
CHAPTER 16: MOOSE MANAGEMENT REPORT

From: 1 July 2011
To: 30 June 2013

LOCATION

GAME MANAGEMENT UNIT: 15A (1,314 mi²), 15B (1,121 mi²), and 15C (2,441 mi²)

GEOGRAPHIC DESCRIPTION: Western Kenai Peninsula

BACKGROUND

Unit 15A. Historical records and reports from residents indicate moose were abundant throughout the 1900s in Unit 15A. Recent population peaks occurred in 1971, 1982, and 1991; the 1971 peak was the highest. The near absence of wolves from 1913 to 1968 and increased moose survival following a 500-square-mile forest fire in 1947 were 2 factors that increased moose numbers throughout the 1950s and 1960s. Although seasons were long and either-sex harvest was allowed, the moose population increased beyond its carrying capacity and extensive overbrowsing occurred by the late 1960s. A wildfire in 1969 burned approximately 135 mi² (11 percent of 15A), initially reducing moose habitat in 15A. Then harsh winters from 1971 to 1974 reduced the moose population over the entire Kenai Peninsula. Estimates for Units 15A and 15B indicate the combined population estimate declined from 7,900 in 1971 to 3,375 by 1975. Unit 15A represents 75% of these estimates, and saw a decline from 5,900 to 2,500 moose. By 1982, following a more favorable winter and high utilization of the 1969 burn area, the moose population estimate for 15A increased to about 3,000. The moose population has continually declined since 1991.

From 1947 to 1969, wildfires that occurred in Unit 15A encompassed an area with a perimeter of about 388,000 acres. From 1970 to 2010 fire perimeters have encompassed only 5,000 acres. Consequently, less browse associated with successional forest stages has been available to moose, and a gradual decline in the moose population size ensued.

The department works with a variety of agencies and landholders. The Kenai National Wildlife Refuge is the largest landholder in Unit 15A and actively participates in a variety of cooperative moose management programs. These include support of the Alaska Department of Fish and Game Moose Research Center near Sterling and cooperative management of Skilak Loop as a wildlife viewing area. There is a need to focus on addressing habitat concerns now that most of the habitat in Unit 15A is past the early successional stage.

A selective harvest strategy with a spike-fork 50-inch bag limit was initiated on the Kenai Peninsula in 1987. The proportion of males in the population subsequently increased, and hunters seem generally satisfied with the selective harvest strategy. We completed a 5-year

evaluation of selective harvest on the Kenai in 1992 (Schwartz et. al., 1992). A 10-year evaluation was conducted in 1999 (Hundertmark et al. 1999). In 2011, the Peninsula harvest strategy was restricted to harvesting 50-inch or 4 brow tines moose due to declines in bull:cow ratios in 15C.

Unit 15B. The moose population in Unit 15B is believed to have been relatively stable from 1990 through 2001, with an estimated population of around 1,000, which has since declined. Composition counts in 15B West suggest a decline from 1994 to 2009. Because these were not censuses, it is difficult to determine the extent of the decline, but the total moose counted in 2009 were less than one half of the 1994 count for similar survey areas. Forests within 15B have succumbed to widespread spruce bark beetle (*Dendroctonus rufipennis*) infestations that began in the 1990s. More than 500,000 hectares of spruce forests have been affected (Kenai Peninsula Borough n.d.). Since 2001, infestation rates have decreased as the number of unaffected trees becomes scarce (U.S. Forest Service and Alaska Department of Natural Resources 2002). Salvage logging efforts are limited because most of the area in 15B is within the Kenai National Wildlife Refuge which limits many motorized and mechanical activities.

Hunting within 15B is by drawing permit only in 15B East, which is designated as a “trophy” area, and by general harvest ticket in 15B West. During this reporting period (1 July 2011–30 June 2013) the quality (antler size) and quantity of moose harvested continued to remain low along with hunter satisfaction.

From 2003–2009 fire perimeters have encompassed about 34,025 acres in Unit 15B. No additional significant fires have occurred in recent years. The above fires should provide areas with improved moose habitat, but benefit to the moose population has been limited to date.

Unit 15C. Available habitat on the Lower Peninsula 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, lower reaches of Fox River and Sheep Creek, and the Homer Bench. Despite several winters of deep snow in the late 1990s, the estimated moose population size increased about 30% between surveys in 1993 and 2002 and continues to slowly increase. Community development continues, increasing interactions of human residents and moose.

Widespread spruce bark beetle infestations have also affected this region of the Peninsula. Portions of the affected forest 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, *Calamagrostis canadensis*, which has poor nutritional value for moose, became the dominant ground cover. Some logged areas were replanted with conifers rather than species beneficial for moose browse such as birch. This area could have produced more high quality moose browse if specific treatments were applied during the salvage logging operations.

Unit 15C has the most potential for good moose habitat in the future as browse recovers in new burns. Since 2004, the perimeter of wildfires has encompassed over 87,000 acres in this unit. We have not evaluated the quality of moose habitat regenerated from these fires, but relative to Units 15A and 15B, Unit 15C has more potential for large areas of quality moose habitat in the near (by 2015) future. Our main concern for moose management in this unit is maintaining an

adequate bull:cow ratio. Hunting restrictions imposed in 2011 increased the bull:cow ratio from 9 bulls:100 cows in 2010 to 22 bulls:100 cows in 2012. Future regulation changes however, may affect overall bull numbers and whether we stay within management objectives.

A census conducted north of Kachemak Bay in February of 2013 resulted in a point estimate of 3,204 (Sightability Correction Factor [SCF] 1.296) which equates to approximately 2.7 moose/mi² (survey area = 1,171mi²).

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

Maintain moose populations at a level to promote public safety through directed harvest, and 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 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.

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

Unit 15B-West

- Maintain a bull-to-cow ratio of 20–25:100.
- Allow for maximum opportunity to participate in hunting in 15B West.

Unit 15B-East

- Maintain a bull-to-cow ratio of 40:100.
- Provide opportunities to harvest large-antlered bulls under aesthetically pleasing conditions.

Unit 15C

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

Intensive Management

The Intensive Management law was passed in 1994. Units 15A and 15C fall under intensive management; Unit 15B was excluded.

- IM objectives Unit 15A
 - Population objective: 3,000–3,500 moose.
 - Harvest objective: 180–350 moose.
- IM objectives Unit 15C
 - Population objective: 2,500–3,500 moose.
 - Harvest objective: 200–350 moose.

METHODS

Unit 15A. During years with adequate snowfall, we conducted aerial surveys in November and December in selected trend count areas to ascertain sex and age composition. Recently, weather conditions permitted limited composition surveys during 2006, 2008, and 2009; however, we surveyed all of our desired count areas during 2010–2013.

Population estimates for Subunit 15A were developed from data collected with a geospatial survey (Kellie and DeLong 2006) in February 2001, February 2008, and February 2013. Sightability correction factors for moose were assumed in 2001 and 2008 but calculated during 2013 efforts.

Unit 15B. Composition surveys were flown in November of 2009 and 2010. This was the first time composition surveys had been conducted since November 1996.

Unit 15C. Fall composition surveys were conducted during 2010–2013. Two additional count areas were added to these surveys compared to previous years. A geospatial census was conducted in February 2013.

Harvest data are provided by hunter reports of harvest and are summarized by regulatory year. A regulatory year runs from 1 July through 30 June (e.g., RY10 = 1 July 2010–30 June 2011).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Composition in Unit 15A

Data from the 1991 census resulted in a 15A population point estimate of 3,432 (Confidence Interval [CI] 95%: 2,921–3,943, SCF 1.21). The February 2001 point estimate for moose was 1,942 (95% CI: 1,555–2,329, assumed SCF 1.25), while the February 2008 census resulted in a population point estimate of 1,670 (95% CI: 1,405–1,934, assumed SCF 1.25). The February 2013 census provided a point estimate of 1,569 (95% CI: 1,296–1,843, SCI 1.27). These data indicate that the population was approximately 54 percent lower in 2013 compared to the most recent peak in 1991.

The bull:cow ratio calculated from the November 2012 composition surveys was 30 bulls:100 cows (Table 1). Information for 2009 includes only one count area in the eastern portion of the unit and should not be compared to other years. The fall calf:cow ratio has fluctuated since 2008 with a low of 16 calves:100 cows to 2012 levels of 25 calves:100 cows (Table 1).

Unit 15A is currently outside its intensive management objectives in both population size and harvest. Harvest objectives are currently unmet due to population size, composition, and harvest restrictions. The current population objective is unattainable due to habitat limitation and will remain so until habitat improvements occur either through direct manipulation such as mechanical treatment and prescribed fire or from natural causes (wildfire). Direct habitat manipulation is currently unlikely to dramatically improve habitat conditions due to management limitations. Controlled burning has not been implemented to date due to resource limitations and burn conditions. Mechanical treatment is costly and only very limited amounts of habitat can be treated by this means.

Population Size and Composition in Unit 15B

A February 2001 census of the 650.4 square miles of suitable moose habitat in Unit 15B estimated the population at 958 moose (95% CI: 777–1,139) and a density of about 1.5 moose/mi². Because the census was conducted during February, after most bulls had shed their antlers, composition by sex was not determined. Calves composed 21% of the population, compared to 10% found in the February 1990 census. Composition surveys were flown in 3 areas in the fall of 2009 and 2 in 2010 (Table 1). Comparing these data to data obtained in 1994 (the last time these areas were surveyed in the fall) indicates there were more than twice the number of moose in 1994 (N=275, count areas 903–905; N=65, count areas 906 and 907) compared to counts in 2009 (N=164, count areas 903–905) and 2010 (N=65, count areas 906 and 907) under similar conditions and flying similar coverage. Because these were composition surveys they only indicate a possible trend. Comparing the bull:cow ratio, which decreased from 57 bulls:100 cows in 1994 to 35 bulls:100 cows in 2009–2010, we see a similar trend. Indications are that the moose population has declined in Unit 15B.

Population Size and Composition in Unit 15C

A random-stratified census (Gasaway 1986) was conducted in lowland portions of Unit 15C north of Kachemak Bay (1,190 mi²) during the winter of 1992–1993. The population was estimated at 2,079 moose (95% CI: 1,425–2,734, SCF 1.49). During the winter of 2001–2002, a

geospatial census (Ver Hoef 2001) conducted over the same area produced an estimate of 3,964 moose (95% CI: 3,491–4,438, assumed SCF 1.33). The 2001-2002 survey however, was not conducted using currently accepted sampling protocols and it is likely biased high. A geospatial census was also conducted in this area during March 2010. This census produced an estimate of 2,195 moose (95% CI: 1,918–2,473) assuming a sightability correction factor of 1.33 (Table 1). In February 2013 (RY12), we conducted a geospatial census that produced a population estimate of 3,204 (95% CI: 2,554–3,855) with a calculated sightability correction factor of 1.3.

The actual number of moose seen during composition counts is not comparable from year to year, because survey intensity and conditions are inconsistent. Composition counts are performed in order to get an adequate sample of moose to calculate ratios of bulls to cows and calves to cows. Composition counts conducted in 2009 in two traditional count areas, one around the Caribou Hills and the other south of the Anchor River, showed 13 bulls:100 cows and 18 calves:100 cows (Table 1). The bull:cow ratio was below the minimum management objective of 15:100. Composition data from the fall 2010 surveys (Table 1) included 2 additional areas. The new areas were added because we thought it would give us a better representation of the overall moose population due to concerns that the moose may have redistributed after the 2007 Caribou Hills Fire. The 9 bulls:100 cows observed during the 2010 surveys (Table 1) indicated a unitwide issue and management actions were taken to address it. These actions of reducing the bull harvest increased the bull:cow ratio to 22 bulls:100 cows by 2012.

Unit 15A is currently below Intensive Management population and harvest objectives. These objectives were based on the peak moose population that existed following the 1969 burn. With no large scale habitat alteration since that time, 15A can no longer support enough moose to realize population or harvest objectives identified under Intensive Management. We continue to work with the Kenai National Wildlife Refuge and other private and public organizations to identify areas where we can improve the habitat in 15A so it is more favorable to moose. In addition to addressing habitat concerns, the department will also consider implementing a wolf control program on lands outside the Kenai National Wildlife Refuge.

Unit 15C is currently within its population objective set under Intensive Management but outside of the harvest objective. This is due to a previous overharvest of the bull segment of the population leading to implementation of harvest restrictions to recover adequate bull to cow ratios. Harvest objectives could be met in the future with an increase in cow harvest and additional bull harvest as bull numbers recover under the current restrictive harvest regulations. When bull ratios are adequately recovered, new regulations can be set to limit the chance of future overharvest but still allow adequate harvest opportunity.

MORTALITY

Harvest

Season and Bag Limit. The general season for Unit 15A and 15B is 10–17 August (archery only), and 20 August–20 September. Unit 15C shares the 20 August–20 September dates but does not have an archery season. From 1987 to 2010, the bag limit was 1 bull with a spike or fork on at least 1 antler, or 50-inch antlers, or antlers with 3 or more brow tines on at least 1 side (SF-50-3bt). Harvest statistics are shown in Tables 2 and 3. In 2011, the bag limit was restricted to 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side (50-4bt).

Board of Game Actions. In 2010, the Board of Game provided additional hunting opportunity (15–19 October) for TM549 due to poor hunting conditions during the regularly scheduled dates and hardships caused by poor salmon returns.

During the March 2011 meeting, The Board of Game reauthorized the antlerless moose permit hunt for the Homer area (DM549), but did not reauthorize the Skilak Loop (DM524) hunt. Other actions taken at the March 2011 meeting included changing the antler requirements for a legal bull from SF-50-3bt to 50-4bt only for all general season hunts in Units 7 and 15. The board also eliminated nonresident moose hunting in Units 15A and 15C and requested that the department develop an Intensive Management proposal that included aerial shooting of wolves in Units 15A and 15C and present the proposal at the November 2011 meeting in Barrow. In March of 2013, the Board of Game directed the department to implement wolf control in Unit 15A.

During its 2006 meeting the Federal Subsistence Board liberalized the moose hunting season in Units 15B and 15C for federally qualified subsistence users. The additional season dates are 20 October–10 November. The SF-50 or 3 brow-tine restrictions still apply to this hunt.

Permit Hunts

Unit 15A. No permits were issued for the SLWMA during this report period and this hunt no longer exists due to action taken at the March 2011 Board of Game meeting.

Unit 15B. 15B East is managed as an area where hunters are able to view and harvest large-antlered bulls through a drawing permit system. Permittees reported harvesting 3 bulls in 2011 and 5 in 2012 (Table 3). During 2008, the number of permits issued for the 26 September–15 October season was reduced from 50 to 10. Following results from the composition surveys in 2010, coupled with low harvests of relatively small antlered bulls, and complaints from the public, no permits have been issued for the 26 September–15 October hunt since 2009.

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. One to 3 bulls have been taken during this season in the last 5 years (Table 3). The antlerless hunt for moose near Homer was initiated in 1995 (DM549). No permits were issued in 2001. During the last 5 years, 50 permits were issued each year with a 5-year average annual harvest of 21 moose (Table 3).

Hunter Residency and Success

Unit 15A. Hunter success ranged 10–13% from 2008 to 2010 and then declined dramatically due to increased harvest restrictions in 2011 and 2012 (1% and 2%, respectively, Table 4). During all years, local residents (people living in Unit 15) accounted for the majority (82–100%) of successful moose hunters.

Unit 15B-West. Hunter success ranged 7–19% during the last 5 years (Table 4). The reduction in success during 2011 and 2012 is most likely due to increased harvest restrictions. During all years, local residents (people living in Unit 15) accounted for the majority (81–100%) of successful moose hunters.

Unit 15C. Hunter success ranged 6–19% during the last 5 years (Table 4). The lower success rates in 2011 and 2012 were most likely due to increased harvest restrictions. During all years, local residents (people living in Unit 15) accounted for the majority (78–96%) of successful moose hunters.

During this reporting period (1 July 2011–30 June 2013) 14% of the reported moose harvest came from Unit 15A, 16% from 15B, and 70% from Unit 15C.

Harvest Chronology. The chronology of the harvest depends on weather conditions and other factors unrelated to moose abundance. The highest proportions of the harvest generally occur at the start and the end of the season (Table 5).

Transport Methods. Most moose hunters use highway vehicles as their primary method of transportation to access hunting areas in Units 15A and 15B (Table 6). The most popular method used in Unit 15C was the all-terrain vehicle (ATV).

Other Mortality

We began a public awareness program in 1990 in an effort to reduce the number of vehicle-moose collisions (Del Frate and Spraker 1991). Unfortunately, while collisions declined for a short time, collisions have again increased, which is likely due to animals seeking forage near roadways as browse species away from roadways in 15A have continued to mature and become unavailable to moose.

“Winter kill” deaths appear to be increasing in 15A. The number of known moose that died from causes other than predation during the late winter of 2012–2013 was twice as high in Unit 15A (69) as either Units 15B (36) or C (28). Interestingly, the winter of 2012–2013 was relatively mild with moderate snowfall compared to previous winters.

Unit 15A. Crippling loss by hunters and loss to predation was unknown. During the last 5 years (RY08–RY12), the yearly average of moose killed in 15A by motor vehicles increased to 94 from the previous 5-year average of 83 (Table 2). Most of the moose killed by vehicles are cows and calves. These data include only moose that were hit by vehicles and died at the collision site. The number of moose that were hit, walked off, but later died from injuries sustained during the collision is unknown.

Unit 15B. Crippling loss by hunters and loss to predation was unknown. During the last 5 years (RY08–RY12), a yearly average of 51 moose have been killed by motor vehicles in Unit 15B (Table 2).

Unit 15C. Crippling loss by hunters and loss to predation was unknown. During the last 5 years (RY08–RY12), a yearly average of 48 moose have been killed by motor vehicles in Unit 15C (Table 2). The high number of moose wintering within the Homer Bench continues to be habitat limited during deep snow winters. The level of mortality for these moose during severe winters is high.

HABITAT

15A

Assessment

The last significant burn (approx. 85,000 acres) in Unit 15A occurred in 1969. Generally, the duration for producing quality moose browse after a burn is 20–25 years and the area has lost its value for producing significant amounts of quality browse. Maturation of the habitat, predation, and collisions with automobiles are the leading causes of declines in the Unit 15A moose population.

Enhancement

In May 1991, approximately 7,000 acres burned in the southeastern portion of 15A near Pothole Lake. This burn increased available moose habitat; however, it only benefited animals in the immediate area of the burn due to its small size. Substantial statewide publicity regarding beneficial effects of wildfire for forest succession wildlife stemmed from the Pothole Lake fire. With the forage benefits for moose lasting 20–25 years post burn, this area is in the final years of producing quality moose habitat.

A 10,369-acre area in the Mystery Creek Road vicinity was to be burned by U.S. Fish and Wildlife Service (USFWS) in the fall of 1991. Unfavorable weather conditions and other factors prevented this prescribed burn project until July 1999, when a small portion of the area was burned. Approximately 40% of this area was left untreated (unburned) as scattered islands for wildlife cover and as a seed source for revegetation.

In March and April 2013, 85 acres of mature mixed hardwoods were mechanically treated through clearcutting and replanting on Kenai Natives Association land north of the Sterling Highway and east of the Swanson River Road. This treatment was conducted by Evergreen Alaska, Inc. The total cost of the project was \$93,137, funded with an appropriation from the Alaska Legislature for the 2013 fiscal year.

Additional interagency habitat improvement projects coordinated by ADF&G are planned for coming years in Unit 15A. ADF&G has requested a long-term funding commitment of \$1 million over the course of 5 years from the Alaska Legislature to facilitate habitat enhancement. This funding is to be directed toward private contractors operating on public and private 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 associated community outreach, additional fuel breaks are expected to be developed to protect communities and infrastructure to support the use of fire for habitat enhancement. Through partnerships with the Alaska Division of Forestry, the Kenai Peninsula Borough, U.S. Forest Service and the Kenai National Wildlife Refuge, ADF&G hopes to return fire to the landscape for the benefit of wildlife and ecosystem processes; this will also reduce the likelihood for high intensity wildland fires prone to result in damaging impacts to the landscape.

15B

Assessment

From 1890 (when a wildfire burned most of the unit) to 2003, no significant wildfires occurred in this unit. However, from 2004 to 2009, fires have encompassed about 34,000 acres. Quality assessment of moose habitat generated by these fires is unknown.

Enhancement

No significant enhancement projects have been identified for this unit.

15C

Assessment

Reduction of beetle-killed forest stands through salvage logging has been underway for more than a decade. Post logging site work that encourages hardwood regeneration beneficial for moose habitat (primarily scarification to expose mineral soil) has been recommended to local foresters and has been conducted on some sites with apparent success. If site preparation is done properly, resulting in a healthy regeneration of hardwoods, habitat quality for moose will probably increase greatly. However, if site preparation is not conducted or is done inadequately, blue-joint grass (*Calamagrostis canadensis*) will initially crowd out hardwood and spruce seedlings, creating less desirable moose habitat and slowing forest succession. Development continues to occur in prime moose habitat, particularly in important wintering areas for moose, increasing the probability of permanent habitat loss. Concerns over future property loss from such development will likely hamper future use of natural and prescribed fires for habitat enhancement.

Enhancement

Mitigation funds stemming from the construction of the Bradley Lake Hydroelectric Project allowed for the creation of Kachemak Moose Habitat Inc., a group focused on improving and protecting moose habitat. This group continues to purchase land and help orchestrate conservation easements to benefit moose habitat on the lower Kenai Peninsula. The Tracey Road fire burned more than 5,000 acres northeast of Homer in May of 2005. It is unknown if this fire was hot enough to burn the ground layer and greatly enhance moose habitat. The Fox Creek fire (summer 2005) south of Tustumena Lake encompassed approximately 35,000 acres, while the Caribou Hills fire (summer 2007) encompassed about 50,000 acres. The long-term benefits for moose habitat production from these fires are unknown at this time.

CONCLUSIONS AND RECOMMENDATIONS

Unit 15A. ADF&G (Hundertmark et al. 1999) completed a 10-year review of the selective harvest strategy in 1999. The bull-to cow-ratio increased from a 5-year (1982–1986) average of 13:100 to 22:100 in 1991, but declined to 16:100 in 1992 following the severe winter of 1991–1992. In RY94 the ratio rebounded to 24:100, and it increased to 30:100 in RY12. The calf to cow ratio has declined significantly from 34:100 in the 1990s to the current average of 25:100.

Currently, the largest impacts on the 15A moose population are declining habitat quality and deaths caused by collisions with motor vehicles. The downward trend in Unit 15A moose

numbers will likely continue in the absence of significant habitat altering events (such as burns encompassing more than 50,000 acres).

Since 1999, Unit 15A has been below Intensive Management (IM) harvest objectives every year excluding 2001. This unit has also been below IM population objectives since at least 2001 (a census year) and has likely been below the objective since the mid-1990s (the nearest census previous to 2001, was conducted in February 1991). The Board of Game (BOG) has considered IM action, and during the board's March 2009 meeting it directed the department to work cooperatively with the Kenai National Wildlife Refuge to develop a plan to address the decreasing moose population and harvest in Unit 15A (to be presented at the January 2010 BOG meeting). As a result of this request, a project to address moose productivity, focusing on pregnancy rates, twinning rate, birthing date as it relates to primary or later estrous breeding, and calf survival to winter was funded and began in late 2011.

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. Interestingly, the IM population objectives were set near the number of moose estimated during the 1991 census and the moose population in 1991 is believed to be similar to the population in 1989. In the absence of periodic (every 20–25 years) and significant (50,000 acres or more) wild fire or other habitat events, 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. That would equate to a population of about 1,300–2,600 moose. Given current conditions the moose population will not recover to the numbers observed during the late 1980s through mid-1990s unless aggressive habitat management is initiated. We will continue to work with the Kenai National Wildlife refuge regarding these issues.

Unit 15B. The number and “quality” of moose taken in the permit hunts in Unit 15B East and complaints from hunters who had difficulty locating and harvesting animals in conjunction with supporting survey results suggested the department needed to take action. Consequently, the number of late season (26 September–15 October) permits was reduced to 10 (down from 50) for the 2008 season and no permits have been issued since 2009.

Harvest levels are well within acceptable guidelines to maintain a minimum bull:cow ratio of 40:100. Hopefully the fires in the past decade (2004, 2005, 2007, and 2009) will produce quality moose habitat in the future and the population will respond. This unit is in prime condition for additional fires, natural or prescribed. ADF&G and USFWS should cooperate on selected habitat enhancement projects (mechanical manipulation and prescribed burns) to improve moose habitat in the western part of the unit. The eastern part is designated wilderness and will have to burn naturally.

Unit 15C. The bull:cow ratio dropped below the previous objective range of 15–20 bulls:100 cows in 2007. However, these ratios vary dramatically across count areas because of clustered distributions of post-rut aggregations. Adequate bull:cow ratios are desired to minimize the length of the rut and ensure most cows conceive during their first estrous cycle (Schwartz et al. 1994). There are uncertainties regarding the movement of moose throughout Unit 15C, especially since the recent fires. Snow depth appears to dictate movements to the Homer Bench,

but we do not know what proportion of moose display this migratory behavior or the source locations for the migrants. Investigations into how movements on the Lower Peninsula contribute to the fitness of the migrants versus nonmigratory moose, a determination of animal locations across seasons, and other answers could contribute greatly to our knowledge of population dynamics of this population. These answers could help us identify and make management decisions for subpopulations of moose that are affected by severe winters and also clarify the bull:cow ratios in specific areas during the rut. Additional funding was secured for research on moose productivity, calf survival, and seasonal movement of cow moose and began in late 2011.

Results from the February 2013 census indicate we are within and likely in the upper 1/3 of our Intensive Management population objectives (census range 2,554–3,855 with a point estimate of 3,204, intensive management objective 2,500–3,500). The point estimate equates to a density of approximately 2.7 moose/mi² over the entire census area (1,171.3 mi²), but likely 4 or more moose/mi² on winter range (below 1,000 ft. elevation during an average snowfall winter, T. McDonough, Wildlife Biologist, ADF&G, Homer, personal communication). Given we are still below Intensive Management harvest objectives, and have a relatively high moose density, we should be looking to increase harvest opportunities in the near future.

The expansion of federal subsistence hunting opportunities, the increased effort associated with these new opportunities, and the inconsistency between state and federal regulations and season dates have confounded the issues surrounding moose management. This dual system will continue to challenge wildlife managers into the future.

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PREPARED BY:

Jason Herreman
Wildlife Biologist II

APPROVED BY:

Gino Del Frate
Management Coordinator

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Table 1. Unit 15 aerial composition counts for moose and estimated population size, 2008–2012.

Unit	Regulatory Year	Bulls: 100 Cows	Calves: 100 Cows	%Calves	Adults	Total Moose Observed	Estimated Population Size
15A	2008	11	21	16	171	204	1,405–1,934 ^a
	2009	84	16	8	79	86	no survey
	2010	20	23	16	288	345	no survey
	2011	36	29	17	402	487	no survey
	2012	30	25	16	312	372	1,269–1,843 ^a
15B	2008	No Surveys Conducted					
	2009	51	11	7	153	164	no survey
	2010	33	9	6	61	65	no survey
	2011	No Surveys Conducted					
	2012	No Surveys Conducted					
15C	2008	13	10	8	492	537	no survey
	2009	13	18	14	368	426	no survey
	2010	9	19	15	625	735	1,918–2,473 ^a
	2011	14	26	19	877	1077	no survey
	2012	22	15	11	580	650	2,554–3,855 ^a

^a Estimates from geospatial census method, estimated population size shown = 95% CI.

Table 2. Unit 15 Reported general season moose harvest and accidental death, 2008–2012.

Unit	Regulatory Year	Reported Hunter Harvest				Accidental death			Total Reported Mortality
		Bull	Cow	Unk	Total	Road	Train	Total	
15A	2008	114	1	0	115	101	0	101	216
	2009	110	0	0	110	45	0	45	155
	2010	117	0	2	119	137	0	137	256
	2011	4	0	0	4	103	0	103	107
	2012	7	0	0	7	84	0	84	91
15B	2008	33	0	0	33	41	0	41	74
	2009	38	0	0	38	61	0	61	99
	2010	51	0	1	52	65	0	65	117
	2011	7	0	0	7	49	0	49	56
	2012	3	0	0	3	41	0	41	44
15C	2008	194	0	1	195	40	0	40	235
	2009	242	2	4	248	51	0	51	299
	2010	214	3	3	220	46	0	46	266
	2011	26	0	0	26	53	0	53	79
	2012	27	0	0	27	52	0	52	79

Table 3. Unit 15 harvest data for drawing permit hunts, regulatory years 2008–2012.

Hunt No.	Regulatory Year	Permits Issued	Permittees that hunted	Percent Success	Harvest			
					Bulls	Cows	Unk.	Total
15B DM530-539 (combined totals)	2008 ^a	60	42	5	2	0	0	2
	2009	50	31	6	2	0	0	2
	2010	50	19	16	3	0	0	3
	2011	50	17	18	3	0	0	3
	2012	49	18	28	5	0	0	5
15C DM549 TM549	2008	50	40	58	0	23	0	23
	2009	50	43	60	0	26	0	26
	2010	50	43	44	0	19	0	19
	2011	50	35	86	0	19	0	19
	2012	50	42	45	0	19	0	19
	2008	4	4	25	1	0	0	1
	2009	4	4	50	2	0	0	2
	2010 ^b	4	4	25	1	0	0	1
	2011	4	4	50	3	0	0	3
	2012	4	4	50	2	0	0	2

^a Only 10 permits were issued for the 26 September–15 October season.

^b Season dates expanded to include 15–19 October.

Table 4. Unit 15 residency and success of moose hunters for the general season, 2008–2012.

Unit	Regulatory Year	Successful				Unsuccessful				Total Hunters
		Local ^a Resident	Nonlocal Resident	Non-Resident	Total ^b (%)	Local ^a Resident	Nonlocal Resident	Non-Resident	Total ^b	
15A	2008	97	12	4	115 (10)	827	162	24	1,020	1,135
	2009	91	11	7	110 (11)	763	137	17	928	1,038
	2010	98	12	4	119 (13)	642	124	14	789	908
	2011	4	0	0	4 (1.4)	227	47	0	286	290
	2012	7	0	0	7 (2.4)	237	33	0	281	288
15B	2008	29	3	1	33 (13)	198	23	1	222	255
	2009	34	2	2	38 (13)	220	32	5	261	299
	2010	42	4	4	52 (19)	186	25	6	221	273
	2011	6	1	0	6 (7)	64	8	0	77	83
	2012	6	0	0	6 (8)	62	5	1	68	74
15C	2008	165	21	5	195 (14)	999	128	23	1,153	1,348
	2009	209	24	12	248 (19)	909	126	21	1,071	1,319
	2010	186	24	7	220 (18)	819	131	17	986	1,206
	2011	22	3	0	26 (6)	352	38	1	399	425
	2012	24	1	0	27 (6)	366	37	0	417	444

^a Local = residents of Unit 15.

^b Includes unspecified residency.

Table 5. Unit 15 moose general season harvest chronology (percent of harvest), 2008–2012.

Unit	Regulatory Year	Harvest Periods							Unknown	Harvest
		8/10– 8/17 ^a	8/20– 8/25	8/26– 8/31	9/1– 9/5	9/6– 9/10	9/11– 9/15	9/16– 9/20		
15A	2008	27	21	6	7	3	12	20	4	115
	2009	25	25	7	4	6	10	19	4	110
	2010	27	24	8	5	8	11	12	7	119
	2011	25	0	0	0	0	25	50	0	4
	2012	14	14	0	0	0	29	43	0	7
15B	2008	30	21	9	3	3	6	24	3	33
	2009	29	16	5	11	8	11	16	5	38
	2010	25	25	6	4	4	10	23	4	52
	2011	0	0	0	0	0	0	71	29	7
	2012	17	0	0	0	33	50	0	0	6
15C	2008	1	34	13	11	8	9	19	4	195
	2009	0	34	10	13	10	11	17	5	248
	2010	2	38	12	7	12	11	13	4	220
	2011	0	4	8	12	4	35	31	8	26
	2012	0	7	7	0	11	22	41	11	27

^a Archery-only season is 10–17 August in 15A and 15B only.

Table 6. Unit 15 general season transport methods for moose hunters (percent of harvest), 2008–2012.

Unit	Regulatory Year	Percent of Harvest							Harvest
		3/4 wheel- ATV	Airplane	Boat	Highway Vehicle	Horse/ Dogteam	ORV	Unknown	
15A	2008	19	2	10	62	2	3	3	115
	2009	15	3	8	65	1	5	4	110
	2010	23	3	6	60	0	6	3	119
	2011	0	0	25	75	0	0	0	4
	2012	0	0	14	57	14	0	14	7
15B	2008	18	0	3	64	9	3	3	33
	2009	11	0	3	79	5	0	3	38
	2010	8	0	6	79	0	4	4	52
	2011	0	14	29	43	0	14	0	7
	2012	0	0	0	67	0	0	33	6
15C	2008	50	0	4	28	7	6	6	195
	2009	46	1	3	33	8	6	3	248
	2010	48	0	2	34	6	8	2	220
	2011	54	0	8	12	23	0	4	26
	2012	48	0	0	11	22	4	15	27