

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

in Game Management Unit 15C

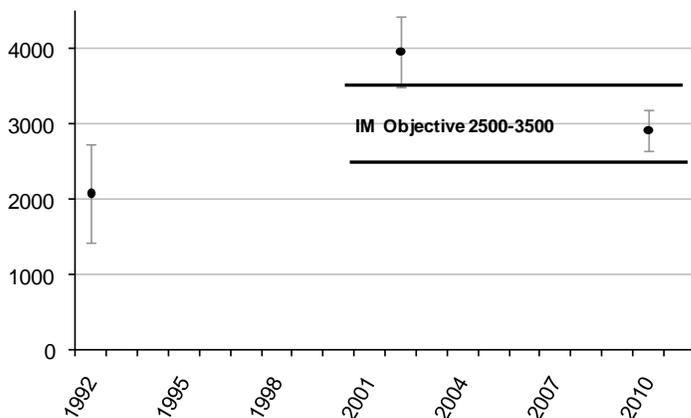
**Prepared by the Division of Wildlife Conservation
December, 2011**



This document represents the Department's assessment of the feasibility of implementing a plan for maintaining or increasing sustainable harvest of moose in Game Management Unit 15C 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 January 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 15C are an Intensive Management (IM) population. Over time, the Department has conducted only three moose population estimates in 15C. These estimates were conducted in 1992, 2002, and 2010 respectively. While the estimate of moose population size conducted in 2010 appears to be greater than the 1992 estimate, these two estimates were conducted using two different survey techniques (Gasaway and GSPE) and overlapping confidence intervals make evaluation of population trends associated with these survey events problematic (Figure 1). The 2002 population estimate was conducted using the GSPE method, but is uncertain as the model failed to “fit” the high strata due to a small sample size and other factors.

Figure 1. Unit 15C moose population size estimates. Sightability correction factors were estimated at 1.49 in the 1992 Gasaway survey and assumed to be 1.33 in 2002 and 2010 GSPE surveys. Intensive Management population objectives, created in 2000, are shown.



Additionally, from 1992-2010, trend count data from Unit 15C count areas has shown no increasing or declining trend in numbers of moose counted/hour of flight (Figure 2).

The reported harvest (Figure 3) varied through 2005, and then leveled out at the lower end of harvest objectives through 2010. Recently, a decline in the bull:cow ratios below management objectives across most of the Kenai Peninsula, but especially in Unit 15C, prompted the Board of Game (Board) to approve the Alaska Department of Fish & Game's (Department) recommendations for a more restrictive bag limit for moose to reduce the harvest and increase survival of younger bulls and some older age class bulls. The Department expects at least a 75% decline in the 2011 and 2012 bull harvests from recent average harvest. This antler restriction will drop the 2011 and 2012 harvest well below IM objectives.

Figure 2. Trend count data (moose per hour) in Unit 15C Caribou Hills and Homer count areas from 1992 to 2010

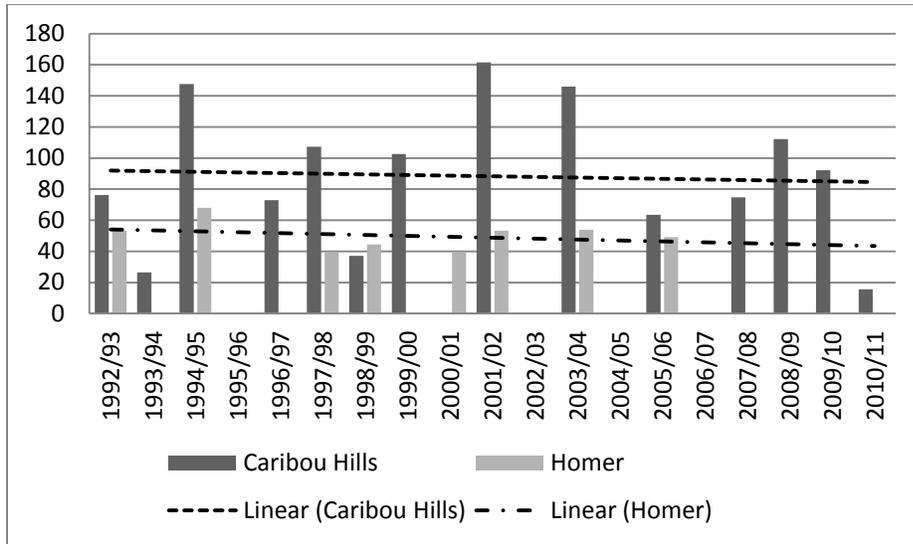
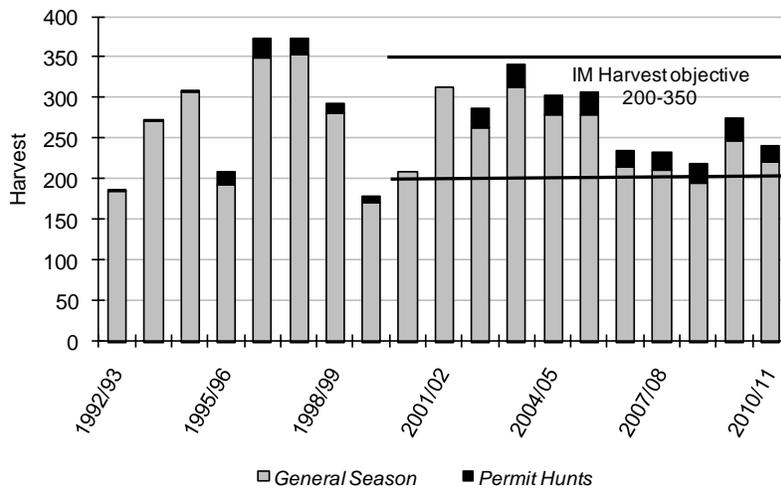


Figure 3. Unit 15C moose harvest from 1992-2010. Intensive management harvest objectives, created in 2000, are shown.



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 and harvest in Unit 15C has been within IM population objectives since the objectives were established. Bull:cow and calf:cow ratios calculated from composition surveys varied depending on count area, survey conditions and moose movements. However, we detected a decline in bull:cow ratios which coincided with lower harvest during the last 5 years. The Department hopes that the antler restrictions will allow the bull:cow ratio to increase back to objective levels in most areas within 2 regulatory years.

Depending on the subsequent harvest strategy adopted, it is possible that minimum IM harvest objectives may again be met in 2013 without any IM action. The Department has had a great deal of internal discussion relative to the hopefully temporary nature of the new antler restrictions and how this relates to 5AAC 92.106 (5) (B). However, unless calf recruitment is improved substantially, even minimum IM harvest objectives may not be sustainable regardless of the harvest strategy that is adopted following the current restrictions.

Since 1992, extensive habitat changes have occurred in 15C due to human settlement, wildfires, proliferation of blue-joint grass, spruce bark beetle infestations, and subsequent timber harvest. Almost 108,000 acres have burned in the past 15 years, 55,000 of which occurred in the Caribou Hills four years ago. Although data is limited, a spring 2011 calf survey showed 30% twinning rate. Consequently, the Department does not believe that habitat is a limiting factor for moose in 15C at this time.

While survey data are limited, the data that are available indicate that recent moose calf numbers are at levels that would at best maintain or result in slowly declining population levels. As previously mentioned, the calf:cow ratios are variable. For example, over the past 5 years, ratios for the Caribou Hills have ranged from 5 to 18 calves:100 cows. Assuming 50% of the calves are female, and if all of the calves in the highest count year (18) survived through the following year, mortality of females older than 5 months of age could be at most 9% and still maintain current population levels. This level of mortality is close to the minimum seen in populations in high quality habitat not subject to periodic severe winters or motor vehicle collisions. Assuming a typical calving rate of 80% with 30% twinning, spring 2011 calf ratios may have yielded as many as 104 calves:100 cows.

The decline in the bull:cow ratio in Unit 15C appears to be caused primarily by an overharvest of bulls despite the selective harvest strategy (SHS; the spike/fork, 50", or 3 brow tine restriction). Specifically, when the SHS was established in 1987, assumptions were made that ½ of the yearling bulls would be protected. This appears not to be supported based on 2010 data where only about ¼ of the yearlings were protected. For the past 13 seasons in Unit 15C, 66% of the annual bull harvest under the SHS has been spike/fork bulls.

The SHS relies upon sufficient numbers of yearling bulls being recruited into the population to offset bull harvest. This relatively high yearling harvest may have reduced recruitment of bulls into the adult age class and contributed to the current declines in bull:cow ratios in Unit 15C. Young and Boertje (2008) showed that a harvest of 24-30% of the pre-hunt bull population resulted in a decline in bull:cow ratios in Unit 20A. Using their same analyses, the Unit 15C harvest took 59% of the available bulls in 2010 and has likely exceeded sustainable limits for some time.

Predator control including aerial wolf control may increase calf survival, thereby increasing the bull:cow ratio because more bulls and cow calves may survive to be adults. In combination with a lower bull harvest rate, this will allow proportionally more bulls to be added to the population than in the past, accelerating the increase in bull:cow ratio beyond that possible with no added survival into adult age classes. This will improve the probability of reaching and sustaining harvest objectives.

During the March 2011 meeting the Board heard public testimony purporting high levels of predation on moose and subsequent low calf survival. Department testimony identified harvest and population size within IM objectives, but indicated that the 2011 harvest would fall well below objectives if the Board adopted antler restrictions recommended by the Department to address low bull:cow ratios. With this predicted decline in the 2011 and 2012 harvest, as well as concerns that harvests in recent years (though exceeding IM minimums) were not sustainable, the Board directed the Department to write an IM plan for moose in Unit 15C that included the aerial wolf control.

Though bears are likely a significant source of moose calf mortality, this IM Feasibility Assessment focuses on the efficacy of aerial wolf control. If bears are strongly limiting calf survival, the main effect of wolf reduction will be a slight increase in survival of neonates and increases in survival of moose >4 months of age.

The proposed program is designed to:

- improve moose survival
- increase harvest levels back within IM objectives
- maintain IM harvest levels over the long term

Although the moose harvest in Unit 15C has been within IM objectives since they were established, there has been a decline in the bull:cow ratios and lower bull harvests over the past five years. The goal of this IM project is not to increase densities significantly, but to reallocate moose from wolves to harvest. If moose survival is substantially improved through wolf removal, additional cow harvest may be warranted to maintain proper bull:cow ratios and population objectives.

These efforts will be focused in the northern portion of Unit 15C, north of Kachemak Bay. Terrain south of Kachemak Bay is heavily forested, mountainous, and holds few moose, but is reported as supporting at least one wolf pack. Providing for increased harvest along the highway may also be a means of reallocating moose killed in vehicle collisions to harvest. This reallocation will be accomplished through alternative harvest strategies.

This IM Feasibility Assessment considers potential effects of wolf control in Unit 15C.

Challenges include:

1. Monitoring wolf/pack numbers and distribution
2. A study conducted by US Fish and Wildlife Service in Unit 15A demonstrated the impact of wolves on moose survivorship, but no similar research effort has been conducted in 15C.
3. The bull:cow ratio will likely improve due to regulatory actions already taken, though this improvement is not likely to result in sustainable harvests within IM objectives without additional calf recruitment.
4. Monitoring the response of moose to wolf removal will require well-designed and more frequent survey effort than conducted historically in Unit 15C.
5. Additional antlerless hunts may eventually be necessary to maintain productivity of the moose population and stay within population objectives.

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

Department recommendation: Assuming aerial wolf control will start in March 2012, the Department is finalizing a plan to implement and measure the progress of aerial wolf control and manage moose for increased harvests. The current moose density in the unit appears to be relatively high compared to other south-central areas. Therefore, the Department's recommendation is to not increase the moose population substantially, but to reallocate moose from wolves to harvest. If calf recruitment is increased substantially through predator control, antlerless harvest will likely be proposed for subsequent population management, and if focused along the roadways it may have the added benefit of reducing vehicle collisions.

Field research will start in March 2012 to aid in the monitoring of this plan. Given the decline in the bull:cow ratio with past harvest rates, the future harvest of bulls may have to be reduced and/or adult cow harvest increased to preserve desired bull:cow ratios. A reduction in the bull harvest may result in a total harvest below IM objectives or a total harvest at the lower threshold within objectives. However, successful aerial wolf control and secondarily the reallocation of "road-kill" moose to harvest could bring the overall harvest to the upper level of the IM objectives. The success of aerial wolf control is contingent on Native Corporations and other land managers allowing access to their lands for wolf control and research activities.

1) Feasibility Assessment

A) Definitions

- i) Define the relevant geographic area for assessing abundance of prey and predators (Appendix 1, part 1); The northern portion of Unit 15C (1,171mi²) north of Kachemak Bay including the Fox River flats.
- 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 = 2500-3500 (current estimate from 2010 = 2919 moose, 95% CI: ± 277 , assumed sightability correction factor of 1.33); Harvest objective = 200-350 (5 yr avg. harvest =240, but was unsustainable, thus prompting the Board to drastically curtail harvest).
- ii) **Provide a brief feasibility review of IM objectives (Appendix 1, part 2) or other objectives for prey species.** The majority of the moose habitat and harvest is in the area north of Kachemak Bay which accounts for 48% (1171/2441 mi²) of the area in Unit 15C. Considering only this core habitat, the Department believes that the IM population

¹ Component factors are discussed in Section 2.

objectives, which equates to 2.1-3.0 moose/mi² are achievable. The IM harvest objectives have been met every year except 2011 (due to antler restrictions). However, the decline in the bull:cow ratio indicates the past harvest rate of bulls was unsustainable. When bull:cow ratios recover and the current emergency harvest restrictions are lifted, the bull-only harvest may not be sustainable at the same level as in the past without running the risk of overharvesting bulls. Successful reallocation of moose from wolves to harvest and potential alternative harvest strategies designed to lower vulnerability of bulls in combination could allow future harvests to reach IM objectives.

- 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 a portion of the harvest along the main roadways which may also lower the frequency of vehicle collisions. Part of this reallocation may be accomplished through alternative harvest strategies.

When the current harvest (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 recruitment. These data will help monitor progress of the plan.

The Department will continue assisting trappers in providing them with information on wolf pack size and location, providing them with game meat that is not salvageable for human consumption for use as bait, continuing to sponsor clinics to improve methods of trapping, snaring, and how to reduce incidental catch of moose, and to facilitate improving access to private lands for trapping.

- ii) **Propose measures of progress toward population or harvest objectives to be evaluated, identifying if additional data collection is necessary.** Along with continued monitoring of harvest related statistics, future research will quantify measures that relate to trends in the moose population and habitat quality including: 1) moose productivity measures such as pregnancy and twinning rates; 2) composition counts and population estimates; 3) monitoring of the wolf population size and distribution; and 4) modeling of the bull:cow ratio, antler

harvest statistics, and composition counts to come up with a long-term management strategy for the moose harvest that is sustainable.

- iii) **Provide a brief explanation for collecting or evaluating data from untreated areas for comparison to areas treated under the management program as evidence in a scientific study design that the treatment effects are working as intended and not simply an artifact of non-treatment effects (e.g., widespread improvement in calf survival because of mild winter across region, not because of predation control in a specific area).** The experimental design for evaluating the program is outlined in greater detail in the Unit 15C IM Operational Plan. Success of the program will be judged by evaluating measures of productivity while monitoring indices or estimates of survival of calves and yearlings. A spatially controlled experiment to measure success of the program will consider movement patterns of moose and wolves. Radio collaring of adult cows will occur in March 2012 and their movements will be monitored. Wolves may also be radio collared. Inferring moose response to wolf control (independent of unit-wide antler restrictions) will require an experimental design having a treatment area (wolf removal) and a control area (no wolf removal); this will be challenging without a clear understanding of moose movements or wolf numbers and ranges. The non-treatment area (i.e., no wolf removal) will remove as much of the confounding effects of moose and wolf movements as possible by being located as far away from wolf removal areas as possible. While imperfect as a control, this design will likely reveal only substantial effects of wolf removal. An index of calf survival and/or calf:cow ratios will be monitored in areas of wolf removal and areas without wolf removal. The degree of monitoring of the Unit 15A program will depend on the level of research and monitoring to be conducted in Unit 15C IM program.
- iv) **Provide an estimated cost of implementation (operations and field staff salary) for the proposed program over the evaluation time period. Five-year cost of predator control program.**

a. Survey and Inventory Activities			
	• Moose surveys and composition counts	\$	40,000
	• Wolf surveys	\$	<u>45,000</u>
	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

15C 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.

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).** The moose population is currently within IM objectives.
- b) **Increase in average estimated harvest (last 3 Regulatory Years [RY: 1 July to 30 June]) to reach harvest objective:** The moose harvest has been within IM objectives. The 2011 harvest was below objectives due to antler restrictions adopted by the Board to address declines in bull:cow ratios, which are hoped to be a temporary (2-year) restriction. However, with past bull harvest being above sustainable limits, future harvests may require reallocation of moose from wolves to harvest and the potential addition of antlerless hunts to maintain the overall harvest within IM objectives. Without increased calf recruitment, any increase in cow harvest is unwarranted because current recruitment is, at best, barely able to balance non-hunting mortality. Hence, additional cow harvest at current levels of calf survival would likely precipitate a population decline.
- c) **Potential to mitigate biological limitations in proposed IM area [Appendix 4.A] (Low, Moderate, High).** Moderate. (While current moose densities are relatively high compared to other adjacent populations, there is no indication of nutritional stress in the 15C moose population. Thus, if wolves are the primary mortality factor responsible for relatively low calf:cow ratios, control of wolves has a high potential to increase calf survival and recruitment if enough area can be treated. This would result in increased recruitment of calves and consequently more bulls and cows available for sustainable harvest). Because we do not wish to increase the current moose population above the IM goals, reallocation of moose from wolves to humans will be necessary to keep the moose population within from not exceeding objectives.
- d) **Potential to reduce or moderate hunting conflicts [Appendix 2.B] (Low, Moderate, High)** High. We do not envision hunter conflicts as a major issue.
- e) **Anticipated public participation 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. (See Unit 15C IM Operational Plan). 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,**

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

Moderate, High). Moderate. The current antler restrictions will limit harvest through 2012 despite benefits from wolf control that may start in January 2012. Increased harvests may be demonstrated starting in the fall 2013 season as hunters are required to report all moose harvested.

- h) **Potential to document reasons for success or failure in population recovery or harvest increase [Appendix 2.A.V] (Low, Moderate, High).** Moderate. Initially, any benefits from aerial wolf control in calf numbers may be difficult to distinguish because of unknown movements of moose between treated and control sites may confound composition surveys. Also, relatively low calf recruitment may have resulted in an increased (older) age structure of cow moose. Older cows are less successful in recruiting calves and have lower survival rates, so any responses from wolf control would be lower than in a population comprised primarily of younger cows in their reproductive prime. This effect may be difficult to detect because we do not have information on age structure of the Unit 15C population. Additionally, no increased harvests 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 15C (2441 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 the northern portion of Game Management Unit 15C north of Kachemak Bay including the Fox River flats (1,171 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
 - RY1996-1998 = 346/yr.
 - RY2008-2010 = 244/yr.

- Accessibility (roads, rivers, trails, landing strips)

Road access available primarily on the western side of the unit with some roads penetrating into the center of the unit such as Falls Creek Road and Oil Well Road. Accessibility to the interior of the unit is primarily through a diverse network of ATV trails and boat access via Tustumena Lake. Approximately 25% of the land in northern Unit 15C is owned by the KNWR and they do not allow ATVs. Access to the roughly 20% of Native land is also limited.
- 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).

883 local residents of the Unit, 134 non-local residents of Alaska, and 19 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: 2,500-3,500 (current est. = 2,919 ± 277 [95%CI], assumed sightability correction factor = 1.33)
 - Harvest Objective: 200-350 (current harvest last 3 RY = 219-274)
 - Effects of weather, habitat capability, diseases and parasites.

While deep snow winters can periodically cause high mortality rates, they are somewhat infrequent. However, yearly snow deposition in the higher elevations force moose down to limited winter range. With present moose densities, habitat is not currently limiting but could begin to affect moose at significantly higher densities. There is no indication that diseases or parasites are a major factor influencing the population dynamics of moose in Unit 15C.
 - Maintenance of viable predator populations.

While predator densities are unknown in Unit 15C, anecdotal accounts and extrapolations of densities taken from adjacent areas indicate abundant and healthy populations of wolves, black and brown bears. In the portion of the unit north of Kachemak Bay, wolf and black bear numbers likely range between 44-52 and 600-800, respectively.
 - Maintenance of habitat conditions suitable for other species in the area. NA
 - 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 hunters.
 - Cost, feasibility and potential effectiveness of possible management actions.

Aerial wolf control will likely have a smaller impact on the bull:cow ratio than the actions taken by the Board to restrict the harvest. Reallocation of moose from wolves to harvest is feasible and would require increased monitoring efforts to document. Monitoring data for much of Unit 15C has been sporadically collected in the past, and thus pretreatment data would be limited. Consequently, significantly increased monitoring and survey effort would be required to (1) document responses to wolf treatments and (2) monitor numbers and composition of the bull moose segment of the population to prevent overharvest as occurred historically. Given adequate resources for monitoring, the success or failure of both wolf treatments and the current restrictive harvest (antler) strategies can be adequately documented.

Given the current antler restrictions, any potential benefit associated with wolf control would be limited to resulting reallocation of older/larger bulls from wolves to harvest until at least 2013. However, assuming adoption of alternative harvest strategies by the Board in March 2013 and successful wolf control in the interim, any improvements in yearling survival could dramatically increase the harvest numbers and sustainability as soon as the new strategy is implemented.

- Land ownership patterns within the range of the population.

Approximately 25% of northern Unit 15C is managed by the KNWR, which does not currently support predator control activities. Approximately 20% of is owned by various Native associations. Approximately 35% is State land.

- Degree of accessibility to harvest.

There is relatively good access to the moose population.

- 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)].

November calf:cow ratios since 2006 are either barely sufficient to maintain the current population size if calf survival overwinter is high and cow mortality at chronic minimums, or are below levels necessary to maintain population size. The harvest in 2011 was below IM objectives because of new harvest (antler) restrictions implemented due to overharvest and/or poor recruitment of males historically. When the temporary (2-year) antler restrictions are reassessed in 2013, the new harvest strategy, without predator control, may result in a harvest that cannot be sustained at minimum IM objectives.

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)]

Yes, enhancement of abundance will likely occur through wolf control.

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 15C.

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, 63 moose/year are documented as dying due to vehicle collisions in Unit 15C. Based on a past study on age and gender structure of roadkill moose, roughly 41% of the kills are from cows, 51% are calves, and 8% are bulls. Over the past decade, approximately 21% of the total human caused mortality of moose in Unit 15C comes from roadkills.

II. Productivity of prey population and habitat (may include prey density effects)

a) **Evidence of inherent habitat limitation (e.g., nutrient deficiency) manifested in low reproduction, body weight, or survival (Y/N).** No. Although data is limited, a spring 2011 calf survey showed 30% twinning rate.

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 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, there has been wide scale habitat change from spruce bark beetle infestations that occurred in the 1990s.

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. In localized areas there is evidence of over-browsing. However, across the unit we do not believe that habitat is limiting with the current moose density.

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?** Extensive habitat changes have occurred during the past 20 years due to human settlement, wildfires, proliferation of blue-joint grass, spruce bark beetle infestations, and subsequent timber harvest. We believe the habitat can support the moose population within the IM objective levels. Increasing the population above IM objective levels is not recommended at this time.

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. There has not been any research quantifying calving locations.
- 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 along the road system and the major river drainages on the western side of the unit.

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 5–15 trappers that actively trap wolves in Unit 15C.
- b) **Estimated wolf harvest rate (percentage of estimated fall population, average of 3 most recent RYs).** A recent wolf count was completed in November 2011 and a minimum number of 44 to 52 in 6 packs was counted. The harvest has averaged 14 wolves/year over the past 3 RYs, which is equivalent to 29% harvest rate.
- 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 extrapolate densities calculated from Unit 15A in the 1980s, the yearly harvest rate in the northern portion of Unit 15C would be approximately 5-6%. The exact harvest rate is unknown.
- 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, 5 brown bears/year are reported killed due to human causes in Unit 15C.
- 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 survey of the subunit has been conducted approximately once every 10 years. However, ability to detect small changes in abundance, 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, wide spread composition counts have not been done consistently so baseline data is limited. Also, we lack sufficient data on productivity and predation rates and the impact of low bull:cow ratios on productivity. However, research starting in March 2012 will start addressing some of these questions.
- 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, November surveys occur after most of the bull harvest, so historic yearling:adult cow ratios are biased low because of high yearling bull harvest. Consequently, because, the recent antler restrictions will result in a large increase in yearling bull survival regardless of wolf control, the pre and post treatment data is not comparable because of the harvest bias. If yearling harvest remains negligible and movement data do not show any significant immigration of yearling males, over time yearling bull:cow ratios may index survival, but these would still have no pretreatment data with which to compare.
- d) **Radio telemetry for survival of specific age cohorts (Y/N).** No. Although age specific survival would be informative, the research priority will be to assess moose productivity in relation to the decline in the bull:cow ratio.
- 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, with the recent changes to antler restriction, there will not be a reallocation of the harvest in 2012. 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 to not 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 may limit productivity, that the moose population in Unit 15C is and has been within IM population objectives, and how increasing densities above objectives may decrease productivity and increase vulnerability of moose 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).** Low. While hunter densities have been relatively high compared to other south-central units, we do not believe there were significant conflicts in the past nor would there be significant conflicts in the future.
- 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, 85% of the hunters are local residents.
- f) **Conflicts or problems associated with access: existing access constraints (Few, Some, Many).** Few. While access is limited on the Kenai National Wildlife Refuge which falls on the eastern side of Unit 15C, hunters would certainly maximize their hunt success across much of unit.
- 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).** Many. There is adequate trail access within Unit 15C outside the KNWR land.
- 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).** Moderate. 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, however, we do not foresee any problems.

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 or caribou herd range.** Approximately 25% of the northern portion of Unit 15C 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.** All of the KNWR within Unit 15C is designated as wilderness, but none of KNWR land will be open for wolf control activities.
- c) **Percentage of Alaska Native corporation land.** Approximately 20% of the unit north of Kachemak Bay.
- d) **Access for predator control or ungulate hunting allowed on Alaska Native corporation lands (Y/N).** Currently unknown. It is likely that wolf control activities will be allowed on Native land but definitive agreements are still being made. If access is not granted, this would severely limit the effectiveness of wolf

control given the distribution of moose during winter is largely on Native land.

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). Extensive
- c) What is the extent of navigable rivers (Limited, Moderate, Extensive). Limited
- d) What is the feasibility of landing fixed-wing aircraft in winter for predator removal (Low, Moderate, High). Moderate
- e) What is the feasibility of landing fixed-wing aircraft in fall for ungulate hunting (Low, Moderate, High). Low
- 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). Yes, but not on KNWR land.
- h) Are there Controlled Use Areas that prohibit aircraft access for ungulate harvest (Y/N). No, but the KNWR has aircraft landing restrictions.

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 and this reduces 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 we do 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. We will cooperate in the planning of prescribed burns with the KNWR and State Forestry. However, potential fire management or habitat enhancement is not a part of this plan.
- b) **Potential to collaborate on forest management or mechanical vegetation treatments to produce wood products or reduce hazardous fuels (Low, Moderate, High).** Low. We will cooperate in the planning for mechanical treatments with the USFWS but in reality, large scale mechanical treatments are costly. State Forestry has attempted some level of habitat revitalization after logging with few positive results in terms of moose habitat.

Appendix 3: Availability of population and harvest information. Data include status of predators, ungulate species, and habitat for modeling predator removal rates and time until increase in harvest of ungulates is feasible (Y/N/unknown/not applicable)

- Ungulate population status:
 - Abundance survey within last 2 years: Yes
 - 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 = 214 local residents, 27 nonlocal residents, 10 nonresidents.
 - Where unreported harvest occurs, public perception of trend. Increasing.
 - Estimate of unreported harvest from telemetry, Division of Subsistence, or other sources. Unknown.
 - Department estimate of current sustainable harvest. RY08-RY10 range = 219-274 moose. This equate to roughly an 8% harvest rate based on a RY09 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. There is an ANS for the small area south of Kachemak Bay, which has an ANS of 5–6. The rest of the Kenai Peninsula is a non-subsistence area. The IM harvest objective is 200-350 moose.
- Historical harvest by non-residents (Y/N). Yes, but it was relatively low (<5%).
- 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 likely ranges between 44-52 wolves based on a November 2011 survey.
 - Survey/census black bear density within last 5 years. No, there has not been a black bear census in Unit 15C. Using the density estimates produced in the 1980s in Unit 15A, this would give 700-900 bears in the northern portion of Unit 15C.
 - 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. Yes. Assuming 44-52 wolves in the northern portion of Unit 15C, this equates to 1 wolf: 57-68 moose. Assuming 700-900 black bears in northern 15C, this equates to about 1 black bear : 3-4 moose.
 - Survey of alternative prey adequate to aid predator recovery. There is a small Dall sheep population (~100 sheep) on the eastern edge of Unit 15C as well as about 100 caribou and about 200 mountain goats.
 - 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 the main population centers within the unit.
 - Most grizzly/brown bear harvest accounted for by sealing data. Yes.
- Habitat condition (methods may be specific to region or species):
 - Proportional removal of browse biomass in previous 5 years with no large population change or widespread disturbance (e.g., fire) since browse survey. Unknown but we do not believe habitat is currently limiting.
 - Proportion of browse species with broomed growth structure (history of browsing). Unknown but we do not believe habitat is currently limiting.
 - Proportion of area burned in last 10 years (potential browse availability). Approximately 6%.
 - Proportion of area in appropriate habitat type based on vegetative classification (define as forage, cover, etc.). Most of the land within the northern portion of Unit 15C (1171 mi²) is used by moose during the year. Winter range is limited to the main drainages and lowlands primarily on the western side of the unit.
- Ungulate nutritional condition (representative of environmental conditions experienced during the most recent population census or estimate; may be specific to area/region or herd):
 - 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 (moose). Twinning rates conducted in the spring 2011 showed 30% of the cows with calves had twins (but the sample size for these surveys was low).

- *Other metrics?* Studies that will start in March 2012 will provide additional measures of pregnancy rates, body condition, and an index of recruitment.

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.