Draft Operational Plan for Intensive Management of Moose in Game Management Unit 15A During Regulatory Years 2012-2017

Prepared by the Division of Wildlife Conservation

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This document provides information about how the department of Fish and Game (department) plans to implement the Intensive Management (IM) plan if passed by the Board of Game (Board). The elements of this plan are based on the enabling regulation (5 AAC 92.125), but as an internal department plan it is subject to change without Board action. This plan, and subsequent modifications, will be the basis of annuals reports to the Board as required by regulation. The department welcomes comments from the public about proposed actions and methodologies and the department may modify the plan though time based on additional input.

Summary of supporting information

This operational plan has been prepared by the Alaska department of Fish and Game (ADF&G) to provide supporting information on the Intensive Management (IM) plan for moose in Unit 15A during 2012-2017. The IM Plan is found in Title 5, Alaska Administrative Code, Section 92, Part 125 (abbreviated as 5 AAC 92.125). Based on the biological and management information for this area (Appendix A), this operational plan describes rationale for evidence of limiting factors; choice of indices for evaluating treatment response; and decision frameworks for predation control, habitat enhancement, and prey harvest strategies. *Agency Protocol For Intensive Management Of Big Game In Alaska* (2011) describes the administrative procedures and the factors and strategies in adaptive management of predator-prey systems to produce and sustain elevated harvests of caribou, deer, or moose in selected areas of Alaska. The IM Plan for moose in Unit 15A has been developed based on the request of the Alaska Board of Game (Board). The IM plan and this operational plan include information and recommendations from a Feasibility Assessment prepared by the department and the recommendations by the Board following public comment at the March 2011 Region II meeting.

Background

The moose population in Unit 15A has been at relatively low densities since the early 1990s. Habitat quality appears to be a major cause of the decline in moose to the current levels. Dating back to the 1880s, the rise and fall of the Unit 15A moose population correlates well with fire history. Moose densities peaked 15-20 years post-fire and by 40 years post-fire densities returned to pre-fire levels. There has not been a major fire in Unit 15A for over 40 years.

The IM objectives for Unit 15A were established in 2000 with a population objective of 3000–3500 moose and a harvest objective of 180–350. The moose population in Unit 15A was below IM population objectives well before the objective was established and has never met objectives to date. The reported harvest in Unit 15A has been below the IM objective in 10 of the 11 years since the objective was established.

The last moose census in Unit 15A conduced in 2008 estimated 2,088 moose (95% CI: ± 264, assumed sightability correction factor [scf] of 1.25; Figure 3). The current estimate equates to a density of 1.6 moose/mi^2. The last three density estimates (1995, 2001, and 2008) have not shown statistical differences. However, there was a 40% decline in the estimates between 1990 and 2008.

A wolf survey conducted in November 2011estimated the wolf population between 60-62 wolves. Based on this estimate, the recent harvest of wolves (5-year average of 10/year) equates

to about a 20% harvest rate, well below maximum sustainable limits. There has not been a black bear estimate calculated in the unit since the mid-1980s. Extrapolating these >20-year-old estimates to the entire unit produces a range of 700-900 black bears. The 5-year average black bear harvest is 62 bears/year (a 7-9% harvest rate), which is less than half of the maximum sustainable limits. Brown bear densities are unknown but the department believes the population is increasing. The annual finite rate of increase of brown bears across the peninsula is 1.8% from 1995-2008. The average reported human-caused mortality of brown bears in the unit averages about 12 bears/year.

Due to widespread declines in the bull:cow ratio throughout the Kenai Peninsula, in March 2011, the Board restricted the legal bag limit of moose from the spike-fork, 50″ or 3 brow tine regulation (SHS) to a bull with 50″ antlers or 4 or more brow tines. This reduced the harvest in Unit 15A by >75%. IM harvest objectives were not being met before this restriction and will be well below objectives with the restriction. The department predicts that the antler restrictions will get the bull:cow ratio back to objectives in most areas within 2 regulatory years.

With the decline in the bull:cow ratio under the SHS regulation, it is evident that the past level of bull harvest, at least the yearling portion, is not sustainable without a significant increase in survival. However, increasing the moose population above current densities would add to the current nutritional stress in the population. One of the many challenges in implementing an IM plan for this area is the poor condition of the habitat and its impact it has on the nutritional stress of moose. A spring 2011 calf survey estimated 16% of parturient females with twins, pregnancy rate of adult cows in 2006 was 73%, preferred browse species show heavy use, and there are cases of late winter and spring mortality due to malnutrition even in mild winters. Based on these conditions the sustained overall population should not be increased and any increase in moose resulting from aerial wolf control should be allocated to harvest. This IM plan includes maintaining current population densities until habitat improves and it sets biological triggers for suspension of wolf control and implementation of antlerless harvest.

This IM plan contains several components tailored to biological circumstances specific to Unit 15A.

1) The plan focuses on wolf control. Bear management actions, beyond liberal hunting seasons, are not included at this time.

2) Given the decline in the bull:cow ratio, the department will initially focus research on productivity changes in response to the recent antler restrictions. This research will assist the Department in developing a long-term management strategy post-SHS regulations. This will also provide baseline data for managing the IM program.

3) Assessing the effectiveness of the plan will be based on measurable changes over time and by comparing the treatment area to a control area. Though specific areas for comparison will be identified as the plan is implemented, initial considerations are to divide the units into an eastern and western portion, because of land ownership patterns.

4) The plan is to maintain current moose densities by increasing human harvest as predation declines.

5) The plan will include working with the Kenai National Wildlife Refuge (KNWR) to develop and implement habitat management plans to improve the quality of the moose range.

Figure 1. Intensive management area for moose in Game Management Unit 15A in the northwest of the Kenai Peninsula, Alaska. Highlighted lighter area shows the Kenai National Wildlife Refuge boundaries.

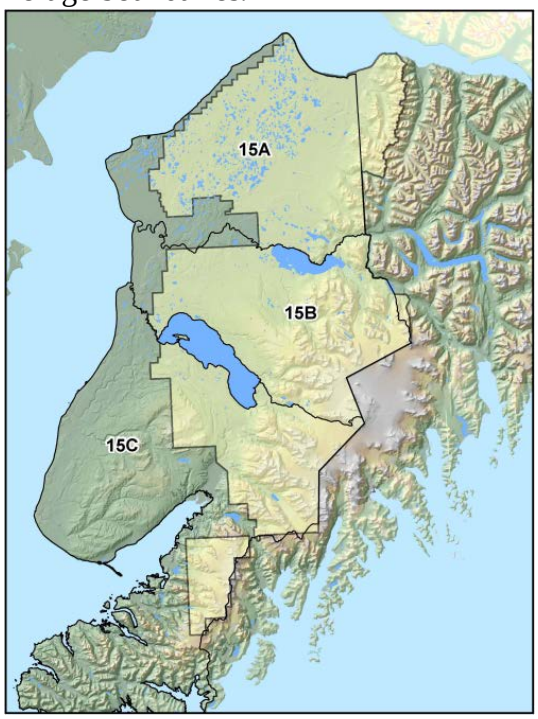


Figure 2. Land ownership in Unit 15A, Kenai Peninsula, Alaska. State land is limited to approximately 15.6 mi^2 in the southwest corner of the unit.

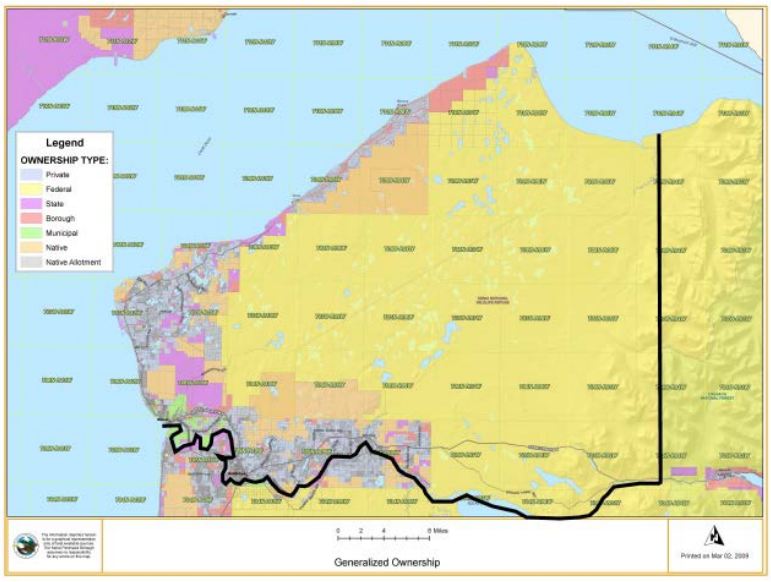


Figure 3. Unit 15A moose population size estimates. Estimates from 1973-1982 were through quadrat sampling; estimates in 1987-1995 were Gassaway surveys; estimates in 2001 and 2008 were GSPE surveys. Sightability correction factors were assumed to be 1.25 in 2001 and 2008. Intensive Management population objectives, created in 2000, are shown.

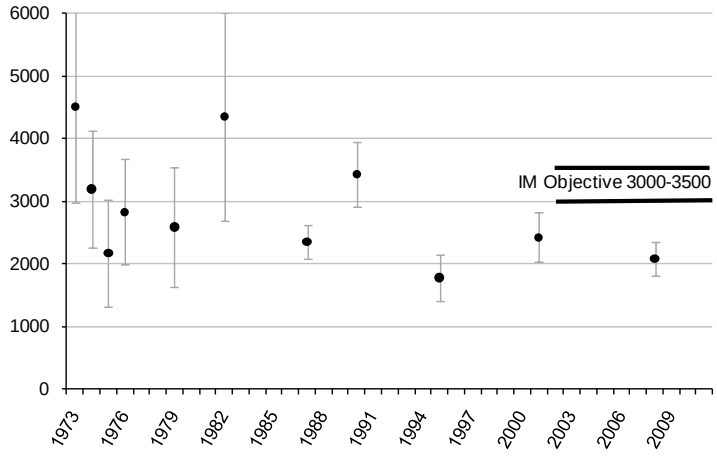
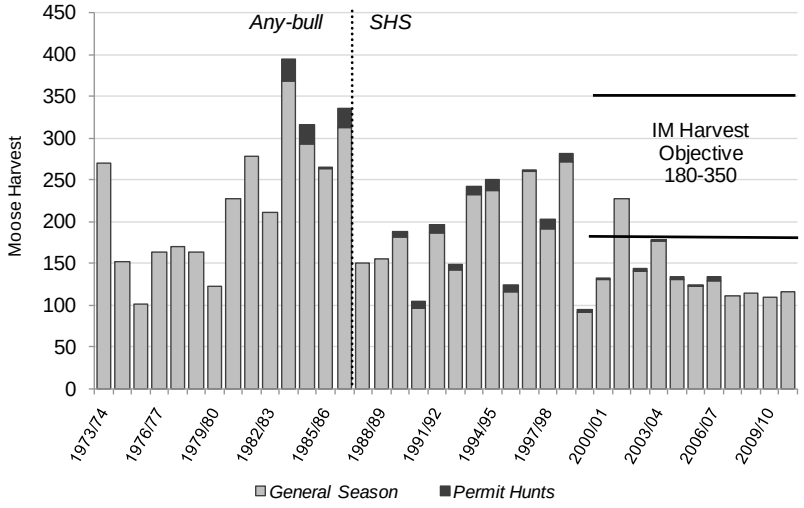


Figure 4. Unit 15A moose harvest from 1973-2010. Intensive Management harvest objectives, created in 2000, are shown. The SHS started in 1987 as is shown with the vertical dotted line.



Adaptive Management Framework

Any section of this framework may be modified as new information comes to light in the study area or the scientific literature. Lack of an anticipated response may require evaluation of additional criteria or a research project to understand which additional factors may be influencing the system and whether they are feasible to manage.

1. **Treatments**

a. Predation control

Aerial removal of wolves within a portion of Unit 15A will utilize fixed winged aircraft by private pilot/gunner teams. Aerial wolf control permits will be issued by the department to selected qualified pilot/gunner teams. Pending Board approval, permits for aerial removal of wolves will start in March 2012 due to the desires expressed by the Board.. Subsequent wolf removal will occur as early as practical (October) each year in order to maximize calf/yearling survival. The control period will run from October 1-April 30. If the wolf removal by private fixed-winged pilot/gunners proves unsuccessful (e.g., <10 wolves/year) due to the limited workable area and/or lack of participation, wolf removal will be conducted by department staff using helicopters. Given the small amount of area available for wolf removal, effective control activities may require frequent monitoring. Follow-up efforts may be conducted if substantial wolf presence is detected. Wolf control will be conducted annually over the course of the five-year program. Given the limited amount of land available for the program, up to 100% of the wolves on available land will be allowed for removal.

The objective is to remove wolves through trapping, hunting, and wolf control activities. We will maintain a minimum of 15 wolves in the population as judged through population surveys, population census, modeling, harvest, or pilot and trapper interviews.

b. Habitat enhancement

Habitat enhancement is the cornerstone of this IM program. Without significant habitat improvement, the moose population, with or without wolf control, will not reach IM objectives. The KNWR in conjunction with the State Division of Forestry are the agencies that have the authority to conduct prescribed burns or manage the suppression of wildfire. The department will continue to work with the KNWR to help identify methods to reduce risks associated with fire management. Fire breaks around communities is a logical method to reduce risks. The high number of residential areas in the unit (Sterling, Soldotna, Kenai, Nikiski), oil and gas development facilities on the KNWR, and the issue of smoke affecting Anchorage, especially Ted Stevens International Airport creates challenges and constraints for using fire management.

Aside from fire management, there are currently no plans for mechanical treatment of habitat. Over two decades ago, the department and the KNWR mechanically treated habitat at a small scale with positive results. Past experience has shown that mechanical habitat treatment is relatively expensive and this point in time there is no funding available to pursue this approach at a broad scale.

c. Prey harvest

The current density of moose in Unit 15A is below IM objectives and already the moose population shows signs of nutritional stress. Also, the recent decline in the bull:cow ratio indicates that the past harvest of bulls is not sustainable. The antler restrictions adopted by the Board for 2011-2012 may return the bull:cow ratio back to management objectives. However, once the bull:cow ratio objective is achieved, we are not likely to return to the same level of bull harvest that occurred previously while maintaining minimum bull:cow ratios without a significant increase in recruitment. While wolf control has the potential to increase this recruitment of bulls, if successful, it will also increase recruitment of cows. As such, it is expected that cow harvest will be necessary to maintain populations at levels appropriate for the habitat while maintaining bull:cow ratios within objective. Antlerless harvests will likely focus on highway corridors to reduce roadkilled moose. The details and extent of the antlerless hunts will be determined from radio collaring work quantifying, among other things, cow movements, and will also depend on the initial success of the wolf control efforts.

2. **Anticipated responses to treatments**

Assuming successful wolf reduction, we would anticipate some increased survival of moose, especially calf and yearlings, ultimately resulting in an increase in the overall moose population. However, predicting the magnitude of the removal of wolves and the response of the moose is difficult. We expect some improvement in the current low bull:cow ratio in response to wolf control.

a. Predator abundance

A November 2011 survey counted 60-62 wolves in Unit 15A. The wolf control objectives are to remove wolves from the population through trapping, hunting, and aerial wolf control activities and retain at least 15 wolves in the population. Wolf surveys will be conducted to determine the current wolf population size and the level of take that will ensure the minimum population objective is met. The vulnerability of wolves to aerial control in the treatment area may be limited by the large home range of wolf packs and abundant forested cover to hide animals. Only a portion of wolves in the unit are expected to use the treatment area.

b. Predation rate

We have no data on the current rates of wolf predation on moose in Unit 15A or total predation including black bears and brown bears. Recent calf numbers were at expected levels for areas with multiple predator species. November 2011 composition surveys showed 29 calves: 100 cows. However, calf numbers in some areas in recent years have been low. A contributing factor to low calf numbers is low productivity [i.e., low pregnancy rates (73% of cows between ages 3-15) and low twinning rates (16%)].

Research will initially focus on assessing the productivity of Unit 15A moose in response to expected recovery of the bull:cow ratio. Efforts will specifically assess calf (>6 month old) and yearling survival rates through radio collaring efforts. This level of monitoring is needed to best evaluate the efficacy of wolf control.

c. Prey abundance

Increases in the moose population from wolf control will be available for human harvest. The goal of the program is to maintain the current level of the moose population. If feasible, decreases in moose numbers via antlerless harvests around highways may help reduce roadkills. It will be challenging to evaluate moose population growth and determine the level of antlerless harvest needed to maintain population stability. Traditional composition counts are used to determine ratios not population abundance. Additionally, due to survey variability and an unknown level of movement across the treatment boundaries, data from GSPE surveys may not be able to detect differences in abundance across treatment areas.

d. Prey recruitment

Removal of wolves, above typical harvest levels from trapping, is expected to improve survival of calf (>6 months old) and yearling moose. However, it is difficult to model the magnitude of the potential increase in recruitment from wolf control given that the current low productivity is driven by poor habitat and to an unknown degree by low bull:cow ratios. Increases in moose density without large scale habitat improvements will likely have negative impacts on moose productivity which is already low, and is not likely to greatly improve bull:cow ratios. Calf:cow ratios provide a crude measure of recruitment but have limitations, especially considering the confounding factors of poor

habitat and low bull:cow ratios. Also, given the likely movement across treatment borders, we may not be able to detect differences in calf:cow or yearling bull:cow ratios across treatments.

e. Prey productivity or nutritional condition

If the moose population increases in response to wolf control, we predict further declines in productivity. To estimate nutritional condition of moose, we will measure rump fat of adult cows in the spring and determine pregnancy and twinning rates from collared cows. Additional measures such as short yearling weights may also be taken depending on research demands associated with the pending IM project in Unit 15C. Given that the twinning rate estimated in the spring of 2011 was observed at 16%, close monitoring of nutritional condition will be required to quantify the level of nutritional stress.

f. Harvest

Wolf control in Unit 15A will result in the reallocation of moose mortality from wolves to harvest.. To do this without increasing moose densities, the department will likely propose antlerless hunts. A decreasing trend in twinning rate or other measures of nutritional condition would indicate potential initiation of antlerless hunts as would increases in the density of moose from population surveys.

g. Use of non-treatment comparisons

In an effort to evaluate the effectiveness of the IM plan, we will try to identify a control area that will serve as a comparison to the wolf removal area in western Unit 15A. Our initial plan is to divide the unit into an eastern and western portion. The western portion (~525 mi^2) will be the treatment area where wolf control efforts will occur on the state and Native lands (<83 mi^2). The eastern portion (~650 mi^2) is KNWR land and will not have aerial wolf reduction and will act as an experimental control.

From collaring we will gain knowledge of moose movements, especially in the western portion of the unit, as the IM program proceeds. Results of this collaring effort may cause a readjustment of the study design depending on what degree of movements we find. If we find that movements of moose and wolves across treatment borders are significant, it may be necessary to adjust the control area or evaluate other areas that might be able to serve as a control.

3. **Evaluation criteria and study design to document treatment response**

Adaptive management with the intent to increase harvestable surplus of prey requires evaluating the biological response and achievable harvest after treatments are implemented. Evaluation will be reported to the Board each year with an interim update of selected criteria each year.

a. Predator abundance and potential for recovery

The size of the wolf population will be determined through aerial surveys. An early winter survey (November) is preferred but snow conditions throughout the unit are typically inadequate at that time of year. A late winter (March) survey is more probable. Depending on weather and other factors, we plan to conduct a wolf survey each winter during active IM activities. We may also capture and radio collar several wolves from identified packs in and out of our treatment areas as available to learn more about their movements.

b. Habitat

No direct forage assessment studies are proposed for this program. However, nutritional indices of moose will be monitored. If declines in twinning rates or other nutritional indices are detected, antlerless harvests will be increased.

c. Prey abundance, herd composition, and nutritional condition

The response of moose to wolf control will be difficult to measure given the limited amount of area open to control activities. We will measure calf numbers through composition surveys. Potential impact of wolf control will also be assessed by judging the number of wolves taken and how this may relate to increased moose survival. A GSPE survey was conducted in 2008 in Unit 15A. After 2-5 years of wolf control efforts, an additional GSPE survey will be conducted. Monitoring of cow condition (rump fat, pregnancy rate, age at first reproduction, productivity, and twinning rate) or short yearling weights will be conducted to determine the nutritional condition of the population.

d. Prey harvest

Moose harvest, success rates, and hunter effort will be monitored through standard harvest reporting methods.

4. **Decision framework to implement or suspend a treatment**

The IM Plan proposes a decision framework to implement and suspend predation control based on nutritional indices and estimates of recruitment. A decision framework can account for the risks associated with taking actions based on survey estimates and their inherent uncertainty. The relationship between management actions and risks of making an incorrect decision based on precision of biological survey data should inform decisions to begin or end management treatments. Public tolerance for risk of making incorrect decisions (i.e., recognition of consequences) should be assessed during the Feasibility Assessment, particularly for on controversial topics such as implementing or suspending predation control, conducting prescribed fire, or failing to implement an adequate harvest strategy to slow, stop, or reverse ungulate population growth that threatens to damage habitat by overuse. Where uncertainty in sampling estimates can be adequately defined, statistical tests can inform the level of risk in making a decision to start or suspend IM actions. In that instance, decision frameworks can be modified (by changing the management objectives and

levels of tolerance) to reflect public opinion regarding the balancing of risks. Risk assessment is addressed in more detail in *Guidelines for IM*.

Thresholds for progress and success are set by the public and Board and provide the means to evaluate effectiveness of treatments. Evaluation criteria are compared to pre-determined threshold values to guide decisions on whether a practice should begin or is no longer needed to achieve a desired outcome. This results in operational efficiency (cost and labor) as well as the minimum required application of controversial practices.

a. Predation control

i. Prey population abundance

The typical thresholds to implement an IM program (depleted population or declining productivity) are clearly evident in Unit 15A moose. This population decline and reduced productivity is certainly affected by poor habitat. The initial goal of the plan is to manage for greater human harvest by reducing predation, but not increasing the overall population. Population growth can be included in the goal when a sustainable improvement in habitat becomes feasible.

We propose the following criterion for suspending the wolf control program. If any of these conditions are met wolf control program will be suspended until corrective actions can be made.

1) If calf:cow ratios fail to improve after 3 years of the program. This could indicate that there is no significant improvement in calf survival as a result of the wolf control efforts, or harvest strategies need to be adjusted.

2) When one or more measure of nutritional stress (e.g., body condition, pregnancy/parturition rates, age at first reproduction, short yearling weights, twinning rates) shows a decline in 3 consecutive years.

3) If the Unit 15A wolf population falls below 15 wolves at any time during the program.

The risks of not successfully managing antlerless hunts are significant. If moose densities grow and result in increase nutritional stress, declines in moose productivity may offset the effectiveness of the wolf reduction. Also, nutritionally stressed moose are more vulnerable to severe winters, which is what caused the crash of the high density moose population in the early 1970s. Conversely, mismanaging antlerless hunts and allowing for harvests that are in excess of what would allow for population stability would result in a decline in densities.

ii. Harvest catch per unit effort

Improved CPUE values would be a positive outcome and will be assessed. However, we do not foresee using changes in CPUE values as a metric to

determine suspension of the wolf control actions because survey and harvest data will be a more direct measure of success.

b. Habitat enhancement

There has not been a significant fire in Unit 15A for over 40 years. Moose will stay at low densities, with or without successful wolf reductions, until significant habitat improvements occur (i.e., >50,000 acres). Initiation of prescribed burns and wildfire management within Federal lands (79% of Unit 15A) are governed by the KNWR in collaboration with the State Division of Forestry. The department has and will continue to work with both entities in planning for and engaging in actions that will lower the risk of conducting prescribed burns and managing natural wildfire. The idea of creating a fuel break along the border of the KNWR is an example of a tangible way to reduce risks associated with fire management. KNWR lists proposed prescribed fires in their fire management plan. The department will continue to work with the KNWR and State Division of Forestry in any way possible to encourage well designed and responsible prescribed fires. Habitat enhancement through means other than fire is encouraged and the department will continue to work with the KNWR on projects that will continue to enhance habitat, even those at relatively small scales. We will use condition indices such as productivity, pregnancy rates, and twinning rates to assess the state of the moose habitat.

c. Prey harvest strategy

i. Population abundance

During the past decade, bulls were harvested in Unit 15A at a rate between 5-10% of the total population (based on 2008 estimate of 2,088 moose). In 2010, this equated to a harvest of 36% of the estimated bull population which is well beyond sustainable limits (Young and Boertje 2008). This overharvest of bulls has likely driven the recent decline in the bull:cow ratio. When the bull:cow ratio increases to objective levels (>20 bulls:100 cows) a bull harvest of 5% of the total population size would likely be sustainable without wolf control. Given present densities, this would equate to a harvest of <100 bulls. At the 2013 Board meeting, the department will submit a detailed proposal for antlerless harvests. The level of antlerless harvests will depend on the success of wolf removal and the responding increase in moose survival.

ii. Nutritional index

Initially we will measure pregnancy rates, body condition, and twinning rates of radio collared cows. Additional measures, such as browse surveys, short yearling weights, and proportion of early reproduction in yearling or 2 year old cows may also be measured.

5. Public involvement

a. Continued outreach by ADF&G

For this IM plan to be successful harvest reporting must be done timely and accurately. The department will work the public to gain their support in providing harvest data. Department staff will present program updates periodically to local ACs and through other public forums with Federal Regional Advisory Councils, Federal Subsistence Board, Kenai National Wildlife Refuge, local tribal councils, and the general public.

b. Continued engagement to confirm criteria chosen for evaluating success

Total harvest, success rate, and the number of days hunted for successful hunts will all be assessed. Research will be conducted to assess productivity and some measure of recruitment (either survival rates or composition count analyses). Compositions surveys will be conducted in the fall and/or spring to assess calf numbers. For targeted antlerless hunts along the highway corridors, a reduction in road-kills would be a measure of success.

c. Participation in prey and predator harvest or predator control

Given that the success of aerial wolf control is uncertain, local hunters and trappers will be encouraged to continue harvest of wolves to maximize the effectiveness of the wolf control effort. Public harvest of wolves and bears in the established seasons will continue to be encouraged. Harvest incentive programs initiated and funded by Alaska Native Corporations are also encouraged. Incentive programs that extend to non-local wolf and bear hunters should be considered by tribal organizations (e.g. land access, supplemental funding for permitted aerial wolf hunters, etc.).

Public support and active participation regarding antlerless harvests will be essential to the success of this program.

d. Monitoring and mitigation of hunting conflict

Communities around the main road system include Sterling, Soldotna, Kenai, and Nikiski. Most of the land along the highway is private or Native land. Any level of harvest of antlerless moose to reduce road-kills and keep moose densities at or below current densities will potentially result in conflicts between hunters and landowners. The department will help facilitate hunting success and reduce conflicts by private and native landowners to help ensure the success of the program.

6. Other considerations

Aerial wolf control program will focus on limited land near the Kenai Airport and the communities of Kenai, Soldotna, Nikiski, and Sterling. Given the number of human residences along the western side of the unit where the wolf control activities will take place, as well as a very high level of recreational snowmachine activity throughout the unit, this will likely be a fairly visible program. The department does not believe these control activities will create a threat to public safety. Nonetheless, the department

intends to work very closely with those holding control permits, as well as the remaining public to ensure that safety is the primary concern in all control activities.

If antlerless hunts are approved, it is likely that there will be changes proposed to the Federal Subsistence regulations. If Federal antlerless seasons are enacted, the IM program may have to adjust our strategy to maintain the goals of the program.

LITERATURE CITED

Alaska Department of Fish and Game. 2011. Guidelines for intensive management of big game in Alaska

Alaska Department of Fish and Game. 2011. Feasibility assessment for maintaining or increasing sustainable harvest of moose in GMU 15A.

Peterson, R. O., J. D. Woolington, and T. N. Bailey. 1984. Wolves of the Kenai Peninsula, Alaska Wildlife Monographs 88.

Young, D. D., and R. D. Boertje. 2008. Recovery of low bull:cow ratios of moose in Interior Alaska. Alces 44:65-71.

Appendix A. Summary of supporting information

Geographic area and land status	
Management area(s)	Unit 15A (1314 mi^2) Prey abundance assessment (1314 mi^2), prey harvest assessment (1314 mi^2), predator abundance assessment (1314 mi^2), predator control (<83 mi^2) – see Figure 1
Land status	For Unit 15A (1314 mi^2); land ownership is roughly as follows (see Figure 2): Potential land available for wolf control: 32 mi^2 (2%) Kenai Native Association, Inc. 16 mi^2 (1%) Salamantof Native Association, Inc. 15 mi^2 (1%) State Mental Health 13 mi^2 (<1%) Kenai Borough 0.8 mi^2 (<1%) CIRI 0.3 mi^2 (<1%) State DNR Total = 83 mi^2 (6% of Unit 15A) Unavailable land for wolf control: 197 mi^2 (15%) private and other small state or Native land that are landlocked within private land 1038 mi^2 (79%) USFWS-Kenai National Wildlife Refuge (KNWR)
Biological and management situation	

Prey population	15A - IM objectives: 3,000-3,500 moose 15A - Estimate in 2008: 2,088 moose (95% CI: ±264, 1.6 moose/mi^2)
Prey harvest (human use)	15A - IM objectives: 180-350 moose Reported in 2010 (SY rate): 117 moose (6% harvest rate of moose based on 2008 population estimate). Amount Necessary for Subsistence: there is no ANS.
Feasibility of access for harvest	Exact measures of trails or navigable waters are unknown but access is considered good. There are >100 miles roads, significant river miles, access is restricted by KNWR, corporation lands are closed to non-corporation members without a purchased land access permit, unleaded gasoline and 100 octane low lead aviation fuel is marginally higher than Anchorage prices.
Nutritional condition	Habitat is very limiting based on a calf-twinning rate of 16% calculated in 2011. Also, pregnancy rates of adult cows captured in 2006 was 73%.
Habitat status and enhancement potential	There has not been a significant fire in the unit for over 40 years. Enhancement potential is determined by fire management actions of the land managers (KNWR) and State Division of Forestry. Given the proximity to major residential areas and smoke inhibiting the Anchorage airport, fire management has significant risks.
Predator(s) abundance	A November 2011 wolf survey estimated a population between 60-62 wolves. Current black bear densities are unknown but likely range between 700-900 bears. Brown bear densities are unknown.
Predator(s) harvest	Within Unit 15A (1314 mi^2) in RY 2010; wolves = 15 (SY= 20-30) black bears = 78 (SY= likely between 130-180) brown bears = 7 (SY= unknown)
Evidence of predation effects	During annual SI surveys in November 2010, calf:cow ratios were 23 calves:100 cows. At predicted calving rates of 73%, and assuming 16% twinning rate, spring 2010 calf ratios may have yielded 84 calves:100 cows. Therefore, 84 calves – 23 calves = ~61 calves:100 cows were lost from approximately June to November. The causes of mortality remain unknown but much is likely due to predation. However, with a low bull:cow ratio in some areas, it is uncertain what the initial calving rate is. Also, the clear nutritional stress shown by low pregnancy and twinning rates may result in calves in poor condition with low survival. Therefore, we cannot ascertain the true impact of predation without knowing the impact low bull numbers may be having on productivity and the impact of nutritional stress on

	survival.
Feasibility of predation control	The moose population in Unit 15A was below IM population objectives well before the objective was established and has never met objectives to date. The recent hunting restrictions initiated by the Board will greatly reduce harvest through 2012 and drop the harvest even further below IM objectives. Given the limited land available for predator control, it is unlikely that aerial wolf control will be effective in significantly reducing the wolf population. Furthermore, given the current nutritional stress of the moose population, any increase in survival caused by wolf removal could add to the nutritional stress of the moose population unless compensated in the human harvest.
Other mortality	On average over the past decade, 85 moose/year die due to vehicle collisions in Unit 15A. Severe winters occur periodically. Currently, significant numbers of moose die due to malnutrition even in mild winters.