15A and 15B was 10–17 August for archery only, and 20 August–20 September from 1999 to 2015. Unit 15C shared the 20 August–20 September dates but did not have an archery season. In 2015 the season dates changed to 22–29 August (archery only) and 1–25 September. From 1987 to 2010, the bag limit was 1 bull with either a spike or fork on at least 1 side of the antlers, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF-50-3bt). In 2011, the bag limit was restricted to 1 bull with greater than or equal to 50-inch antlers or antlers with 4 or more brow tines on at least 1 side (SF-50-4bt), and hunting was closed to nonresidents in Units 15A and 15C. Spike bulls were again legal to harvest in 2013. In 2015, moose hunting was once again opened to nonresident hunters in Unit 15C. The ability to harvest bulls with at least 3 brow tines was reinstated in 2019. Current Unit 15 moose season dates and bag limits are available online at:

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

During its 2006 meeting, the Federal Subsistence Board liberalized the moose hunting season in Units 15B and 15C for federally qualified subsistence users on federal lands. These users gained additional time at the beginning and end of the hunting season with a start date of 10 August for all methods, and a second season from 20 October–10 November after the traditional state

season dates. Federal subsistence users did not experience the restriction in the bag limit that users hunting under state regulations did from 2011–2014. The bag limit remained at SF-50-3bt. Additionally, the Federal Subsistence board added a cow hunt in 2014 for Unit 15C with season dates of 10 August–20 September. Current regulations and information on qualified users can be found at: https://www.doi.gov/subsistence.

Results and Discussion

Harvest by Hunters

Moose harvest is beginning to increase again in Unit 15. The RY15–RY19 average yearly general season harvest was 256 moose from Unit 15 compared to the previous 5-year (RY10–RY14) annual average general season harvest of 169 moose. Most of this increased harvest has occurred in Unit 15C due to decreased antler restrictions that were relaxed after bull-to-cow ratios recovered. Unit 15A harvest is currently below the IM harvest objective (Tables 3 and 4) due to low population numbers that make objectives unreasonable to attain. Unit 15B harvest has been severely limited in recent years due to low moose numbers and hunter participation in permit hunts. With recent habitat and regulation changes in Unit 15B, harvest will likely increase as moose numbers begin to increase.

	Regulatory	F	Reported h	_	Reported		
Unit	years	Bull	Cow	Unknown	Total	Roadkill	mortality
15A	2015	34	0	0	34	99	133
	2016	44	0	0	44	63	107
	2017	32	0	0	32	101	133
	2018	31	0	0	31	99	130
	2019	59	0	0	59	94	153
15B	2015	17	1	1	19	46	65
	2016	21	0	0	21	37	58
	2017	25	0	0	25	59	84
	2018	26	0	0	26	57	83
	2019	32	0	0	32	38	70
15C	2015	145	0	8	153	71	224
	2016	170	1	0	171	39	210
	2017	152	0	0	152	61	213
	2018	189	0	0	189	69	258
	2019	294	0	0	294	61	355

Table 3.	Reported general	season moose h	arvest and roadkill,	regulatory years 2	2015–2019,
Unit 15,	Alaska.				

Permit Hunts

UNIT 15A

No permits were issued for SLWMA during RY15–RY19 and an any-bull permit hunt was established for this area by the Board of Game in 2019. No implementation is planned for this hunt until positive changes are seen in population numbers.

UNIT 15B

Unit 15B East was managed as an area for hunters to harvest large-antlered bulls through a drawing permit system. The hunt was split by regulation into an early and late season. Since 2009, no permits have been issued for the late season due to low harvest levels, hunter complaints, and population concerns. Permittees reported harvesting an average of 4 bulls per year RY15–RY19 (Table 4). Regulations for this area were changed at the 2019 Board of Game meeting and all of Unit 15B is now managed under the general season hunt and a limited any-bull hunt for which tag numbers can be changed on an annual basis as the population level changes.

		Regulatory	Permits	Permittees that	Percent							
Unit	Hunt No.	year	issued	hunted	success	Bulls	Cows	Total				
15B	DM530-	2015	50	15	0	0	0	0				
	DM539	2016	50	15	7	1	0	1				
	(combined	2017	50	22	18	4	0	4				
	totals)	2018	50	23	30	7	0	7				
		2019	50	22	27	6	0	6				
	RM572	2015	130	100	45	23	22	45				
		2016	146	113	45	27	24	51				
		2017	119	84	32	15	12	27				
						2018	121	89	28	9	16	25
		2019	100	84	42	18	17	35				
15C	DM549	2015	50	41	61	0	25	25				
		2016	50	41	73	0	30	30				
		2017	50	40	60	0	24	24				
		2018	50	41	71	0	29	29				
		2019	50	39	67	0	26	26				
	TM549	2015	4	4	50	2	0	2				
		2016	4	4	75	3	0	3				
		2017	4	4	75	3	0	3				
		2018	5	4	50	2	0	2				
		2019	4	3	33	1	0	1				

Table 4. Harvest data for drawing and registration permit hunts, regulatory years 2015–2019, Unit 15, Alaska

Note: Hunts DM530–DM539 are located in Unit 15B East.

Kalgin Island was moved to Unit 15B for management purposes in 2016. An average of 37 moose were harvested from Kalgin Island each year, with a sex ratio of 50:50 during RY15–RY19.

UNIT 15C

Since 1987 there has been a Tier II subsistence hunt (TM549) for any bull in a portion of Unit 15C southwest of a line from Point Pogibshi to the point of land between Rocky and Windy bays. An average of 2 bulls have been taken annually during this season in the last 5 years (Table 4). The antlerless hunt for moose near Homer was initiated in 1995 (DM549). During RY15–RY19, 50 permits were issued each year which produced an average annual harvest of 27 moose (Table 4). An any-bull permit hunt was established for this area by the Board of Game in 2019, with implementation in 2020. Permit numbers can be adjusted on a yearly basis to match population changes.

Hunter Residency and Success

During this reporting period 16% of the reported general season moose harvest came from Unit 15A, 10% from Unit 15B, and 75% from Unit 15C.

UNIT 15A

General season hunter success continued to decline in Unit 15A ranging from 6% to 11% during RY15–RY19 (Table 5). During all years of RY15–RY19, local residents (people living in Unit 15) accounted for the majority (86–94%) of reported successful moose hunters.

Nonlocal residents took a maximum of 14% of harvested moose annually in Unit 15A during RY15–RY19 (Table 5). Starting in 2011, moose hunting in Unit 15A was restricted to resident hunters only.

UNIT 15B WEST

General season hunter success ranged 10–15% during the last 5 years (Table 5). During all years, local residents (people living in Unit 15) accounted for the majority (80–100%) of reported successful moose hunters.

UNIT 15C

General season hunter success ranged from 14–24% during RY15–RY19 (Table 5). This is a significant increase from 2011 and 2012 when harvest success was around 6% most likely due to relaxed harvest restrictions. During all years, local residents (people living in Unit 15) accounted for the majority of harvest (85–91%) reported by successful moose hunters. Nonlocal residents took a maximum of 8% of reported harvest and nonresidents did not exceed 6% of reported harvest in any given year.

Transport Methods

Highway vehicles are the most common method of transportation to access hunting areas in Units 15A and 15B (Table 6). The most popular method used in Unit 15C is a 3- or 4-wheeler.

			Suc	cessful ^a	Unsuccessful ^a				Total	
Unit	Regulatory year	Local resident ^b	Nonlocal resident	Nonresident	Total ^c (%)	Local ^b resident	Nonlocal resident	Nonresident	Total ^b	reported hunters
15A	2015	32	1	1	34 (6)	504	65	5	578	612
	2016	38	6	_	44 (8)	453	66	_	520	564
	2017	28	4	_	32 (6)	447	54	1	502	534
	2018	27	4	_	31 (6)	413	50	_	464	495
	2019	54	5	—	59 (11)	431	40	_	475	534
15B	2015	16	2	0	19 (10)	148	16	5	169	188
	2016	20	0	1	21 (12)	130	16	0	148	169
	2017	20	2	3	25 (14)	138	3	0	157	182
	2018	26	0	0	26 (14)	143	19	3	165	191
	2019	30	1	1	32 (15)	161	18	1	181	213
15C	2015	136	12	4	153 (14)	825	82	16	929	1,082
	2016	155	11	3	170 (16)	774	71	26	873	1,043
	2017	136	11	5	152 (15)	786	79	18	884	1,036
	2018	167	14	8	189 (18)	737	88	15	843	1,032
	2019	250	20	18	294 (24)	799	99	15	917	1,211

Table 5. Residency and success of general season moose hunters, regulatory years 2015–2019, Unit 15, Alaska.

^a Includes illegal harvest and hunting.
 ^b Local residents of Unit 15.
 ^c Includes unspecified residency.

	Demonst of howyoost											
		Fercent of harvest									-	
	Regulatory	3- or 4-					Highway	Horse/			Snow	
Unit	year	wheeler	Airboat	Airplane	Boat	Foot	vehicle	dog team	ORV ^a	Unknown	machine	Reported
15A	2015	18	0	2	3	5	56	0	5	11	0	616
	2016	19	0	1	6	5	52	1	6	11	0	568
	2017	16	0	1	6	4	60	1	6	6	0	535
	2018	19	0	1	4	6	56	0	5	8	0	495
	2019	21	0	1	4	6	54	0	6	7	0	535
15B	2015	11	0	2	11	12	48	3	2	13	0	190
	2016	8	0	1	9	18	47	2	2	14	0	169
	2017	7	1	2	8	13	54	1	4	11	0	184
	2018	11	0	3	6	17	42	3	1	18	0	192
	2019	15	0	2	3	12	52	0	5	10	0	214
15C	2015	38	0	1	5	6	30	3	5	13	0	1,090
	2016	40	0	1	6	6	28	3	6	11	0	1,047
	2017	40	0	0	4	7	31	3	6	9	0	1,043
	2018	42	0	1	5	6	26	2	8	9	0	1,033
	2019	40	0	1	5	5	28	2	10	9	0	1,213

Table 6. General season transport methods for moose hunters (percent of harvest), regulatory years 2015–2019, Unit 15, Alaska.

^a Off-road vehicle.

Other Mortality

Vehicle-moose collisions (i.e., roadkill) remain one of the highest sources of human-caused mortality in Unit 15 (Table 3). In Units 15A and 15B, vehicle collisions currently outnumber moose taken under general season hunting regulations. The majority of moose killed by vehicles are cows and calves, affecting recruitment. These data do not include moose that are hit by vehicles and manage to walk away but later die from injuries sustained during the collision. Therefore, these data underestimate the effect that vehicle collisions are having on moose populations in Unit 15.

Known illegal harvest including animals turned into ADF&G, wanton waste cases of animals left in the field, and animals tracked down by the Alaska Wildlife Troopers was substantial during RY15–RY19 averaging 21% of the general season harvest. This is an increase of 4% from RY10–RY14. Reasonable documentation of illegal harvest has only occurred on the Kenai since sealing requirements went into place in 2011. An additional percentage of illegal harvest and wounding loss is believed to occur every year that goes undocumented, which we surmise would raise the average illegal take and wounding loss to approximately 25% during RY15–RY19.

Known harvest occurring under federal permits averaged 15 animals or 4% of the total annual harvest during RY15–RY19.

Alaska Board of Game Actions and Emergency Orders

A season extension was requested for TM549 every year during RY15–RY19, but no extensions were granted. The most recent season extension for TM549 occurred in 2010 when the Board of Game (BOG) provided additional hunting opportunity (15–19 October) due to poor hunting conditions during the regularly scheduled dates and hardships caused by poor salmon returns.

During the March 2015 meeting the BOG established a roadside hunt in Unit 15C (AM550) to be instituted at the department's discretion during high snow years. The BOG also changed the general season dates to 1–25 September. In 2016, the BOG established that a point within 2 inches of the base and less than 3 inches long does not count as a point and moved the management of RM572 (Kalgin Island) to Unit 15B. In 2017, moose hunter orientation became required for all Kenai Peninsula moose hunters. At the March 2019 Board of Game Meeting moose with 3 brow tines were added to the general season bag limit. More information on Board of Game actions and proposals can be found at: ADF&G website | Regulations | Process | Board of Game | link: http://www.adfg.alaska.gov/index.cfm?adfg=gameboard.meetinginfo.

Recommendations for Activity 2.1

Continue monitoring harvest through antler sealing and required hunter reports, and document additional human-caused mortality.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor moose browse production and removal to better understand sustainability of moose density.

Data Needs

Information on the quality and use of moose browse in Units 7 and 15 is needed to better understand if moose density is reaching habitat carrying capacity in any units. Browse biomass removal can also be used as an index of moose nutritional condition (Seaton 2002, Boertje et al. 2007, Seaton et al. 2011). Monitoring browse plant architecture provides additional information on the effects of moose browsing on vegetation condition as a function of moose density (Seaton 2002, Paragi et al. 2015). Body condition, reproductive measures, and other animal parameters should be collected in conjunction with browse data to assess habitat condition and trend, and gauge whether more moose could be sustained on the landscape.

Methods

Forage plant production, architecture, and browse removal are characterized using methods from Seaton (2002). Work is also conducted with partner agencies to classify vegetation communities in relation to moose forage across Unit 15 and monitor vegetation response to recent fire activity. Activities will be expanded to Unit 7 as time and monies allow.

Results and Discussion

Browse removal studies were conducted in Unit 15C in the spring of 2016–2018. Results from this work indicate that moose in Unit 15C are removing browse at a relatively high rate compared to other areas in the state where similar work has been conducted even in years of low snow cover. Snow depth was shown to directly corelate to the proportion of browse removed with more browse removed during years of higher snow depth (Herreman *In prep*²).

The U.S. Forest Service completed the Kenai Peninsula Existing Vegetation Map (KPEVM; Bellante 2020) in December 2018. ADF&G reviewed the final product to determine if the objective to create a map that could be used to assess moose habitat preferences was met. Unfortunately, the mapping effort fell short of this objective. The U.S. Forest Service developed a key to define the dominance-type classes within each map group. Across the Kenai Peninsula, 5.8% of the land area (334,361 acres) is classified in the "mesic-herbaceous dominance" type, 1 of 5 types within the herbaceous map group which includes less than 10% tree cover, less than 25% shrub cover, and 25% herbaceous vegetation. The KPEVM classified 45% of the Funny River fire burn area in the mesic-herbaceous dominance class. The mesic herbaceous type is moderate in moisture and composed of bluejoint reedgrass, fireweed (*Epilobium angustifolium*), and mixed forbs. While moose are known to occupy these areas and eat these plants, their nutritional requirements exceed what this community provides. Global Positioning System (GPS) collared moose in Unit 15B were in the mesic-herbaceous class 43% of the time between 2015 and 2019. The extent of this cover type does not coincide with visual observations of the

² The initially published version (Herreman 2022) has been retracted and is being revised.

burned area by ADF&G staff, nor does it match the preferred moose habitat characteristics to meet the objectives stated above.

Recommendations for Activity 3.1

Browse removal metrics should be analyzed in conjunction with body condition and reproductive metrics to validate removal metrics as indicators of forage condition and moose health. Field surveys should be conducted to collect vegetation composition and browse characteristics within the KPEVM dominance classes in Units 15A and 15B that correlates to recorded summer moose locations to monitor habitat changes and moose response of recent fire disturbance. Browse quality monitoring should continue throughout Unit 15 as funding and time allows.

ACTIVITY 3.2. Conduct habitat enhancement activities to increase moose population numbers in Unit 15A.

Data Needs

Moose harvest and population numbers are below management objectives in Unit 15A. Objectives cannot be met without habitat improvements. Information is needed on the best locations to implement treatments to help facilitate future prescribed and wildland fire use for habitat enhancement.

Methods

Work with land managers to identify treatment areas that would be most beneficial to facilitate future prescribed and wildland fire use for wildlife habitat enhancement and provide protection to communities from wildfires. Hire private contractors to continue work on fuel breaks near local communities, plan and conduct prescribed fires as appropriate, and work with local land management agencies to conduct treatments for moose habitat enhancement.

Results and Discussion

In 2014, ADF&G received an additional \$2,743,900 in federal aid from the Wildlife Restoration Program (with matching in-kind funds from Chugachmiut Native Corporation) specific to the Kenai Peninsula for habitat enhancement and moose research in response to fire. These funds are serving expansion of fuel breaks so that wildland and prescribed fire may be used in the Kenai National Wildlife Refuge along with projects to directly improve forage opportunities to benefit habitat on a landscape level.

Construction of the Sterling Fuel Break was initiated in April 2016 with the intention to remove and thin fuels around the community. This would protect homes and infrastructure from fire and make it possible to allow some fires to burn north of the community where late successional forests could be brought back to an early seral state increasing moose forage through hardwood regeneration.

In 2018, plans were initiated by the Kenai National Wildlife Refuge and ADF&G to burn 9,600 acres within the refuge to directly enhance moose habitat (East Fork prescribed burn area). On 4 June 2019, the Swan Lake wildfire was ignited by lightning. This fire burned through the entire planned East Fork prescribed fire unit and another 157,582 acres freeing up funds previously

designated for the prescribed burn. Fuel breaks prepared for the prescribed burn acted as control lines for the wildfire and helped prevent spread in unwanted directions in the beginning weeks of managing the fire. The Sterling Fuel Break was used as a contingency line during the Swan Lake wildfire, allowing residents to remain in place and not be evacuated. The regenerating vegetation is expected to greatly benefit moose and other wildlife species.

In 2020, ADF&G partnered with the Homer Soil and Water Conservation District to redirect the funds planned for the East Fork prescribed fire to mechanical treatments for moose browse on public and private lands and the continued construction of fuel breaks in Unit 15A. This would aid future prescribed fire efforts and to help mitigate against possible wildfires.

ADF&G is working with land management agencies to coordinate future habitat improvement projects in Unit 15A. The legislature committed \$1 million in funding for habitat enhancement projects statewide over 5 years, with \$400,000 of this dedicated to the Kenai Peninsula. This funding is to be directed toward private contractors operating on public lands along with wildland firefighters to support interagency burn operations, both natural and prescribed. Building on the work of the Spruce Beetle Task Force and the associated community outreach, additional fuel breaks are expected to be developed to protect communities and infrastructure and support the use of fire for habitat enhancement. Through partnerships with the Alaska Department of Natural Resources, Division of Forestry; the Kenai Peninsula Borough; the U.S. Forest Service, and the Kenai National Wildlife Refuge, and others; ADF&G hopes to return fire to the landscape for the benefit of wildlife and ecosystem processes. This will also reduce the likelihood of high intensity wildland fires prone to damaging private property and infrastructure.

Recommendations for Activity 3.2

Continue habitat improvement projects that support the use of prescribed fire on the landscape to enhance available moose browse.

ACTIVITY 3.3. Conduct activities to prepare for future habitat enhancement work in Unit 15B.

Data Needs

Identify treatment areas that would be most beneficial to facilitate future prescribed fire efforts and provide protection to communities from wildfires.

Methods

No habitat enhancement activities were completed during RY15–RY19. The 2014 Funny River fire burned over an area of 195,000 acres in Unit 15B. Vegetative response is being monitored in selective locations by research staff.

Results and Discussion

Nothing to report.

Recommendations for Activity 3.3

No change.

ACTIVITY 3.4. Conduct habitat enhancement activities for moose population sustainability in Unit 15C.

Data Needs

Moose population and harvest objectives cannot continue to be met without habitat turnover and browse regeneration. Habitat is being lost to continued development. Current fire mitigation methods and regulations are stifling the possibility of habitat turnover from natural sources. Critical winter habitat that can be protected and enhanced needs to be identified and areas that can be mechanically treated to promote prescribed fire and wildfire protection identified.

Methods

Work with Kachemak Moose Habitat Inc. and other local nonprofits to improve moose habitat on the southern Kenai Peninsula using mitigation funds from the construction of the Bradley Lake Hydroelectric Project and other resources. Work to establish fuel breaks and modify wildfire protection standards through the Kenai Peninsula Interagency Wildfire Working Group.

Results and Discussion

Department staff continued to work with Kachemak Moose Habitat Inc. and other local conservation groups to identify and purchase land parcels for moose habitat protection. Several new parcels of land were purchased by Kachemak Moose Habitat in recent years including additional parcels around Beluga Lake, the Anchor River, Diamond Ridge, Stariski Creek, and Lampert Lake. Additionally, 3 treatment areas were identified within the Anchor River Fritz Creek Critical Habitat Area for mechanical treatment: Fritz Creek Experimental Fields, Beaver Flats, and the south end of the North Fork Road. Funds redirected from the East Creak prescribed fire area were used to partner with Homer Soil & Water Conservation District and hire private contractors to carry out mechanical treatments. Treatments should be completed within the next reporting period (RY20–RY24). Efforts and discussions with adjacent land managers to identify areas where fuel breaks can be created within the Fox River Flats Critical Habitat for future prescribed fire treatments continue.

Recommendations for Activity 3.4

Continue to identify future habitat enhancement projects that would facilitate the future use of prescribed fire in Unit 15C.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

No nonregulatory management problems or needs have been identified at this time. Viewing opportunities for moose remain available throughout Unit 15 but are limited in some portions of the unit due to current population levels in some subunits.

Data Recording and Archiving

- GSPE data are stored on an internal database housed on a server (http://winfonet.alaska.gov/index.cfm).
- Composition count data are stored on the computer server in the Homer office: (O:\DWC\ADF&G-Homer Files\Species Data\Moose\Survey Data).
- Field data sheets are stored in filing cabinets in the ADF&G office in Homer, in the assistant area biologist's office. Electronic copies are scanned and housed on the computer server in the Homer office (O:\DWC\ADF&G-Homer Files\Species Data\Moose\Survey Data).

Agreements

No management agreements exist at this time for Unit 15 moose.

Permitting

Capture and handling of moose in Units 7 and 15 has been conducted under ADFG IACUC permit numbers 2016-40, 0046-2017-46, 0046-2018-64, 0046-2019-61, 0046-2020-54, 2016-47, 0053-2018-03, and 0053-2019-05.

Conclusions and Management Recommendations

UNIT 15A

The Unit 15A moose population is doing poorly. Currently, the largest impacts on the moose population are declining habitat quality and deaths caused by collisions with motor vehicles. The 2019 Swan Lake fire provided some habitat turnover that will likely benefit moose in years to come and start to halt the downward trend in Unit 15A moose numbers.

IM objectives for Unit 15A need to be evaluated and adjusted to match our current understanding of moose population and habitat dynamics. This unit has not met the harvest or population-level IM objectives almost every year since they were established. IM objectives are currently based on the peak moose population that existed following the 1969 burn. Schwartz and Franzmann (1991) stated that by 1989 the moose population in Unit 15A was likely above carrying capacity in the area encompassed by the 1969 burn, and IM population objectives were based on the 1989 population size. In the absence of periodic (every 20–25 years) and significant (50,000 acres or more) wildfire or other habitat events that would improve the availability of moose browse, it is unlikely we can maintain a moose population of 3,000–3,500 moose (the IM population objective) in Unit 15A. Without periodic and significant habitat alteration, a more reasonable expectation would be for Unit 15A to support a moose density of 1–2 moose per square mile on a sustained basis. This equates to a population of about 1,300–2,600 moose.

Direct habitat manipulation is currently unlikely to dramatically improve habitat conditions under current management limitations. Mechanical treatment is costly and only very limited amounts of habitat can be treated by this means. Controlled burning has not been implemented to date due to resource limitations, burn conditions, and management directives.

Enhancing habitat at a landscape scale will require the use of fire to regenerate tree and shrub species needed to increase the quality and quantity of moose forage such as early seral hardwood species. In addition to creating winter forage for moose, using wildland and prescribed fire reduces the volume of "fuel" in this expansive forested area.

Through the Kenai Peninsula interagency fuel break working group, ADF&G; Alaska Department of Natural Resources, Division of Forestry; U.S. Fish and Wildlife Service; and Chugachmiut are leveraging funds and capacity across land ownership boundaries to build fuel breaks at the wildland urban interface. ADF&G is contributing funds it receives through the federal Wildlife Restoration Program to support fulfillment of the combined objectives: to protect lives and infrastructure from wildland fire, enhance wildlife habitat, and restore ecosystem functions. Once established, the fuel breaks around Sterling and other north Kenai communities will allow for the use of wildland and prescribed fire in Unit 15A.

As a token effort to increase harvest levels, the Board of Game instituted wolf control in a small portion of Unit 15A (49 mi² later expanded to 63 mi²) through ground trapping and permitted aerial gunning. This effort was not biologically justified because the limiting factor in this population is habitat not predation, and the area in which wolf control could be conducted was too small to be effective. ADF&G does not support implementing wolf control under the current habitat conditions, particularly with an inadequate treatment area.

UNIT 15B

The Unit 15B moose population is currently at low numbers. In May of 2014, however, the Funny River Fire burned approximately 195,290 acres in Unit 15B. The fire burned in a mosaic pattern leaving some portions of the burn untouched or lightly burned while completely consuming fuels in other areas. Current indications are that this burn will provide good moose habitat in Unit 15B in coming years, which may lead to the recovery of moose numbers. Recent regulation changes along with projected increases in moose numbers should provide increased harvest opportunity.

UNIT 15C

Moose numbers continue to remain high and bull ratios have been above management objectives in recent years allowing good harvest opportunity. Enough habitat has recently turned over to provide for a stable population in the near term. We should, however, be careful not to let moose numbers increase to the point of overrunning critical wintering habitat. Habitat turnover is needed in order to maintain current population levels. Habitat continues to be steadily lost to development increasing the need to maintain high-quality moose habitat in remaining areas.

Uncertainties regarding the movement of moose throughout Unit 15C remain. Snow depth appears to dictate movements to the Homer Bench and other low-lying areas, but we do not know what proportion of moose display this migratory behavior or the source locations for the migrants. Investigations into movements on the Lower Peninsula and a determination of animal

locations across seasons could contribute greatly to our knowledge of population dynamics of this area. These data would help us identify and make management decisions for subpopulations of moose that are affected by severe winters and harvest pressure, and also help clarify the bull-to-cow ratios in specific areas during the rut. Current research being conducted in Unit 15C (Federal Aid in Wildlife Restoration Project 1.72) should help answer some questions but continuing research that includes a bull collaring component would be useful.

Overall, the outlook for moose on the Kenai Peninsula in coming years is positive. The expansion of federal subsistence hunting opportunities and the associated increased effort by subsistence qualified users with these new opportunities, however, continues to restrict the potential to allow additional hunting opportunity for the general public. This dual system will continue to challenge wildlife managers into the future.

II. Project Review and RY20-RY24 Plan

Review of Management Direction

MANAGEMENT DIRECTION

There are no new management plans or broad changes in management direction.

GOALS

- G1. Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- G2. Provide the greatest sustained yield opportunity to participate in hunting moose.
- G3. Provide an opportunity for nonconsumptive uses (e.g., to view and photograph moose).

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Amounts reasonably necessary for subsistence uses (ANS) objectives are expected to remain the same through RY20–RY24:

- C1. Units 15A and 15B have a negative customary and traditional use finding for moose under 5 AAC 99.025(8).
- C2. Unit 15C has a positive customary and traditional use finding of 5–6 moose in the portion southwest of a line from Point Pogibshi to the point of land between Rocky Bay and Windy Bay.

Intensive Management

No changes in intensive management objectives were requested by the department during the 2019 Board of Game meeting. The department will address the issue of proposed changes to IM objectives with the Board of Game during the 2022 Southcentral Board of Game Meeting. It is expected that the department will be recommending the following:

<u>Unit 15A</u>:

- Modify existing population objective of 3,000–3,500 moose to a density of 1.5–2.0 moose per square mile on a sustained basis or a population objective of 2,000–2,600 moose.
- Modify the existing harvest objective of 180–350 moose so that the objective matches 5% of the lower population objective and 6% of higher population objective (100–160 moose).

<u>Unit 15C</u>:

- Reaffirm the existing population objective of 2,500–3,500 moose.
- Modify the existing harvest objective of 200–350 moose so that it matches 5% of the lower population objective and 6% of higher population objective (125–210 moose).

MANAGEMENT OBJECTIVES

Objectives will remain the same as RY15–RY19 during RY20–RY24 except for Unit 15B:

M1. Unit 15:

• Maintain moose populations at a level to promote public safety through directed harvest and participate in land management decisions that affect moose movements to direct moose into areas with lower vehicle traffic.

M2. Unit 15A:

• Maintain a healthy population of moose with a posthunting bull-to-cow ratio of at least 20–25:100 in Unit 15A, except for the Skilak Loop Wildlife Management Area (SLWMA).

Primary moose management objectives in the SLWMA are to:

- Provide opportunities to view moose in a natural setting throughout the year.
- Provide opportunities to view all components of the moose community, including their behavior and habitat.
- Provide opportunities to harvest moose when a reduction in numbers is desirable to achieve other objectives.
- Achieve and maintain the resident population at 130 animals or a density of 1.8 to 2.0 moose per mi². Resident moose in excess of 130 will be available for harvest.
- Maintain a bull-to-cow ratio of at least 40 bulls:100 cows.

M3. Unit 15B:

- Maintain a bull-to-cow ratio of 20–25:100.
- Maintain a healthy and productive population.

M4. Unit 15C:

- Maintain a bull-to-cow ratio of 20–25:100.
- Maintain a healthy and productive population.

REVIEW OF MANAGEMENT ACTIVITIES

All RY15–RY19 activities will be continued for RY20–RY24 with changes to data needs and methods as described below.

1. Population Status and Trend

ACTIVITY 1.1. Conduct annual composition counts in late November or early December in survey areas 2, 5, 8, 9, 10, and 13 in Unit 15A; survey areas 14, 15, 16, and 17 in Unit 15B; and survey areas 20, 21, 24, and 26 for Unit 15C.

Data Needs

No change in the type of data needed. Collection of data on a yearly basis would serve to better inform management.

Methods

No change in methods.

ACTIVITY 1.2. Conduct composition counts in trend area 30 for Unit 15C every 2 years.

Data Needs

No change from RY15–RY19.

Methods

No change. As possible, the frequency of flights will be increased to provide additional data.

ACTIVITY 1.3. Conduct a census to estimate population levels once every 3 years.

Data Needs

No change from RY15–RY19.

Methods

Continue with the following modifications: Population census methods need to be improved so that surveys can take place in low-snow years. Good survey conditions are becoming rarer as snow fall consistency declines. The development of new techniques such as the use of Forward-Looking Infrared Radar (FLIR) and/or genetic-based census methodology need to be developed so that estimates can be produced on a reliable basis. This should be done in conjunction with standard GSPE methods.

ACTIVITY 1.4. Research the productivity, survival, and condition of cow and calf moose in Units 15A and 15C.

Data Needs

With the introduction of any-bull draw tags to the Kenai Peninsula, and increased hunting pressure requiring changes in harvest restrictions to maintain a healthy moose population, more information is needed on the growth, movements, and survival of bull moose in addition to the information provided from the cow moose collaring program.

Methods

Continue with modifications: Capture and maintain a collared sample of 15 bull moose per year in each unit with expandable GPS collars. Take yearly post-season measurements of antler size for all collared bulls using aerial photography and photogrammetry. Collect teeth, antler measurements, and genetic samples from all harvested bulls to look at age at legal size and to archive samples for future genetic analysis.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor annual harvest and mortality patterns in Unit 15.

Data Needs

No change from RY15–RY19.

Methods

Data collection methods used during RY15–RY19 are sufficient and will continue into RY20– RY24. However, transitioning to an electronic system during the sealing process would be beneficial. Development of a WinfoNet database that will include all mortality including known illegal harvest, defense of life and property (DLP) kills, roadkill, moose killed by train, and "legal harvest" that is not properly reported on a harvest ticket is needed. Currently, WinfoNet only tracks legal harvest that is documented through a harvest ticket or permit report.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor moose browse production and removal on an annual basis to better understand sustainability of moose density.

Data Needs

No change.

Methods

Browse surveys following the methods of Seaton (2002) will be instituted in all IM units, if time and funding allows. Browse surveys will also be conducted in any unit for which a population estimate is not currently achievable due to methodological limitations.

ACTIVITY 3.2. Conduct habitat enhancement activities to increase moose population numbers in Unit 15A.

Data Needs No change from RY15–RY19.

Methods

No change from RY15–RY19.

ACTIVITY 3.3. Conduct activities to prepare for future habitat enhancement work in Unit 15B.

Data Needs No change from RY15–RY19.

Methods

No change from RY15–RY19.

ACTIVITY 3.4. Conduct habitat enhancement activities for moose population sustainability in Unit 15C.

Data Needs
No change from RY15–RY19.

Methods

No change from RY15–RY19.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

The current push from forces outside the department to institute predator control in management units for which it is not biologically justifiable is problematic. Predator control is a controversial management tool. Predator control efforts are costly and often require significant personnel time that could be spent on other pressing issues. If this tool is not implemented wisely, public outcry could lead to expensive litigation costs and loss of an effective management tool. We will continue to exercise caution in the use of predator control and implement it only when it is biologically reasonable or when obligated to do so by regulation.

A reliable survey technique to estimate moose population numbers in years of low snow needs to be developed. In recent history, composition counts and population estimates have not been completed during the same season due to snow levels and timing, and in many years, population estimate surveys have not been viable. As climate change continues, current survey techniques are likely to become less reliable for all management areas. Management staff will continue to work with research staff to develop new ways to assess population levels.

Data Recording and Archiving

- GSPE data are stored on an internal database housed on a server. (http://winfonet.alaska.gov/index.cfm)
- Composition count data are stored on the computer server in the Homer office (O:\DWC\ADF&G-Homer Files\Species Data\Moose\Survey Data).
- Field data sheets are stored in filing cabinets in the ADF&G office in Homer, in the assistant area biologist's office. Electronic copies are scanned and housed on the computer server in the Homer office (O:\DWC\ADF&G-Homer Files\Species Data\Moose\Survey Data.
- Historical (pre-2010) survey notes and data sheets are stored in the Homer AAB's office and are being scanned onto the office server office (O:\DWC\ADF&G-Homer Files\Species Data\Moose\Survey Data.

Agreements

There are no planned moose specific management agreements for Unit 15 during RY20-RY24.

Permitting

Capture and handling of moose in Units 7 and 15 will be conducted under ADF&G IACUC permits. IACUC permit numbers for work beginning in RY20 include 0046-2020-54, 0046-2021-53, 0096-2020-08, and 0096-2021-06.

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