Draft Operational Plan for Intensive Management of Moose in Game Management Unit 15C 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 Department to provide supporting information on the Intensive Management (IM) plan for moose in Unit 15C. 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 15C has been developed based on the request of the 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

Three moose population surveys have been conducted in Unit 15C beginning with a 1992 Gassaway estimate of 2,079 moose, followed by a 2002 GSPE estimate of 3,965 moose, and most recently a 2010 GSPE estimate of 2919 moose (Figure 3). The current estimate equates to a density of 2.5 moose/mi^2. There is concern that the 2002 survey had inadequate sampling and was likely biased high but the magnitude of the bias is unknown. These data suggest that the population increased between 1992 and 2002 and declined from 2002 to 2010, though the confidence intervals allow for the possibility that the population has changed little over this time period.

The IM objectives for Unit 15C were established in 2000 with a population objective of 2500–3500 moose and a harvest objective of 200–350. The moose population in Unit 15C has been within IM objectives since the objectives were established, as has the harvest. For the 2011 season, the total harvest will be well below IM harvest objectives because of the changes in antler restrictions adopted by the Board to address low bull:cow ratios. Previous to the 2011 season the moose harvest and hunter success rates, and the average number of days spent on a successful hunt have not changed significantly in the past 20 years. The Department has little data available to assess population size or trends in predator numbers in Unit 15C except that the annual rate of increase of brown bears across the peninsula has shown 1.8% growth from 1995-2008. In November 2011 a reconnaissance survey in the area north of Kachemak Bay (1171 mi^2) resulted in an estimate of 44-52 wolves. The harvest of wolves and black bears within the northern portion of Unit 15C is likely well below maximum sustainable limits.

Based on a spring 2011 calf survey, showing 30% of parturient females with twins, habitat in Unit 15C appears adequate to sustain present moose densities. In the 1970s, when moose population densities were likely higher than present densities due to a 50-year absence of wolves that ended in the 1960s, the twinning rate in Unit 15C was 11%. This low twinning rate was indicative of nutritional stress and, along with probable reduced productivity, increased the vulnerability of moose to severe winters. Subsequent severe winters in the early 1970s caused a crash in the moose population followed by years of low harvest. There has been 136 mi^2 of fires in Unit 15C within the past decade that may result in improved moose habitat. However, habitat in Unit 15C differs from Units 15A and 15B in that aspen is largely absent and blue joint grass is ubiquitous. Therefore, fire will have limited benefits on moose habitat in Unit 15C compared to the habitat response predicted for Units 15A and 15B, where aspen is abundant and the prevalence of blue-joint grass is lower. We do not expect to see a large increase in moose numbers as a result of these recent fires.

Due to a recent decline in the bull:cow ratio (down to 9 bulls:100 cows) which is well below management objectives of 20 bulls:100 cows, in March 2011 the Board eliminated non-resident hunting and 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 will likely reduce the harvest by >75% in Unit 15C and result in a harvest below IM objectives. It is likely this regulation change will allow the bull:cow ratio to improve within a few years. It is expected moose harvest will increase again after antler restrictions are again liberalized.

With the decline in the bull:cow ratio (under the SHS regulation), the past level of bull harvest, at least the yearling portion, is not sustainable without a significant increase in survival. According to the last census, the population size is still within IM objectives and any increase in population densities may result in declines in productivity due to nutritional stress. To meet a higher level of the IM harvest objectives with a lower sustainable harvest of bulls and to ensure the population does not grow above objective densities, alternative harvest strategies, such as antlerless hunts, will likely be proposed at some point.

This proposed IM plan contains several components tailored to the specific biological issues inherent in Unit 15C.

1) Initially the plan will focus on wolf control measures; bear management actions, beyond liberal hunting seasons, are not included in this plan 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) Treatment areas to assess predator control will divide the unit into 2 parts, a northern and southern portion, where wolf control will occur only in the southern portion.

4) The IM plan is to maintain current moose densities but reallocate the take of moose from wolves to harvest, which will likely require antlerless harvests to successfully meet IM harvest objectives.

Wolf control and monitoring efforts will not take place across the entire area in Unit 15C (2441 mi^2). The area south of Kachemak Bay is mountainous, holds few moose (an average harvest of 1-4 moose/year), and is heavily timbered. Our focus will be on the part of the unit north of Kachemak Bay including the Fox River Flats (1171 mi^2). This is the same area boundaries used for the GSPE surveys. For this plan, any reference to Unit 15C addresses this 1171 mi^2 subsection of the unit (Figure 1).

Figure 1. Intensive management (IM) area for moose in Game Management Unit 15C. Highlighted area shows the Kenai National Wildlife Refuge (KNWR) boundaries. Hatched area in Unit 15C shows proposed IM boundaries (1171 mi^2) including about 300 mi^2 of KNWR south of Tustumena Lake and land north of the Fox River Flats to Glacier Creek.

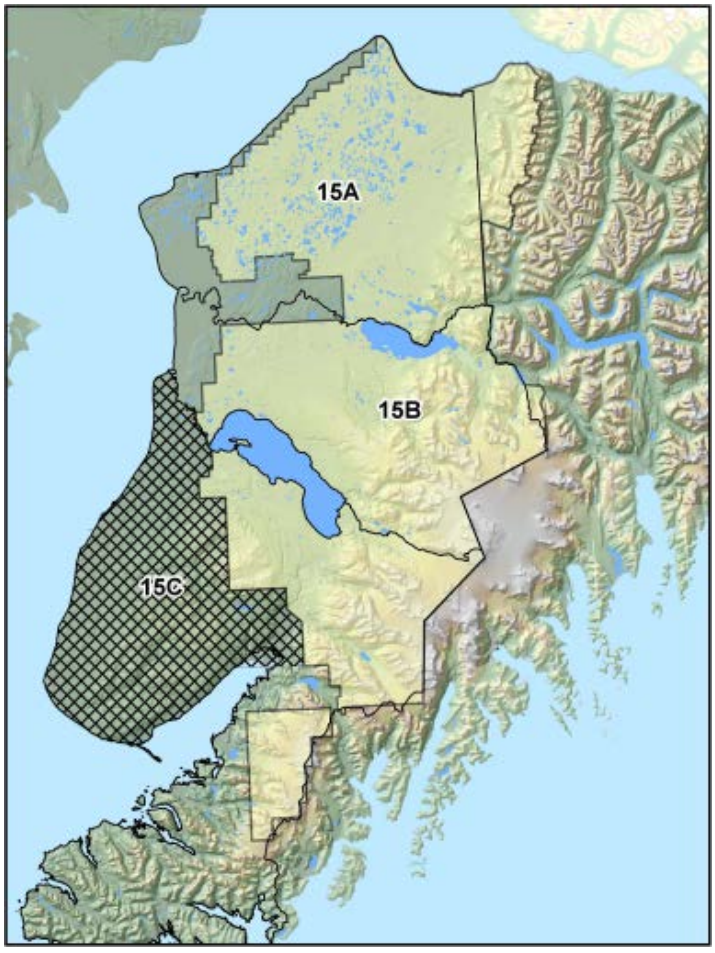


Figure 2. Land ownership in the northern portion of Unit 15C, Kenai Peninsula, Alaska.

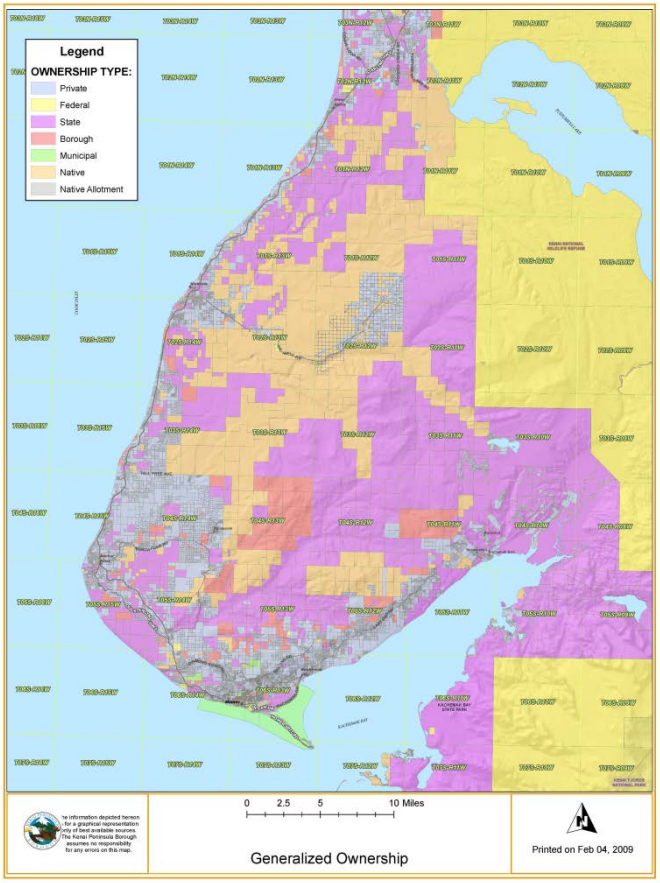


Figure 3. Unit 15C moose population size estimates. Sightability correction factors were estimated at 1.49 in the 1992 Gassaway survey and assumed to be 1.33 in 2002 and 2010 GSPE surveys. Intensive Management population objectives, created in 2000, are shown.

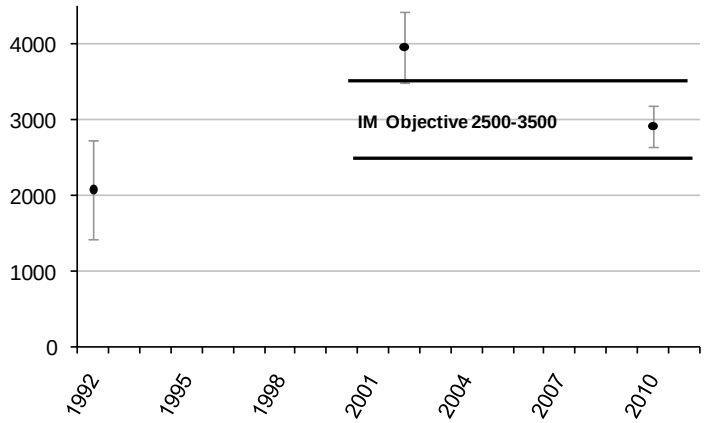
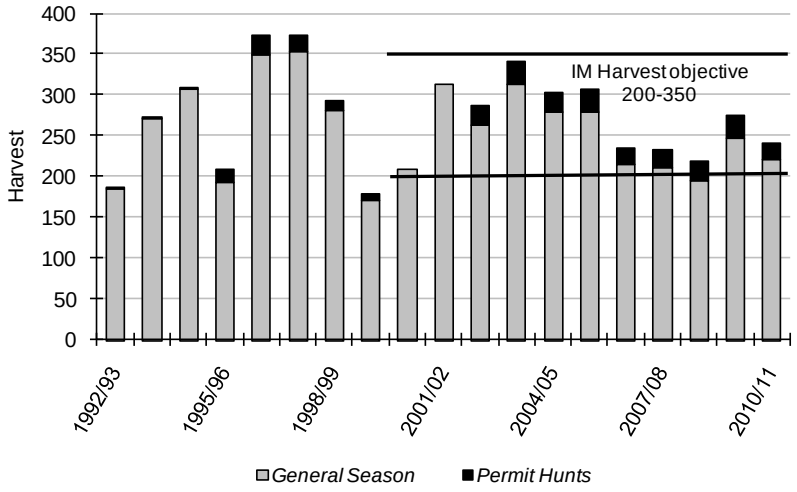


Figure 4. Unit 15C moose harvest from 1992-2010. Intensive Management harvest objectives, created in 2000, are shown.



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 15C 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. Subsequent wolf removal will occur as early as practical in early winter (October) 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, trappers, and hunters proves unsuccessful (e.g., <20 wolves/year taken) due to the limited workable area and/or lack of participation, wolf removal may be conducted by the Department staff using helicopters. Wolf control will be conducted annually over the course of the five-year program. The objective number of wolves to be removed depends on future assessments of the wolf population size and distribution. The proportion of wolves to be removed, depending on the treatment limitations outlined below, will be up to 100% of the wolves in the treatment area.

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 from population surveys, population census, modeling, harvest, or pilot and trapper interviews.

Present level of black bear and brown bear predation on moose calves and adults is unknown but may offset increases in moose survival caused by wolf control. The Department will initiate research to address these questions starting in March 2012.

b. Habitat enhancement

There are no habitat enhancement projects proposed in this plan. As detailed in the Background section above, Unit 15C has had significant timber harvest and fires in the past decade but the response of habitat to these disturbances is not likely to greatly improve moose habitat compared to potential habitat response to habitat disturbance in the northwestern part of the Kenai Peninsula.

c. Prey harvest

To maintain the current population density within IM objectives and to avoid declines in productivity if the population grows beyond IM objectives, there will have to be a reallocation of moose from predation to harvest, including some level of antlerless harvest. Antlerless harvest will accomplish two goals: 1) to keep the moose population from exceeding IM objective levels and thereby maintaining a productive population without excessive nutritional stress; 2) to add additional harvest opportunities to what is likely to be a more restrictive bull harvest in 2012. Antlerless harvests will likely occur along the highway corridor as a secondary objective to reduce road-kills. This antlerless harvest will be proposed by the Department to the Board during the spring 2013 meeting. The details and extent of the antlerless hunts will be determined by what the Department learns 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 anticipate 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 that there will be considerable improvement to the bull:cow ratio in response to the recent Board action and there may be long-term benefits to the bull:cow ratio through wolf control.

Regarding the antlerless hunts along the highway corridor, if we can successfully determine the growth in the cow segment of the population in response to wolf control, we would theoretically be able to determine the correct level of antlerless harvest. Antlerless harvests along the highway corridor may reduce the number of road-kills.

a. Predator abundance

A November 2011 survey resulted in a count of 44-52 wolves in the northern portion of 15C. 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. Resilience of wolves and recovery after control efforts will vary with changes in average litter size, pack size, and natural mortality rate (Peterson et al. 1984). Monitoring of the wolf population after suspension of the program to document recovery or possible reinstatement of the control program will be necessary.

b. Predation rate

We have no data on the current rates of predation on moose by wolves in Unit 15C or total predation including black bears and brown bears. However, the recent calf numbers show levels associated with predation rates that would maintain population stability (17% calves in the population in March 2010, 19 calves: 100 cows in November 2010). However, it is unknown to what degree the low bull:cow ratios may be contributing to declines in productivity.

The primary research focus will be on assessing the productivity of Unit 15C moose in response to the fall and expectant recovery of the bull:cow ratio. Research efforts specifically conducted to directly assess calf (>6 month old) and yearling survival rates through radio collaring efforts could be conducted in conjunction with the productivity study. This level of monitoring would be needed to best evaluate the efficacy of wolf control. Using composition surveys will not directly measure survival rates but may show trends in recruitment and may help evaluate the impact of wolf control.

c. Prey abundance

Any increases in the moose population due to wolf control will be reallocated to harvest. The goal of the program is to not increase the moose population. If feasible, decreases in moose numbers via antlerless harvests around highways may help reduce road-kills. 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 between the treatment areas.

d. Prey recruitment

Successful removal of wolves above past harvest levels from trapping efforts 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 the undetermined influence low bull:cow ratios on productivity. Wolf control is not likely to greatly improve bull:cow ratios. Calf:cow ratios provide a measure of recruitment but have limitations, especially considering the confounding factor of 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 above IM objective levels in response to wolf control, we expect that declines in productivity may result. 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 these and other research demands.

Given that the twinning rate estimated in the spring of 2011 was only 30%, close monitoring of nutritional condition will be required to quantify the level of nutritional stress.

f. Harvest

Successful wolf control in Unit 15C will result in the reallocation of moose mortality from wolves to harvest. This reallocation may include antlerless harvest. The management challenge will be to accurately determine the necessary hunting effort on antlerless moose to ensure population stability. This will require significant research and monitoring efforts.

g. Use of non-treatment comparisons

One method of evaluating the effects of predator control programs is to compare various biological parameters in the IM area to other areas not receiving the predator control. The department will consider using areas outside of Unit 15C as potential controls, but given the proximity of the Kenai Refuge, and the fact that predator control is not currently allowed within the refuge, the refuge may provide a reasonable area for comparison. Selection of non-treatment control area, if located on the peninsula, will be made after more information on wolf and moose movements are better understood through planned research studies.

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) would be preferred but snow conditions throughout the unit are typically inadequate at this time of year. A late winter (March) survey is more probable. Our management objectives for how many wolves to remove and how many to

retain may change based on wolf survey results that will most likely occur after the initiation of aerial wolf control. We may attempt to capture and radio collar several wolves from identified packs in and out of our treatment areas as available to learn more about their movements.

Depending on the initial success of fixed-winged control efforts, having wolves radio collared in a particular pack can expedite eliminating the pack when the pack leaves protected land and moves onto land available for aerial take. Radio collaring wolves outside the refuge could provide information on pack size, dynamics, distribution, and movements. A rigorous monitoring effort on wolves in Unit 15C will help determine if there is a spatial distinction between our treatment and non-treatment areas. Given that wolf packs on the northern Kenai Peninsula in the 1970s ranged between 70-600 mi^2 (Peterson et al. 1984), determining the level of wolf movements across the treatment borders may cause us to change or abandon the study design.

We need to learn about wolf movements across our treatment areas to better construct biologically justified treatment areas and wolf management objectives. We will develop specific wolf management objectives after wolf surveys are completed. However, until these data become available, the objective of the program will be to remove all wolves from the treatment portion of the unit. We will adapt our study design as we learn more about moose and wolf movements.

Once the wolf control activities are suspended, wolf surveys will be conducted to monitor the response and subsequent effects on the moose population.

b. Habitat

No forage assessment studies are proposed for this program at this time. 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 most pressing management issue facing moose in Unit 15C is the impact of the low bull:cow ratio and the recent failure of the SHS. Our primary research activity to address this issue is to quantify productivity, body condition, and parturition dates. Through these efforts we will be able to produce an indirect measure of calf survival by monitoring collared cows. We will also measure calf numbers through composition surveys, and these may provide the best index for how wolf control affects calf numbers. 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 2010 in Unit 15C. 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 as funding allows to determine the nutritional condition of the population.

d. Prey harvest

Prey harvest (bulls and antlerless moose), success rates, and hunter effort will be monitored through standard harvest reporting methods. Potential antlerless harvest will be managed to reduce the nutritional stress in the population and to help meet IM harvest objectives.

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 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*.

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

We plan to use the following criterion for suspending the wolf control program. If any criterion is met the wolf control program will be suspended until the condition is corrected or an assessment is made about modifications to the plan.

1) If the moose population exceeds 3.0 moose/mi^2 (a population size greater than the upper IM population objective of 3500 moose) either the antlerless harvest needs to increase resulting in a decrease in moose density or wolf control needs to be suspended.

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

3) When measures are consistent with significant levels of nutritional stress [e.g., twinning rates ≤20%, adult female (>2 years old) pregnancy rates below 80%].

4) If the Unit 15C 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 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. On the other side, the risks of 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 (CPUE)

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

While there have been recent human-caused fires in Unit 15C, the habitat in the unit does not respond to fire similarly to areas to the north or interior habitats. There are no significant tracks of aspen in the unit. Therefore, habitat enhancement is not as efficacious an option to aid moose as it would be elsewhere. We will use condition indices such as productivity, pregnancy rates, and twinning rates to assess the state of the moose habitat. While we would encourage land managers to use prescribed burns to enhance habitat, we understand that this option is limited due to inherent risks in fire management.

c. Prey harvest strategy

i. Population abundance

During the past decade, bulls were harvested in Unit 15C at a rate roughly between 7-11% of the total population (based on 2010 estimate of 2,919 moose). In 2010, this equated to a harvest of 59% 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 about 5-6% of the total population size would likely be sustainable without wolf control. Given present densities, this would equate to a harvest of <200 bulls. At the 2013 Board meeting, the Department will submit a detailed proposal for alternative harvest strategies including 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

We will initially measure pregnancy rates, body condition, and twinning rates of cows to be radio collared in March, 2012. 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 Department

For this IM plan to be successful, harvest reporting must be done timely and accurately. The Department will certainly make this clear to all communities and participating hunters. 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 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 corridor, a reduction in roadkills 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 reduction efforts. 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 on the western side of the unit include Kasilof, Clam Gulch, Happy Valley, Ninilchik, Anchor Point, Nikolaevsk, and Homer. Any level of harvest of antlerless moose to reduce roadkills and keep moose densities from exceeding IM population objectives will potentially result in conflicts between hunters and

landowners. Any facilitation to help hunting success and reduce conflicts by private and native landowners will help ensure the success of the program.

6. Other considerations

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 Federal Subsistence hunters will submit proposals to the Federal Subsistence Board to have antlerless hunts on Federal land under Federal 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

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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 15C north of Kachemak Bay (1171 mi^2) Prey abundance assessment (1171 mi^2), prey harvest assessment (1171 mi^2), predator abundance assessment (1171 mi^2), predator control (1171 mi^2) – see Figure 1
Land status	For the portion of Unit 15C north of Kachemak Bay (1171 mi^2); land ownership is roughly as follows (see Figure 2): Potential land available for wolf control: 352 mi^2 (30%) State DNR 140 mi^2 (12%) CIRI 95 mi^2 (8%) Ninilchik Native Association

	0.6 mi^2 (<1%) BLM 0.2 mi^2 (<1%) State Mental Health Unavailable land for wolf control: 295 mi^2 (25%) private and other small state or Native land that are islands within private land 275 mi^2 (23%) USFWS 17 mi^2 (1%) University of Alaska
Biological and management situation	
Prey population	15C - IM objectives: 2,500-3,500 moose 15C - Estimate in 2010: 2919 moose (95% CI: ±277, 2.5 moose/mi^2)
Prey harvest (human use)	15C - IM objectives: 200-350 moose Reported in 2010: 240 moose (8.2% harvest rate of moose based on 2010 population estimate). Amount Necessary for Subsistence: only in a small portion of 15C south of Kachemak Bay, ANS = 5-6 moose (there is no subunit-wide 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, >200 miles ATV trails, extensive snow machine access, 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, hunting season dates allow for road and ATV hunting opportunities.
Nutritional condition	Habitat does not appear to be excessively limiting based on a calf-twinning rate of 30% calculated in 2011.
Habitat status and enhancement potential	136 mi^2 (12%) of IM area burned in the last 10 years. The area is essentially free of aspen and the beneficial response of the production of moose habitat to fire will be somewhat limited.
Predator(s) abundance	A November 2011 wolf survey resulted in a population estimate between 44-52 wolves. Black bear and brown bear densities are unknown within Unit 15C north of Kachemak Bay (1171 mi^2) however black bear likely number 600-800.
Predator(s) harvest	Within Unit 15C north of Kachemak Bay (1171 mi^2); wolves = 12 (SY= unknown but likely 20-35) black bears = 56 (SY= unknown but likely between 100-200) brown bears = 9 (SY= unknown)
Evidence of	During annual Composition surveys in November 2011, showed 21

predation effects	calves:100 cows. At predicted calving rates of 80%, and assuming 30% twinning rate, spring 2011 calf ratios may have yielded 104 calves:100 cows. Therefore, 104 calves – 21 calves = ~83 calves:100 cows were lost from approximately June to November. The causes of mortality remain unknown but much is likely due to predation (black and brown bears, and wolves). However, with the declining bull:cow ratio, it is uncertain what the initial calving rate is. Low bull numbers may be causing low pregnancy rates. Therefore, we cannot ascertain the true impact of predation without knowing the impact low bull numbers may be having on productivity.
Feasibility of predation control	We have been within IM objectives in Unit 15C. The recent hunting restrictions initiated by the Board will greatly reduce harvest through 2012 and drop the harvest well below IM objectives. In 2013, when the antler restrictions are reassessed and hunting opportunities for bulls potentially increase, a reduced bull-only harvest will likely be below IM objectives. Antlerless harvest that result from increased opportunities stemming from wolf control may allow the harvest (bulls+antlerless moose) to be within IM objectives. Given that the current moose densities are within IM objectives, success of wolf control will be contingent upon public acceptance and participation in antlerless harvests. The ability of the Department to create a study design to monitor the success of the program is limited due to the timing of initiation of wolf control (March 2012), the lack of baseline data from which to judge success, and other confounding factors.
Other mortality	On average over the past decade, 70 moose/year die due to vehicle collisions in Unit 15C. Severe winters occur periodically.