

**Feasibility Assessment for Maintaining or Increasing Sustainable
Harvest of Moose**

in Game Management Unit 15A

**Prepared by the Division of Wildlife Conservation
October, 2011**



This document, or substantially similar language, will be submitted to the Board of Game for its January 2011 meeting as Departmental recommendations for substitute language if the Board decides to proceed with adopting proposals 35 and 36, which are listed in the 2011-2012 Proposed Changes to Regulations booklet. The topic of developing intensive management plans for Units 15A and 15C has been under discussion and open to public comment several times at recent meetings, and has been again noticed for the November meeting. Final wording for such plans is developed during the meetings, following Departmental input and public comment. The public is encouraged to study these submissions and provide specific comments to the Board for its consideration of proposals 35 and 36.

Background: Moose in Unit 15A are an Intensive Management (IM) population and have been at relatively low densities since the early 1990s. Habitat quality is the major cause of the decline in moose to the current levels. Dating back to the late 1800s, the rise and fall of the Unit 15A moose population correlates with fire history. Moose densities peak 15-20 years post-fire and by 40 years post-fire, densities return to pre-fire densities. There has not been a major fire of significant size in Unit 15A for over 40 years. The Kenai National Wildlife Refuge (KNWR), in conjunction with the State Division of Forestry (DF), has the authority to conduct prescribed burns and is responsible for decisions regarding wildfire suppression. The use of fire management to improve habitat is limited because of the risks to human settlements, oil and gas facilities, and the impact of smoke on the Anchorage airport. The Alaska Department of Fish & Game (Department) has initiated discussions with the KNWR, the U.S. Forest Service, and the DF to find ways to reduce the risk associated with fire management on the Kenai Peninsula.

The IM objectives for Unit 15A were established in 2000 with a population objective of 3,000–3,500 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 (Figure 1.). The IM objective density is approximately 2.3–2.7 moose/mi². Moose densities in Unit 15A are currently about 1.6 moose/mi². The reported harvest in Unit 15A has been below the IM objective in 10 of the 11 years since the objective was established (Figure 2.).

Figure 1. Unit 15A moose population size estimates. Estimates from 1973-1982 were through quadrat sampling; estimates in 1987-1995 were Gasaway 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.

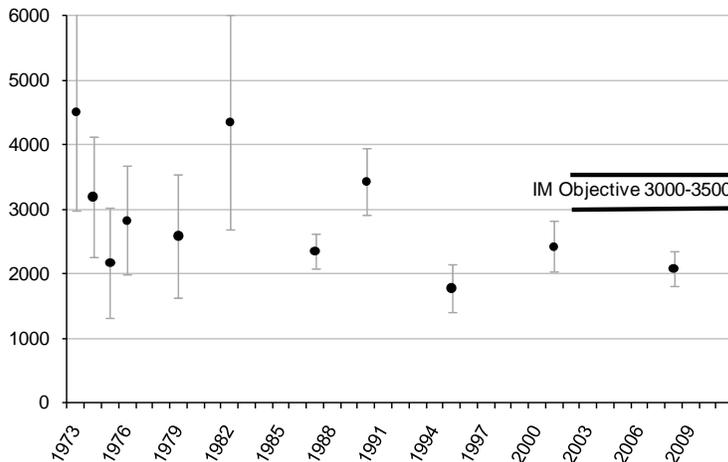
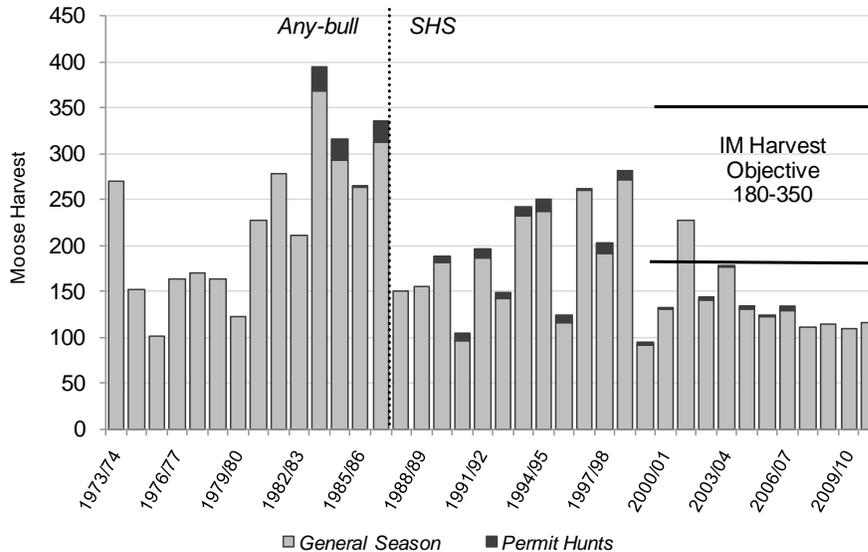


Figure 2. Unit 15A moose harvest from 1973-2010. Intensive Management harvest objectives, created in 2000, are shown. The SHS started in 1987 as is shown with the vertical dotted line.



In an IM plan and Feasibility Assessment presented to the Board of Game (Board) in March 2011, the Department focused solely on habitat improvement because of the important affect it has on increasing moose carrying capacity. At that time, the Board directed the Department to also consider the feasibility of an aerial wolf control program in Unit 15A on limited state land adjacent to the Kenai Airport, Native land around the airport and north of Sterling, and small tracks of borough land. Unit 15A is 1,314 mi² with 79% of the land managed by the KNWR who currently does not support predator control activities on federal land.

This IM Feasibility Assessment includes potential effects of wolf control as well as the habitat improvements previously described to the Board. Challenges include:

1. The current state of the habitat may not support a significantly larger moose population without causing additional declines in nutritional condition and productivity.
2. Aerial wolf control will be limited to a patchwork of non-Federal land totaling <100 miles² (6%) of Unit 15A.
3. The vulnerability of wolves to aerial control in the treatment area may be limited by the large home range of wolf packs and extensive forested cover to hide animals. (While a March 2010 assessment estimated 41-45 wolves in the unit, an unknown portion of these wolves will use the treatment area).
4. Monitoring response of moose to wolf removal compared with non-treated areas will be difficult because of numerous small treatment areas and movements of moose and wolves at scales larger than treatment areas.
5. Habitat improvement at the scale needed to benefit the moose population will be difficult to achieve in the short term, although progress on fuel breaks near communities may reduce fire risk (potentially increasing tolerance of fire on adjacent wild lands) and improve forage for moose.

Overall assessment of potential to increase harvest (Low, Moderate, High)¹: Low

Department recommendation: Given the condition of the moose habitat and the limited land available for IM actions, it is not likely that wolf control alone will increase the moose population size to IM objectives. Until a large fire (or other large scale habitat altering event) occurs to improve habitat on a substantial portion of Unit 15A, the carrying capacity of the moose habitat will limit the long-term potential for population growth. However, if a sufficient number of wolves are removed, additional moose may be available for harvest. Given these limitations, the Department recommends wolf control as a means of increasing human harvest. This approach will focus harvest in easily accessible areas including along roadways to potentially reduce vehicle collisions.

Assuming additional moose are produced due to wolf control and the current bull harvest restrictions, the Department will propose alternative harvest strategies to the Board at the 2013 meeting. The Department will continue coordination with the KNWR in planning for prescribed burns and potentially increasing fuel breaks around residential areas to reduce the risk of fire management. We also plan to continue discussions with the KNWR regarding creation of more predator hunting opportunities on KNWR land. Furthermore, we will continue to increase our efforts in getting information to trappers, increase their access to unsalvageable game meat to use as bait, and to facilitate access for trappers to access private lands.

1) Feasibility Assessment

A) Definitions

- i) Define the relevant geographic area for assessing abundance of prey and predators (Appendix 1, part 1); The entire Unit 15A (1,314 mi²).
- ii) Recommend a time period for evaluation of the proposed program that matches the regional Board cycle. 5 years (not 6 years because this action is taken outside the south-central Board cycle).
- iii) Note if the feasibility assessment is for IM (Intensive Management; legal requirements in Appendix 1 and the *IM Guidelines*) or another purpose. Yes, this is an IM action.

B) Review of objectives and current abundance and harvest

- i) **List the population and harvest objectives for prey species and current abundance of each; objectives may be in regulation for IM (Appendix 1, part 2).** Population objective = 3000-3500 (current estimate from 2008 = 2088 moose, 95% CI: ±264, assumed sightability correction factor of 1.25); Harvest objective = 180-350 (5 yr avg. harvest =116).
- ii) **Provide a brief feasibility review of IM objectives (Appendix 1, part 2) or other objectives for prey species.** The current objectives were established by the Board in 2000. Since the 1950's, the moose population in Unit 15A has fluctuated, but the large scale wildfires of 1947 (483 miles²) and 1969 (135 miles²) were the most significant events

¹ Component factors are discussed in Section 2.

resulting in subsequent increases in moose numbers. There is generally 15-20 years of quality moose habitat available following a large scale wildfire. There have been 4 moose census in Unit 15A that used different methods (Gasaway and Geospatial Population Estimate). The Intensive Management population objective was based on the highest of these estimates obtained during 1991, which was 22 years post burn, with the understanding that habitat enhancements (i.e., fires) would likely continue to occur. It has been over 40 years since the last large scale burn in Unit 15A and the minimal habitat enhancement that has occurred since then has had an insignificant impact on moose population numbers. Given the growth in human population and infrastructure, and proximity to the Anchorage airport, it is unlikely that large wildfires would be allowed to burn in the future without suppression efforts. However, small scale prescribed burns or mechanical treatments of habitat (e.g., 10-20 miles² per year) done consistently over time would improve habitat with less risk than a large scale burn. The IM harvest objectives were established using 6% of the lower population objective and 10% of the upper objective. During the March 2011 Board of Game meeting, the Department recommended reducing the population objective and allow for an increased harvest rate based on new population objectives. While the Board recognized the long term habitat limitations that exist in Unit 15A, they opted to try to increase harvest by reallocating moose from wolves to humans via predator control, rather than reducing the population objectives at this time.

- iii) **List the population and harvest objectives for predator species in Survey and Inventory reports.** Wolf management objective for Units 7&15 is to maintain a population of wolves that allows for multiple uses. The black bear management objective for Units 7&15 is to provide the opportunity to hunt black bears, using seasons and bag limits to regulate the take so we do not exceed an average of 40% females in the harvest during the most recent 3-year period. The brown bear management objective for Units 7&15 is; to maintain a healthy population, minimize negative bear/human interactions, and to not exceed 10 human caused mortalities of adult females annually. However, changes to the hunt strategy to increase harvest opportunities for brown bears are currently under consideration.

C) Recommended management strategy

- i) **Briefly describe the proposed management strategy for the ungulate population (actions to be taken on habitat, predation, harvest, access, or other factors).** The proposed IM action of aerial wolf control will result in the reallocation of moose from wolves to humans. This reallocation will focus harvest in easily accessible areas including along the main roadways which may also lower the frequency of vehicle collisions. This reallocation of harvest will help ensure the moose population does not increase beyond the limits of the available forage as wolf control activities are initiated. With any future significant habitat enhancement, the Department will monitor productivity and may allow the population to increase gradually over the long-term.

When the current antler restrictions are reassessed at the 2013 Board meeting, the Department will present a harvest strategy to ensure a sustainable harvest of bulls and maintenance of healthy bull:cow ratios (Young and Boertje 2008). At this time, the Department will also have data on moose productivity and an index of recruitment. These data will help manage the IM program.

	Sub-total	\$	85,000
b. Research (5 years during wolf removals)			
• Moose productivity/survival monitoring	\$	500,000*	
• Wolf captures	\$	<u>15,000</u>	
	Sub-total	\$	515,000
c. Intensive Management (aerial wolf control, 5 years)			
• Personnel time as administrator	\$	50,000	
• Potential wolf control via helicopter	\$	<u>50,000</u>	
	Sub-total	\$	100,000
	Total	\$	700,000

* This represents a research effort that may be reduced if practical.

This budget is for the feasibility of conducting intensive monitoring and research for the Unit 15A IM plan and assumes the work will be done independent of other projects. If research/monitoring are required for IM work in both Units 15C and 15A done simultaneously, we would anticipate additional costs.

D) If the Board requests development of an IM Plan, the Department should engage the public to receive input on:

- i) Measures of progress toward objectives and criteria of program success;
- ii) Acceptable methods for enhancing ungulate abundance and harvest, including a discussion of expected harvest levels and “hunter carrying capacity”
- iii) Other topics unique to a proposed management program

2) Potential to achieve ungulate population and harvest objectives²

- a) **Population increase in ungulates required to reach population objective (may be represented as comparable density):** increase from ~1.6 moose/mi² to 2.3-2.7 moose/mi²
- b) **Increase in average estimated harvest (last 3 Regulatory Years [RY: 1 July to 30 June]) to reach harvest objective:** Recent average harvest of 114 moose/yr would need to increase 58% in order to reach the lower harvest objective of 180 moose and 207% to reach the upper harvest objective of 350 moose.
- c) **Potential to mitigate biological limitations in proposed IM area [Appendix 2.A] (Low, Moderate, High).** Low. Unless the habitat conditions improve, the moose population would not be able to increase significantly even with predator control. The productivity of the current moose population is low indicating nutritional stress. An increase in moose densities without significant habitat enhancement may further reduce productivity.
- d) **Potential to reduce or moderate moose hunting conflicts [Appendix 2.B] (Low, Moderate, High).** Moderate. Access is somewhat limited given restrictions on the KNWR and any hunting along the highway corridor to reduce the frequency of road-kills may cause

² The background data used in evaluating potential are found in Appendix 2.

conflicts if hunters are not properly informed of landownership boundaries.

- e) **Anticipated public participation in predator control or harvest based on expense and other factors [Appendix 2.C] (Low, Moderate, High).** High. For wolf control, there are pilots/gunners teams in the local area.
- f) **Data availability for designing an effective management plan [Appendix 3] (Low, Moderate, High).** Moderate. Research will start in March 2012.
- g) **Potential to measure or demonstrate progress in ungulate population recovery or an increase harvest within a defined time period [Appendix 2.A.V and Appendix 3] (Low, Moderate, High).** Moderate. Hunters are required to report all moose harvested, however, given the modest potential increase in expected harvest, detecting the effect will be difficult.
- h) **Potential to document reasons for success or failure in population recovery or harvest increase [Appendix 2.A.V] (Low, Moderate, High).** Low. Initially, any benefits from aerial wolf control in calf numbers may be difficult to distinguish from the benefits gained from the current antler restrictions. Additionally, aside from any resulting reallocation of older/larger bulls from wolves to harvest, no additional harvest will occur at least through 2012 due to current antler restrictions. Also, potential alternative harvest strategies would need to be proposed at the 2013 Board meeting.

Appendix 1. Legal elements and criteria for IM objectives and a feasibility assessment

1. Definition of populations:

- The relevant area for defining an ungulate population under intensive management is that defined as a positive determination in Title 5, Alaska Administrative Code, Chapter 92, Section 108 (5 AAC 92.108)
Game Management Unit 15A (1,314 miles²).
- “Game population” is defined in AS 16.05.940(20) as a “group of game animals of a single species or subgroup manageable as a unit,” so clarify the purpose of ungulate or predator management zones proposed to be smaller than areas under 5 AAC 92.108
The moose population within Game Management Unit 15A (1,314 mi²)
- Consider whether a population with a positive determination for IM (5 AAC 92.108) should match or differ from Amounts Necessary for Subsistence (5 AAC 99.025) for the same geographic area. NA

2. The Board has established population and harvest objectives for intensive management of identified ungulate populations for a high level of human harvest:

- Positive determination made for species and herd (caribou) or GMU subunit (moose, deer) per 5 AAC 92.106:
 - Historic harvest that meets or exceeds defined levels (caribou: 100, deer: 500, moose:

- 100); the highest 3 consecutive years and 3 most recent years are provided by Department
- RY1983-1985 = 325/yr.
 - RY2009-2011 = 114/yr.
 - Accessibility (roads, rivers, trails, landing strips)

Accessibility is limited due to 79% of the land in Unit 15A owned by the KNWR. Off-road ATV use is prohibited on the USFWS land as is snowmachine use (unless minimum snow accumulation is achieved). On USFWS land, floatplane access is limited to identified lakes, there is no wheeled plane access outside of municipal airports and private strips along the human residential areas, and use of planes for moose hunting before Sept. 11th is prohibited.
 - Use of harvest primarily for meat.

Moose harvest is primarily for meat, but there is demand for targeting large trophy-class bulls.
 - Hunter demand (reported hunting effort – RY2010).

608 local residents of the Unit, 108 non-local residents of Alaska, and 13 non-residents. However, hunter demand can change across south-central Alaska based on moose dynamics and hunting success in different areas.
- Population and harvest objectives established per 5 AAC 92.108:
 - Population Objective: 3,000-3,500 (current est. = 2,088 ± 264 [95%CI], assumed sightability correction factor = 1.25)
 - Harvest Objective: 180-350 (current harvest last 3 RY = 109-115)
 - Effects of weather, habitat capability, diseases and parasites:

Habitat is limiting based on calving surveys in 2011 (16% twinning rate), observations of high browse utilization and browse-caused mortality of vegetation, and examples of prime aged moose dying of or showing signs consistent with malnutrition. Most current annual growth of preferred browse species is removed each year.
 - Maintenance of viable predator populations.

A wolf survey in March 2010 estimated 41-45 wolves. Current densities of black and brown bears are unknown, but appear abundant and healthy from anecdotal accounts.
 - Maintenance of habitat conditions suitable for other species in the area.

There is a small (<150) but stable caribou population that seasonally ranges within Unit 15A.
 - Effects on subsistence users.

The current antler restrictions imposed due to the low bull:cow ratios are greatly reducing the harvest for both State and Federal moose hunters.
 - Cost, feasibility and potential effectiveness of possible management actions

Conducting aerial wolf control on small and disconnected areas may not be effective at raising the moose population near minimum IM objectives, but may result in modest increases in the moose population in the short-term. Habitat improvement is necessary to see any long-term increase in the moose population resulting from increased productivity. As identified by past moose research in Unit 15A, any significant predator reduction activities aimed at increasing moose population size without associated habitat improvements may result in increased nutritional stress and decreased productivity of moose. Reallocating mortality from wolf control directly to

harvest will help prevent a reduction of nutrition and productivity.

Given the current antler restrictions, there may be a reduced benefit of wolf control to the harvest in 2012. However, assuming adoption of alternative harvest strategies by the Board in March 2013, the harvest in subsequent years that results from wolf control will likely result in an additional number of moose harvested that is less than 50 moose/year.

- Land ownership patterns within the range of the population.

Approximately 79% of the land in Unit 15A is owned by the KNWR who are currently not in support of predator control activities. Of the remaining 21% of the land, <2% is State land.

- Degree of accessibility to harvest.

While access is relatively limited, there are ample opportunities and options for hunters to go afield.

- Other factors considered relevant by the Board.

3. Depletion of the ungulate population [abundance or harvest below objectives] or reduction of the “productivity” [recruitment] of the population has occurred and may result in a “significant” reduction in the allowable harvest per Alaska Statute, Title 16, Chapter 5 (AS 16.05.255(e)).

Yes. The moose population and harvest has been below IM objectives. During annual SI surveys in November 2010, we estimated 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, 61 calves:100 cows (84 calves – 23 calves) were lost from approximately June to November and many of these are likely attributable to predation.

4. Enhancement of abundance or productivity of the big game prey population is feasibly achievable utilizing recognized and prudent management techniques [AS 16.05.255(e)(3)]

Enhancement of abundance and productivity is achievable through habitat improvements. Wolf control may increase densities and recruitment, but given the state of the habitat, it may be at the expense of productivity.

5. The Board is not required to adopt regulations to provide for an intensive management program per AS 16.05.255(f)(1) if a proposed IM program is:

- (A) ineffective, based on scientific information
- (B) inappropriate due to land ownership pattern
- (C) against the best interest of subsistence uses

6. The Board may forego a feasibility assessment if per AS 16.05.255(f) (2) it declares that a biological emergency exists and takes immediate action to protect or maintain the big game prey population in conjunction with the scheduling for adoption of those regulations that are necessary to implement section (e).

Appendix 2: Elements of a feasibility assessment

A. Biological factors

I. Non-predation and non-hunting mortality of prey

- a) **How frequently is there markedly reduced survival due to annual weather variation?** Deep snow conditions occur periodically, but infrequently across Unit 15A.
- b) **How extensive is vehicle mortality along road and rail system that reduces harvestable surplus in the population (estimated number killed annually or as a percentage of total kill by humans that includes harvest and DLP)?** Over the past decade, 85 moose/year are documented dying due to vehicle collisions in Unit 15A. Based on a past study on age and gender structure of road-kill moose, 41% of the kills are from cows, 51% are calves, and 8% are bulls. Over the past decade, approximately 38% of the total human caused mortality of moose in Unit 15C comes from road-kills.

II. Productivity of prey population and habitat

- a) **Evidence of inherent habitat limitation (e.g., nutrient deficiency) manifested in low reproduction, body weight, or survival (Y/N).** Yes. A spring 2011 calf survey showed 16% twinning rate. In a 2007–2008 study we found pregnancy rates of adult cows at 73%. Measures of rump fat were relatively low (average <1cm in March). In late winter and early spring there are cases of prime aged cows dying due to malnutrition, even during mild winters.
- b) **How strong a negative effect from the local prevalence of diseases or parasites? (Low, Moderate, High).** Low. We have no evidence of prevalent pathogens that would be compromising productivity or survival.
- c) **Evidence of longer term weather (climate) trend changing forage production or other habitat requirements and its consequence for the ungulate in question (Y/N).** No. However, in a system where the moose population responds to frequent fires, there has not been a significant fire in the area for over 40 years.
- d) **Evidence of high or excessive levels of forage use (excessive means evidence of plant mortality from inability to rejuvenate caused by persistent grazing or browsing at some proportional level of biomass removal) (Y/N).** Yes, there are many examples of moose forage species not regenerating due to chronic browsing and heavy chronic browsing of the current annual growth of preferred browse species.
- e) **Has the combination of natural and human-caused disturbance produced an extent and mixture of vegetative seral stages capable of maintaining the present productivity if the population increased due to management treatment?** No, any significant increase in population size may produce added nutritional stress. If the moose population size is increased without improvements in the habitat, the already low productivity of the population will likely decline.

III. Potential effectiveness of predator control based on seasonal prey location

- a) **Is effect of predation by individual predator species known for the ungulate species of interest in the proposed area (Y/N/Unknown)?** No.

- b) **Is predation control being proposed for one or multiple predator species? (list predator species)** Predation control is proposed only for wolves.
- c) **Are there concentrated calving and/or young rearing areas of ungulates for focused bear or wolf control (Y/N/Unknown)?** Unknown. The recent radio collaring efforts in Unit 15A have been limited to moose that reside along the eastern highway corridor. Previous assessments identified the area between Sunken Island Lake and the oilfields within the KNWR as a calving area but this has not been substantiated recently through research and the habitat, and therefore the distribution of moose, may have changed due to habitat succession.
- d) **Are there concentrated winter ranges of ungulates suitable for focused wolf control (Y/N/Unknown)?** The current areas that hold the highest densities of moose in the winter are around the human populated areas in Nikiski, Kenai, Soldotna, and Sterling and around the Skilak Loop area on the KNWR.

IV. Potential effectiveness of public participation in predator control (under permit) or predator harvest (see also C.I and C.II in this Appendix)

- a) **Number of licensed hunters and trappers within or near proposed management area (size of potential participant group).** Typically there ranges between 4–11 trappers that actively trap wolves to varying degrees in Unit 15A. In RY2010/11, 120 residents of the unit reported hunted black bears in Unit 15A.
- b) **Estimated wolf harvest rate (percentage of estimated fall population, average of 3 most recent RYs).** The harvest has been <40% of the fall population.
- c) **Estimated black bear harvest rate (percentage of estimated spring population, average of 3 most recent RYs).** We do not know current black bear densities. If we use densities estimated in the 1980s, the yearly harvest rate in Unit 15A would be approximately 8-12%.
- d) **Estimated grizzly/brown bear harvest rate (percentage of estimated spring population, average of 3 most recent RYs).** We do not know brown bear densities. Without an approximate density, we are unable to calculate the harvest rate of brown bears. On average, 9 brown bears/year are reported killed due to human causes in Unit 15A.
- e) **Historical effectiveness of a predator control program in this area (where applicable).** There has not been recent predator control in this area.
- f) **Number of competing predator control programs in the region and the anticipated impact of adding an additional program (potential dilution of participation by skilled members of the public).** There are local pilots/gunners teams.

V. Ability to confirm treatment response (e.g., predator control, habitat enhancement, selective

harvest) in treatment areas with data from nearby and comparable untreated areas through assessment of biological parameters using existing techniques. Low sample size for survey data may limit applicability in low density situations. Describe whether the following criteria for evaluating response to treatment are possible or recommended (Y/N):

- a) **Established periodic survey for abundance (Y/N).** Yes, a moose census of the subunit has been conducted approximately every 6-8 years. However, ability to detect small changes in abundance (and causes of these changes), given inherent variability in surveys, will be difficult.
- b) **Fall composition surveys for young to adult female ratio as index to survival (Y/N).** Yes, however, there are potential confounding factors with interpreting calf:cow ratios. First, the nutritional condition of cows may be currently limiting productivity. Second, the low bull:cow ratio may be reducing pregnancy rates or causing second estrus breeding. These two confounding factors may be affecting calf production and survival and, therefore, may obfuscate our ability to detect the impact of wolf control. However, research starting in March 2012 will start addressing some of these questions. This research may allow us to show if the treatment succeeded and why.
- c) **Fall composition surveys for yearling to adult female ratio as an index to survival (Y/N).** Yes, however, there are potential confounding factors with interpreting yearling:cow ratios. First, the recent antler restrictions will result in a large increase in yearling bull survival regardless of wolf control. This factor may be affecting subsequent yearling recruitment and, therefore, may obfuscate our ability to detect the impact of wolf control at least during the first year of the program.
- d) **Radio telemetry for survival of specific age cohorts (Y/N).** No. The initial research priority is to assess moose productivity in relation to the decline in the bull:cow ratio. Future research may attempt to quantify age specific survival.
- e) **Total prey harvest and age-sex composition of harvest among local residents, state residents, and non-residents (Y/N).** Yes
- f) **Harvest per unit effort, particularly in focused program areas where the initial intent is reallocation of mortality from predators to harvest to first meet local harvest needs(Y/N).** No. However, data on harvest effort will be available and may provide some useful information on harvest per unit effort.

B. Societal factors associated with hunting conflicts (e.g., constraints to access, acceptable methods, and harvest expectations), hunter access, and public tolerance for intensive management practices.

- I. Public expectation for predator control and increased ungulate harvest must be understood prior to initiating programs to increase ungulate populations. Public conflicts over ungulate harvest methods can reduce options for controlling population growth. Failure to limit growth can reduce the condition of habitat and ungulates to the extent of reduced productivity. Critical components of conflict mitigation are

identifying acceptable predation control methods, as well as the potential for additional ungulate harvest opportunities that are acceptable to the hunting and non-hunting public. Defining the benefits of increased harvest is complex because hunter motivation may include economic factors (cost of meat replacement) and intangible measures of satisfaction (continuation of hunting culture, time spent in the field with family or friends, etc.).

- a) **Has the public defined an acceptable quantity and sex/age structure of ungulate harvest?** Not yet. The goal of the IM plan is not to increase moose densities, but to reallocate moose from wolves to harvest. This will require alternative harvest strategies which will be proposed at the 2013 Board meeting.
- b) **Does the level of unreported or unknown harvest hinder the ability of the Department to evaluate response to management treatments?** No. While the level of unreported harvest is unknown, we do not believe unreported harvest in this area would greatly hinder our ability to evaluate the program.
- c) **Has the Department informed constituents about ecological and biological constraints (nutrition, forage condition) relative to setting upper limits for population densities of managed ungulates (Y/N).** Yes. Department staff frequently addresses how habitat is limiting productivity of the moose population in Unit 15A and how increasing densities without large scale habitat improvements may result in decreased productivity and an increased vulnerability to severe winters.
- d) **If possible from historic data, characterize hunter density where significant conflicts occur between hunters (Low, Moderate, High) and between hunters and non-hunters (Low, Moderate, High).** Moderate. Hunter densities were much higher in the mid-1980s (near 2000 hunters) compared to recent years (just above 1000 hunters). It is likely that there were more conflicts between hunters and with non-hunters when hunter densities were much higher. However, given that the moose population will not significantly increase until there is a large scale habitat improvement, we do not believe that hunter densities, and an increase in potential conflicts, are currently problematic.
- e) **If possible from historic data, what is potential for conflict in rural areas between local hunters and non-local hunters (Low, Moderate, High).** Low. Typically, 80% of the hunters are local residents.
- f) **Conflicts or problems associated with access: existing access constraints (Few, Some, Many).** Many. While access is limited on the KNWR, hunters would and do maximize their hunting effort across much of Unit 15A, despite these restrictions. Access off the KNWR is generally road assessable areas in and adjacent to residential areas.
- g) **Acceptable strategies to spread out hunters and minimize trespass on private lands (Few, Some, Many) and minimize unacceptable levels of trail damage on public lands (Few, Some, Many).** Few. Most of the available land in Unit 15A is

KNWR which has access restrictions. This concentrates hunters without access to certain means (e.g., airplane) to highway vehicle based hunting along road corridors.

- h) **Acceptance of restricted methods or means for harvest, particularly near communities (e.g., archery or muzzleloader) (Y/N).** Yes
- i) **Anticipated increase in vehicle mortality with ungulate population growth (poses a public safety risk) (Low, Moderate, High).** Moderate. We do believe there will be an increase risk of vehicle collisions if the moose population increases. However, this could be somewhat ameliorated by focusing new hunts along road corridors and reallocating harvest from wolves, or mortality from vehicle collisions.
- j) **Anticipation of strongly adverse public reaction to a management tool (e.g., predation control, prescribed fire, selective harvest), geographic area, or other facet of the proposed program (Low, Moderate, High).** High. The public would likely not support the risks of non-suppression of wildfire or with the increase health and safety burden associated with smoke. Additional concerns from communities outside the Kenai relative to smoke could be great given the northern tip of 15A is only 14 miles from Anchorage International Airport. The Advisory Committees are generally in support of predator control and alternative harvest strategies under certain circumstances.
- k) **Potential for predator control to have indirect negative effects on alternate prey, such as increase in medium predators that can prey on ungulate young, particularly in species of high interest to hunters (Low, Moderate, High).** Low.
- l) **Coordination among hunters and trappers about control methods and allocation among ground based trappers, aerial gunners by permit, and Department use of helicopters (Low, Moderate, High).** Unknown. The local trappers association has expressed concern with the prospect of more people trapping wolves and encroaching on established lines.

II. Land Ownership may influence or restrict access for predator control or ungulate harvest. Proximity of restrictive status to communities or areas where management treatments would be most effective is the important context (see discussion of management strategy in Section 1). If the objective is to increase harvest in a local area as progress toward a larger area objective, a program to reallocate mortality from predation to harvest without a substantial increase in ungulate abundance may be feasible with harvest coordination.

- a) **Percentage of National Park or Preserve and National Wildlife Refuge (where predator control may be restricted) in Game Management Unit or subunit.** 79% of Unit 15A is KNWR.
- b) **Percentage of area in federally designated wilderness or wilderness study areas where habitat or wildlife management may be subject to more extensive public process.** Approximately 28% of the land in Unit 15A is federally designated wilderness, but none of KNWR land will be open for wolf control activities.

- c) **Percentage of Alaska Native corporation land.** The larger contiguous blocks of land owned by two Native Corporations totals 49 mi² (4% of Unit 15A). Not included in this total is 51.5 mi² of Native Corporations lands where predator control would need support of the KNWR pursuant to ANSCA Section 22g.
- d) **Access for predator control or ungulate hunting allowed on Alaska Native corporation lands (Y/N).** Unknown. The 51.5 mi² of Tyonek land in the northwestern portion of Unit 15A has ANSCA 22g status and would likely not be available for predator control. On the other Native land, the Department is contacting landowners to determine if predator control activities or access for public hunting would be allowed.

III. Access for predator reduction and ungulate harvest (see also Section B, Parts I.f and I.g in this appendix)

- a) What is the extent of all-season roads (Limited, Moderate, Extensive). Limited
- b) What is the extent of ATV trails (Limited, Moderate, Extensive). Limited
- c) What is the extent of navigable rivers (Limited, Moderate, Extensive). Moderate
- d) What is the feasibility of landing fixed-wing aircraft in winter for predator removal (Low, Moderate, High). Low
- e) What is the feasibility of landing fixed-wing aircraft in fall for ungulate hunting (Low, Moderate, High). Moderate
- f) What is the feasibility of ocean shoreline access for hunting or predator removal (Low, Moderate, High). Low
- g) Is use of helicopters by public (under permit) allowed for trapping or retrieval of carcasses from aerial shooting (Y/N). Not on KNWR land but it would likely be allowed on the 15.6 mi² of state land and may be allowed on the 49 mi² of Native land.
- h) Are there Controlled Use Areas that prohibit aircraft access for ungulate harvest (Y/N). Yes, the use of aircraft for hunting moose is prohibited before Sept. 11th of each season.

C. Economic factors: define estimated costs of management programs and expectations for public participation in predator control programs for comparison to perceived benefits by the Board and public

I. Cost of participation in prey harvest or predation control by public

- a) Price (Dollars/gallon) of unleaded gasoline (average among communities). \$4.00-4.50/gal.
- b) Price (Dollars/gallon) of 100 octane low lead aviation fuel (average among communities). \$5.00-6.00/gal.
- c) Cost to hunters per prey animal harvested from alternative strategy or area (e.g., transportation cost to hunt in adjacent areas with harvestable surplus of ungulates) (Low, Moderate, High). Moderate
- d. Value of predator hides or other parts legal to sell. A large proportion of the

wolves on the entire Kenai Peninsula are infested with lice reducing the value of the hides.

II. Potential for participation in predator control or harvest by public

- a) **Would creating a new predation control program hinder ability to maintain public involvement in existing predation control programs in the region?**
Not likely. There are many local pilots on the Kenai that participate in the predator control programs in Units 16B and 19D.
- b) **Will a predation control program, habitat enhancement project, or ungulate harvest strategy conflict with existing harvest of predators by reducing opportunity for local hunters or trappers?** There may be some conflicts, but the Department does not believe they will be substantial.
- c) **Potential to conduct a Department sponsored control programs if public participation is lower than expected (Low, Moderate, High).** High. If fixed-winged control effort proves unsuccessful after 2 winters, the Department may use helicopter control by March, 2013.

III. Potential for cost sharing in habitat enhancement (see also Section B, Part II in this appendix).

- a) **Potential to collaborate on prescribed fire where hazardous fuel reduction is the primary goal (Low, Moderate, High).** High. The Department will cooperate in the planning of prescribed burns with the KNWR and State Forestry. The Department will continue exploring the idea of creating fire breaks around residential areas to decrease the risk in fire management.
- b) **Potential to collaborate on forest management or mechanical vegetation treatments to produce wood products or reduce hazardous fuels (Low, Moderate, High).** Low. The Department will cooperate in the planning for mechanical treatments with the USFWS, but large scale mechanical treatments are expensive.

Appendix 3: Availability of population and harvest information. (Y/N/unknown/not applicable)

- Ungulate population status:
 - Abundance survey within last 2 years: No
 - Abundance surveys on set schedule to estimate trend: Yes
 - Composition survey within last 2 years: Yes
 - Estimate of parturition rate within last 5 years: No
 - Young survival estimate with mortality causes identified: No
- Harvest of prey:
 - Trends in reported harvest by residents and “local” (GMU) residents among general season, drawing permit, registration permit, and Tier II categories over last 10 years. RY2001-2010, average harvest per year = 115 local residents, 16 nonlocal residents, 6 nonresidents.

- Where unreported harvest occurs, public perception of trend. Stable.
 - Estimate of unreported harvest from telemetry, Division of Subsistence, or other sources. Unknown. Trooper reports are an inadequate indicator of unreported harvest.
 - Department estimate of current sustainable harvest. RY08-RY10 range = 109-115 bulls. This equates to roughly a 6% harvest rate based on a RY08 population estimate. However, it is apparent that this rate is not sustainable given the decline in bull:cow ratios. A future sustainable rate of bull-only harvest is unknown but will likely be at a level below past harvest rates.
 - Amount Necessary for Subsistence. All of GMU 15A is within a non subsistence use area. There is no designated ANS for Unit 15A. The IM harvest objective is 180-350 moose.
 - Historical harvest by non-residents (Y/N). Yes but it was relatively low (<2%).
 - Present harvest by non-residents(Y/N). No. The Board eliminated nonresident hunting in 2011.
- Status and harvest of predators:
 - Survey/census of wolf density within last 5 years. Yes. The wolf population in Unit 15A was surveyed in March 2010 and estimated to have a range of 41-45 wolves (not including 6 wolves trapped before the survey). The RY2010/11 harvest was 15 wolves which would roughly equate to a 30% harvest rate.
 - Survey/census black bear density within last 5 years. No. There has not been a black bear census since the 1980s. The 1980s estimates were 205 and 265 bears/1000km². The RY2009/10 harvest was 82 bears which, using the old population estimate, roughly equates to a harvest rate of 9-12%.
 - Survey/census grizzly/brown bear density within last 5 years. No. There has never been a census of brown bears on the Kenai Peninsula.
 - Predator-prey ratio estimated. Incomplete. Roughly 1 wolf : 40 moose. Using the 1980s black bear density estimates, roughly 1 black bear : 3 moose.
 - Survey of alternative prey adequate to aid predator recovery. There is a small population of caribou (<350) and Dall sheep (<100) on the eastern edge of Unit 15A as well as a small (<150) caribou population that ranges into the southern portion of Unit 15A and northwest Unit 15B.
 - Most wolf harvest accounted for by sealing data. Yes.
 - Most black bear harvest accounted for by sealing data. Yes.
 - Department estimate of black bear harvest where sealing does not occur. Sealing options occur in most communities within the unit.
 - Most grizzly/brown bear harvest accounted for by sealing data. Yes.
- Habitat condition
 - Proportional removal of browse biomass in previous 5 years with no large population change or widespread disturbance (e.g., fire) since browse survey. Habitat is limiting based on twinning surveys in 2011 (16% of parturient cows with twins), observation of browse utilization is high and there are abundant examples of browse-caused mortality of vegetation, and yearly cases of mortality of prime aged cows due to malnutrition.
 - Proportion of browse species with broomed growth structure (history of browsing). Based on observations, a majority of the preferred browse species are severely broomed.
 - Proportion of area burned in last 10 years (potential browse availability). <5%.

- Proportion of area in appropriate habitat type based on vegetative classification (define as forage, cover, etc.). Outside of lakes/ponds and residential areas, almost all of the land in Unit 15A is moose habitat that would likely regenerate following fire.
- Ungulate nutritional condition
 - Percentage of productive 3-yr-old females. Unknown.
 - Weight of 4-month- or 10-month-old females. Unknown.
 - Two estimates of twinning rate in previous 5 years with no large population change. Twinning rates conducted in the spring 2011 showed 16% of parturient cows had twins.
 - *Other metrics?* During radio collaring work done in 2006, March pregnancy rates of adults cows were at 73%. Measures of rump fat were relatively low (average <1cm in March).

Literature Cited

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