Upcoming Dall Sheep research in Region 2

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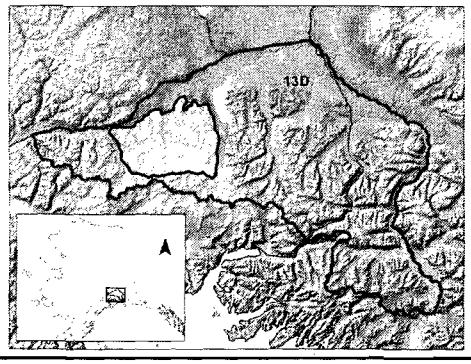
Experience and biography

- BS, Northwestern University, 1991
- MS, University of Wyoming, 1998
- Ph.D., University of Wyoming, 2002
  - Research on denned black bear metabolism
- Director, Kenai Moose Research Center 2003-2008
  - Research on nutritional requirements of pregnancy
- Lifetime outdoorsman, hunter, fisherman

Proposed study area



Project Background

- 13D – Declining sheep populations

Unit-wide estimates
- ~1580 in 2002
- ~1280 in 2008

- Count history specific to proposed study area:

Nelchina Gl. to Matanuska Gl.
- 475 sheep in 1976, 138 in 2008

➢ Declines approximately equal in ram and ewe component

Project Background

- Weather–

  Surveys show that in some years with late, heavy spring snows, many ewes are seen without lambs

- Predation –

  AK range study (S. Arthur) showed that ~90 % of lamb mortality due to predation, primarily coyotes (40%) and eagles (30%). All deaths of adults were caused by predation (wolves = 57%, bears 7%, wolverines 7%)

  Lamb survival to 1 yr = 26%

  Adult survival = 86%

Project Background

- Habitat and nutrition –

  Bighorn sheep very susceptible to mineral deficiencies, results in low pregnancy rates

- Disease -

  Die offs in OR, ID, WA, other states related to pneumonia. Same bacteria have been found in SOME sheep in AK.

- Focus initial research efforts on these four topics – identify cause of decline

Project Background

•Variability in other research (AK range) suggests more than one year of research necessary

•Weather, habitat likely different between interior and Southcentral—

Coastal influence/warm wet winters/ICINg

•Predation has an effect, but losses to predation could be very different than in interior

Eagle staging areas, Bears, Coyotes, Wolves

➢Cannot generalize, must conduct research in these ranges and on these sheep

Project Calendar

•March 15-31, 2009– Radio collar ~40 adult ewe sheep

At capture, assess health and nutritional condition, disease screen, pregnancy check

• May 15-June 15, 2009 – Monitor adult ewes to determine birth rate

Project Calendar

•May 15-June 1, 2009. Radio collar ~30 newborn lambs (expandable collar, releases @ ~1 yr)

Weigh and measure lambs, collect blood sample, (genetics, health)

•Monitor radiocollared ewes and lambs to 1 year

determine amount and cause of mortality, and RECRUITMENT

Project Calendar

•Summer, 2009

•Field collections (fecal, browse) to check for disease and to evaluate habitat quality

•Hunting season, 2009

•Request that hunters recover (volunteer basis) liver and lung samples to test for mineral deficiencies and for lungworm/pneumonia

Project Calendar

• Fall and winter, 2009-10. Using radio collared animals to identify winter range, establish temperature and snow depth monitoring sites

•Measure snow depth from fixed-wing when we monitor radio collared sheep

•Temperature loggers will record daily temperature ranges –IS ICE FORMING?

•If funding available (depends on how much flying we have to do during summer '09) we will measure snow hardness on sheep winter range

Project Calendar

•2010 and 2011

•Repeat work conducted in 2009 as necessary

Additional projects & future

- GPS collars (CO Bighorn Society)
- Validate use of ultrasound to measure % body fat and protein
- Other study areas
  - Kenai (?)
  - Wrangell St. Elias NP (?)
- Predator diet composition

KC 112

3/6/2009

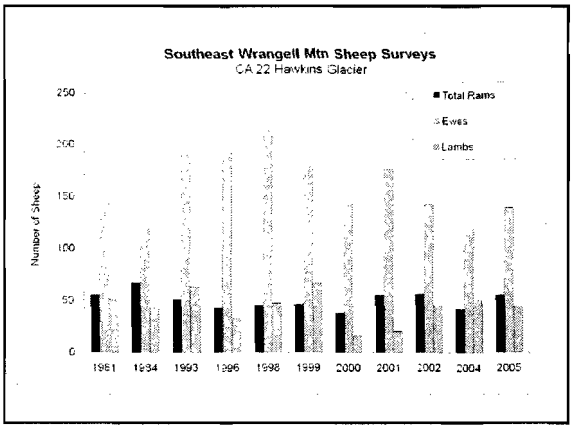
Region II Sheep Proposals

PROPOSALS 104 and 105

- This proposal would change the resident bag limit for Dall sheep in GMU 11 from ¾ curl to full curl.

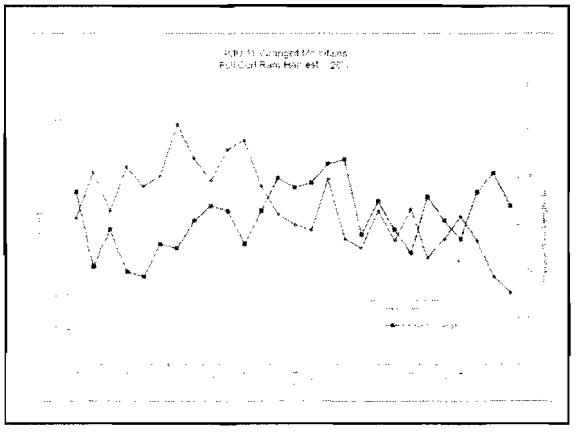
- **DEPT. RECOMMENDATION:**
  - **Do Not Adopt**

3 SLIDES



GMU 11 Sheep Sealed

	State Harvest	Full+	<Full Curl: 8yrs+ or double broomed	< 8yrs old: ½-7/8	< 8yrs old: 7/8-Full	Legal under ¾ reg
2006	32	22	5	4	1	5 (16%)
2007	26	13	6	4	3	7 (27%)
2008	35	14	7	7	7	14 (40%)



Proposal 216

Effect of the proposal:

Define bag limit as 'full curl only' for all sheep hunts in Region II

Do Not Adopt

Proposal 216

Issues & rationale

• This proposal was submitted in response to the new 'any ram' drawing hunts in GMU 13D and 14A.

Proposal 216

Issues & rationale

• Any ram drawing hunts authorized in 2007 with the understanding that this strategy would be evaluated over several years.

•We only have one year of data at this time

•Hunts established in response to high harvest levels

Proposal 216

Issues & rationale

- Extremely restrictive, limited entry hunt preserves at least some hunting opportunity, while we evaluate this harvest strategy over the next BOG cycle

Proposal 216

Issues & rationale

- Some rams will never reach full curl
- Under a general hunt with a full curl restriction, many full curl rams were shot as soon as they became legal, leaving rams that would never reach full curl to do the breeding.

Proposal 216

Issues & rationale

- The any ram, drawing permit hunts will allow legal harvest of these rams while leaving some full curl rams to breed and preserving highly desirable trophy characteristics in this population.

Proposal 216

Issues & rationale

- These hunts provide an opportunity for hunters looking for a trophy sheep but not comfortable judging full curl
- Other sheep managers report extremely high hunter satisfaction under the any ram management strategy

Proposal 216

- 13D West – 10 permits any ram
  3 sheep harvested (2 res, 1 nonres)
  - 1 "full-curl"or better
- 14A Chugach – 40 permits any ram
  9 sheep harvested, (8 res, 1 nonres)
  - 3 " full-curl" or better

Proposal 218

Effect of the proposal:

Modify season dates to allow residents earlier opportunity in Region II

No recommendation

Proposal 218

Issues & rationale

- Allocation issue
- Board failed similar proposal in March 2008

Proposal 209

Effect of the proposal:

Eliminate drawing hunts and return to a full curl bag limit and general season in GMUs 13D and 14A.

Do Not Adopt

Proposal 213

Effect of the proposal:

Change all sheep hunts to drawing permits and allocate a specific number of permits to nonresidents in Region II

Do Not Adopt

Proposal 213

Issues & rationale

- Allocation issue
- New drawing permit hunts authorized in 2007, first season of these hunts was 2008. We cannot evaluate this strategy with one year of data
- Do not support change to sheep management in R2 at this time.

Proposal 109

Effect of the proposal:

Establish nonresident drawing hunts for sheep in all of GMU 13 and GMU 14.

Do Not Adopt

Proposal 109

Issues & rationale

- Drawing hunts already exist in portions of 13 and 14
- Department would like additional time to evaluate drawing permit hunts before expanding areas or adding permit hunts

Proposal 184

Effect of the proposal:

Establish nonresident drawing hunts for sheep in GMU 14, and limit permits available

Do Not Adopt

Proposal 184

Issues & rationale

- Allocation issue
- 14A and 14C Chugach already under drawing permit, department would like additional time to analyze effects of drawing hunt
- Department does not see need to create additional drawing hunts in Reg. 2 at this time

Proposal 212

Effect of the proposal:

Limit nonresident permits for sheep in Region II.

No recommendation

Proposal 212

Issues & rationale

- Allocation issue

Proposal 214

Effect of the proposal:

Limit nonresident sheep harvest in Region II.

Take no action

Proposal 214

Issues & rationale

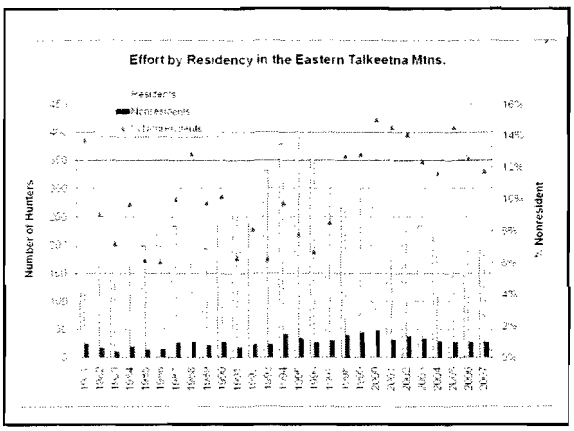
- Allocation issue
- How to administer?

PROPOSAL 108

- This proposal would do one of three things to sheep hunting regulations in GMU 13A:
  - -create harvest quotas for residents and nonresidents and allow ADF&G to close the individual seasons once quotas are met
  - -create an early and a late season and allow ADF&G to close the individual seasons once quotas are met
  - -allow nonresidents to hunt only under a drawing hunt permit

- **DEPT. RECOMMENDATION:**
  - **Do Not Adopt**

1 SLIDE



Proposal 210

Effect of the proposal:

Establish early season drawing permit for archery sheep hunt in Region II.

No recommendation

Proposal 210

Issues & rationale

- Allocation issue
- In many GMUs, harvestable surplus fully allocated
- Unclear if new permit hunts would encompass entire subunit or be restricted to to-be-determined area

Proposal 211

Effect of the proposal:

Establish late season drawing permit for archery sheep hunt in Region II.

Do Not Adopt

Proposal 211

Issues & rationale

- Conservation concern if passes as written, although success rate would likely be low
- In many GMUs harvestable surplus is fully allocated
- As written, would allow harvest of ewes which is prohibited in most hunts/GMUs due to declining populations

Proposal 106

Effect of the proposal:

Establish late season drawing permit for archery sheep hunt Oct. 1-10 in GMU 13D and 14A.

Do Not Adopt

Proposal 106

Issues & rationale

- Allocation issue, but in many areas harvestable surplus is already fully allocated.
- Existing (rifle hunt) permits would have to be reduced to maintain desired harvest level
- Will complicate evaluation of existing hunts

PROPOSAL 107

- This proposal would create additional archery-only drawing permits for sheep in 13D from 10 August – 15 October, with a bag limit of 1 full curl ram.

- **DEPT. RECOMMENDATION:**
  - **Do Not Adopt**

Proposal 217

Effect of the proposal:

Repeal sealing requirement for sheep in Region II.

Do Not Adopt

Proposal 217

Issues & rationale

- Similar proposal failed at statewide BOG meeting in 2008
- Sealing allows Dep't to collect important data
- Sealing allows Dep't hunter contact
- Hunters know animal will be checked for legality

Proposal 215

Effect of the proposal:

Require sealing of all rams harvested in Region II.

Adopt

Proposal 215

Issues & rationale

- Proposal will establish consistency in the sealing program across Region 2.
- Opportunity for the Dep't to obtain valuable data
- Opportunity for hunter contact

Proposal 219

Effect of the proposal:

Require sealing of all rams harvested in Region II.

Take no action (based on #215)

Proposal 180A RC 113

5 AAC 85.045(12). Hunting seasons and bag limits for moose

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 14(A)		
1 moose per regulatory year, only as follows:		
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side, by bow and arrow only; or	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17] (General hunt only)	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17]
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side; or	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20] (General hunt only)	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20]
1 antlerless moose by drawing permit only; up to 500 antlerless moose permits may be issued	Aug. 20 - Sept. 25 (General hunt only) Nov. 1 - Nov. 15 (General hunt only)	No open season.
Unit 14(B)		
1 bull per regulatory year, only as follows:		
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side, by bow and arrow only; or	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17] (General hunt only)	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17]
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side; or	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20] (General hunt only)	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20]

...

(14)

Unit 16(A)		
1 bull per regulatory year, only as follows:		
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side, by bow and arrow only; or	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17] (General hunt only)	**Aug. 20 - Aug. 28** [AUG. 10 - AUG. 17]
1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side; or	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20] (General hunt only)	**Sept. 1 – Sept. 25** [AUG. 20 - SEPT. 20]

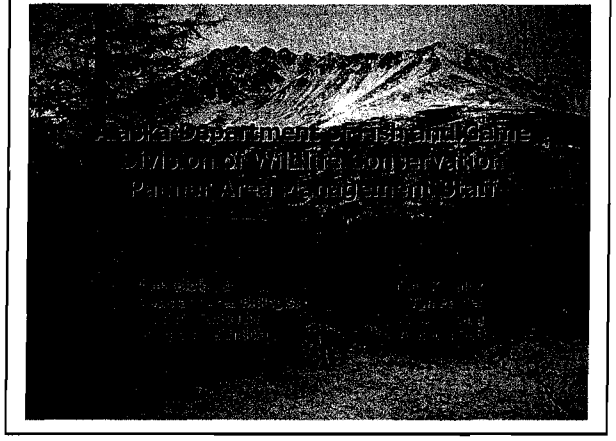
RC114

Board of Game

March 2005

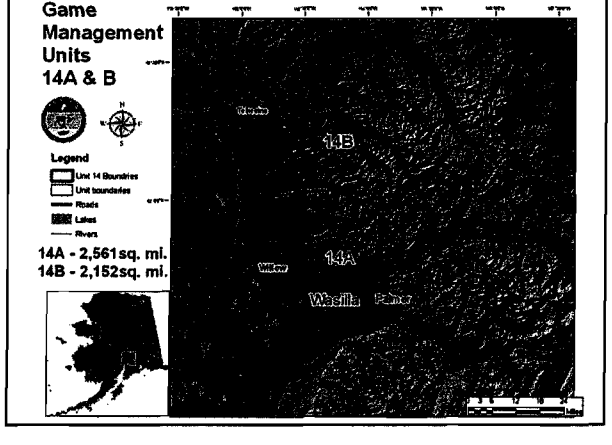
Palmer Area Office

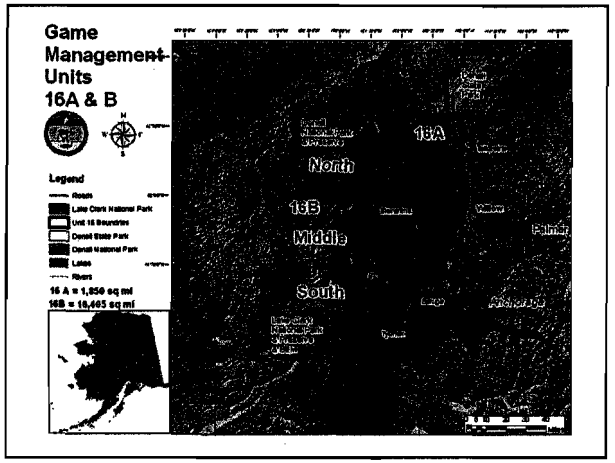
Proposal Review



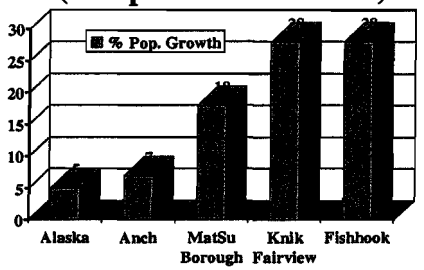
Palmer Area Issues

- **High growth in the Matanuska-Susitna valley**
- **Increased development impacts to wildlife**
- **Moose are our bread and butter species**
- **Predator populations and control activities require a significant amount of staff time**
- **High public service and front office work demand**
- **Road and Railroad moose collisions can impact moose numbers and staff time**
- **Increasing Potlatch moose requests from Anchorage and the valley areas**





Population Growth in 2000-2004 (compared to the state)



•Estimated Population of over 81,000 (Mat –Su Borough estimate)

•Estimated to be 240,000 by 2030!

Moose

- GMU 14A: Stable at or above objectives, high demand
- GMU 14B: Low pop. and harvest, higher bull:cow ratios
- GMU 16A: Low pop. and harvest, high hunting pressure due to access
- GMU 16B: Low pop and harvest, but improving populations in portions of unit, high bull:cow ratios, Tier II hunting in Unit 16B, Tier I this fall
- GMU 16B, Kalgin Island: Stable at high numbers, continues to provide either-sex opportunity with limited access

8 Proposals for Moose

Moose Population & Harvest Goals

GMU	Population	Harvest	Bull:100 Cow
14A	6000-6500	360-750	20-25
14B	2500-2800	100-200	≥ 20
16A	3500-4000	190-360	20-25
16B	6500-7500	310-600	20-25
16B-Kalgin	20-40	-	15

Current Moose Population Estimates

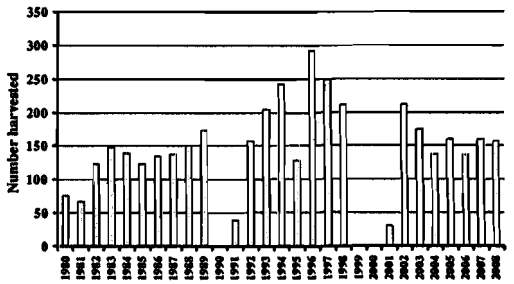
GMU	Estimate	Bull/100 Cows	Calves/100 Cows
14A	6,613	23	42
14B	1,412	30	21
16A	1,619	22	19
16B – N	917	57	12
16B – M	2,446	54	21
16B – S	-950*	78*	18*
16B Total	4312		

* Estimate and ratios based on 3 trend area counts

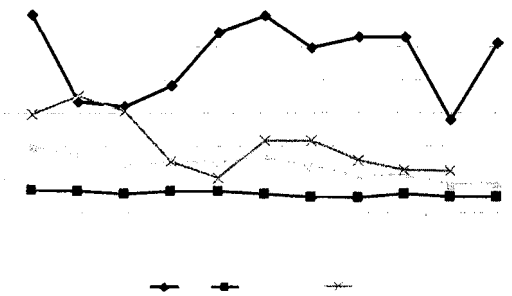
GMU 14A Antlerless Hunts 2008

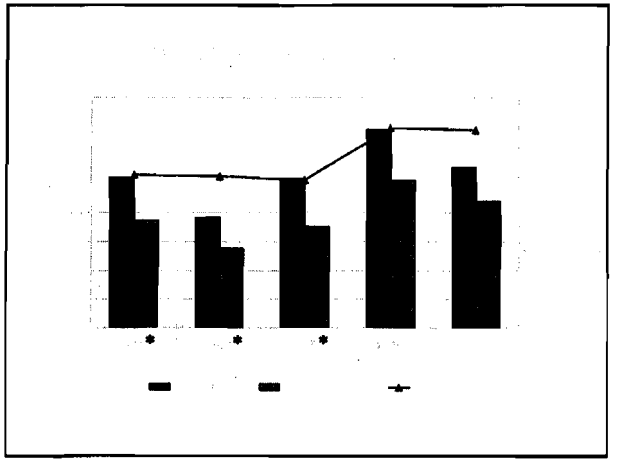
Hunt	Description	Permits	Harvest*
• DM400	Big Su – Redshirt Lake	20	8
• DM401	Big Su – Figure 8 Lake	10	6
• DM402	Point MacKenzie	40	21
• DM403	Big Lake	20	13
• DM406	Bald Mountain Ridge	40	23
• DM407	Matanuska River (North)	60	39
• DM408	Matanuska River (South)	50	24
• DM410	Knik River	30	20
• DM412	Point MacKenzie (Youth)	10	3
	TOTAL	280	157

Antlerless Moose Harvest, Unit 14A
1980-2008

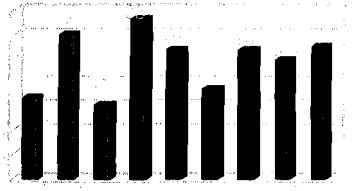


Matanuska Valley Moose Harvest 1998 - 2008



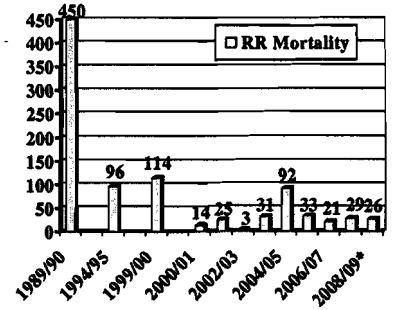


Road caused mortality of moose in 14A, 14B, and 16A



* as of March 3, 2009

Rail caused mortality of moose in 14A and 14B



* as of February 12, 2009

Proposals from the public for Moose

- Proposals to change the season dates for the general and archery hunting seasons
- Proposal to move archery moose seasons to after the rut
- Proposal to create new archery antlerless moose drawing hunts
- Proposal to eliminate non-resident archery season

Sheep

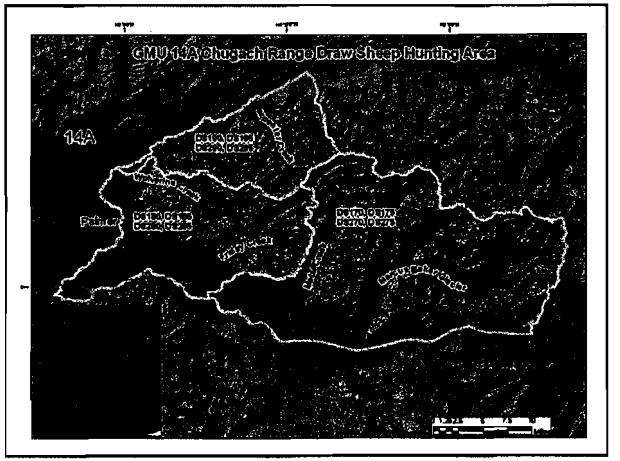
- Draw Permit hunt in the Chugach Range
- Alaska Range population low but maybe increasing?
- Talkeetna population is recovering from the winter of 2000
- Chugach population stable at low level (14A)
- Sealing of sheep for the first time in 2004

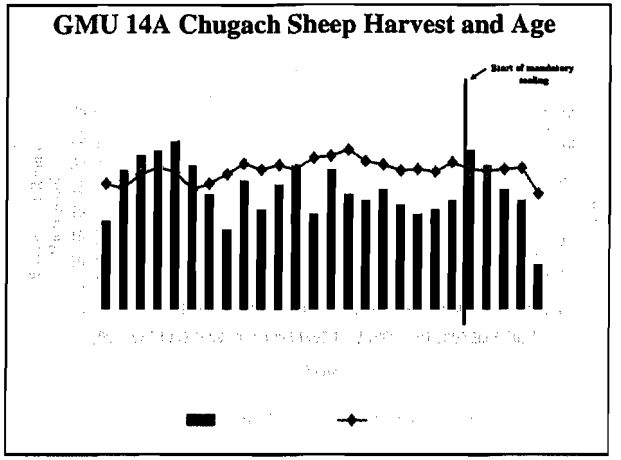
Proposals for Sheep

(addressed earlier in the BOG meeting)

Draw Hunts in 14A Chugach Range

- 14A Chugach subdivided into 3 hunt areas
- Season divided into two permit hunt periods
- Separate drawings for RES and NON-RES
- No horn restrictions – "any ram" bag limit
- 40 Permits (36 RES, 4 NR) given for Fall 2008
- 28 Reported hunting (25 RES, 3 NR)
- 9 Rams harvested (1 by NR)
- 6 Rams less than full curl, 2 Rams less than 3/4





Proposals from the public for Sheep

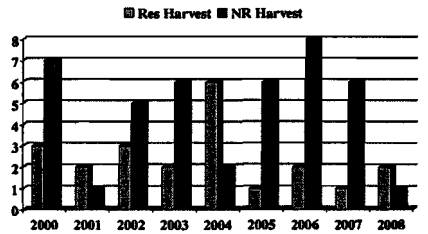
- Proposal to make the Talkeetna area of 14A and/or 14B a draw hunt for non-residents
- Related proposals for sheep covered by other ADFG staff during this meeting

Mountain Goat

- Talkeetna population unknown
  No hunting season at this time
- Chugach population stable to increasing
  New Drawing hunt DG 866 in 2008
  (formerly RG 866)

No Proposals

Goat Harvest for RG866/DG866

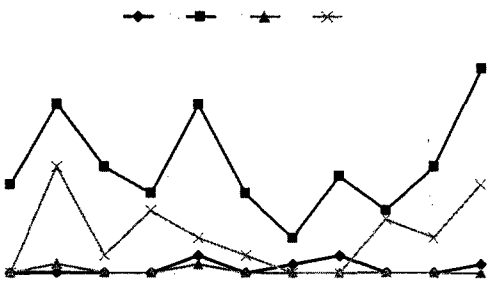


Caribou

- Rainy Pass (16B) herd stable (declining?)
  General Season (1 Bull)
- Talkeetna population small (est. 300)
  Drawing hunt DC 590

1 Proposal

Caribou Harvest



Black Bear

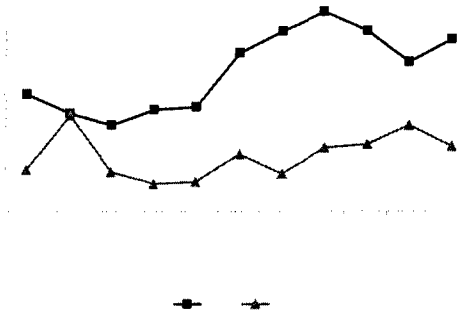
- Population undetermined for 14A, 14B however nearby surveys allow for a decent estimate
- Estimated 2500 to 3500 in Unit 16
- Increased harvest opportunity in 2006
- Predation on moose calves an issue
- Unit 16 Black Bear Control in 2007/08

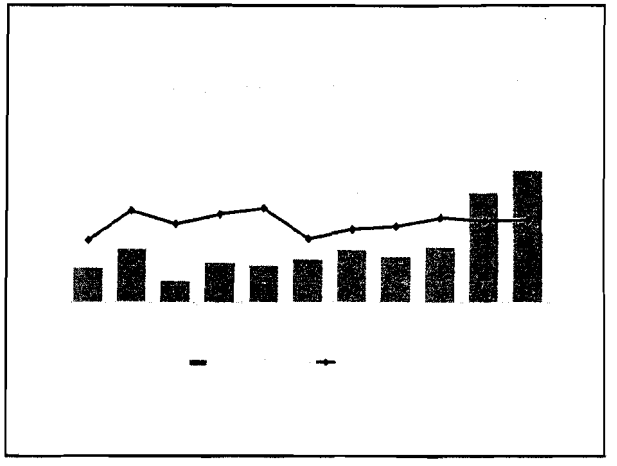
11 Proposals for Black Bear
(including control)

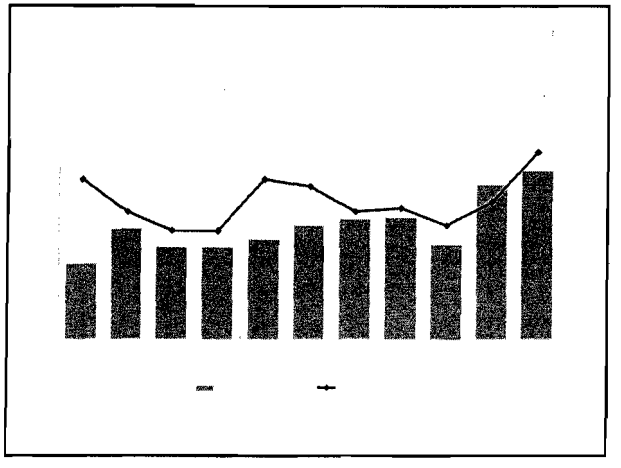
Black Bear Population Estimates

14A	250 - 500
14B	200 - 450
16A	400 - 500
16B	2500 - 3000

GMU 14 Black Bear Harvest 1997 to 2007







Proposals from the public regarding the Black Bear control program

- Proposals to add snaring and/or trapping
- Proposals to allow the use of helicopters to ferry control permittees to and from bait stations
- Proposals to allow non-residents and/or children to participate in the program
- Proposal to allow bear baiting through the summer for the Unit 16 Black Bear Control program

Brown Bear

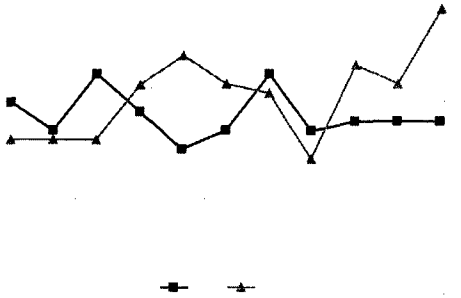
- Population uncertain
- Increased harvest opportunity in 2005
- Predation on moose a concern
- Growing bear viewing industry in southern 16B
- Few nuisance bear complaints near communities

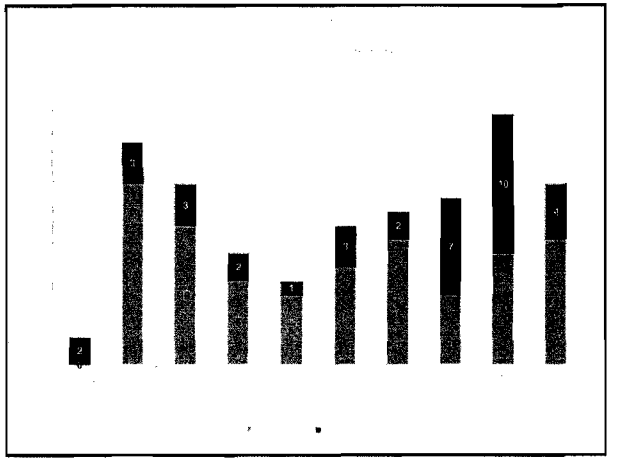
3 Proposals

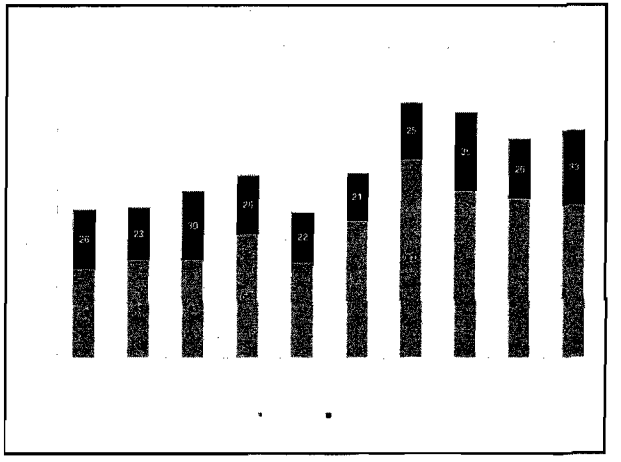
Brown Bear Population Estimates

14A	30 – 60
14B	90 – 130
16A	100 - 150
16B	625 - 1250

GMU 14 Brown Bear Harvest 1997 to 2007







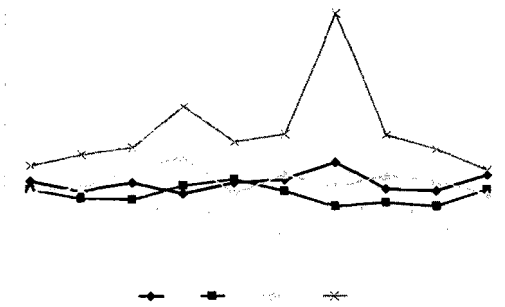
GMU 16B Brown Bear Skull Size

Wolf

- Reduced numbers (Unit 16 PCA) since 2003
- Stable to increasing (Unit 14A and 14B)
- Predation on moose a concern
- SDA Wolf Control in Unit 16B from 2005
- SDA Wolf Control Area expanded to include portions of Unit 16A Spring 2006

2 Proposals

Wolf Take 1998 to 2007



Furbearers (other than wolves)

- Most species stable to increasing harvest
- Issued 19 nuisance beaver control permits last year
- Higher reported harvest of wolverine and otter during recent years
- Lynx Harvest Tracking Strategy

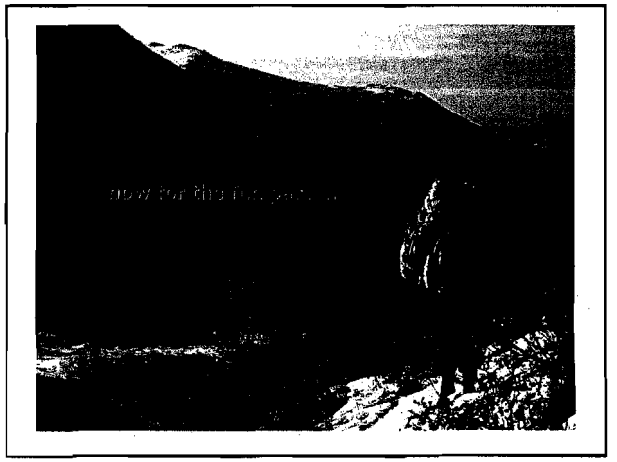
1 Proposal

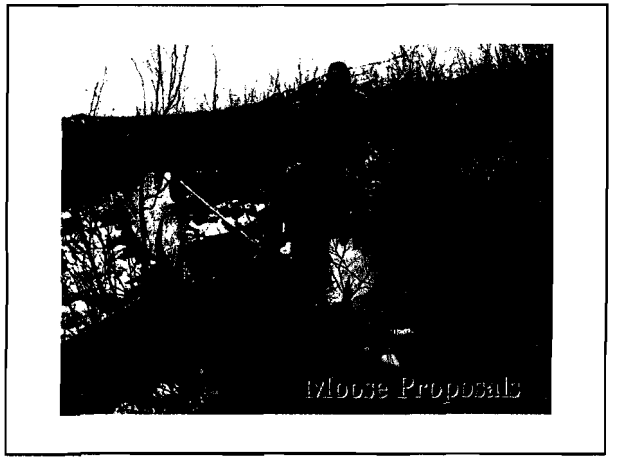
Habitat Enhancement Activities

- Matanuska Moose Range ADF&G/Ruffed Grouse Society habitat enhancement project
- Division of Forestry proposed timber sale activities
- Mat-Su Borough and private timber sale activities
- Demand for valley firewood and saw logs for milling
- Miller's Reach Fire (Big Lake) – major moose wintering area

Department Proposals

- Regulation language clarification for Palmer-Wasilla Management Area
- Antlerless Moose Permit hunt reauthorizations for 14A and Kalgin Island
- Review of some intensive management options to be used by the Department of Fish and Game





Proposal 181

Change the general moose season for moose in GMU 14A, 14B, and 16A from 8/10 – 8/17 to 8/22 -8/30 for archery and from 8/20 – 9/20 to 9/1 – 9/30 for general season

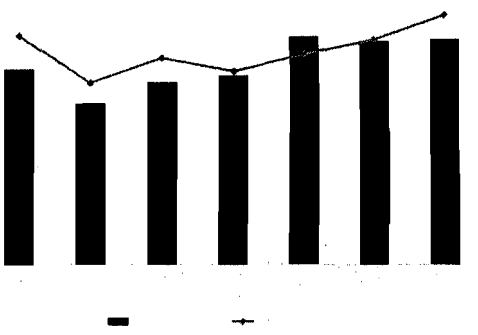
Take No Action

Proposals 180, 181, 179, 177

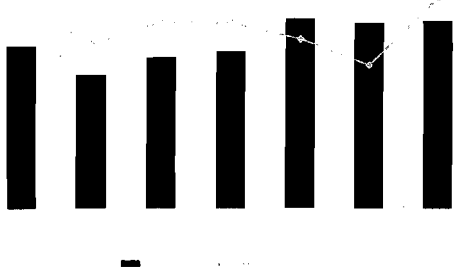
Issues and Management Considerations

- Hunts that coincide with the rut can disrupt breeding during the first estrus
- If the bull to cow ratio is low (e.g. 14A) this disruption could have a negative impact on breeding and recruitment
- Concerns about existing long seasons in Mat-Su GMU's
- More illegal harvest suspected during expanded seasons
- Late season hunts stress already weakened bulls
- Bull Moose are more vulnerable during late season hunts

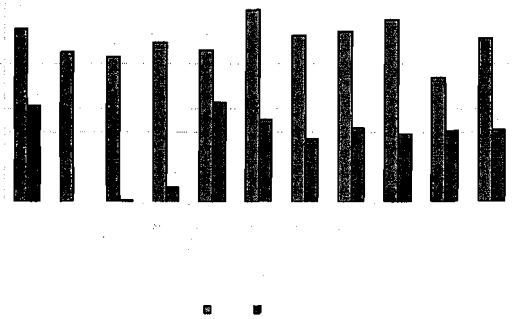
Proposals 180, 181, 179, 177



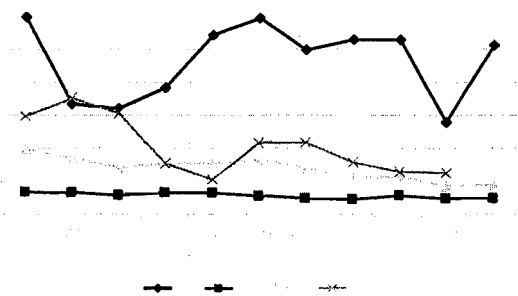
Proposals 180, 181, 179, 177



Proposals 180, 181, 179, 177



Matanuska Valley Moose Harvest 1998 - 2008



Proposal 180

Change the general moose season for moose in GMU 14B, and 16A from 8/20 – 9/20 to 9/1 -9/25 and archery season from 8/10 – 8/17 to 8/20 – 8/28

Amend and Adopt

Amend to include GMU 14A

Proposal 177

Make some of the antlerless permits in GMU 14A archery only

No Recommendation

Proposal 176

Move the archery hunt for moose in GMU 14B from 8/10 – 8/17 to 9/23 – 9/30

Do Not Adopt

Proposal 179

Change archery season in GMU 14A and 14B from 8/10 – 8/17 to 11/1 – 11/7

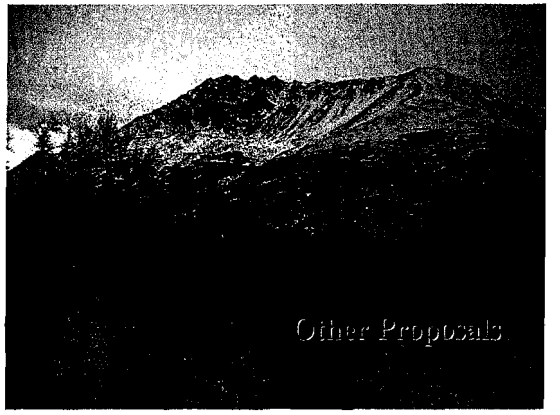
Do Not Adopt

Proposal 182

Eliminate Non-resident archery season for moose in GMU's 14A, 14B, and 16B

No Recommendation

Allocation issue, however only 2 moose have been taken during the archery season by non-residents in the past 20 years in these units.



Proposal 175

Change the caribou season in Unit 16B from August 10 to September 30, to August 10 to October 5

Do Not Adopt

Proposal 175

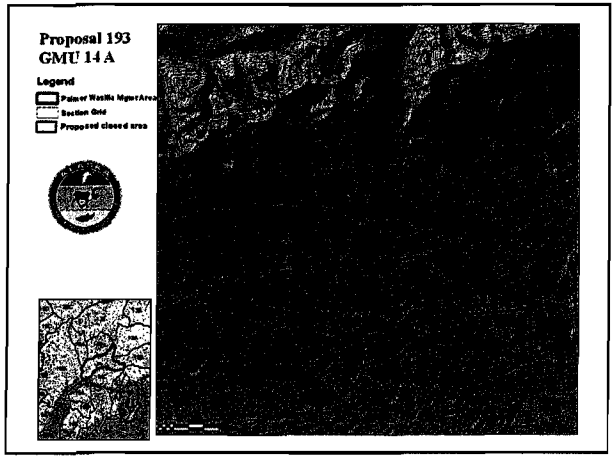
Issues and Management Considerations

- **No population information to suggest they can support a longer season**
- **GMU 19 Area Biologist does not support an increase in season length**
- **October closing date gets into the rut which effects meat quality.**

Proposal 193

Prohibit the use of vehicles in the area known as Government Peak in Hatcher Pass State Park, GMU 14A

No Recommendation

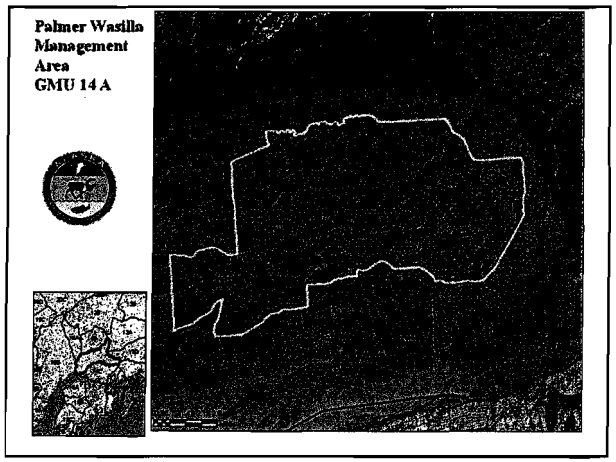


Proposal 191

Clarify the definition of firearms allowed for hunting and trapping in the Palmer-Wasilla Management Area

Adopt

Mat Valley AC 13 0 0

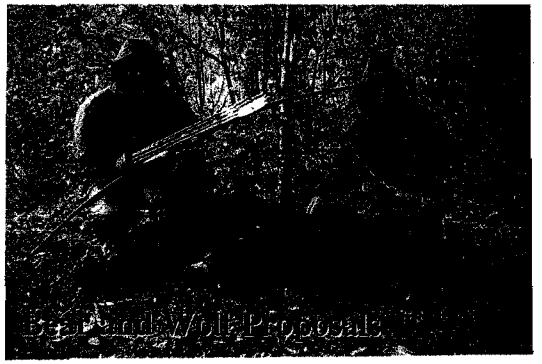


Issues and Management Considerations

- **Current definition in regulation was intended to limit hunters to "short range" firearms**
- **The limitation of firearms was intended to reduce the potential for problems with the discharge of firearms in the higher density housing and developed areas of the greater Palmer-Wasilla area**
- **Under the definition of methods allowed for the taking of furbearers under a trapping license, modern firearms such as .22 caliber rim-fire rifles and handguns as well as high-powered rifles are legal**
- **The existing language does not allow for the taking of deleterious exotic wildlife such as starlings, pigeons, and rats**

Proposed Regulation Language

- **Include <u>deleterious exotic wildlife</u> in the animals that may be taken by muzzleloading black-powder firearm, shotgun, air rifle, falconry, or bow and arrow;**
- **Insert <u>furbearers taken on a trapping license by methods other than by trapping or snaring may be taken by muzzleloading black-powder firearm, shotgun, air rifle, falconry, or bow and arrow only;</u>**

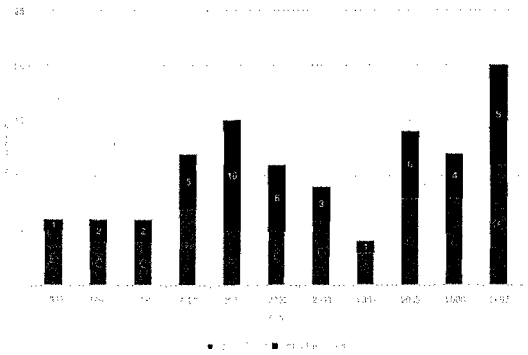


Proposal 172

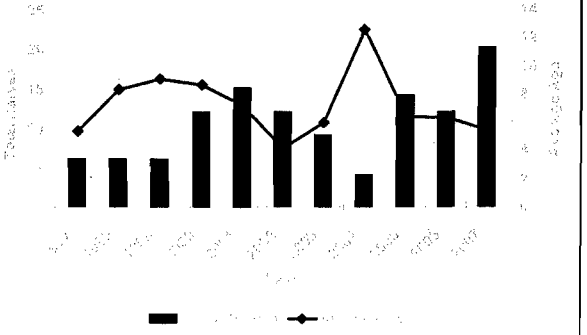
Change the brown bear bag limit in 14B from 1 bear every 4 years to 1 bear per year

No Recommendation

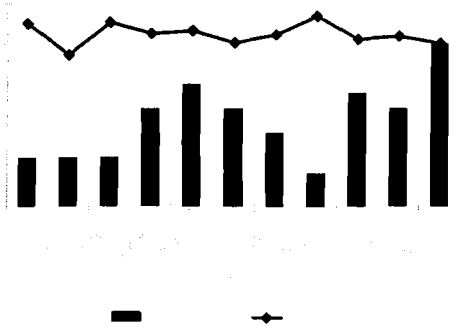
Brown Bear Harvest for Unit 14B 1997 - 2007



Average Age of Brown Bears Taken in Unit 14B



Average Skull Size of Brown Bears Taken in Unit 14B



Proposal 172

Issues and Management Considerations

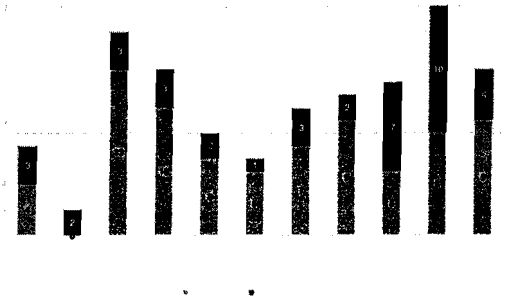
- **Unit 14B has a significantly reduced moose population**
- **Unit 14 has met or exceeded the brown bear harvest objective of 10 to 15 bears for several years**
- **Management objectives for Unit 14 will be reviewed with an eye toward addressing individual subunits**
- **The department does not have population data for Unit 14B, however nuisance complaints, and reports by guides, hunters, and anglers indicate a healthy brown bear population**

Proposal 173

Change the brown bear season in GMU 16A from September 1 to May 31, to August 10 to May 31 (Change starting date from Sept 1 to Aug 10)

Adopt

Brown Bear Harvest for Unit 16A 1997 - 2007



Proposal 173

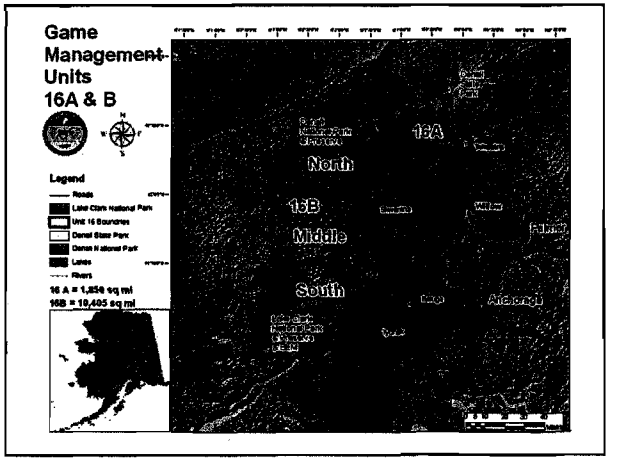
Issues and Management Considerations

- **Unit 16A has a significantly reduced moose population**
- **The earlier starting date would align the brown bear season with adjacent Unit 16B**
- **There is a desire by the public to optimize opportunities for taking brown bears during existing big game seasons**
- **Our population estimate combined with nuisance complaints, and reports by guides, hunters, and anglers indicate a healthy brown bear population.**

Proposal 174

Within the Denali National Preserve portion of Unit 16B change the brown bear bag limit from 2 bears per year to 1 every 4 years, and change the season dates from 8/10 – 5/31 to 9/1 – 5/25

<u>Do Not Adopt</u>



Proposal 174

Issues and Management Considerations

- **No hunter in the past 20 years has taken more than one brown bear in the area**
- **No hunter has taken a bear in the preserve during the expanded season**
- **Creating different season and bag limits inside and outside of the preserve unnecessarily creates regulations and confuses hunters**

Proposal 186

Reduce the bag limit for hunting wolves in the Denali Natural Preserve portion of 16B from 10 wolves to 5 wolves

Do Not Adopt

No hunter has taken more than 4 wolves in any part of 16B

Proposal 185

Align Unit 16 wolf and coyote trapping season with Unit 13 (October 15 to April 30)

Adopt

Proposal 185

Issues and Management Considerations

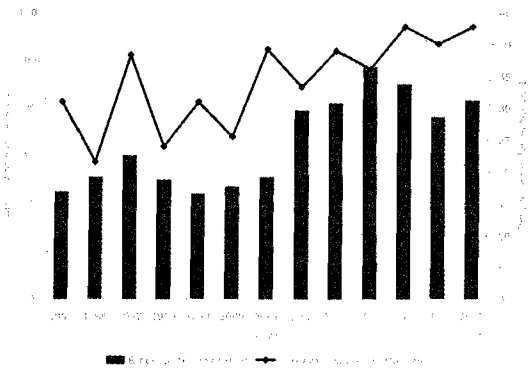
- This proposal would align the trapping season dates with Unit 13 and reduce trapper confusion, especially in 16A and 13E
- There is a desire from the public to increase opportunity to take wolves and coyotes to help reduce predation on big game
- Trappers who trap along the border area between 13E and 16A would directly benefit in an area where there is good access
- In most years there is not enough snow or sufficient ice on rivers to allow mid-October access to Unit 16

Proposal 167

Raise the black bear limit in GMU 14A from 1 bear per year to 3 bears per year

Do Not Adopt

GMU 14A Black Bear Harvest and Percent Females

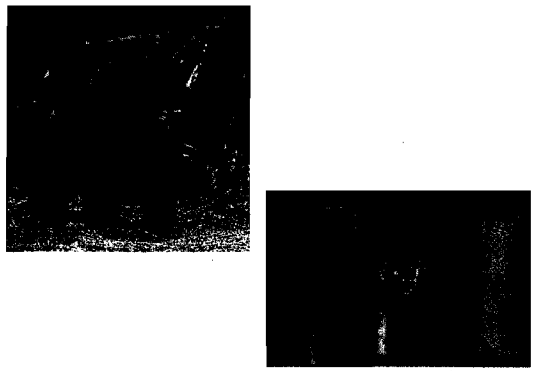


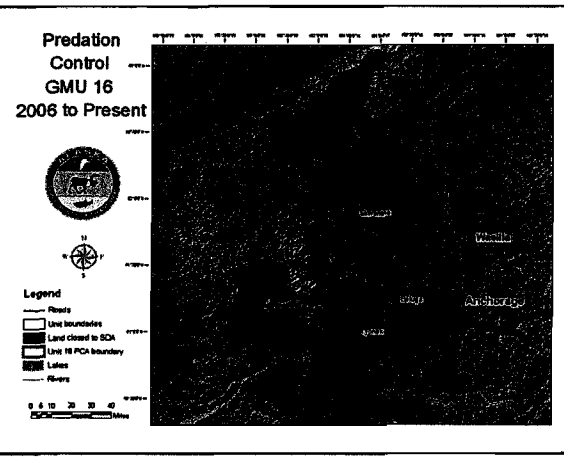
Proposal 167

Issues and Management Considerations

- No biological data or justification to raise the limit
- No closed season and 1 bear limit provides ample opportunity while minimizing nuisance complaints
- Moose population is above objective with excellent calf: cow ratios
- Would draw hunters away from the control program in Unit 16B

Predator Control in Unit 16





Unit 16 PCA Wolf Harvest & Statistics

Year	Fall Estimate	Harvest and SDA	Spring Estimate	Population objective
2004-05	180-200	115	65-85	22-45 (16B)
2005-06	85-114	42	43-72	22-45 (16B)
2006-07	98-145	47	51-98	30-60 (16)
2007-08	105-113	33	72-80	30-60 (16)
2008-09	83-111 *	23 *	?	30-60 (16)

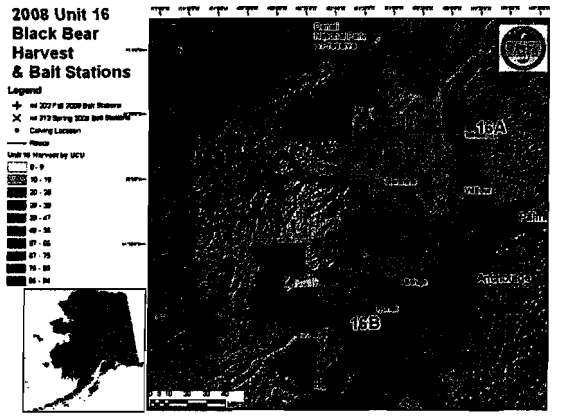
* Reported as of 3/5/2009

Unit 16 Black Bear Control Program

- Black Bear Control Permits issued to licensed residents
- No bag limit and no closed season
- Allow for up to four bait stations per control permit
- Allow for the taking of cubs or sows with cubs
- Permittees may take black bears the same day they have flown, provided that they are at least 300 feet from the airplane
- Raw hides, tanned hides, or skulls may be sold with an ADFG issued permit to sell as long as the sale tag remains attached

Black Bear Control since Fall 2007 .....

- Issued 283 ML202 Control Permits - Fall 2007
- Issued 487 ML212 Control Permits - Spring 2008
- Issued 233 ML202 Control Permits – Fall 2008
- Tracking numbers of bears taken complicated
  - Male or Female, adult, yearling, COY
  - By GMU (16B,16A) and PCA (inside, outside)
  - Taken on general hunting license or Control Permit
  - Over bait or other method (includes SDA w/Control Permit)
  - Sale Permit issued or not requested
- Requires cooperation of DWC in Anchorage, Soldotna, and Homer
- Reviewing sealing reports from taxidermists and other fur-sealers
- Assistance from Mike Harrington, Lynn Delane, and Sean Farley



Recent Bear Harvest and Take

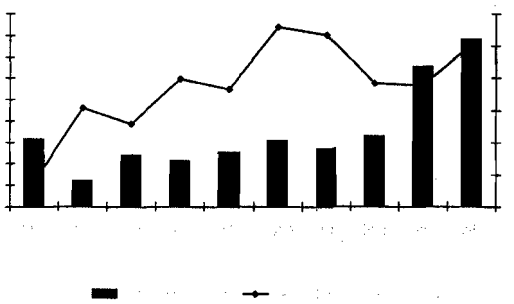
2005-2006	Unit 16 total black bear harvest (General Hunt harvest only)	235
2006-2007	Unit 16 total black bear harvest (General Hunt harvest only)	414
* Mar 2007	BOG – Approved Black Bear Control *	
2007-2008	Unit 16 total black bear take (Gen Hunt and Control take combined)	501
Fall 2008	Unit 16 total black bear take (Gen Hunt and Control take combined)	121

Black Bear Harvest and Control Take

Fall 2007 and Spring 2008

- 501 Black Bears taken in Unit 16
- 400 in GMU 16B, 101 in GMU 16A
- 144 Control vs. 357 General Harvest
- 405 Resident vs. 96 Non-resident
- 338 Males, 154 Females, and 8 COY
- 251 Taken over bait vs. 250 other methods
- 34 Sale permits issued

GMU 16B Black Bear Harvest and Predator Control take 1998 to 2007

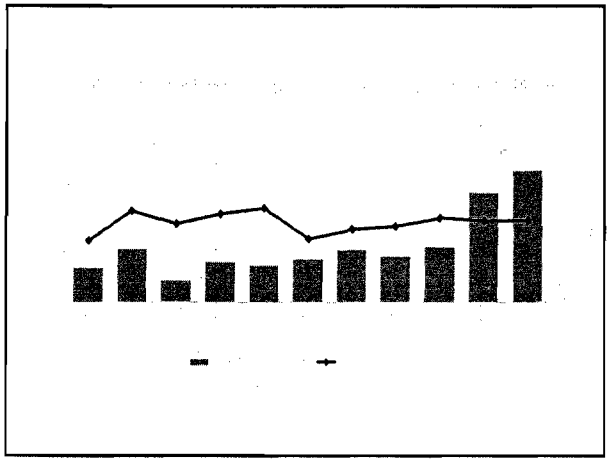


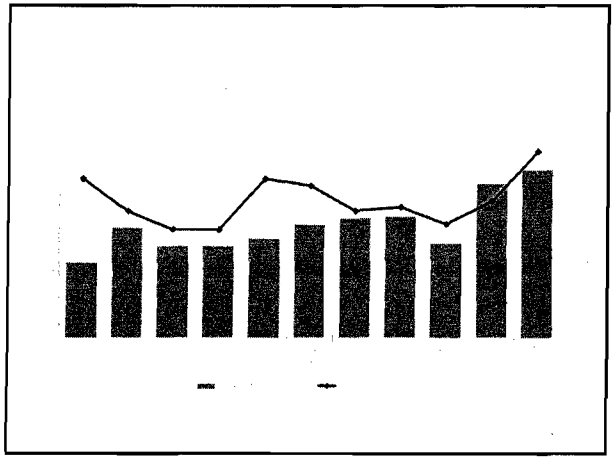
Bear Management Objectives for GMU 16

- Maintain a black bear population largely unaffected by human harvest
- 3-year average harvest > 270 black bears (45 in 16A, >225 in 16B) with > 30% being female

Black Bear Population Estimates

16A	400 - 500
16B	2500 - 3000





Presentations

Mark Keech

Bruce Dale

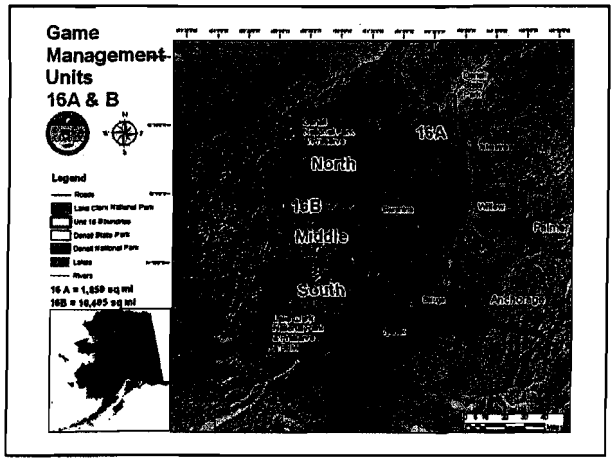
Proposal 188

Combine population and harvest objectives for GMU's 16A and 16B to 10,000 – 11,500 and a harvest objective of 500 to 960

Do Not Adopt

Moose Population Objectives and Harvest Goals for 16A, 16B, and combined 16A & B

GMU	Population	Harvest
16A	3500-4000	190-360
16B	6500-7500	310-600
Combined 16	10,000- 11,500	500-960



Proposal 188

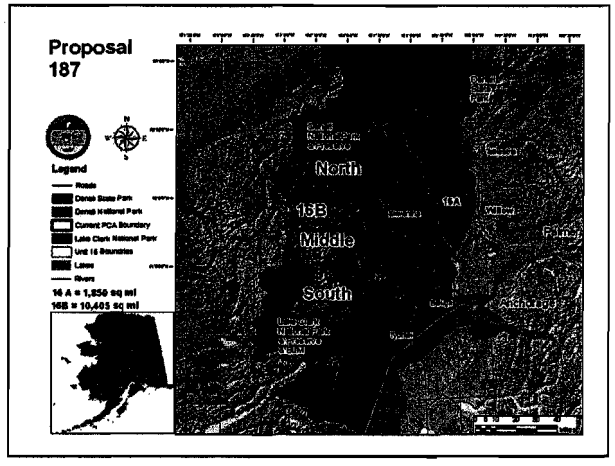
Issues and Management Considerations

- Unit 16B is identified primarily for subsistence to include a winter Tier II moose hunt; unit 16A is managed with a general season hunt that includes non-residents
- Unit 16B off of the road system, remote, and generally accessed using airplanes and/or boats; unit 16A is accessible off of the Parks Highway and has several roads and communities in the eastern portions of the unit
- Combining objectives will not aid in population recovery and may hinder management efforts in the future
- There is no reason to believe that recovery in one subunit would preclude recovery in the adjacent subunit

Proposal 187

Expand the predator control area for black bears to include all of Unit 16A

Do Not Adopt



Proposal 187

Issues and Management Considerations

- **Expansion into populated parts of the unit may result in conflicts between permittees and land owners**
- **Permitted activities conducted next to the Parks Highway, other roads, and developed areas may result in public relations issues and erode support for the program**
- **Currently there remains underutilized opportunity for black bear baiting in Unit 16A outside of the predator control area**
- **The current PCA was intended to focus on the 16B moose and wolf populations**
- **The percent of females in the harvest is increasing**

Proposal 189

Allow the use of helicopters to access bait stations and camps, and allow baiting all summer.

Take No Action

Based on the rationale in the A&R and the action the Board takes on proposal 168.

Proposal 169

Allow youth under 16 to participate in predator control under the direct supervision of a permit holder

Take No Action

Based on action taken in proposal 168

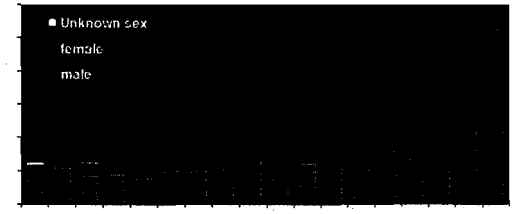
Proposal 168

Allow the use of helicopters in PCA, no closed baiting period, youth under 16 may participate under the permit of a parent or guardian, participants can hunt on each others bait sites, non-residents may be permitted to participate in the program

Amend and Adopt

Current Black Bear Control Program

- All participants must have a control permit
- No bag limit, no closed season, residents only
- Allow for the taking of cubs or sows with cubs
- Allow for up to four bait stations per permittee
- Permittees may take black bears the same day they have flown, provided that they are at least 300 feet from the airplane
- Raw hides, tanned hides, or skulls may be sold with an ADFG issued permit to sell as long as the sale tag remains attached

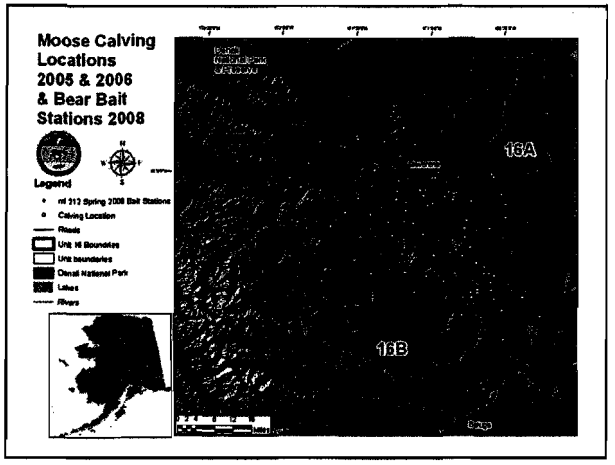


* Current estimate of black bears reported sealed as of 2/6/2009

Proposal 168

Issues and Management Considerations

- Helicopter use would be allowed under additional guidelines including a separate permit for pilots. This would allow access to otherwise inaccessible areas to take bears.
- Continuation of bear baiting in July and August will allow for the taking of more bears especially females that tend to come to bait stations later in the season.
- Resident youth participation would be supported as long as they were accompanied by a permitted adult. Bears would be recorded and sealed as part of the permittees reported control bear take.



Proposal 168

Issues and Management Considerations (cont.)

- **The department supports permittees taking bears over another permittees registered control bait station as long as there is written permission and the person using the other's site does not independently participate in establishing or maintaining the site.**
- **The department is opposed to the participation of non residents in any control program because of the similarity in non-resident costs associated with sport hunting and control activities (i.e. non-resident license and tag fees, transportation costs, etc.)**

Proposal 192

Allow the use of helicopters for bear and wolf control

Adopt

Proposal 192

Issues and Management Considerations

- **The department supports additions to regulatory language in order to provide additional options for conducting predation control activities in Intensive Management Areas**
- **Any permits issued should be done so according to the recommendations described by the Department and as outlined in the A&R for Proposal 168**

Proposal 190

Review the intensive management options to be used by the Department of Fish & Game or contracted government agents of the department

Adopt?

Proposal 190

Issues and Management Considerations

- **The Department is presenting these additional methods to be discussed as alternatives for predation control activities in areas identified for Intensive Management**
- **These methods are intended as tools to boost prey populations where no other options are available or sufficient to achieve the desired goals**
- **The department supports additions to regulatory language in order to provide additional options for conducting predation control activities in Intensive Management Areas**

Proposal 166

Modify Unit 16 Black Bear Control to be open all summer, reduce the distance from bait stations to cabins to 600 feet, allow the taking of black bears with snares, and allow the taking of up to 2 brown bears at black bear bait stations.

Do Not Adopt

Proposal 166

Issues and Management Considerations

- **Snaring to be addressed in proposals 170 and 171**
- **Expanded bear baiting season in Unit 16 addressed by the Board in proposal 168**
- **600 feet may be too close and increase the likelihood of nuisance bear conflicts for area residents and recreational cabin owners**
- **There is currently no brown bear control program in 16, black bears are believed to be largely responsible for current moose predation, and brown bear harvest is currently high and believed to be effecting the brown bear population**

Proposal 171

Allow the use of traps for black bear control in Unit 16

Take No Action

Based on the rationale in the A&R and action the Board makes on proposal 170.

Proposal 170

Amend the regulations to allow the use of traps and snares for predator control

Amend and Adopt

Proposal 170

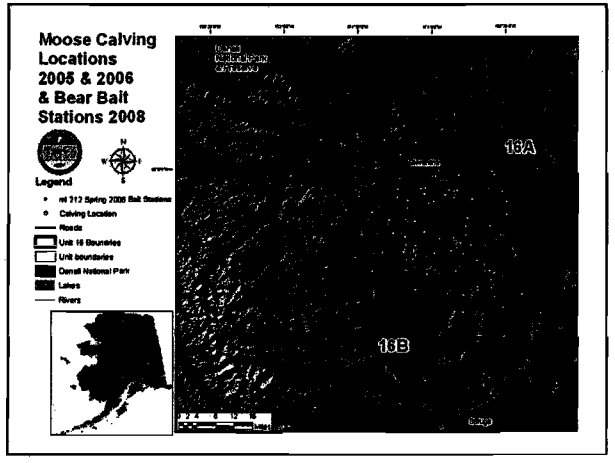
Issues and Management Considerations

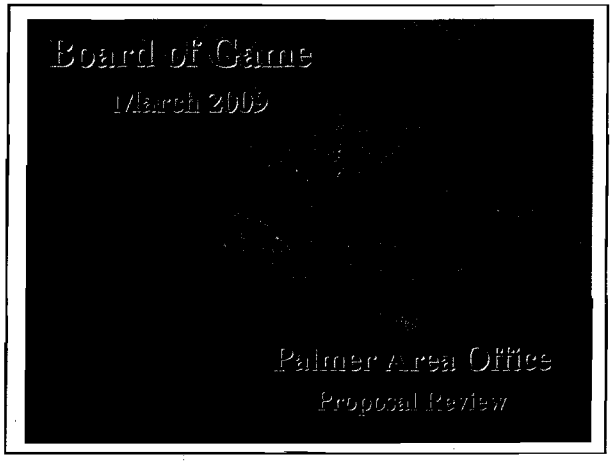
- **This proposal outlines regulatory language to allow the department and / or others to participate in trapping or snaring black bears for the purposes of predation control.**
- **In order to increase the recruitment of moose calves in Unit 16, a substantial decrease in the black bear population is warranted. In order to achieve this decrease non-traditional measures of population reduction are being considered.**

Proposal 170

Issues and Management Considerations (continued)

- **This proposal would allow selected individuals or contracted professionals to take black bears with snares after receiving specific training from ADFG.**
- **Protocols and permit conditions would be developed to address methods and means, as well as how to handle non-target catches.**


Moose Calving Locations 2005 & 2006 & Bear Bait Stations 2008
Legend
Calving Location
Roads
Unit 16 Boundary
Unit boundaries
Denali National Park
Lakes
Rivers
16A
16B


Board of Game
March 2009
Palmer Area Office
Proposal Review

RC 115

Unit 19A Wolf Predation Control Implementation Plan and Activities
Division of Wildlife Conservation Report to the Alaska Board of Game
March 2009

Background

Prior to 2004, the Central Kuskokwim Fish and Game Advisory Committee had expressed concern to the Board about declining moose numbers in both Units 19A and 19B. The committee submitted several regulation proposals and recommended wolf predation control to halt the decline of the moose population and boost moose numbers in the area. In response to the concerns of the advisory committee and other users, the Alaska Department of Fish and Game initiated a comprehensive planning process for the area with a citizen based planning committee composed of a broad cross-section of stakeholders in Units 19A and 19B wildlife management. Upon reviewing information on the moose populations the majority of the Central Kuskokwim Moose Management Planning Committee agreed:

> ***"There is a major concern that the moose populations in Units 19A and 19B will not meet the needs of local subsistence users and other consumptive users. Local observations and available scientific data indicate that the moose population has substantially declined and in some areas is very low and will continue to jeopardize subsistence and other uses."***

The Central Kuskokwim Moose Management Plan was developed by the planning committee and is a comprehensive plan for the area that included a recommendation for a wolf predation control program for Units 19A and 19B. The control program is one component of a multifaceted plan to rebuild the moose populations in the Central Kuskokwim region. The planning committee recommended that the first priority for wolf predation control efforts should be the areas most important for providing moose for subsistence uses. Unit 19A is where the majority of subsistence moose hunting by local residents and residents of Unit 18 occurs.

A wolf control implementation plan was first adopted by the Board of Game in March 2004 for the Central Kuskokwim and consisted of Units 19A and 19B. It was approved for 5 years and began on July 1, 2004. The Board authorized the commissioner to issue public aerial shooting permits or public land and shoot permits for Unit 19A only as methods of wolf removal pursuant to AS 16.05.783. In January 2006, the Board adopted a revised implementation plan in the form of an emergency regulation. The emergency regulation limited control activities to Unit 19A to make it consistent with the Board's previous findings that implemented wolf control in Unit 19A only. Also, the emergency regulation clarified and updated key components of the plan that included: wildlife population and human use information, predator and prey population levels and objectives, plan justifications, methods and means, time frame for updates and evaluations, and miscellaneous specifications. In May 2006, the Board further modified the emergency regulation and adopted it as a final regulation. Authorization to issue

public aerial shooting permits or public land and shoot permits was reaffirmed, and the following prey and predator population estimates and population objectives were specified.

- 2006 moose population: 2,700–4,250
- Moose population objective: 7,600–9,300.
- Fall 2004 precontrol wolf population: 125–150
- Wolf population control objective: 30–36

Plan Implementation Activities

2007–2008 CONTROL PROGRAM

We conducted control activities during regulatory year (RY) 2007–2008 in Unit 19A under authority of the wolf control implementation plan adopted by the Board in May 2006 (regulatory year begins on July 1 and ends June 30, e.g., RY07 = July 1, 2007–June 30, 2008). During RY07, we had received 87 applications for public wolf control permits and issued 53 permits, 19 to pilots and 34 to gunners. The control program was in effect during November 1, 2007–April 30, 2008. To achieve the upper end of the control objective (30–36) we needed to remove 30–57 wolves. This was later revised based on a February survey to 38 wolves. By the end of the program, we removed 24 wolves from Unit 19A including 9 wolves through normal hunting and trapping methods and 15 wolves through wolf control efforts (Table 1).

Table 1. Wolf harvest and wolf control take in Unit 19A, RY01–RY06.

Regulatory Year	Hunting and Trapping Harvest	Wolf Control Take	Total Kill
2001–2002	49	-	49
2002–2003	25	-	25
2003–2004	30	-	30
2004–2005	29	43	72
2005–2006	33	47	80
2006–2007	3	7	10
2007–2008	9	15	24

2008–2009 CONTROL PROGRAM

We are conducting control activities during RY08 in Unit 19A under authority of the wolf control implementation plan adopted by the Board in May 2006. As of February 16, 2009, we had received 68 applications for public wolf control permits and issued 31 permits, 13 to pilots and 18 to gunners. The control program will be in effect during November 1, 2008–April 30, 2009 or until the wolf population is reduced to the control objective of 30–36 specified in the in the May 2006 plan. To achieve the upper end of this objective we need to remove 48–54 wolves. As of February 16, 2009 3 wolves had been reported taken in Unit 19A.

Status of Prey and Predator Populations

MOOSE POPULATION

Population Composition. In November 2005, we conducted composition surveys in central Units 19A and B in the Holitna–Hoholitna drainage and in western Unit 19A in the Aniak drainage including the Kuskokwim River from Lower Kalskag to Napaimiut. In central Units 19A and B, a total of 307 moose were observed and the bull:cow ratio was 8:100 with most bulls classified as yearlings (12 of 19). The calf:cow ratio was 24:100. The low bull:cow ratios observed during this and past composition surveys indicate that hunting pressure has been high in this area. In western Unit 19A, a total of 410 moose were counted, with a bull:cow ratio of 20:100 and a calf:cow ratio of 23:100. No composition surveys were completed during November 2006 because survey conditions were unsuitable, and current data are insufficient to evaluate the effect of the wolf control program on the moose population. Composition surveys are planned for November 2007 if survey conditions are suitable.

In May 2007, we conducted twinning surveys in Unit 19A in the Aniak and Holitna River drainages. In the Aniak drainage, too few moose were located to provide for a meaningful analysis. In the Holitna River drainage, we located 71 moose, with 7 of 11 litters produced twins (64% twinning rate).

In November 2007, we conducted composition surveys in the Aniak drainage including the Kuskokwim River from Aniak to Lower Kalskag and in the Holitna drainage within the Holitna, Titnuk, and Hoholitna Rivers beginning at the southern part of the Macar Hills (labeled Kulukbuk Hills on the map) and ending approximately 10 miles south of Sleetmute. In the Aniak survey we found 122 moose, including 68 cows, 35 calves (including 6 sets of twins and one set of triplets; 51 calves:100 cows), and 28 bulls:100 cows. In the Holitna survey, we found 200 moose, including 111 cows, 50 calves (including 9 sets of twins; 45 calves:100 cows), and 35 bulls:100 cows.

In November 2008, we conducted composition surveys in the Aniak drainage including the Kuskokwim River from Aniak to Lower Kalskag and in the Holitna drainage within the Holitna, Titnuk, and Hoholitna Rivers beginning at the southern part of the Macar Hills (labeled Kulukbuk Hills on the map) and ending approximately 10 miles south of Sleetmute. In the Aniak survey we found 51 moose, including 31 cows, 7 calves (including 1 sets of twins; 23 calves:100 cows), and 42 bulls:100 cows. This sample size is less than ideal. In the Holitna survey, we found 117 moose, including 77 cows, 21 calves (including 3 sets of twins; 27 calves:100 cows), and 34 bulls:100 cows.

Population Size. In March 2006, we estimated 2,700–4,250 moose (0.27–0.42 moose/mi^2) were present in Unit 19A. This estimate was corrected for moose sightability and was based upon extrapolation of population estimation surveys conducted in the entire area south of the Kuskokwim River in February 2005 (0.27 moose/mi^2 ±16%, 90% CI) and south of the Kuskokwim between Kalskag and Crooked Creek in March

2006 (0.39 moose/mi^2 ±15%, 90%CI; 3440 mi^2). The estimated population is well below the objective of 7,600–9,300 moose.

In March 2008 we estimated 3200–5275 moose (0.32–0.53 moose/mi^2) were present in Unit 19A. This estimate was based upon extrapolation of a population survey conducted in a 3874 mi^2 of the Holitna, Hoholitna, and Stony River drainages (0.55 moose/mi^2 ± 28% at 90% CI) that was corrected for moose sightability.

It appears that moose numbers with the Holitna, Hoholitna, and Stony River drainages increased between 2006 and 2008. Analysis of survey data from the 3874 mi^2 survey area indicated a density of 0.28 moose/mi^2 (± 17% at 90% CI) in 2006 and .44 moose/mi^2 (± 28% at 90% CI) in 2008. Neither estimate was corrected for sightability. This apparent growth is coincident with reduction of wolves to a very low level in these drainages.

Harvest. Based upon current estimates of recruitment, population density and bull:cow ratios, there is no harvestable surplus of moose in eastern Unit 19A (upstream from and excluding the George River). The hunting season was closed in eastern Unit 19A beginning in RY06, with the exception of the Lime Village Management Area (LVMA). Hunting is currently allowed in the LVMA under a state Tier II permit during August 10–September 25 and November 20–March 31 with a bag limit of 2 bulls and under a federal community harvest system during July 1–June 30 with a quota of 28 bulls. 2 bulls were reported taken during this regulatory year under the state and federal hunts.

In western Unit 19A (downstream from and including the George River), the harvestable surplus is estimated to be 60 bulls. Beginning in RY06, hunting in this area was restricted to a state Tier II permit hunt with 200 permits issued and a federal permit hunt with 100 permits issued during September 1–20. The bag limit was 1 bull. Reported harvest during RY06 included 26 bulls taken by Tier II permittees and 6 bulls taken under the federal permit. During RY07, 230 Tier II and 100 federal permits were issued. Reported harvest included 54 bulls taken by Tier II permittees and 16 bulls taken under the federal permit. During RY08, 230 Tier II and 97 federal permits were issued. Reported harvest included 56 bulls taken by Tier II permittees and 11 bulls taken under the federal permit.

In addition, moose are allowed to be taken outside normal seasons and bag limits consistent with 5 AAC 92.019 for Alaska Native funerary or mortuary religious ceremonies. During RY06, 4 parties took 2 moose, including 1 bull and 1 cow. During RY07, 9 parties took 4 moose, including 4 bulls and 0 cows. During RY08 as of February 16, 2009, 18 parties took 12 moose, including 8 bull and 4 cows with 5 parties not reporting as of February 16, 2009.

WOLF POPULATION

Population Size. We conducted a complete wolf survey in Unit 19A in January and March of 2006, and estimated 107–115 wolves in 26–27 packs or approximately 1.1–1.2 wolves/100 mi^2. Sixty-seven wolves were reported killed after the survey was completed,

leaving an estimated 40–48 wolves in the population when all take of wolves by control program permittees and hunters and trappers was suspended on April 4, 2006.

We conducted a complete wolf survey in Unit 19A in February 2008, and estimated 74 wolves in 17 packs or approximately 0.74 wolves/100 mi^2. As of February 8, no wolves were known to be reported killed.

Harvest. Hunting and trapping harvest during RY01–RY07 averaged 25 wolves annually (Table 1). Periodically, higher harvests occurred and are probably related to effects of snow on travel in the Aniak and Holitna drainages. An additional 43, 47, 7, and 15 wolves were taken in the wolf control program during the last 4 regulatory years, respectively.

Recommendations to Achieve Plan Objectives

We recommend reauthorizing wolf control for an additional 5 years beginning on July 1, 2009 and establishing a Central Kuskokwim Villages Moose Management Area (MMA) within the Unit 19(A) Predation Control Area. The MMA would encompass approximately 3,913 mi^2, generally within the Holitna, Hoholitna, and Stony river drainages. The purpose of the MMA would be to focus intensive management activities, including predator control and habitat management, in a relatively small area where moose are accessible to hunters, rather than spread this effort over the entire game management unit. Wolf control would be conducted only within the MMA, and the department requests the discretion to adjust its size and shape up to 40% (approximately 4,000 square miles) of Unit 19(A).

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5AAC 92.125. Predation Control Areas Implementation Plans. Reauthorize the Unit 19A Predation Control Implementation Plan as follows:

...

(e) **Unit 19(A) Predation Control Area:** the Unit 19(A) Predation Control Area is established and consists of those portions of the Kuskokwim River drainage within Unit 19(A), encompassing approximately 9,969 square miles; this predator control program does not apply within National Park Service or National Wildlife Refuge lands unless approved by the federal agencies; notwithstanding any other provision in this title, and based on the following information, the commissioner or the commissioner's designee may conduct a wolf population reduction or wolf population regulation program in the Unit 19(A) Predation Control Area:

(1) the discussion of wildlife population and human use information is as follows:

(A) **a Central Kuskokwim Villages moose management area (MMA) is established within the Unit 19(A) Predation Control Area, encompassing approximately 3,913 square miles generally within the Holitna, Hoholitna, and Stony river drainages; the purpose of the MMA is to focus intensive management activities, including predator control and habitat management, in a relatively small area where moose are accessible to hunters, rather than spread this effort over the entire game management unit; wolf control will be conducted only within the MMA, and the department will have the discretion to adjust its size and shape up to 40% (approximately 4,000 square miles) of Unit 19(A);**

(B) [(A)] prey population information is as follows:

(i) the moose population size for Unit 19(A) was estimated in March 2004, based upon earlier estimates of density in portions of the unit; in March 1998, 1.25 moose per square mile (plus or minus 14 percent at an 80 percent confidence interval) was estimated in a portion of the Holitna-Hoholitna drainage; in March 2001, 0.7 moose per square mile (plus or minus 21 percent at a 90 percent confidence interval) was estimated in a portion of the Aniak drainage; extrapolation of data from both estimates to all of Unit 19(A) resulted in an estimated total population size of 4,300 - 6,900 moose; the population size for Unit 19(A) was updated in February 2005, based upon an estimate of 0.27 moose per square mile (plus or minus 16 percent at a 90 percent confidence interval) obtained from a survey in the portion of the unit south of the Kuskokwim River; extrapolation of this data to all of Unit 19(A) resulted in an estimated total population size of 3,000 - 4,000 moose (0.3 - 0.4 moose per square mile), which was corrected for sightability of moose and was lower than the 2004 estimate indicating moose numbers had declined; the population size estimate was [AGAIN] updated in March 2006, based on an estimate of 0.39 moose per square mile (plus or minus 15 percent at a 90 percent confidence interval) obtained from a survey conducted south of the Kuskokwim River, from Kalskag to the mouth of Crooked Creek (3,440 square miles); extrapolation of **these** [THIS] data to all of Unit 19(A) resulted in a estimated total population size of 2,700 - 4,250 moose (0.27 - 0.42 moose per square mile), which was also corrected for sightability; **the population size was updated again in March 2008, based on an estimate of 0.55 moose per square mile (plus or minus 28 percent at the**

90 percent confidence interval) obtained within a 3,874 square mile moose survey area located south of the Kuskokwim River, within the Holitna, Hoholitna, and Stony River drainages; extrapolation of these data to all of Unit 19(A) resulted in an estimated total population size of 3200 - 5275 moose (0.32 - 0.53 moose per square mile), which was corrected for sightability;

(ii) in November 2001, a survey on the Holitna–Hoholitna Rivers in Unit 19(A) was conducted; a total of 196 moose were classified with an observed bull-to-cow ratio of 6:100 and an observed calf-to-cow ratio of 8:100; the low numbers observed could have been influenced by an atypical moose distribution caused by shallow snow and relatively temperate late-fall weather;

(iii) in November 2004, a survey was conducted to estimate composition in the Holitna–Hoholitna, Oskawalik, and Stony River portion of Unit 19(A) (4,828 square miles); a total of 226 moose were classified and the bull-to-cow ratio (19:100, plus or minus 76 percent at a 90 percent confidence interval) and calf-to-cow ratio (32:100, plus or minus 38 percent at a 90 percent confidence interval) estimates were higher than observed in the November 2001 trend count survey; some improvement in the ratios is indicated; however, results of the two surveys cannot be directly compared because the 2004 survey covered a much larger geographic area and was done using different methods than the 2001 survey; the estimated percent moose calves in the total population during the November 2004 composition survey was 22 percent (plus or minus 38 percent with a 90 percent confidence interval);

(iv) in November 2005, composition surveys were conducted in the Holitna–Hoholitna drainage in Units 19(A) and 19(B) and in the Aniak drainage including the Kuskokwim River from Lower Kalskag to Napaimiut in Unit 19(A); a different technique was implemented than what was used for previous composition surveys because of the concern about possible atypical moose distribution when confining the survey area to the river corridor and the concern about wide confidence intervals in the November 2004 survey; a total of 307 moose were observed and the observed bull-to-cow ratio was 8:100 with most (12 of 19) bulls classified as yearlings; the observed calf-to-cow ratio was 24:100 and the percent of calves was 18 percent; the low bull-to-cow ratios observed during the past three composition surveys indicate that hunting pressure has been high in the Holitna-Hoholitna drainage; in the western portion of Unit 19(A), the Aniak River drainage and the Kuskokwim River from Lower Kalskag to Napaimiut was also surveyed; composition data had not been collected previously in this portion of Unit 19(A); a total of 410 moose were counted with an observed bull-to-cow ratio of 20:100 and an observed calf-to-cow ratio of 23:100;

(v) in November 2007, composition surveys were conducted in the Holitna–Hoholitna drainage in Unit 19(A) and in the Aniak drainage downriver from the Buckstock River including the Kuskokwim River from Lower Kalskag to Aniak in Unit 19(A); in the Holitna–Hoholitna drainage a total of 200 moose were observed, the bull-to-cow ratio was 35:100, the calf-to-cow ratio was 45:100, and the percent of calves was 25 percent; in the Aniak drainage a total of 122 moose were observed, the bull-to-cow ratio was 28:100, the calf-to-cow ratio was 51:100, and the percent of calves was 29 percent; in November 2008, composition surveys were again conducted in the same area; in the Holitna-Hoholitna drainage a total of 117 moose were observed, the bull-to-cow ratio was 34:100, and the calf-

to-cow ratio was 27:100, and the percent of calves was 18 percent; in the Aniak drainage a total of 51 moose were observed, the observed bull-to-cow ratio was 42:100, and the observed calf-to-cow ratio was 23:100, and the percent of calves was 14 percent;

(vi) [(V)] birth rate among radiocollared cows in Unit 19(A) is high; in 2005, of nine radiocollared cows in the lower Holitna River, three had twins, four had a single calf, and two had no calf (78 percent birth rate); of eight radiocollared cows in the Aniak River drainage, two had twins and six had single calves (100 percent birth rate); overall, the 2005 birth rate among radiocollared cows in Unit 19(A) was 88 percent;

(vii) [(VI)] a late winter survey to estimate calf survival, conducted in April 2003 in Unit 19(A), resulted in an estimate of 7.6 percent calves in the moose population in Holitna-Hoholitna drainage (sample size 107 adults and 9 short-yearlings) and 8.9 percent in the moose population in the Aniak River drainage (sample size 61 adults and six short-yearlings); spring population surveys conducted south of the Kuskokwim River drainage and west of the Holitna-Hoholitna drainage (3,440 square miles) in 2006, resulted in 17 percent calves and 9 percent **calves** respectively (plus or minus 30 percent at a 90 percent confidence interval); the calf-to-cow **ratios** [RATIONS] in fall and the percent of calves found in spring surveys support the conclusion that calf survival in the moose population is very low, and a decline in moose numbers is probably occurring;

(viii) [(VII)] based on current estimates of recruitment, population density and bull-to-cow ratios, there is no harvestable surplus in eastern Unit 19(A) (upstream from and excluding the George River), excluding the Lime Village Management Area; in western unit 19(A) (downstream from and including the George River), the harvestable surplus is 60 bulls, using a conservative harvest rate for bulls that is based on three percent of the total estimated population;

(ix) [(VIII)] the intensive management moose population objective established by the board for Units 19(A) and 19(B) is 13,500 - 16,500 moose; based on the relative sizes of the two units, the proportional population objective for Unit 19(A) alone is 7,600 - 9,300 moose; the intensive management moose harvest objective for Units 19(A) and 19(B) is 750 - 950 moose; the proportional harvest objective for Unit 19(A) alone is 400 - 550 moose; achieving the population and harvest objectives for Unit 19(A) will contribute to achieving the intensive management population and harvest objectives established for Units 19(A) and 19(B);

(x) [(IX)] based on data available, habitat is probably not a factor limiting population growth in moose in the central Kuskokwim region; a browse survey in Unit 19(D) (in the upper Kuskokwim River) during spring 2001, found that moose were removing about 16 percent of current annual growth; these removal rates are near the midpoint of the range observed in areas of low to high moose browse use (9 - 42 percent); a browse survey in fall 2002 below Lower Kalskag on the Kuskokwim River (Unit 18) found that 78 percent of shrubs were unbrowsed and none were heavily browsed by moose; there is some indication that cows are in average or good body condition because twinning rates of 32 percent were observed in spring 2000 on the Holitna and Hoholitna Rivers, although sample sizes were small (less than 10); of 15 radiocollared cows in Unit 19(A) that had calves in 2005, five produced twins for a 33 percent twinning rate; if

observations of browsing upriver and downriver from Unit 19(A), and limited observations of twinning are indicative of the situation in Unit 19(A), habitat enhancement alone is unlikely to cause a significant population increase in moose in the foreseeable future; the highest quality moose habitat in the unit is found in the lower Holitna River floodplain; high quality habitat is present in riparian areas along the Kuskokwim River and adjacent drainages; other portions of Unit 19(A) have lower quality habitat;

(xi) [(X)] total estimated mortality is likely high relative to the size of the moose population; information gained from studies on moose mortality in Unit 19(D) East and other similar areas of Alaska, and observations by local residents indicate that wolves are currently a major limiting factor for moose in Unit 19(A); research from Unit 19(D) East also indicates that black and brown bear predation is likely a factor that contributes to limiting the moose population in Unit 19(A); of 38 adult moose radiocollared in October 2003, seven had died by November 2005; moose mortality from harvest by humans is also high, relative to the population size, and regulatory proposals have been submitted to severely restrict harvest;

(xii) [(XI)] the number of animals that can be removed from the Unit 19(A) moose population on an annual basis without preventing growth of the population or altering the composition of the population in a biologically unacceptable manner is less than the harvest objective established for the population in 5 AAC 92.108; the moose population in Units 19(A) and 19(B) is well below the IM objective set by the board; the moose population in Unit 19(A) is also well below the objective calculated by the department for the unit;

(xiii) [(XII)] without an effective wolf predation control program, moose in Unit 19(A) are likely to persist in a low density dynamic equilibrium state with little expectation of increase; data from moose mortality studies, and predator and prey studies, conducted throughout Alaska and similar areas in Canada suggest that reducing the number of wolves in Unit 19(A) can reasonably be expected to increase the survival of calves as well as older moose, particularly yearlings; reducing wolf predation on moose, in combination with reducing harvest, particularly of cows, can reasonably be expected to initiate an increase of the moose population towards the population objective;

(C) (B) the human use information for prey population is as follows:

(i) the division of subsistence conducted household surveys on the subsistence use of big game in communities in Unit 19(A) between April 2003 and March 2004; moose was the most widely used and hunted animal in all eight communities surveyed; overall, 76 percent of all households in the central Kuskokwim area used moose, 57 percent of all households attempted to harvest moose, and 22 percent of all households successfully harvested one or more moose; of the estimated 107 moose harvested by the eight survey communities, 64, or 60 percent, were taken in Unit 19(A), 14 or 13 percent, were taken in Unit 18, and the remainder 27 percent were taken in other subunits of Unit 19 or in unreported locations; an estimated 426 individuals, or 28 percent of the area population, spent a total of 4,591 hunter days in pursuit of moose; to put this number in perspective, it is equivalent to a period of nearly 12.6 years, a clear testament to the importance of moose as a subsistence resource in the central Kuskokwim region; of the 426

individuals who went hunting, only 96, or 23 percent, were successful in harvesting a moose; the average number of days spent hunting by successful households per moose harvested (14.7) is higher than any previously reported numbers in the state where similar methods of data collection and analysis were employed; households were asked to compare their 2003 - 2004 harvest of moose with their harvest both five years and 10 years before, and the householders overwhelmingly noted harvesting fewer moose in 2003 - 2004;

(ii) between June 1982 and June 1983, the staff of the division of subsistence conducted extensive research on the resource use patterns and community characteristics of Chuathbaluk and Sleetmute; a comparison of that information with the 2004 data indicates a significant decline in household harvest rates; from an average of 0.55 - 0.2 moose harvested per household in Chuathbaluk and from 0.68 - 0.3 moose harvested per household in Sleetmute;

(iii) residents of Unit 19(A) have always had a high demand for moose for subsistence needs; since the 1990s when larger boats became available to residents in the lower Kuskokwim River and income from commercial fishing increased the ability to purchase fuel for long hunting trips, demand for moose in Unit 19(A) has increased; since 2004, there has been a moratorium on moose hunting in the Kuskokwim River drainage in Unit 18 and this has increased the demand for moose for subsistence purposes in Unit 19(A);

(iv) the amount necessary for subsistence established by the board for Unit 19 (including the Lime Village Management Area) is 430 - 730 moose; most of the human population in Unit 19 is residents of communities along the Kuskokwim River in Unit 19(A); the amount necessary for subsistence for Unit 19 is also based on subsistence need by residents of Unit 18; Unit 19(A) includes the most accessible portion of Unit 19 for the main population base in the region; subsistence hunters have depended on Unit 19(A) to provide the majority of subsistence harvest in Unit 19 as a whole; harvest in Unit 19(A) is a critical component of the amount necessary for subsistence for Unit 19 and the ability to meet subsistence needs in the region;

(v) according to harvest ticket reports, the numbers of hunters and moose harvested declined substantially between the mid-1990s and 2002; the total reported moose harvested in Unit 19(A) declined from the 1994 - 1995 season (168 moose) to the 2002 - 2003 season (67 moose); in Unit 19(A), the number of moose reported harvested by local residents and other Alaska residents declined approximately 65 percent, from 138 moose to 48 moose, between 1994 - 1995 and 2002 - 2003; after the RM 640 registration permit hunt for Alaska residents was implemented in fall 2004, harvest reporting greatly improved; in 2004 reports indicate that 107 moose were harvested in Unit 19(A); **during** [PRELIMINARY ANALYSIS OF THE] fall 2005 **176** [HUNT INDICATES THAT 170] moose were **reported** harvested; while it may appear that moose harvest increased significantly after the registration permit hunt was established, the increase is most likely attributable to better reporting rates; **during 2006, 2007 and 2008, reported moose harvest was 43, 77, and 75, respectively; these lower harvests were influenced by Tier II hunt restrictions and moose hunting closures;**

(vi) the average number of nonresident hunters in Unit 19(A) between 1994 - 1995 and 2002 - 2003 was 52 hunters; the peak number of nonresident hunters was 91 in 2000 - 2001; when Unit 19(A) was closed to nonresident hunting in March 2004 several guides protested vigorously that their agreements with clients could not be met and their businesses would suffer; since that time demand for nonresident hunting opportunity has not been met;

(vii) demand for moose harvest in Unit 19(A) is likely to increase in the future; if the moose hunting moratorium in Unit 18 is successful in increasing the moose population in that area it will help relieve some of the demand on Unit 19(A); still, with more than 20,000 residents in Unit 18 there will be high demand for moose throughout the region indefinitely into the future; clearly, demand is not being met now; if the wolf control program is successful it will help to meet the need for moose in the region in the future; without a wolf predation control program, there is a very low probability that the moose population will increase sufficiently to meet subsistence needs or other harvest demands in the future;

(D) (C) the predator population information is as follows:

(i) the pre-control wolf population in Unit 19(A) was estimated in fall 2004 using an extrapolation technique combined with sealing records and anecdotal observations the population in the entire 9,969 square mile area was estimated at 180 - 240 wolves in 24 - 28 packs or approximately 1.8 - 2.4 wolves per 100 square miles; a revised pre-control estimate of 125 - 150 was calculated in 2006 because wolf survey data collected during early 2006 and moose survey data collected during 2005 and 2006 indicated the initial pre-control wolf population estimate was too high;

(ii) after a complete wolf survey was conducted in Unit 19(A) in January and March 2006, a total of 107 - 115 wolves was estimated in 26 - 27 packs or approximately 1.1 - 1.2 wolves per 100 square miles; **a complete wolf survey was conducted again in Unit 19(A) in February 2008, a total of 74 wolves was estimated in 17 packs or approximately 0.74 wolves per 100 square miles;** in areas with limited human developments, habitat is not considered a significant factor in limiting wolf populations and it is presumed that numbers of wolves are limited mainly by prey availability; there is no evidence of disease or any other naturally occurring factors that would cause wolf mortality to be higher than normally expected;

(iii) using the **2008** [2006] moose and wolf population estimates, the moose-to-wolf ratio in Unit 19(A) is between **43:1 and 71:1** [23:1 AND 40:1];

(iv) when present, the Mulchatna caribou herd provides an alternative source of prey for wolves in Unit 19(A); because migrations of the herd into portions of 19(A) vary each year, the herd is not consistently available to wolves in the plan area;

(v) studies in Alaska and elsewhere have repeatedly concluded that large reductions are required to affect wolf population levels and to reduce predation by wolves on their prey; research indicates a reduction of about 60 - 80 percent of the pre-control wolf population may be necessary to achieve prey population objectives; once the wolf population has been reduced to

the population control objective, annual reductions of less than 60 percent will likely regulate the wolf population at the control objective; the wolf population control objective during winters 2004 - 2005 and 2005 - 2006 was 40 - 53 wolves in order to achieve a reduction of between 60 and 80 percent of the pre-control estimate of 180 - 240; beginning in winter 2006 - 2007, the wolf population control objective was change to 30 - 36 wolves based on the revised pre-control wolf population estimate of 125 - 150; the minimum wolf population control objective will achieve the desired reduction in wolf predation, and also ensure that wolves persist within the plan area;

(vi) without a wolf predation control program, the wolf population is expected to decline somewhat due to further decline in the moose population and reduced availability of prey; the moose and wolf populations in Unit 19(A) are in a low density dynamic equilibrium state where both predator and prey numbers are likely to stay at low levels indefinitely; if wolf predation control efforts continue and the wolf population is reduced according to the wolf population and harvest objectives, the wolf population will be maintained at 30 - 36 wolves for several years, but once the moose population increases and wolf control efforts are discontinued, the wolf population will increase in response to the increased prey base;

(E) (D) the human use information for the predator population is as follows:

(i) total reported harvest of wolves in Unit 19(A) by both hunters and trappers between 1998 and 2004 ranged between 21 and 49 wolves; during the winter of 2004 - 2005, a total of **72** [70] wolves were reported taken in Unit 19(A); of those, 43 wolves were taken in the wolf predation control program and **29** [27] wolves were taken by trappers and hunters; **during the winter of 2005 - 2006, a total of 80 wolves were reported taken in Unit 19(A); of those, 47 wolves were taken in the wolf predation control program, and 33 wolves were taken by trappers and hunters; during the winter of 2006 - 2007, a year with low snow and poor travel conditions, a total of 10 wolves were reported taken in Unit 19(A); of those, 7 wolves were taken in the wolf predation control program and 3 wolves were taken by trappers and hunters; during the winter of 2007 - 2008, a total of 24 wolves were reported taken in Unit 19(A); of those, 15 wolves were taken in the wolf predation control program and 9 wolves were taken by trappers and hunters;** it is likely that a few additional wolves (estimated 5 - 10) are harvested in the area, but are used locally and do not get sealed and reported;

(ii) the human population in Unit 19(A) is concentrated along the Kuskokwim River corridor; there are large portions of the unit that are remote from communities in the region and access is difficult; the central Kuskokwim region weather is influenced by coastal conditions and often warm spells in the winter will melt snow and make travel and tracking conditions poor; in addition, the low price of wolf pelts and cost of fuel make it difficult for local residents to harvest a high number of wolves throughout the unit;

(iii) in the first year of the Unit 19(A) wolf predation control program reported wolf harvest by hunters and trappers was 27 wolves, within the range of previous years' harvest; without a wolf predation control program in place wolf harvest is expected to remain relatively constant;

(2) the predator and prey population levels and population objectives, and the basis for those objectives, is as follows:

(A) the **2008** [2006] estimated moose population in Unit 19(A) is **3,200 – 5,275** [2,700 - 4,250] moose; the moose population objective for Unit 19(A) is 7,600 - 9,300 moose; this objective is based on the intensive management objective for Units 19(A) and 19(B) established by the board and the proportion of the land area in the combined subunits that is within Unit 19(A); intensive management objectives were based on historical information about moose numbers, carrying capacity of the habitat, sustainable harvest levels, and human use;

(B) the revised pre-control estimated wolf population in Unit 19(A) was 125 - 150 wolves during fall 2004; studies in Alaska and elsewhere have repeatedly concluded that large, annual reductions of wolves are required to diminish wolf population levels and predation by wolves on their prey; consistent with scientific studies and department experience, the objective of this plan is to substantially reduce wolf numbers from pre-control levels in order to relieve predation pressure on moose and allow for improved recruitment to the moose population; this plan also has as a goal to maintain wolves as part of the natural ecosystem within the described geographical area; to achieve the desired reduction in wolf predation, but ensure that wolves persist within the plan area, the wolf population in Unit 19(A) will be reduced by no fewer than 30 wolves;

(C) the wolf population control objective for Unit 19(A) is 30 - 36 wolves; a minimum population of 30 wolves is within the 60 - 80 percent recommended reduction from the pre-control minimum estimated wolf population; the minimum wolf population control objective will achieve the desired reduction in wolf predation, and also ensure that wolves persist within the plan area;

(3) the justifications for the predator control implementation plan are as follows:

(A) the estimated **2008** [2006] density of the moose population in Unit 19(A) is in the range of **0.32 – 0.53** [0.27 - 0.42] moose per square mile with a population of **3200 – 5275** [2,700 - 4,250] moose; based on current estimates of recruitment, density, and bull-to-cow ratios, there is no harvestable surplus in eastern Unit 19(A) upstream from and excluding the George River), excluding the Lime Village Management Area; in western Unit 19(A) (downstream from and including the George River), the harvestable surplus is 60 bulls, using a conservative harvest rate for bulls that is based on three percent of the estimated population; harvestable surplus is not sufficient to provide the amount of moose necessary for subsistence purposes or provide for nonsubsistence uses; the moose population and harvest objectives for Unit 19(A) are not being met because mortality has exceeded recruitment into the population causing a decline in moose numbers; wolf predation is an important cause of moose mortality;

(B) kill rates by wolves are affected by availability of moose, snow depth, number of alternate prey, size of wolf packs, and other local factors; in Alaska and Canada where moose are the primary prey of wolves, studies documented kill rates ranging from four to seven moose per wolf per winter;

(C) reducing wolf numbers through a wolf predation control program, combined with reduction in moose harvest is the approach most likely to succeed in a recovery of the moose population; wolf harvest through hunting and trapping efforts has not resulted in lowering the wolf population sufficiently to allow the moose population to grow; a regulation change in March 2002 to allow the use of snowmachines to take wolves has not resulted in a measurable increase in wolf harvest; public information and education programs have been implemented in the central Kuskokwim region to improve understanding of the biological effect of killing cow moose and the potential benefits to the moose population of increasing harvest of wolves and bears; education should help in the long-term but is not expected to result in a significant increase in the moose population in the short-term; Unit 19(A) was closed to nonresident hunting and a registration permit system for resident hunters was established in 2004; beginning in fall 2006, moose hunting was closed upstream from and excluding the George River drainage and excluding the Lime Village Management Area; a Tier II permit hunt was implemented downstream from and including the George River drainage; these changes were made in response to new information obtained during 2005 surveys;

(D) presently known alternatives to predator control for reducing the number of predators are ineffective, impractical, or uneconomical in the Unit 19(A) situation; hunting and trapping conducted under authority of ordinary hunting and trapping seasons and bag limits is not an effective reduction technique in sparsely populated areas such as Unit 19(A); the numbers of hunters and trappers are relatively low and educational programs to stimulate interest and improve skills in taking wolves are in the early stages of development, and so far have been unsuccessful in increasing the harvest of wolves; the inherent wariness of wolves, difficult access, and relatively poor pelt prices also explain low harvest rates; application of the most common sterilization techniques, including surgery, implants, or inoculation, are not effective reduction techniques because they require immobilization of individual predators, which is extremely expensive in remote areas, relocation of wolves is impractical because it is expensive and it is very difficult to find publicly acceptable places for relocated wolves; habitat manipulation is ineffective because it may improve the birth rate of moose in certain circumstances, but it is poor survival, not poor birth rate that keeps moose populations low in rural areas of interior Alaska; supplemental feeding of wolves and bears as an alternative to predator control has improved moose calf survival in two experiments; however, large numbers of moose carcasses are not available for this kind of effort and transporting them to remote areas of Alaska is not practical; stocking of moose is impractical because of capturing and moving expenses; any of the alternatives to a wolf predation control program are not likely to be effective in achieving the desired level of predator harvest;

(E) moose hunting seasons and bag limits have been reduced in Unit 19(A); **in 2004 - 2005** the nonresident season in Unit 19(A) was closed and resident hunters in Unit 19(A) **were** [ARE] required to have a registration permit; the resident winter moose hunting season in Unit 19(A) was eliminated to reduce overall harvest and eliminate incidental cow harvest to improve the reproductive potential of the population; **beginning in fall 2006 moose hunting in the eastern part of Unit 19(A) outside the Lime Village Management Area was closed and the remainder of Unit 19(A) was limited by Tier II permit;** [THE OVERALL REPORTED NUMBER OF MOOSE TAKEN IN UNIT 19(A) HAS DECLINED BY OVER 60 PERCENT FROM 168 IN 1994 - 1995 TO 67 DURING 2002 – 2003;] while helpful, these measures alone

will not likely stop the decline in the moose population and they will not be enough alone to allow the moose population to increase;

(F) without an effective wolf predation control program, the wolf harvest objective cannot be achieved and moose in Unit 19(A) are likely to persist in a low density dynamic equilibrium state with little expectation of increase; data from moose mortality studies, and predator and prey studies, conducted throughout Alaska and similar areas in Canada suggest that reducing the number of wolves in Unit 19(A) can reasonably be expected to increase the survival of calves as well as older moose; reducing wolf predation on moose, in combination with reducing harvest, particularly of cows, can reasonably be expected to initiate an increase of the moose population towards the population objective; aerial wolf predation control makes it possible to increase the take of wolves over large expanses of territory in a vast and remote region like the majority of Unit 19(A); with a reduction in wolf-caused mortality and restrictions in harvest, the moose population is expected to grow;

(4) the permissible methods and means used to take wolves are as follows:

(A) hunting and trapping of wolves by the public in Unit 19(A) during the term of the program will occur as provided in the hunting and trapping regulations set out elsewhere in this title, including use of motorized vehicles as provided in 5 AAC 92.080;

(B) **notwithstanding any other provisions in this title,** the commissioner may issue public aerial shooting permits or public land and shoot permits as a method of wolf removal under AS 16.05.783 ;

(5) the anticipated time frame and schedule for update and reevaluation are as follows:

(A) for up to five years beginning on July 1, **2009** [2004], the commissioner may reduce the wolf population in Unit 19(A);

(B) annually, the department shall to the extent practicable, provide to the board at the board's spring board meeting, a report of program activities conducted during the preceding 12 months, including implementation activities, the status of moose and wolf populations, and recommendations for changes, if necessary, to achieve the objectives of the plan;

(6) other specifications the board considers necessary are as follows:

(A) the commissioner will suspend wolf control activities

(i) when wolf inventories or accumulated information from permittees indicate the need to avoid reducing wolf numbers below the management objective of 30 wolves specified in this subsection;

(ii) when spring conditions deteriorate to make wolf control operations infeasible; or

(iii) no later than April 30 in any regulatory year;

(B) wolf control activities will be terminated

(i) when prey population management objectives are attained; or

(ii) upon expiration of the period during which the commissioner is authorized to reduce predator numbers in the predator control plan area;

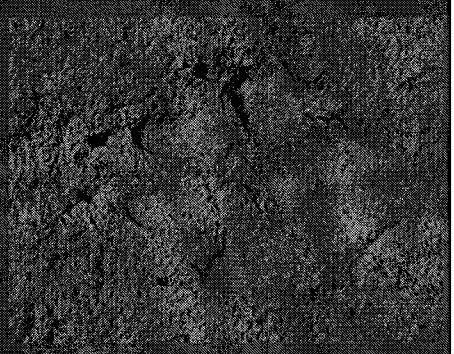
(D) the commissioner will annually close wolf hunting and trapping seasons as appropriate to ensure that the minimum wolf population objective is met.

RC 117

Proposal 235

Effect of the proposal:

Reauthorize the Wolf Control Implementation Plan for Unit 19A



Recommendation:

Amend and Adopt

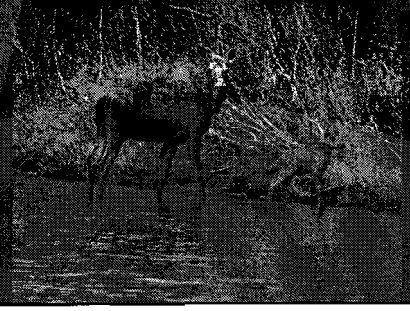
Existing proposal requests a 6 year renewal

- **This should be amended to a 5 year renewal to re-establish review of this program in cycle with the regular Board cycle**

Amend the size of the area where aerial wolf control is conducted

CKMMP

- Framework for moose management in Unit 19A
- Multiple stakeholders made up the CKMC
- Board endorsed this plan in spring 2004



Moose population data

- Density estimate south of the Kuskokwim in a 7155 mi^2 area in February 2005
  - 0.27 observable moose/mi^2 ±16%, 90% CI

Moose population data

Density estimate in western 19A (Aniak area 3440 mi^2) in 2006

- **0.39 observable moose/mi^2 ±16%, 90% CI**

Moose population data

Density estimate in Eastern 19A (Holitna area 3874 mi^2) in 2008

- **0.44 observable moose/mi^2 ±28%, 90% CI**
- **0.28 observable moose/mi^2 ± 17% at 90% CI in 2005**

Unit 19A moose estimate

Three areas to consider:

- **West: 0.39 moose/mi²**
- **East: 0.44 moose/mi²**
- **North: 0.12 moose/mi²**

Unit 19A total: 2528–3351–4174

W/SCF: about 3200–4200–5275

Longitude (Decimal Degrees)

UNIT 19A COMPARISION OF POPULATION ESTIMATES AND IM OBJECTIVES

	Population Objective 7600 – 9300
	Population Estimate for 19A (9969 mi²)
Observed	2,528–4,174
w/SCF	3,200–5,275

Approximately 4200 moose in Unit 19A

Spring Twinning Surveys

Small sample sizes

- 2005 38% of collared cows had twins (5/13)
- sample sizes are generally low

Moose fall composition data: Holitna

Year	Bulls: 100 cows	Yrl bulls: 100 cows	Calves: 100 cows
2005	8	5	24
2007	35	21	45
2008	34	12	27

Moose fall composition data:
Aniak

Year	Bulls: 100 cows	Yrl bulls: 100 cows	Calves: 100 cows
2007	28	9	52
2008 (small sample)	42	6	23

Reported Moose harvest

Reg year	Reported Harvest
2004	107
2005	174
2006	43
2007	77
2008	75

Reported mortuary moose take

Reg Year	Total parties	Bulls	Cows	Unsuccessful	Pending
06-07	4	1	1	2	0
07-08	9	4	0	5	0
08-09	18	8	4	1	5

UNIT 19A COMPARISION OF POPULATION ESTIMATES AND IM OBJECTIVES

YEAR	Harvest Objective 420 - 530 Reported Harvest for 19A
2008-09	87

Browse assessment surveys

- **April 2006**
  - **Low removal rate (10%)**
    - **suggests that moose are not forage limited**

Snow depth data

Currently being compiled

Black Bear Population Size

Location	Area (mi^2)	Population estimate	Population Density (bears/1000mi^2)
19A	9969	2500 – 3000	250 - 300

Unit 19A Black bear harvest

Year	Harvest
2002-03	2
2003-04	2
2004-05	14
2005-06	2
2006-07	8
2007-08	6
2008-09	8

Grizzly Bear Population Size

Location	Area (mi^2)	Population estimate	Population Density (bears/1000mi^2)
19A	9969	200	20

Unit 19A Grizzly bear harvest

Year	Harvest
2002-03	8
2003-04	3
2004-05	5
2005-06	6
2006-07	10
2007-08	18
2008-09	11

Wolf population

- The 2004 pre-control wolf population estimate was 125 – 150
- Control objective is 30 – 36

Unit 19A Wolf population estimates RY04 – RY07

Regulatory year	19A fall estimate	Fall estimate upriver of PASL
2004	125 – 150	75 – 125
2005	113 – 133	42 – 44
2006	–	–
2007	74	24

Wolf harvest and wolf control take in Unit 19A, RY01–RY07.

Regulatory Year	Hunting and Trapping Harvest	Wolf Control Take	Total Kill
2001–2002	49	-	49
2002–2003	25	-	25
2003–2004	30	-	30
2004–2005	29	43	72
2005–2006	33	47*	80*
2006–2007	3	7	10
2007–2008	9	15	24

* Includes one SDA wolf killed & not recovered.

Unit 19A Wolf population estimates and take by all methods RY04 – RY07

Year	19A fall estimate	Total take	%Take 19A			
2004	125 – 150	72	48 – 58			
2005	113 – 133	80	60 – 71			
2006	–	10	–			
2007	74	24	32			

Unit 19A Wolf population estimates and take by all methods RY04 – RY07

Year	19A fall estimate	Total take	%Take 19A	Fall Estimate Above PASL	Take above PASL	%Take above PASL
2004				75 – 100	44	44 – 59
2005				42 – 44	37	84 – 88
2006				–	7 – 8	–
2007				24	18 – 19	78 – 83

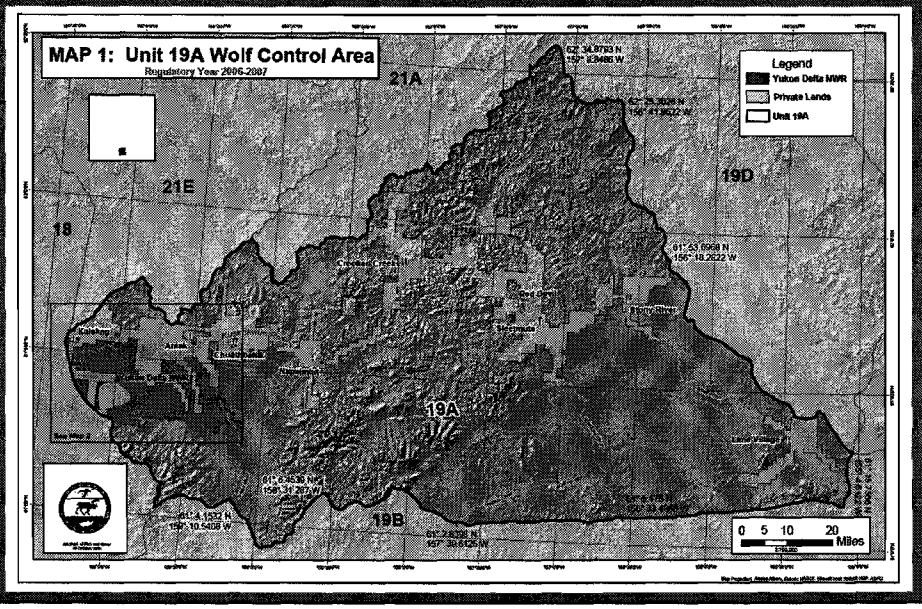
Unit 19A Wolf population estimates and take by all methods RY04 – RY07

Year	19A fall estimate	Total take	%Take 19A	Fall Estimate Above PASL	Take above PASL	%Take above PASL
2004	125 – 150	72	48 – 58	75 – 100	44	44 – 59
2005	113 – 133	80	60 – 71	42 – 44	37	84 – 88
2006	–	10	–	–	7 – 8	–
2007	74	24	32	24	18 – 19	78 – 83

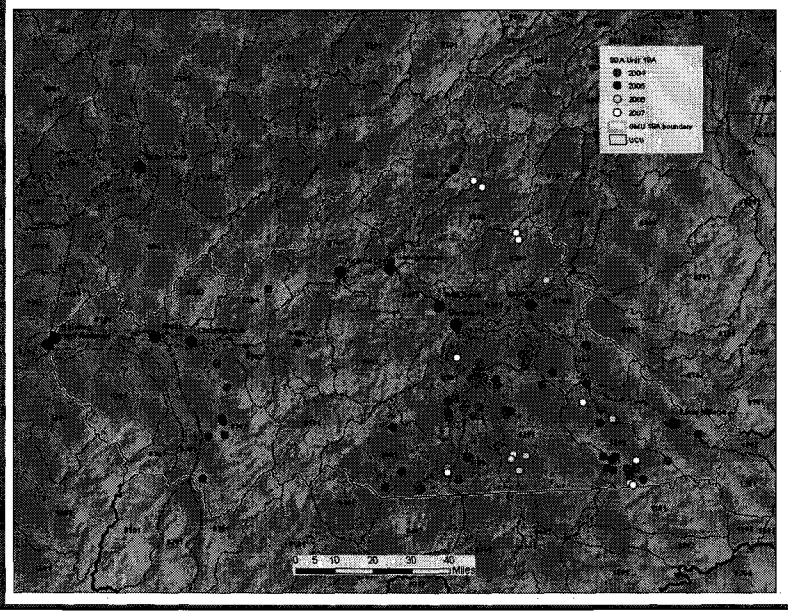
Reasons for Wolf control not working downriver of Sleetmute: -It's not just one thing-

- Land ownership
- Topography and vegetation
- Weather and snow conditions
- Other factors

Land ownership

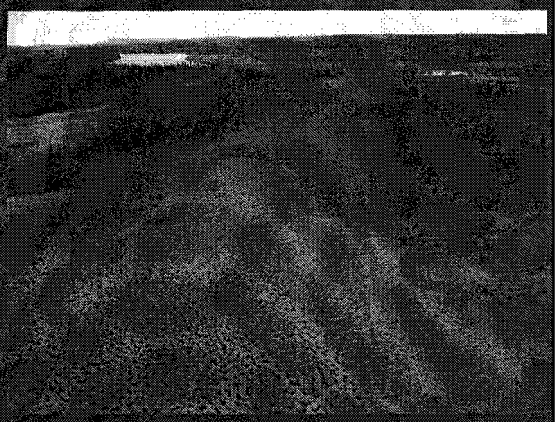


Topography and vegetation
Weather and snow conditions



Other factors

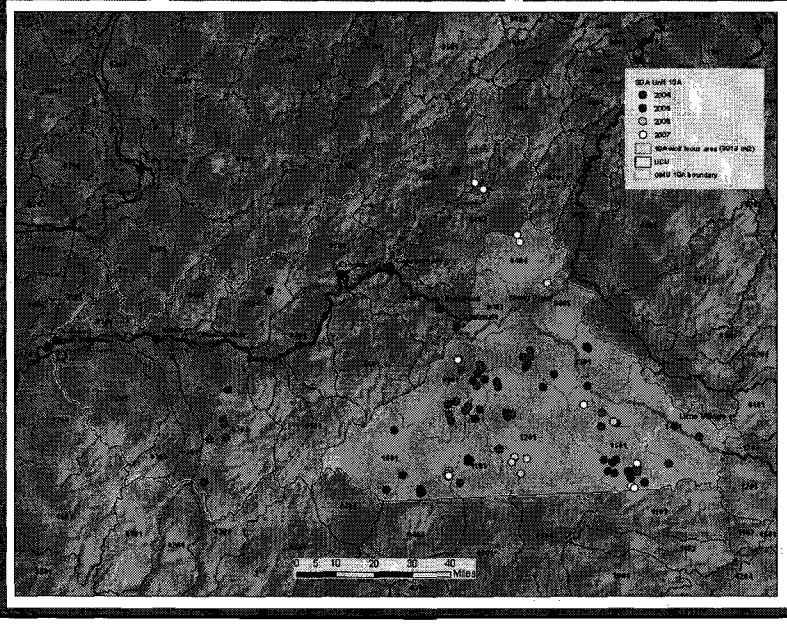
- High fuel costs
- Pilot preferences
- Available meadows
- Personal factors
- Arrangement of all factors



Recommendations for 2009

- Establish Central Kuskokwim Villages MMA within Unit 19A
  - Drainages upriver of PASL
  - Based on UCUs to simplify accounting
- Focus on the area closed to moose hunting

Proposed Unit 19A Central Kuskokwim Villages Moose Management Area



Where does that leave western Unit 19A?

We know this SDA wolf control program doesn't reduce wolf predation in western 19A as it stands

With eastern moose population recovery, we can shift to western 19A

- **Will need time**
- **Will need access**
- **Will need tools**

Summary

- Wolf control is working, but only above Sleetmute
- Downriver, we don't see benefits from wolf control
- Restructured program focuses on the area where wolf control is most effective and hunting is closed
- Need new approach for the western part of 19A

Proposal 235 Summary

Effect of the proposal:

- Reauthorize the Wolf Control Implementation Plan for Unit 19A

Department recommendation:

- Amend the proposal to a 5 year renewal
- Amend the size of the area where aerial wolf control is conducted
- and adopt.

RC 118

PROPOSAL 234A-Unit 20A- 5AAC 85.045(a)(18). HUNTING SEASONS AND BAG LIMITS FOR MOOSE. Reauthorize the antlerless moose hunting season in Units 20A.

5 AAC 85.045. Hunting seasons and bag limits for moose. (a) ...

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
...		
(18)		
Unit 20(A), the Ferry Trail Management Area, Wood River Controlled Use Area, and the Yanert Controlled Use Area		
RESIDENT HUNTERS:		
1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on one side; or	Sept. 1 - Sept. 25 (General hunt only)	
1 antlerless moose by drawing permit only (up to 500 permits may be issued); a person may not take a calf or a cow accompanied by a calf; a recipient of a drawing permit is prohibited from taking a bull moose in Unit 20A;or	**Aug. 25 - Oct. 31 (General hunt only)**	
1 antlerless moose by registration permit only; a person may	**Jan. 10-Feb. 28 (General hunt only)**	

not take a calf or a cow accompanied by a calf; or	
[1 ANTLERLESS MOOSE BY REGISTRATION PERMIT ONLY; A PERSON MAY NOT TAKE A CALF OR A COW ACCOMPANIED BY A CALF; OR]	[AUG. 25 – FEB. 28] [(GENERAL HUNT ONLY)]
1 bull by drawing permit only; up to 1000 permits may be issued; or	Sept. 1 - Sept. 25 (General hunt only)
1 bull by drawing permit only; by muzzleloader only; up to 75 permits may be issued	Nov. 1 - Nov. 30 (General hunt only)
NONRESIDENT HUNTERS:	
1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side; or	Sept. 1 - Sept. 25
1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; by muzzleloader only; up to 75 permits may be issued	Nov. 1 - Nov. 30
Remainder of Unit 20(A)	
RESIDENT HUNTERS:	

1 bull with spike-fork antlers or 50-inch antlers or antlers with 3 or more brow tines on one side; or	Sept. 1 - Sept. 25
1 antlerless moose by drawing permit only (up to 500 permits may be issued); a person may not take a calf or a cow accompanied by a calf; a recipient of a drawing permit is prohibited from taking a bull moose in Unit 20A;or	**Aug. 25 - Oct. 31 (General hunt only)**
1 antlerless moose by registration permit only; a person may not take a calf or a cow accompanied by a calf; or	**Jan. 10-Feb. 28 (General hunt only)**
[1 ANTLERLESS MOOSE BY REGISTRATION PERMIT ONLY; A PERSON MAY NOT TAKE A CALF OR A COW ACCOMPANIED BY A CALF; OR]	[AUG. 25 – FEB. 28] [(GENERAL HUNT ONLY)]
1 bull by drawing permit only; up to 1000 permits may be issued	Sept. 1 - Sept. 25
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side	Sept. 1 - Sept. 25

RC 119

PROPOSAL 234B – Unit 20B - 5AAC 85.045(a)(18). HUNTING SEASONS AND BAG LIMITS FOR MOOSE. Reauthorize the antlerless moose hunting season in Unit 20B.

5 AAC 85.045. Hunting seasons and bag limits for moose. (a) ...

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
...		
(18)		
...		
Unit 20(B), that portion within Creamer's Refuge		
1 bull with spike-fork or greater antlers by bow and arrow only; or	Sept. 1 - Sept. 30 (General hunt only) Nov. 21 - Nov. 27 (General hunt only)	Sept. 1 - Sept. 30 Nov. 21 - Nov. 27
1 antlerless moose by bow and arrow only, by drawing permit only; up to 150 permits may be issued in the Fairbanks Management Area; [A PERSON MAY NOT TAKE A CALF OR A COW ACCOMPANIED BY A CALF;] a recipient of a drawing permit is prohibited from taking an antlered bull moose in the Fairbanks Management Area; or	Sept. 1 - Nov. 27 (General hunt only)	Sept. 1 - Nov. 27
1 antlerless moose by muzzle-loader by drawing permit only; up to 10 permits may be	Nov. 21 - Nov. 27 (General hunt only)	Nov. 21 - Nov. 27

issued; [A PERSON MAY NOT TAKE A CALF OR A COW ACCOMPANIED BY A CALF;] a recipient of a drawing permit is prohibited from taking an antlered bull moose in the Fairbanks Management Area		
Unit 20(B), remainder of the Fairbanks Management Area		
1 bull with spike-fork or greater antlers by bow and arrow only; or	Sept. 1 - Sept. 30 (General hunt only) Nov. 21 - Nov. 27 (General hunt only)	Sept. 1 - Sept. 30 Nov. 21 - Nov. 27
1 antlerless moose by bow and arrow only, by drawing permit only; up to 150 permits may be issued; [A PERSON MAY NOT TAKE A CALF OR A COW ACCOMPANIED BY A CALF;] a recipient of a drawing permit is prohibited from taking an antlered bull moose in the Fairbanks Management Area	Sept. 1 - Nov. 27 (General hunt only)	Sept. 1 - Nov. 27
Unit 20(B), that portion within the Minto Flats Management Area		
1 moose by registration	Sept. 1 - Sept. 25	No open season.

permit only; or	(Subsistence hunt only) Jan. 10 - Feb. 28 (Subsistence hunt only)	
1 bull with spike-fork antlers or 50-inch antlers or antlers with 4 or more brow tines on one side	Sept. 11 - Sept. 25	No open season.
Unit 20(B), the drainage of the Middle Fork of the Chena River		
1 bull; or	**Sept. 1 - Sept. 20**	**Sept. 1 - Sept. 20**
1 bull, by bow and arrow only	**Sept. 21 - Sept. 30**	**Sept. 21 - Sept. 30**
1 antlerless moose by drawing permit only; up to 300 permits may be issued; a person may not take a calf or a cow accompanied by a calf	**Aug. 15 – Nov. 15 (General hunt only)**	**No open season.**
Unit 20(B), that portion of the Salcha River drainage upstream from and including Goose Creek		
1 bull; or	**Sept. 1 - Sept. 20**	**Sept. 1 - Sept. 20**
1 bull, by bow and arrow only	**Sept. 21 - Sept. 30**	**Sept. 21 - Sept. 30**
[UNIT 20(B), THE DRAINAGE OF THE MIDDLE FORK OF THE CHENA RIVER		

AND THAT PORTION OF THE SALCHA RIVER DRAINAGE UPSTREAM FROM AND INCLUDING GOOSE CREEK]		
[1 BULL; OR]	[SEPT. 1 - SEPT. 20]	[SEPT. 1 - SEPT. 20]
[1 BULL, BY BOW AND ARROW ONLY]	[SEPT. 21 - SEPT. 30]	[SEPT. 21 - SEPT. 30]
Remainder of Unit 20(B) 1 bull; or	Sept. 1 - Sept. 15	Sept. 5 - Sept. 15
1 antlerless moose by drawing permit only; up to **900** [300] permits may be issued; a person may not take a calf or a cow accompanied by a calf	**Aug. 15 – Nov. 15** [SEPT. 1 – SEPT. 30] (General hunt only)	No open season.

...

RC 120

PROPOSAL 234C-Unit 20D - 5AAC 85.045(a)(18). HUNTING SEASONS AND BAG LIMITS FOR MOOSE. Reauthorize the antlerless moose hunting season in Unit 20D.

5 AAC 85.045. Hunting seasons and bag limits for moose. (a) ...

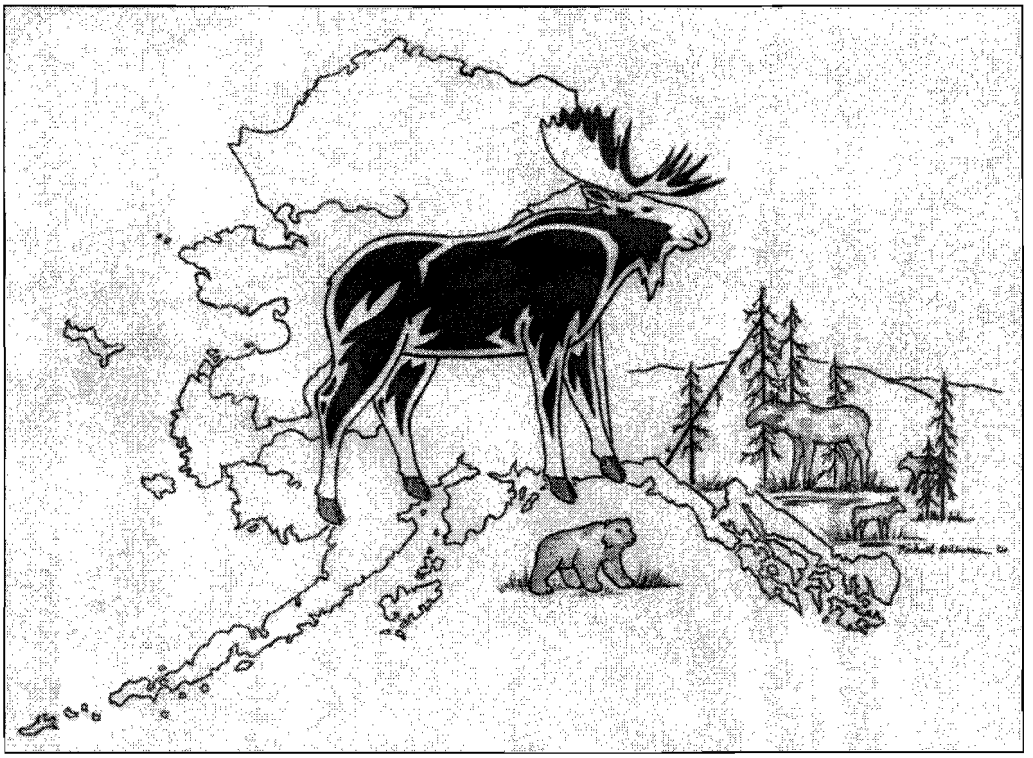
Units and Bag Limits	**Resident Open Season (Subsistence and General Hunts)**	**Nonresident Open Season**
...		
(18)		
...		
Unit 20(D), that portion lying west of the west bank of the Johnson River and south of the north bank of the Tanana River, except the Delta Junction Management Area and the Bison Range Youth Hunt Management Area		
RESIDENT HUNTERS:		
1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on one side; or 1 bull by drawing permit; or	Sept. 1 - Sept. 15 (General hunt only)	
	Sept. 1 - Sept. 15 (General hunt only)	
1 antlerless moose by drawing permit only; up to 1,000 permits may be issued in combination with that portion in the Delta Junction	Oct. 10 - Nov. 25 (General hunt only)	

Management Area; a person may not take a calf or a cow accompanied by a calf; or		
1 antlerless moose by registration permit only; a person may not take a calf or a cow accompanied by a calf	Oct. 10 - Nov. 25 (General hunt only)	
NONRESIDENT HUNTERS:		
1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side		Sept. 5 - Sept. 15
Unit 20(D), that portion within the Bison Range Youth Hunt Management Area	Sept. 1 - Sept. 30	Sept. 1 - Sept. 30
1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on one side; or 1 antlerless moose, per lifetime of a hunter, by drawing permit only; up to 10 permits may be issued; a person may not take a calf or a cow accompanied by a calf	Sept. 1 - Sept. 30 (General hunt only)	Sept.1 - Sept. 30
Unit 20(D), that portion within the Delta Junction Management Area		
RESIDENT HUNTERS:		

1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 30 permits may be issued; or	Sept. 1 - Sept. 15 (General hunt only)
1 antlerless moose by drawing permit only; up to 1,000 permits may be issued in combination with that portion lying west of the west bank of the Johnson River and south of the north bank of the Tanana River; a person may not take a calf or a cow accompanied by a calf; or	Oct. 10 - Nov. 25 (General hunt only)
1 antlerless moose by registration permit only; a person may not take a calf or a cow accompanied by a calf	Oct. 10 - Nov. 25 (General hunt only)
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on one side by drawing permit only; up to 30 permits may be issued	Sept. 5 - Sept. 15

RC 121

ADAPTIVE PLAN FOR INTENSIVE MANAGEMENT OF MOOSE IN GAME MANAGEMENT UNIT 21E



Drawing by Michael Williams, Beaver

Vers. 1, March 6, 2009

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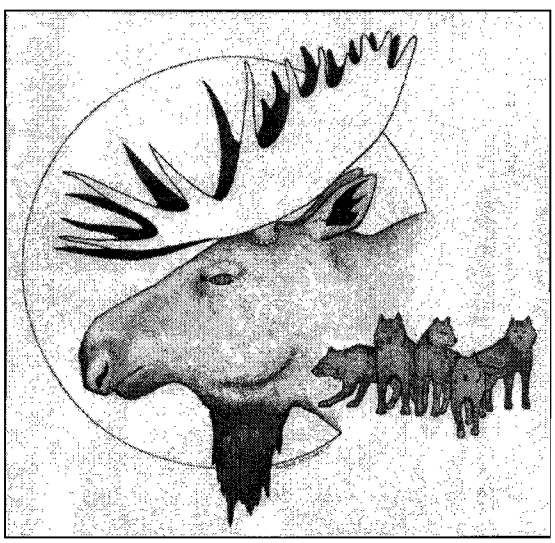


Drawing by Michael Williams, Beaver

EXECUTIVE SUMMARY

This Adaptive Plan for Intensive Management serves as a guide for actions intended to maintain or increase the moose population in Game Management Unit (Unit) 21E. The plan was developed from recommendations of the Yukon-Innoko Moose Management Working Group (YIMMP 2006:24) and was requested by the Alaska Board of Game (BOG) at its March 2006 meeting. The plan evaluates intensive management (IM) options and provides recommendations designed to maintain a high level of moose harvest according to the State of Alaska IM law [AS 16.05.255(e)-(j)]. For Unit 21E (7995 mi^2), the IM objectives for the moose population (9,000-11,000) and moose harvest (550-1,100) were set by the BOG in 2000.

Moose population surveys were conducted in 5070 mi^2 survey area in Unit 21E during late winter of 2000 and 2005. In February 2000 the density of moose in Unit 21E was estimated to be 1.0 observed moose/mi^2 (approximately 5000 moose in the survey area), whereas in March 2005 the density was estimated to be 0.9 observed moose/mi^2 (approximately 4500 moose in the survey area). These population estimates were not statistically different from one another. Local residents suggest a decline in moose occurred prior to 2000 (YIMMP 2006). Coincident with the perceived decline in moose, ADF&G Division of Subsistence household surveys indicated that harvest of moose by local residents of Unit 21E declined from an average of 226 moose per year during 1996-1999 to an average of 115 moose per year during 2002–2004. The most recent estimates for Unit 21E are a population of 7,000 – 9,000 moose and a harvest by all hunters of 340 moose (YIMMP 2006). Moose abundance estimates are done in this area once every 3 years, survey conditions permitting.

Predation has been documented as limiting moose abundance and harvest yield in areas of interior Alaska and western Canada where predators are lightly harvested. Predator populations in Unit 21E are extrapolated to be 180-240 wolves, 120-180 grizzly bears, and 800-1200 black bears based on predator densities determined in other areas of the western Interior where moose population densities and habitat are similar. Hunting and trapping harvest of these predators is presently estimated to be below a level that can regulate predation on moose. Habitat does not appear to presently be a major limiting factor on moose abundance in Unit 21E based on recent twinning rates (average 29%, 2000-08) and browse removal by moose (21% of current annual biomass by April 2006).

This Adaptive Plan proposes a decision framework to start and end predation control based on (1) management objectives for moose abundance, (2) moose survey results that incorporate the relative precision (uncertainty) in estimates of abundance, and (3) the statistical chance of making incorrect decisions based on the uncertainty in a moose survey. The biological risk for moose populations of making incorrect decisions to *start* predation control based on survey results would be a delayed population recovery. The biological risk for moose populations of making incorrect decisions to *end* predation control based on survey results would be growth in the moose population to a level that reduces nutritional condition or population productivity. To ensure at most a 5% chance of incorrectly waiting to *start* predation control when the true population is actually less than or equal to 4500 observed moose, a survey estimate of fewer than 5648 moose would result in a recommendation to implement predation control (example assumes 20% relative precision at the 90% confidence level). If predation control was undertaken, to

ensure at most a 5% chance of incorrectly *ending* predation control before the true population is actually greater than 5000 observed moose, a survey estimate would have to exceed 6275 moose before a recommendation to end predation control would occur (example assumes 20% relative precision at the 90% confidence level).

If predation control is recommended based on the decision framework, wolf predation control is proposed as the initial IM program. Recently in approved programs of predation control, ADF&G has issued permits for aerial shooting and/or land and shooting of wolves to members of the public who are qualified as pilots and gunners. As an alternative, or should that method alone not achieve a sufficient reduction in numbers of wolves, consideration could be given to authorizing Department employees using helicopters to remove wolves. If approved, wolf control is proposed for an approximately 2617 mi^2 Moose Management Area (roughly 33% of Unit 21E) within the moose survey area. The objective would be for up to 80% removal of the pre-control wolf population in Unit 21E by 30 April of each regulatory year (July 1 to 30 June). If the first moose survey following at least a 4-year aerial control of wolves in Unit 21E produces an estimated moose density of fewer than 0.9 observed moose/mi^2 based on the decision framework, the Department should take action to reduce bear predation through a control program if effective methods are identified and nutritional indicators continue to suggest that habitat is not limiting moose population growth.

Measures of moose productivity and nutritional condition (twinning rate in spring and age-sex composition in the fall population) will continued be monitored with annual surveys to evaluate the effects of any IM programs on the moose population. If predation control occurs, effects of increased moose abundance on the habitat will be gauged from measures of moose productivity and periodic browse surveys, and abundance of predator populations will be periodically assessed. An increase in moose abundance will allow an increase in harvest through options for fall and winter hunts. The IM population and harvest objectives and the decision framework will be reviewed periodically, and recommendations to modify them may occur as more information becomes available on moose and predator populations, moose habitat, and harvest of moose and predators in Unit 21E.

INTRODUCTION

This Adaptive Plan for Intensive Management (Adaptive Plan) has been prepared by the Alaska Department of Fish and Game (ADF&G) to serve as a guide for actions intended to maintain or increase the moose population in Game Management Unit (GMU or Unit) 21E. The plan has been developed based on the recommendation of the Yukon-Innoko Moose Management Working Group and at the request of the Alaska Board of Game (BOG). The plan evaluates management options and provides recommendations designed to maintain high levels of harvest of moose in the unit according to Alaska Statute 16.05.255(e)-(j). Part of this statute is commonly known at the Intensive Management (IM) law. This law requires that the BOG to adopt regulations to intensively manage certain moose, caribou and deer populations for high levels of human harvest in certain situations.

Adaptive management of renewable resources recognizes the uncertainty in resource responses to treatments in complex systems of human-environmental interactions (Walters 1986). It uses a systematic learning process to improve understanding of the system and management decisions over time. Adaptive management was recommended as a constructive approach for designing treatments of predator-prey systems to increase prey harvest in Alaska (National Resource Council 1997). However, practical limitations on replicate treatment and control sites occur in field experiments at the scale of large mammal systems (Hayes et al. 2003). This Adaptive Plan characterizes the level of Survey and Inventory data and study design constraints typical for game management programs without substantial research components at remote locations in Alaska.

Unit 21E encompasses approximately 7995 square miles in western Alaska (Figure 1). It is defined by the Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage, and the Innoko River drainage downstream from the Iditarod River drainage. The communities of Grayling, Anvik, Shageluk and Holy Cross lie within Unit 21E.

DESCRIPTION OF THE PROBLEM AND NEED FOR INTENSIVE MANAGEMENT OF MOOSE IN UNIT 21E

Residents of Unit 21E, the Grayling-Anvik-Shageluk-Holy Cross (GASH) State Fish and Game Advisory Committee (AC) and other hunters who use the area have expressed concerns about a decline in the moose population and a perceived increase in predation on moose in the area since the mid 1990s. Division of Subsistence household surveys indicated that harvest of moose by residents in Unit 21E declined from an average of 226 moose per study year (April-March) in 1996-1999 (Polly Wheeler, U.S. Fish and Wildlife Service, presentation to BOG, March 2002) to an average of 115 moose per study year during 2002–2004 (Brown et al. 2004, 2005). In January 2003 the GASH AC voted to close the state winter season for antlerless moose in an attempt to maintain the productivity and prevent a severe decline in the moose population.

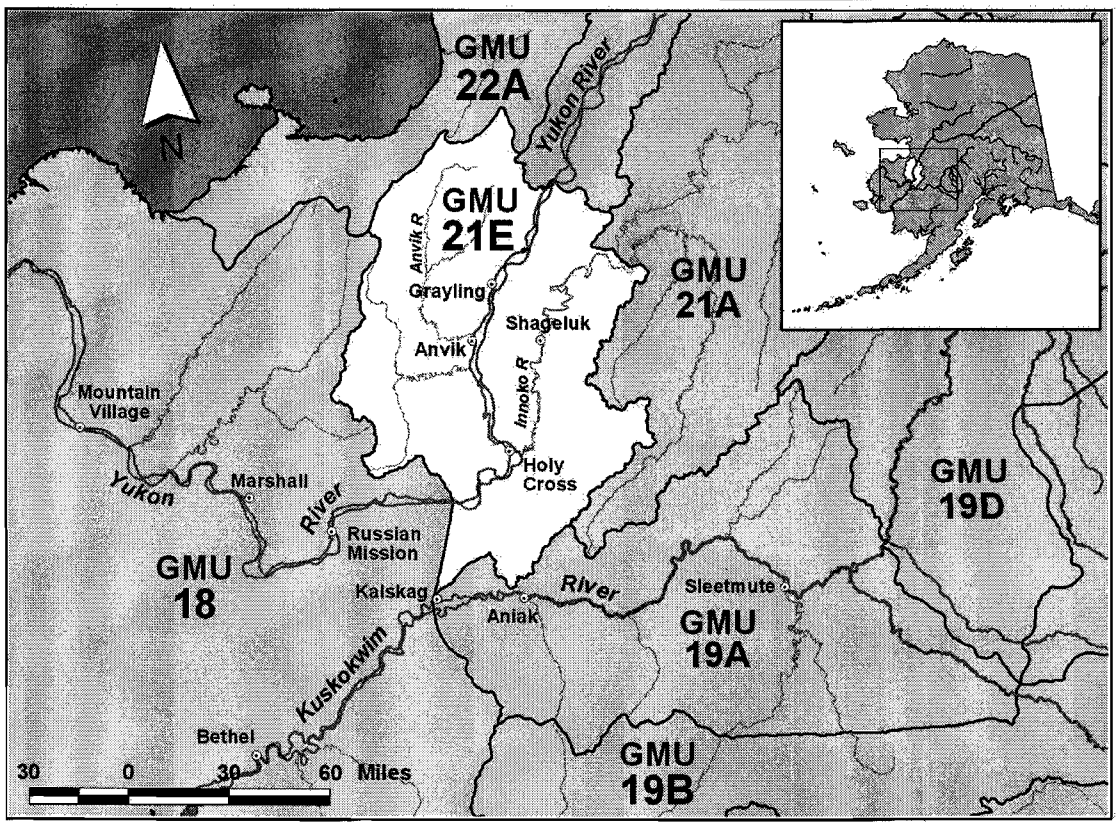


Figure 1. Location of Game Management Unit (GMU) 21E in western Alaska.

Moose population surveys were conducted in a portion of Unit 21E in 2000 and 2005. In February 2000 the density of moose in Unit 21E was estimated to be 1.0 observed moose/mi^2, whereas in March 2005 the density was estimated to be 0.9 observed moose/mi^2. Although many people agree that the moose population has been in decline, these two surveys did not indicate a statistically significant decline in the moose population. It is possible that a decline occurred prior to the 2000 survey. There is other evidence that density of moose in Unit 21E may have been higher in the 1990s than present. First, harvest in the mid-late 1990s was higher. Also, residents of Unit 21E and other hunters who use the area have expressed concerns about their perception of increasing predation on moose in the area since the mid 1990s. Hunting of wolves the same day hunters were airborne (i.e., land and shoot) was increasingly restricted in the 1990s (Regelin et al. 2005). The habitat may have been able to support a higher density of moose in the past based on a recent browse survey that documented large expanses of feltleaf willow produced by extensive floods in the 1970s, much of which had grown beyond the reach of moose by 2006 (T. F. Paragi, ADF&G, pers. comm.).

The 90% confidence limit around the February 2005 moose population estimate in Unit 21E was approximately 7,000–9,000. The upper end of this population estimate is equal to the lower end of the range of the IM population objective, which is 9,000–11,000 moose (Table 1). Estimated total harvest is well below the IM objective.

Table 1. Status of the moose population in Unit 21E in relation to the IM population and harvest objectives.

Intensive Management Objectives for Moose in Unit 21E (5 AAC 92.108)	Current Estimated Moose Population and Harvest (reported and unreported) for Unit 21E
Population: 9,000 – 11,000 moose Harvest: 550 – 1,100 moose	Population: 7,000 – 9,000 Estimated Harvest: 340

To address concerns about the decline in moose harvest and possible decline in moose numbers in Units 21E, in January 2005 the ADF&G, Division of Wildlife Conservation (DWC) established a citizen-based advisory group, the Yukon-Innoko Moose Management Working Group (YIWG or Working Group). The Working Group was given the task of reviewing all available information and developing a comprehensive moose management plan for the area. Preliminary moose population modeling conducted during the Yukon-Innoko moose planning process indicated that a conservative harvest rate of 4% or less is needed to prevent a decline in the moose population. Harvest in Unit 21E is presently very close to the maximum that can be allowed with sustained-yield management. Habitat does not presently appear to be a major factor limiting productivity in moose (see below, Condition of the Habitat Available to the Prey Population). If the moose population declines below the 2005 level, measures to reduce predation on moose are recommended along with more restrictions on hunting opportunity, including the possibility of closing the non-resident seasons, eliminating the winter antlerless season under federal subsistence hunting regulations, and possibly additional restrictions in resident fall hunting. Based on the knowledge that a decline in the moose population would require additional restrictions in hunting opportunity, the YIWG felt it was essential to recommend an aerial wolf predation control program to prevent a decline in the moose population and maintain hunting opportunities in Unit 21E.

The Yukon-Innoko Moose Management Plan (YIMMP 2006), developed through the cooperative efforts of the Working Group, ADF&G and federal agency staff, provides a comprehensive evaluation of all factors that affect the moose population in Units 21A and 21E and includes a variety of recommendations to maintain or increase the moose population. The YIMMP was endorsed by the BOG in March 2006 and by the Federal Subsistence Board (FSB) in May 2006. The BOG also established a non-resident drawing permit system intended to cap the level of non-resident hunting in Unit 21E and liberalized wolf and bear harvest regulations. When the BOG endorsed the YIMMP in March 2006, it requested the Department to proceed with developing an Adaptive Plan for moose in Unit 21E to be considered by the BOG at the next available opportunity. This Adaptive Plan is a direct result of the efforts of the Working Group and will help to follow through with many of the recommendations included in the YIMMP. This Adaptive Plan is designed to proactively manage moose in Unit 21E to prevent a major decline in the population and sustainable moose harvest in the area while monitoring biological parameters and evaluating IM population and harvest objectives over time.

STATEMENT OF PURPOSE

The purpose of this Adaptive Plan for moose in Unit 21E is the same as the mission statement included in the YIMMP which is as follows:

> Maintain healthy and abundant moose populations by proactively managing moose, predation and habitat and keeping moose harvest within sustained yield so that subsistence needs for moose are met on an annual basis and there is sufficient moose to provide for personal and family use by Alaska residents and some nonresident hunting opportunity for generations to come.

MAIN RECOMMENDATIONS INVOLVED IN THE ADAPTIVE PLAN FOR INTENSIVE MANAGEMENT

The primary recommendations of this Adaptive Plan are to:

1. Acquire additional information on the status of moose and wolf populations and moose winter range in Unit 21E to better verify the trend in moose numbers and productivity, improve information on habitat capability, and obtain a more definitive estimate of the number of wolves present.

2. If additional information suggests a the population has dropped below 0.9 observed moose/mi^2 in the survey area, implement an aerial wolf predation control program focused along the Yukon and Innoko River floodplain to remove up to 80% of the wolves in Unit 21E by 30 April of each regulatory year.

3. If recommendation 2 occurs, submit a proposal or special action request to the Federal Subsistence Board to temporarily close the federal winter antlerless moose season in Unit 21E to help maintain the productivity of the moose population (number of breeding age cows).

4. Work with land owners and managers to identify where changes in fire management options along the Yukon and Innoko Rivers can be made from Full suppression to Modified or Limited to allow a greater chance for wildland fire to improve moose browse in the long term without putting other human resources at risk.

5. Evaluate the IM population and harvest objectives at least once every 4 years on the BOG cycle as new information is gained on habitat condition, moose nutritional condition, and harvest demand.

The Department recommends that the BOG adopt a regulatory proposal to authorize an aerial wolf predation control program in a portion of Unit 21E at the March 2009 meeting (implementation date pending approval by the Commissioner of ADF&G). This will allow the Department to obtain additional biological information and be prepared to take timely action to prevent a major decline in the moose population if and when additional biological and harvest results indicate the need for wolf control. If additional survey information indicates that the moose population has likely declined below 0.9 observed moose/mi^2 in the survey area, the Department will recommend issuing permits for aerial shooting and land and shooting of wolves

to members of the public who are qualified as pilots and gunners. Should that method alone not achieve a sufficient reduction in numbers of wolves, consideration should be given to authorizing Department employees to remove wolves using helicopters.

The wolf predation control implementation plan adopted under 5 AAC 92.125 should include all of Unit 21E. Wolf predation control efforts will be allowed only in the GASH Moose Management Area (MMA), which encompasses approximately 2617 mi^2 (Figure 2) or about 33% of Unit 21E. Wolves can sustain a harvest rate of 30-50%, thus control efforts must exceed 50% removal (Gasaway et al. 1992, National Research Council 1997, Hayes et al. 2003, Adams et al. 2008). The objective in the GASH MMA is to reduce the number of wolves to the lowest level possible while ensuring that the pre-control wolf population in Unit 21E is reduced by no more than 80%. The Department will have the discretion to adjust the size and shape of the GASH MMA up to approximately 40% (approximately 3200 mi^2) of Unit 21E. Aerial wolf control will not be allowed in that portion of Unit 21E outside of the MMA (approximately 5380 mi^2), thereby assuring that wolves will remain present in the Unit. Hunting and trapping of wolves will continue throughout the entire subunit. Wolf control activities and harvest of wolves under the hunting and trapping regulations will be suspended prior to the annual closing date of 30 April in a regulatory year (RY) if the wolf population in Unit 21E is reduced to the management objective of 40 wolves (20% of the pre-control wolf population estimate). (RY runs from July 1 of one year to June 30 of the following year; e.g., RY 2002 = July 1, 2002 to June 30, 2003.)

In addition to the proposed authorization for an aerial wolf predation control program, the actions listed below will also help progress toward the moose IM population and harvest objectives.

- Continue to monitor the capability of winter range to support higher numbers of moose resulting from wolf control, including another browse survey if the moose population increases significantly.

- Use new information on the extent and quality of moose habitat to reevaluate IM population and harvest objectives and, if necessary, develop recommendations to the BOG for changes to the IM objectives and whether to initiate habitat enhancement.

- Continue conducting annual fall composition counts and spring twinning surveys to monitor the health and productivity of the moose population and as an index to habitat quality, and conduct a moose population estimation survey in March 2009.

- Conduct additional monitoring to adequately assess the biological situation including completion of a baseline wolf population estimation survey in Unit 21E as soon as possible.

- Conduct public information and education efforts to encourage better harvest reporting and understanding of state and federal hunting regulations and to provide information on the biological effects of predation on moose and harvest of cow moose, as resources permit.

- Further evaluate the significance of black and grizzly bear predation on moose and actions that may be implemented to reduce bear predation, if needed to help maintain or increase the moose population, as resources permit.

- Adjust moose harvest regulations as necessary to keep harvest within sustained yield and prevent a decline in the moose population.

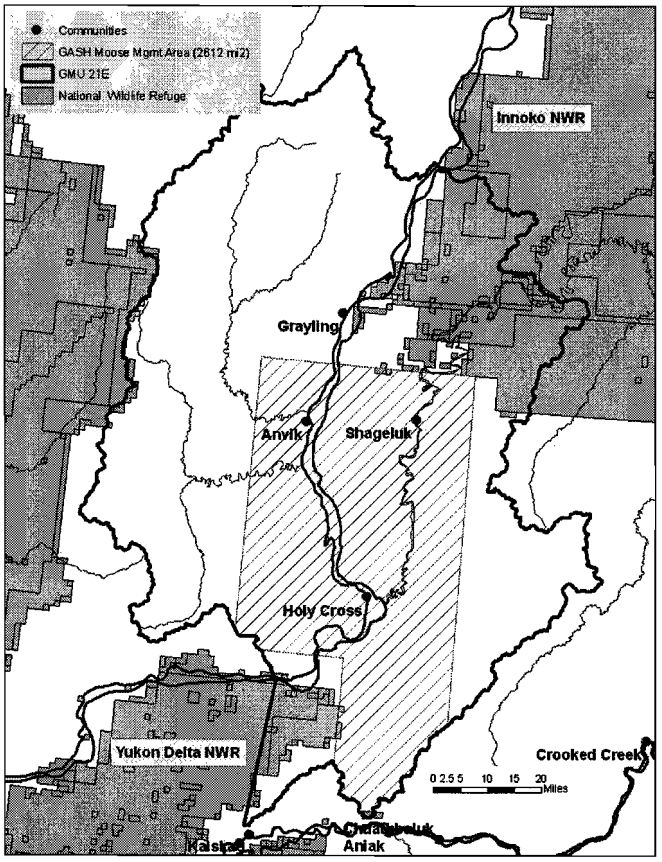


Figure 2. GASH Moose Management Area (MMA) encompasses about 1/3 of GMU 21E.

EXPECTED RESULTS

Under the guidance of this Adaptive Plan, and with the necessary resources available, the Department expects to be better able to prevent a major decline in the moose population and maintain moose harvest opportunity in Unit 21E. Implementing an aerial wolf control program to remove up to 80% of wolves in Unit 21E for at least 4 years (National Research Council 1997) is expected to increase the moose population and the harvestable surplus (Gasaway et al. 1992). Unless public harvest of wolves can regulate population recovery when a control program ends, wolf abundance is expected to recover to roughly pre-control levels in 3-5 years, requiring subsequent predation control to maintain elevated yield of moose (National Research Council 1997:50). Monitoring moose habitat and the nutritional condition of moose before, during, and after any predation control programs is expected to identify when habitat may become a limiting factor in moose population growth. If habitat becomes limiting following moose population

growth, reevaluation of IM population and harvest objectives is warranted to identify how far harvest should be increased and whether habitat enhancement may be warranted.

BIOLOGICAL AND MANAGEMENT SITUATION ANALYSIS

MOOSE POPULATION INFORMATION

A GeoSpatial Population Estimation (GSPE) survey conducted in March 2005 in a 5,070 mi^2 portion of Unit 21E (Figure 3) resulted in an estimate of 3,897–5,448 moose with an approximate density of 0.9 observed moose/mi^2 and 18% calves. Using the 2005 density estimate from the survey area, the extrapolated estimate for the moose population in all of Unit 21E is 7,000–9,000 moose. No sightability correction factor was used in this analysis. Survey results for moose population estimates conducted in Unit 21E are reported as "observed moose," which is a conservative population estimate because a Sightability Correction Factor (SCF) has not been estimated for Unit 21E. The SCF is an estimate of the percentage of moose that are not observed at a given survey intensity (minutes of search/mi^2) because of background color, light, size of moose, vegetation cover, etc. (Gasaway et al. 1986). Boertje and Kellie (ADF&G memo, 23 May 2007) recommended a SCF of 1.25 for fall moose surveys in interior Alaska and noted that SCF for late winter surveys could be as high as 1.40. Because of frequent deep snow, moose in Unit 21E often concentrate in dense willow stands near the floodplain of major rivers by mid-winter and are not subject to the extent of shadows or concealment that may occur in forest-dominated areas of the Interior. Thus, for comparison to other areas, density correction for moose in Unit 21E will be the observed density times a conservative SCF of 1.25 until a SCF can be estimated for this area.

Moose habitat in the GSPE survey area within the floodplain of the Yukon and Innoko Rivers is generally of better quality as winter range than the habitat found in the forested hillsides in the western portion of Unit 21E. Better refinement of the variability in moose habitat in Unit 21E (now underway as a research project across the Interior) will help to determine how to best extrapolate the moose population density found in the GSPE survey area to all of Unit 21E for evaluating and recommending changes to the IM population objective. Evaluating moose habitat and the nutritional condition of moose is a key component of this Adaptive Plan.

Composition surveys conducted during November 1987–1998 and 2007–2008 in the Holy Cross area indicated bull-to-cow ratios and the calf-to-cow ratios were at or above 25–30 bulls:100 cows and 30–40 calves: 100 cows. Seven aerial surveys conducted during spring 2000–08 have shown an average twinning rate of 29 percent (range: 16-47%, n = 25-40 parturient cows), which suggests habitat is not presently limiting productivity in moose (see below, Condition of the Habitat Available to the Prey Population).

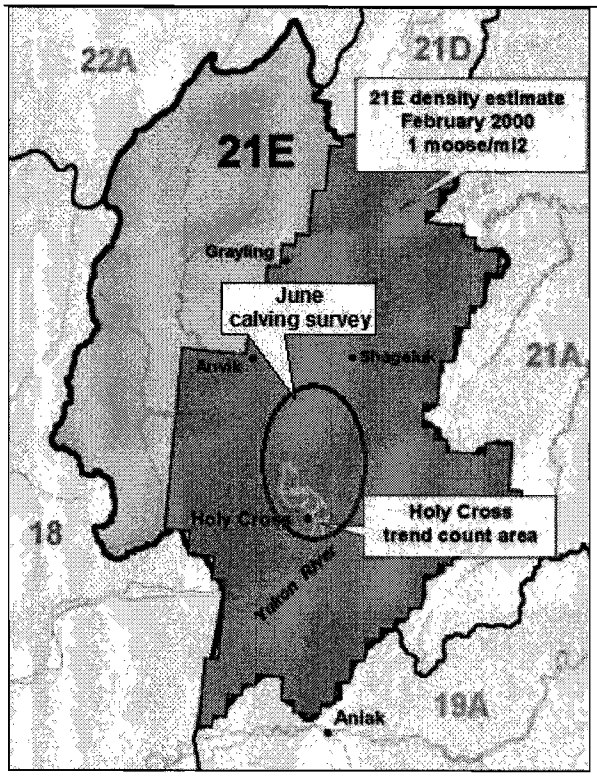


Figure 3. Moose survey areas in Unit 21E. The dark green shading represents the 5070 mi^2 moose survey area for GSPE population surveys conducted in the 2000 and 2005.

Mortality factors including estimated predation, harvest, and other factors.

Declines in a moose population occur when mortality exceeds recruitment. Wolf predation is an important cause of moose mortality in Alaska and western Canada where moose are the primary prey of wolves (Gasaway et al. 1992, Hayes et al. 2003). Information gained from studies on moose mortality in Unit 19D-East (Keech 2005; M.A. Keech, ADF&G, pers. comm.) suggest that wolves are currently a limiting factor for moose in Unit 21E. Research from Units 19D-East (Keech, pers. comm.) and from Units 21B and 21D (Osborne et al. 1991) also indicates that black and brown bear predation is a factor that contributes to calf moose mortality in western interior Alaska. Therefore, bears may be a significant limiting factor to the moose population in Unit 21E as well. Deep snow, spring flooding, and human harvest are also causes of moose mortality in Unit 21E. Deep snow caused a decline in moose calf survival even when wolf control had reduced overwinter predation mortality in Unit 19D East during 2004-05 (Keech, pers. comm.).

Harvest rate and harvestable surplus

A conservative harvest rate of less than or equal to 4% of the estimated moose population was established for Unit 21E in the YIMMP at the current moose population level. The estimated allowable harvest of moose in Unit 21E based on the 90% confidence interval for the 2005 population estimate (7,000-9,000) and using a 4% harvest rate is 280–360 moose. The estimate of the current average harvest in Unit 21E is 340 moose, (including approximately 20 – 25 cows

taken during a federal winter season) which is near the upper end of the range of the allowable harvest. A significant increase in the moose population is necessary before harvest levels could be increased to achieve the current IM harvest objectives.

The upper end of the range of the estimated moose population in Unit 21E is equal to the lower end of the range of the intensive management population objective. The number of animals that can be removed from the Unit 21E moose population on an annual basis without preventing growth of the population or altering the composition of the population in a biologically unacceptable manner is less than the harvest objective established for the population in BOG regulations (Section 5 Alaska Administrative Code 92.108). A harvest of 6% would be required to meet the lower IM harvest objective of 550 moose. Population modeling conducted during the YIMMP process suggested that a 6% harvest would not be sustainable and would cause the population to decline.

Comparison of the current moose population level with historic population levels

Since the mid 1990s, local residents and other hunters have reported a decline in the moose population; however, there is little quantitative information available on the number of moose in Unit 21E prior to 2000.

Moose population estimation surveys were conducted in late February and early March in 2000 and 2005 in a 5,070 mi^2 portion of eastern Unit 21E. In March 2000, the moose density in this survey area was estimated at 1.0 moose/mi^2 or 5151 moose ± 13% (90% Confidence Interval) with an estimated 16% calves. In February 2005, the moose density in the same area was estimated at 0.9 moose/mi^2 or 4673 moose ± 17% (90% CI) with an estimated 18% calves. The difference between these estimates is not statistically significant.

Depleted or reduced productivity of the moose population

Under the criteria established in the IM regulations [5 AAC 92.106] the moose population in Unit 21E is depleted or reduced in productivity as follows:

A. The number of animals that can be removed from the Unit 21E moose population on an annual basis without preventing growth of the population or altering the composition of the population in a biologically acceptable manner is less than the harvest objective established for the population, and;

B. The moose population in Unit 21E is below the IM objective set by the BOG.

Productivity by this definition is actually recruitment of calves into the breeding population, not the number of young produced per cow or a similar index such as twinning rate. The 21E population is depleted because the population and harvest are below the IM objectives

Expected trends in the population, with or without implementation of an IM program.

The 2005 estimate of 0.9 observed moose/mi^2 within the Unit 21E population survey area is considered to be near the upper range of moose density associated with Low Density Dynamic Equilibrium (LDDE) typical for moose populations in ecosystems with lightly-harvested

predators in interior Alaska (Gasaway et al. 1992, National Research Council 1997). Although this is slightly lower than the late winter 2000 density estimate of 1.0 moose per square mile, lack of a statistically significant difference (because of the levels of relative precision in these two surveys) makes it difficult to conclude that the moose population is in a downward trend on the basis of survey data alone. Population modeling conducted during the YIMMP planning process indicated that presently harvest needs to be kept at less than or equal to 4% of the total population, including no more than 40 cows, to prevent a decline in the population.

A decline in moose numbers will result in the population moving further into the LDDE. Without an effective wolf control program, the moose in Unit 21E are likely to persist in this state indefinitely with little expectation of increase, although widespread habitat improvements through natural disturbance (e.g., flooding or fire) combined with winters of low severity and public harvest of predators may prevent further decline (National Resource Council 1997). If the next moose population survey indicates with adequate statistical evidence that the population has declined further, a wolf predation control program is recommended to reverse the trend. Evidence from moose mortality and predator/prey studies conducted throughout Alaska and western Canada (Gasaway et al. 1992, Hayes et al. 2003) suggests that reducing the number of wolves in Unit 21E can reasonably be expected to increase moose survival for all age classes. Wolf control activities within the GASH Moose Management Area, in combination with carefully managing harvest (including minimizing cow harvest), can reasonably be expected to increase moose densities in the control area and surrounding areas and increase the number of moose that can be harvested. This increase would represent progress toward the IM harvest objective.

HUMAN USE OF THE MOOSE POPULATION

According to harvest ticket reports, the number of moose harvested Unit 21E has declined from an average of 182 annually during the 1998–2002 seasons to 127 during the 2003–2007 seasons. Most of this decline can be attributed to a decrease in harvest by non-local residents and nonresidents. In recent years as moose have become more abundant in the lower Yukon River in Unit 18 there has been a significant decrease in the number of hunters from Unit 18 who travel upriver to hunt moose in Unit 21E.

The Division of Subsistence conducted household surveys in Grayling, Anvik, Shageluk and Holy Cross to estimate subsistence harvest of big game species for the study years of 2002-03, 2003-04 and 2004-05. (Subsistence surveys are done for a study year of April to March, whereas regulatory years run from July to June.) During the three years surveyed, moose harvest by residents of Unit 21E declined from 133 to 118 to 94 respectively. Harvest was unusually low in RY 2004 due to low water levels in rivers and forest fires that burned all the way into the moose hunting season. For comparison, in a March 2002 report to the BOG, the Division of Subsistence estimated the average annual harvest of moose by residents of Unit 21E from 1996-1999 to be 226 moose. In recent years annual harvest has included approximately 20-25 cows.

Because a significant portion of the harvest is not reported, harvest ticket reports alone do not provide a reliable indication of total harvest. An estimate of total harvest by Alaska residents in Unit 21E was developed during preparation of the YIMMP based on both reported harvest and

household subsistence harvest data (methods used to develop this estimate are fully described in the YIMMP). The average annual harvest of moose by residents of Unit 21E during 2000-04 was estimated to be 143 moose. During this same period the average annual harvest of moose by residents of Units 18 and 19 was estimated to be 127 moose and the harvest by Alaskans from outside these areas was estimated to be 41 moose.

During RY 2007, 11 moose, including 6 cows and 5 bulls, were reported taken for customary and traditional, Alaska Native funerary or mortuary religious ceremonies in Unit 21E allowed under 5AAC 91.019. These moose do not represent additional take beyond that estimated above, but rather, indicates better reporting of harvest taking place for this purpose.

The result is an estimated average annual harvest of 311 moose in Unit 21E by all Alaska residents. The average nonresident harvest between 2000 and 2004 was 30 moose. Rounded-off, this makes the total estimated annual moose harvest in Unit 21E 340 moose.

Amount of moose necessary for subsistence

The BOG has made a positive finding of Customary and Traditional (C&T) subsistence use of moose in Unit 21. The amount of moose reasonably necessary for subsistence (ANS) in Unit 21, established by the BOG (5 AAC 99.025), is 600–800 moose. However, this number has not been broken down by subunit of the game management unit.

History of regulations controlling harvest of the prey population

In 1977 the Paradise Controlled Use Area was established to reduce the competition for moose between local unit residents in Unit 21E who used primarily boat access and other hunters who used a combination of boat and aircraft access. Based on the recommendations of the GASH AC, at the spring 2003 meeting the BOG eliminated the February resident season for any moose. At the spring 2006 meeting the BOG took several steps to implement the YIMMP including reducing the non-resident season in Unit 21E by 5 days and establishing a drawing permit system to cap the number of nonresident hunters. These changes have persisted through RY 2008.

Predicted trends for demand and harvest, with and without Intensive Management

Demand for the harvest of moose in Unit 21E is currently affected by several factors. As moose populations have risen along the Yukon River in Unit 18 fewer hunters from down river are traveling to 21E to hunt. In addition, there has been a steady increase in the price of gasoline in the area and across the state which has also likely limited travel from lower Yukon River villages.

At the same time however, recent restrictions on moose hunting in the Kuskokwim River drainage in Units 18 and 19A may have resulted in increased demand for moose harvest in Unit 21E. Beginning in RY 2007 a permit system was initiated for non-residents to limit harvest; however this permit was undersubscribed in both RY 2007 and RY 2008. If the adaptive management program is successful in Unit 21E, there will likely be additional opportunity for residents of 21E as well as other Alaska residents, and nonresidents.

The IM harvest objective for Unit 21E is 550–1,100 moose. Based on management experience gained in Unit 19D East and other areas of Alaska, an increase in the moose population is expected if the wolf population is reduced substantially (although less rapidly than if bear predation was reduced concurrently, as in Unit 19D East). If a moose population increase occurs in Unit 21E, more harvest can be allowed, and a greater portion of the unmet demand for moose in Unit 21E can be satisfied. Although the most pronounced effect is expected to be within the GASH MMA, it is reasonable to expect some lesser degree of increase in the moose population in the area immediately surrounding the MMA because it is most likely that some packs hunt both inside and adjacent to the MMA.

Without a successful IM program it is likely that the number of moose in Unit 21E will not be sufficient to meet the harvest demand. The moose resource has already reached the point where the demand for winter antlerless harvest cannot be met and if the population declines further more reductions in hunting opportunity will be required. Residents of Unit 21E are very concerned that a major decline in the moose population could result in harvest being restricted to subsistence only through Tier II permits or closed completely as has recently been the case in nearby GMUs in the Kuskokwim River drainage.

PREDATOR POPULATION INFORMATION

ADF&G has not conducted wolf, black bear, or brown bear surveys in Unit 21E. Population estimates for Unit 21E are extrapolated from predator densities determined in other areas (e.g.; Unit 19D-East; M.A. Keech, ADF&G, pers. comm.) where habitat and moose population densities are similar (Table 2).

Table 2. Extrapolated estimates of wolf, grizzly bear, and black bear populations and reported harvest of wolves and grizzly bears in Unit 21E, regulatory years 2000 to 2007.

Species	Extrapolated Population Estimates	Average Reported Harvest
Wolf	180—240	23 wolves/year
Grizzly Bear	120—200	5 grizzly bears/year
Black Bear	800—1200	1 black bear/year[a]

[a]Sealing of hides not required in 21E.

Using the mid point of the population estimates (Table 2) and a midpoint estimate of 8,000 moose from the 2005 survey, the ratio of wolves to moose is approximately 1:38, grizzly bears to moose is 1:50, and black bears to moose is 1:8. Harvest of wolves and grizzly bears is estimated from records of hide sealing, which is not required for black bears in Unit 21E (Table 3). Hide sealing data should be considered a minimum estimate of predator harvest in Unit 21E. Division of Subsistence household surveys on big game harvest in communities in Unit 21E showed an

average of 48 wolves and 2.6 black bears taken by local residents per year during RYs 2002 to 2004 (Brown et al. 2004, 2005).

Table 3. Average reported harvest of predators taken by shooting (typically hunting) and other methods (typically trapping) in Unit 21E during specified regulatory years (RYs).

Species	Harvest Method	Average Reported Harvest RYs 1986-95	Average Reported Harvest RYs 1996-2007
Wolf	Shooting	15	12
	Other	6	16
Grizzly bear	Shooting	3	7
Black bear [a]	Shooting	<1	1

[a]Sealing of hides is not required in Unit 21E.

Alternative prey species available

Alternative prey species for wolves are limited, particularly in the winter. Rarely portions of the Western Arctic Caribou Herd and Mulchatna Caribou Herd may enter into Unit 21E; however, this has occurred fewer than once every 10 years. Bears are capable of utilizing a wide range of food resources; however, moose calves during their first 6 weeks of life can be an important food item.

Management goals for predator species

Wolf: Ensure the long-term conservation of wolves throughout their historic range in Alaska in relation to their prey and habitat.

Provide for the broadest possible range of human uses and values of wolves and their prey populations that meet wildlife conservation principles and which reflect the public's interest.

Increase public awareness and understanding of the uses, conservation, and management of wolves, their prey, and habitat in Alaska (Alaska Department of Fish and Game 2006)

Grizzly bear: Provide the greatest sustained opportunity to hunt grizzly bears (Alaska Department of Fish and Game 2007).

Black bear: Provide the opportunity to take black bears (Alaska Department of Fish and Game 2005).

The management objective for wolves in Unit 21E is presently to provide for a sustained annual harvest rate of up to 30% from the wolf population, except where greater removal

rates are mandated by approved wolf predation control implementation plans. Harvest rates of <30% are unlikely to regulate wolf populations from increasing (Adams et al. 2008). Goals and objectives for hunting and trapping of predators in Unit 21E will be reviewed in the next cycle of Survey and Inventory reports.

History of regulations and programs affecting the predator populations

There have been no predation control programs in Unit 21E in the last few decades, and harvest of wolves, grizzly bears, and black bears has been administered through hunting and trapping regulations. When the BOG adopted the YIMMP in March 2006 they liberalized several regulations for hunting and trapping predator species. These changes included: 1) waiving the $25.00 resident grizzly bear tag fee; 2) increasing the hunting bag limit for wolves to 10 wolves per season, and; 3) authorizing the use of snow machines to position a hunter to take a wolf for harvest per 5AAC 92.080 (4)(B)(iii) (excluding on lands administered by the U.S. Fish and Wildlife Service). These changes have persisted through the RY 2008 season.

Predicted trends in predator populations, with and without Intensive Management

Regulation changes to increase opportunity to harvest predator species have not resulted in a significant increase in harvest.

Hunting and trapping conducted under ordinary seasons and bag limits alone are not normally an effective wolf reduction technique in sparsely populated areas such as Unit 21E. Effort by hunters and trappers in Unit 21E is relatively low and educational programs to stimulate interest and improve skills in taking wolves have not resulted in higher harvests. The inherent wariness of wolves, difficult access, relatively poor pelt prices, and high gas prices also explain low harvest rates.

In areas with limited human developments, habitat is not considered a significant factor in limiting wolf populations and it is presumed that numbers of wolves are limited mainly by prey availability. There is no evidence of disease or any other naturally occurring factors that would cause wolf mortality to be higher than normally expected in western interior Alaska.

Studies in Alaska and western Canada have concluded that large reductions are required to affect wolf population levels and to reduce predation by wolves on their prey (Gasaway et al. 1992, National Research Council 1997, Hayes et al. 2003). A reduction of about 60–80 percent of the pre-control wolf population may be necessary to achieve prey population objectives. Once the wolf population has been reduced to the population control objective, annual reductions of >30-40% (Adams et al. 2008) would be needed to regulate the wolf population from growing larger than the control objective. The wolf control objective of up to 80% removal of the pre-control population will achieve the desired reduction in wolf predation while ensuring that wolves remain within Unit 21E.

If a wolf control program is implemented in Unit 21E, the numbers of wolves is expected to be substantially reduced in the MMA. However, the majority of Unit 21E is not included in the proposed MMA. Once the wolf predation control program is discontinued, wolf numbers in the

GASH MMA can be expected to return to pre-control levels within a relatively short period of time if trapping and hunting harvest of wolves remains at its present low level.

CONDITION OF MOOSE HABITAT

In forested regions of Interior Alaska, abundant moose browse is generally associated with relatively recent disturbance such as flooding of riparian habitats and post-fire seral stages on upland sites. Riparian habitat in Unit 21E is found along the Yukon and Innoko Rivers and their tributaries. Additional riparian habitat exists along smaller creeks and around boreal lakes and ponds. Ice scouring and naturally occurring wildfires have created a mosaic of vegetative successional stages.

Each year willows and young trees (paper birch, quaking aspen, balsam poplar) put on new growth that is used as winter forage by moose. Measuring the proportion of this current annual growth that moose remove by late winter is a gauge of the nutritional condition of the population. The higher the proportion of browse removal, the greater the chance that forage is limiting productivity (Boertje et al. 2007). In spring 2006, ADF&G sampled moose browse at 32 sites in Unit 21E using methods developed in the Interior (Seaton 2002). Survey crews also measured snow depth and noted the age of dominant plant species at each site. Moose in 21E were removing 21% of current annual biomass, which is a moderate level along the gradient of removal observed in Interior moose populations (Paragi et al. 2008, Fig. 6), which indicates that forage is not strongly limiting productivity.

Observers in the browse survey noted abundant felt leaf willow on the islands and floodplain of the middle Yukon River and diamond leaf willow in extensive meadows adjacent to the Yukon and lower Innoko Rivers. Portions of most islands had lower terraces with cohorts of felt leaf willow 1-5 yrs old. However, browse availability is much less than historic highs because of time since the last major flood disturbance (early 1970s according to local residents). This has allowed large stands of felt leaf willow on higher terraces to grow beyond the reach of moose and non-preferred browse species like alder to increase in abundance. Lateral stems on the bole of felt leaf trees still provide available forage, although at far lower production than during primary succession in the active floodplain (T.F. Paragi, pers. comm.). Snow was deep enough in 2006 when the survey was conducted (average 30 inches, range 12-39 inches) to begin restricting moose movements to sites with higher browse production, such as river floodplains (Coady 1974).

Twinning rate is another indicator of the nutritional condition of a moose population. It is the percentage of cow moose with calves that have twin calves soon after birth in spring, before predation or other mortality has occurred. As a moose population grows and competition for forage increases, a decline in twinning rate (negative feedback) can be monitored as a signal to managers of when to slow population growth by increasing harvest (Boertje et al. 2007). Year to year variation in estimates of twinning rate can occur as a result of severe weather events or sampling error, so rates are best derived from two or more consecutive annual surveys to reflect habitat conditions (Boertje et al. 2007). If 20% or more of cows with calves have twins, it is unlikely that poor nutrition is a major factor limiting production. Twinning surveys conducted in Unit 21E during 2000-08 have shown an average twinning rate of 29%.

Ability of the habitat to support a higher moose population

A direct measure of carrying capacity is difficult or impossible to estimate for free-ranging wildlife populations due to variability in habitat composition at the landscape scale. Additionally, annual weather conditions influence forage production of both summer and winter ranges, and snow depth affects winter energy expenditure by moose (Coady 1974).

The Department is currently undertaking research to better identify winter range for moose across Region III. It will be based on snow depth, habitat types containing browse, habitat selection by moose, and possibly other factors. This research is intended to identify the spatial extent to which density estimates from moose population surveys (often conducted in limited portions of a GMU where moose congregate) should be extrapolated for purposes of setting population objectives.

Based on the recent browse survey, a density of 0.9 moose/mi^2, and good twinning rates, habitat does not appear to be limiting moose productivity in Unit 21E. Fortuitous occurrences of natural disturbances (i.e., fire and flooding) can enhance or expand winter range for moose. Promoting "let burn" policies with wildfire is a good long-term strategy for maintaining or improving moose habitat. Prescribed fire on a small or large scale and mechanical crushing of willows on a small scale are proactive habitat measures that will continue to be considered in terms of cost effectiveness. Large prescribed fires would be challenging to implement successfully because of the complex land ownership in central Unit 21E, the remote location for supporting aerial ignition helicopters, and the maritime influence on weather.

Based on 21% biomass browsing removal by moose in Unit 21E and knowledge of browse removal in other populations across the Interior, and an average 29% twinning rate, Unit 21E appears to have moderate to high potential for moose population growth. Thus, factors other than nutrition are likely limiting growth of the moose population. The survey and inventory program described in this Adaptive Plan includes annual monitoring of twinning rate and conducting another browse survey if the density of moose in the survey area increases significantly (i.e., to the level of ending predation control in the event a control program had been started). If the moose population increased substantially as a result of predation control, a subsequent decrease in twinning rates indicative of declining nutritional condition could be used as an index to implement antlerless harvest (Boertje et al. 2007)

RESOURCES NEEDED TO IMPLEMENT INTENSIVE MANAGEMENT

Survey and inventory program

The DWC intends to conduct a moose population estimation survey in Unit 21E every 3 years as allowed by funding and acceptable weather conditions. The next survey is planned for March 2009. Additionally, annual fall composition surveys combined with spring twinning surveys will be conducted to evaluate some aspects of moose demographics.

Additional information needs relative to Intensive Management

A moose movement study would better define the population being managed. During the 1980's a cooperative collaring study between ADF&G, Innoko National Wildlife Refuge and BLM

showed large scale movements in the moose population with 50% of cows and 75% of bulls moving away from the Yukon River riparian areas during the summer months. Therefore, movement information could be used to understand the impacts of fall vs. winter hunts, identifying areas for twinning surveys, and defining areas where browse surveys should be focused. A survey to estimate the wolf population will be completed as soon as possible to refine the pre-control population estimate and thus refine control objectives (number of wolves to remain in Unit 21E if a control program is implemented). Another browse survey may be done in the future if twinning rates indicate habitat may be limiting, particularly if the moose population increased following predation control. Annual information on snow depth will be collected monthly during winter from existing reporting sites (National Resource Conservation Service and National Weather Service) and by fixed-wing overflight of existing snow stakes in adjacent GMUs to gauge winter severity as a potential effect on calf survival, particularly during predation control programs. Locations for new snow stakes that would improve monitoring of winter severity for moose in remote sections of Unit 21E will be identified for when potential funding sources for installation and monitoring become available.

Additional resources needed to support Intensive Management

Additional resources will be needed to support this IM program, including sufficient funds for periodic wolf surveys, and a moose population movement study.

Staff time: A Tech II/III for 7 months (mid-October to mid-May) for administrative support of the wolf control program. This program will also require 1 to 2 months of time each for the McGrath Area and Assistant Area biologists. The regional wildlife education specialist and the regional wolf trapping education specialist would need to dedicate 1 to 2 months time to conduct programs associated with cow moose harvest, wolf trapping, and harvest reporting. The regional wildlife planner would be needed to contribute expertise at the appropriate stages of this program. Continuing assistance from the regional intensive management coordinator as well as the management coordinator and assistant management coordinator would be needed. Additional assistance from the regional fire and habitat management biologist would be valuable assets to the program.

HUNTING EXPERIENCE AND EFFECTS ON SUBSISTENCE USERS

Unit 21E provides a remote hunting experience for local residents and visitors to the area. The hunting experience is characterized by relatively low numbers of hunters and the availability of traditional campsites. There can be considerable boat traffic along the Yukon River and some of the main tributaries but there are also remote areas where few, if any, other hunters are likely to be encountered. The Paradise Controlled Use Area (PCUA) prevents competition between hunters using boat access and those who prefer airplane access. Other portions of Unit 21E are open to airplane access.

During the process of developing the YIMMP members of the YIWG re-affirmed the importance of the PCUA but also expressed a willingness to accept greater hunter numbers if the moose population increased and a higher level of harvest could be sustained. In general, Unit 21E has relatively good access to boat traffic along the major rivers and airplane access outside the

PCUA. The area is located a long distance from hunters who live in major urban areas of Alaska and non-residents but is relatively close to Bethel. If the moose population were increased to the point where even the lower end of the IM harvest objective (6% = 550 moose) could be sustained, a large increase in the number of hunters would be required to harvest that many moose. It is likely that the existing local and non-local hunters would not find it acceptable to have the greater number of hunters present that would be needed to achieve the IM harvest objective during a fall, bulls-only hunt. Even with potential conflicts aside, it may be difficult to attract the number of hunters required to achieve the IM harvest objective during a fall, bulls-only hunt. However, there are over 10,000 people in 15 villages outside of Unit 21E (Alaska Community Database, Division of Community and Regional Affairs) with access to Unit 21E via marked snowmachine trails that provide relatively easy winter access under good conditions. Early winter hunts in years when ice conditions are safe for travel could still focus on bulls. In years when travel conditions are poor in early winter, late winter hunts (which pose a risk of cow harvest) could be offered at higher moose populations.

The current IM harvest objective is 6-10% of the IM population objective in Unit 21E. A detailed analysis of managing for high yield in GMU 20A, where deep snow is infrequent and bear predation is relatively low, estimated that total predation was still 80% of mortality and a harvest >6% of the fall moose population (including some antlerless harvest) caused an intended slow decline in the population (Boertje et al., In press). In a remote area like Unit 21E, which has wolves, relatively abundant bears, and periodic deep snow that can decrease calf survival even if overwinter predation was controlled, a 6% sustainable harvest may be the highest level achievable.

If the moose population declines and a wolf predation control program is implemented, a proposal will be submitted to the FSB to temporarily close the federal winter antlerless moose hunting season. Eliminating antlerless harvest will result in the loss of opportunity for federally qualified subsistence users to harvest a moose in the winter if they were not successful during the fall hunt.

REVIEW OF POSSIBLE INTENSIVE MANAGEMENT STRATEGIES

Public information and education programs

The YIMMP recommended that information and education programs should be developed to encourage better harvest reporting, and understanding of state and federal hunting regulations. Recommended components of the program include: 1) an explanation of how the hunting regulatory year of July 1 to June 30 works; 2) the requirements for harvest reporting under both state and federal regulations; 3) clarify that there is a one moose bag limit per regulatory year that includes the fall and winter hunts; 4) explain the importance of harvesting bulls only when trying to increase a population of moose; 5) provide public information and education on the effects of predation to encourage increased harvest of predators; 6) work with village councils to conduct wolf snaring and trapping clinics in communities in Unit 21E on a periodic basis, according to local interest.

While information and education programs are an important aspect of IM and can help to promote legal hunting practices and increase harvest of predator species, these programs alone are not likely to effect a significant change in the moose population.

Reduction in moose harvest

Additional actions that could be taken to reduce moose harvest include 1) elimination of the federal season for antlerless moose to minimize all human mortality on cows, and; 2) shorten the federal fall season (August 20-September 25) to align it with the State season (September 5-September 25). Both of these options would require action from the FSB.

If a more significant decline in the moose population occurs seasons and bag limits may need to be shortened for nonresident and resident hunters incrementally and it is possible that registration and drawing permits may be needed to manage resident harvest. Further reductions in harvest could involve complete elimination of the nonresident season (Tier I) or restriction of resident subsistence harvest through a subsistence/Tier II permit system.

The concept of the YIMMP and this Adaptive Plan is to proactively manage the moose and predator populations to prevent a major decline in the moose population that could otherwise result in the need for major harvest reductions, and prolonged periods of population recovery. Other than the possible temporary elimination of the Federal winter antlerless moose season if wolf control is implemented, no additional harvest reductions are desirable options for increasing the prey population at this time.

Habitat restoration and enhancement

In recent years planning and implementation of prescribed burns to improve moose habitat has become very problematic due to land manager concerns, budget constraints, and air quality concerns. Nonetheless, if these concerns can be resolved prescribed burning can be one of the most effective tools to maintain or improve moose habitat. Managing wildland fires to enhance moose habitat will continue to be important for maintaining moose habitat into the future.

The YIMMP recommends working with village corporations and other landowners to revise fire management guidelines to provide for a natural fire regime to the greatest degree possible in consideration of the need to protect homes and property. Currently most of the area along the Yukon and Innoko Rivers is in "full suppression" management status. Changing the fire management guidelines in portions of Unit 21E to "modified" or "limited" could be effective in helping to regenerate moose browse in the long term.

Mechanical habitat improvement is possible, but until the point is reached where habitat is actually limiting productivity, this is not likely to increase moose numbers on a large scale. Habitat enhancement near villages (such as dozer crushing of old willow stands) could improve hunting success by attracting local moose and possibly increase the overwinter survival of a small proportion of the population in severe winters.

Options to reduce predation through management practices not involving predation control

Continuing to waive the $25 resident tag fee for grizzly bears in Unit 21E allows opportunistic harvest of grizzly bears. In addition the bag limit for wolves under hunting regulations could be increased to 10 wolves per day. While these options have the potential to increase harvest of predators, our experience is that they have not substantially changed bear harvest in Unit 21E or other GMUs where this has been attempted.

Options for Predator Control

After considerable thought and deliberation, the YIWG concluded that implementing an aerial wolf predation control program in Unit 21E would likely be the most effective method of maintaining or increasing the moose population and harvest opportunities in Unit 21E.

Land status in 21E is predominately Native corporation (39%) and federal with 42% being managed by the U.S. Bureau of Land Management (BLM) and 11% by the U.S. Fish and Wildlife Service (USFWS). Approximately 8% of the Unit is State land. Aerial wolf control has not been approved for USFWS lands in Alaska. The USFWS position is that before aerial wolf control can occur on their lands, it would be necessary to first complete a National Environmental Policy Act review (NEPA), and also an Environmental Impact Statement. Local Native village corporations have indicated support for implementing a wolf predation control program on their lands, and access to their lands for state personnel and public control permittees would be required before control could be implemented. Presently, an aerial wolf control program could occur on State, BLM, and Native corporation lands.

The primary method currently being used in aerial wolf control programs in Alaska is through ADF&G issuance of permits for aerial shooting and/or land and shooting of wolves to members of the public who are qualified as pilots and gunners. As an alternative, or should that method alone not achieve a sufficient reduction in numbers of wolves, consideration could be given to authorizing Department employees using helicopters to remove wolves.

Department-conducted bear predation control through live-capture and relocation in the McGrath program was restricted to a relatively small area and, although successful, was logistically difficult and expensive and, therefore, not practical for Unit 21E. Lethal bear predation control efforts by the public in McGrath (shooting black bears over bait the same day airborne, sale of black bear or grizzly bear hides and skulls, baiting grizzlies) have been ineffective thus far in achieving an increase in the take of bears and are not recommended at this time for Unit 21E.

If the proposed wolf predation control program and other techniques do not achieve the desired biological results with the techniques that are initially available, the IM program may need to be re-evaluated to determine what additional methods may be successful.

Options for increasing harvest of an abundant moose population

If wolf control is successful and additional harvest can be provided, the YIMMP provides a framework for increasing harvest opportunities.

Options for maintaining harvest of predators at a level sufficient to limit the growth of wolf and bear populations following predation control efforts

We will encourage the public to harvest predators through hunting and trapping in an attempt to slow growth of the wolf population in 21E after the moose population objectives have been achieved and wolf predation control has been suspended. This is helpful to sustain both the increased moose population and the increased moose harvest resulting from the control program. Options for limiting the growth of predator populations are hampered by poor prices on the fur market for wolf pelts and escalating costs of gasoline to trappers operating snow machines. This is a widespread problem especially in rural areas of Alaska and is likely to be the case in Unit 21E. It is essential that the public and the Department continue to explore all options to sustain an elevated harvest of wolves, realizing that the viability of each option is likely to vary between different areas, and what works in 21E may not work elsewhere. Recent average wolf harvest (minimum estimate based on pelt sealing records; Table 3) is 16% of the lower estimate of autumn wolf abundance in Unit 21E (Table 2), about half the harvest rate required to regulate population growth (Adams et al. 2008). Unless the present rates of hunting and trapping of wolves are likely to increase, it would greatly enhance the long-term viability of the Adaptive Plan in 21E to periodically issue permits for aerial control of wolves as necessary.

Additional costs to the Department to implement different Intensive Management treatments

All approaches to IM will involve additional costs (labor, surveys, research & planning) to the Department. Public information and education programs and working to change fire management categories to promote a natural fire regime are less expensive, but require staff time to implement. Prescribed burns could be used to rejuvenate habitat on a large or small scale. Mechanical habitat manipulation could be used to affect areas on a smaller, more localized scale. Staff time is required to manage a permit program for aerial wolf control conducted by the public and considerable staff time can be required to conduct surveys and other field work and respond to public information requests. Utilizing state employees in helicopters as a secondary method to back up public permittees to remove wolves is expensive but also provides more certainty that the desired biological results can be achieved.

There are significant costs to the Department (both staff time and financial) regardless of whether the public or the Department removes wolves. If the Department removes the wolves, the following additional resources will be required: Helicopter time and 2 fixed wing spotter planes for 3-5 days; wolf handling costs; fuel delivery and storage; lodging, travel and other logistics.

THE RECOMMENDED ADAPTIVE MANAGEMENT PROGRAM

This Adaptive Plan incorporates objectives to address IM in a multifaceted approach that includes public information and education; managing harvest of moose and predators of moose; monitoring and enhancing habitat where necessary and feasible; implementing a wolf predation control program if the next moose population survey demonstrates a decline is underway; and adapting the IM objectives as knowledge is gained about the system of predators, prey, habitat, and harvest. Cautiously managing the harvest of moose and implementing a wolf predation

control program are the actions that have the most potential at this time to help initiate an increase in the moose population and progress toward meeting the IM harvest objective. Achieving the objectives outlined below will represent progress towards achieving the IM objectives for moose in Unit 21E.

OBJECTIVES OF THE INTENSIVE MANAGEMENT PROGRAM

1. Maintain the Unit 21E moose population at or above 0.9 observed moose/mi^2 as measured within the moose survey area (the density that was estimated to be present in 2005).

2. Conduct a moose population estimation survey (GSPE survey) in Unit 21E in March 2009 and schedule subsequent surveys every 3 years in sequence with other survey areas.

3. If any late winter population estimate in the moose survey area is less than a critical value that ensures a high probability of the true population density being less than 0.9 observed moose/mi^2, implement an aerial wolf predation control program in the GASH MMA within Unit 21E (see next section for decision framework).

4. If a wolf predation control program is initiated, the decision to end wolf predation control would require a late winter population estimate in the moose survey area that is greater than a critical value that ensures a high probability of the true population density being greater than 1.0 observed moose/mi^2 (see next section for decision framework).

5. Ensure that a population of wolves remains in Unit 21E by leaving up to 60% (4798 mi^2) the unit out of the area where aerial wolf control will be conducted, and removing no more than 80% of the pre-control wolf population from the entire subunit. This will ensure that wolves will remain present in Unit 21E throughout the wolf control program. Once wolf predation control efforts are suspended, the wolf population in Unit 21E will likely grow at a rate that will depend on the level of wolf harvest from hunting and trapping.

6. Continue to monitor habitat conditions and consider habitat manipulations such as willow crushing and prescribed burns if twinning rates fall below 20%.

7. Use new information as it becomes available on vegetation cover types (typically classified from satellite imagery) and the frequency and distribution of deep snow (>35 inches; typically obtained with field sampling) to better define the extent of moose winter range during years of low-moderate and deep snow in Unit 21E. This information will be used to re-evaluate the IM population objective in terms of potential moose density that may be sustained in a portion of Unit 21E.

8. Keep total moose harvest at less than or equal to 4% of the population with no cow harvest when the moose density in the moose survey area is below 0.9 observed moose/mi^2 or a predation control program is active. A higher harvest rate and harvest of

antlerless moose will be considered at higher moose density or after predation control programs have ended as a result of moose population growth (see point 4 above).

Framework for management decisions

The 2006 Yukon-Innoko Moose Management Plan sought to *proactively* manage the moose population in Unit 21E so it did not drop below a density of 0.9 observed moose/mi^2 estimated in March 2005. This equates to approximately 4500 observed moose in the 5070 mi^2 survey area. Applying a sightability correction factor of 1.25 results in a density of 1.1 moose/mi^2, which is the upper end of the Low Density Dynamic Equilibrium (Gasaway et al. 1992).

Setting a management objective of 4500 moose in the Unit 21E survey area and establishing precision objectives for moose surveys serves to define the framework for making decisions on whether to take an action to increase or decrease the population. Biologists often compare estimates of population size from field surveys to an objective and make management recommendations, and the BOG makes a decision (takes an action) based on a variety of information. However, we can never know the *true* abundance of a wildlife population in a large area. Instead, abundance is estimated using field surveys, which have a level of uncertainty. This uncertainty means there is a risk of taking an incorrect action based on the information we obtain. An incorrect action can result in either failure to take warranted action or taking an unwarranted action. The risk of taking incorrect actions to start or end predation control may lead to delayed population recovery or to growth in prey population to a level that reduces nutritional condition or population productivity (Table 4).

A decision framework was constructed to account for the risks associated with taking actions based on survey estimates and their inherent uncertainty. We specify risk:action relationships to serve as the basis for separate decision frameworks for starting and ending predation control. Details of the statistical tests (which form the basis of the decision framework) and examples of decision scenarios are found in Appendix A. The decision frameworks can be modified (by changing the management objectives and tolerance level for making incorrect decisions based on survey precision) to reflect public opinion regarding the balancing of risks (see Appendix A).

Biological Survey, Inventory and Research Programs

Moose population estimates (GSPE) will be conducted every 3 years (survey conditions permitting). Additionally, fall composition and spring twinning surveys for moose will be conducted annually. If a predation control program is active, assessing productivity between population estimates will be important to document changes in calf survival. With adequate sample sizes, an index to productivity from fall composition surveys is calf: cow ratio (ideally >30 calves: 100 cows). In years of late winter density estimates, the proportion of calves will be an index to over-winter survival (ideally calves >20% of the total population). The Department will also conduct a wolf population survey conditions allow. A moose movement study will be initiated if sufficient staff and funding become available for the state to participate in a cost share with federal cooperators. A better understanding of moose movements may identify whether a segment of the population in Unit 21E is migratory and help interpret fall harvest data in the context of fall composition surveys and winter density surveys. Radio-collared moose would also allow estimation of a sightability correction factor to improve density estimates. Snow

depth will be monitored monthly during winter in adjacent areas (Units 19A and 19D) but cannot be expanded to Unit 21E given present workload in the McGrath office.

Recommendations for wolf and/or bear predation control implementation plans

Additional data, including a new moose population estimation survey and a wolf population estimation survey are needed to further evaluate the status of the moose population and prepare for the possibility of implementing an aerial wolf predation control program. If approved by the BOG, the Department intends to implement an aerial wolf control program when the data indicate that the biological thresholds for implementing the program that are described in this Adaptive Plan have been reached. These surveys will more clearly delineate the need for the program and serve as a baseline to better evaluate the effectiveness of a wolf predation control program after it has begun.

The portion of Unit 21E within the proposed GASH MMA is approximately 2,617 square miles and the remainder of Unit 21E is approximately 5,380 square miles. The proposed MMA encompasses the primary moose over-wintering habitat in Unit 21E. The topography is flat, consisting of the floodplains and meadows of the Yukon and Innoko Rivers which are conducive to aerial methods of taking wolves. With aerial wolf control on the 2,617 mi^2 MMA, the remaining 67% of Unit 21E will essentially be a refuge from aerial control efforts, simplifying the task of ensuring that the wolf population is not reduced below 80% in all of Unit 21E. Wolf take from an aerial wolf predation control program will be closely monitored. Wolf control activities and harvest of wolves under the hunting and trapping regulations will be suspended prior to 30 April in a regulatory year if the wolf population in Unit 21E is reduced to the management objective of 40 wolves (20% of the pre-control wolf population estimate). This 80% removal may not be achieved in years when poor snow conditions hinder tracking, but that objective helps ensure adequate removal each year. A review of predation control programs to enhance moose and caribou populations noted that wolf removal of at least 55% should occur for at least 4 years for a high chance of success in increasing ungulate populations (National Research Council 1997). Although reducing wolf predation on calves during winter is expected to improve calf survival, unpredictable weather events (spring flooding reducing newborn survival and deep snow affecting calf mortality) may decrease calf survival in some years.

The Department should continue to evaluate the importance of bear predation on moose in interior Alaska. Although implementing bear control concurrently with wolf control could result in a more rapid increase in the moose population, especially through improved calf survival (M.A. Keech, pers. comm.), there are currently no successfully demonstrated bear control methods in Alaska that could be readily applied to Unit 21E. As we begin adaptive management in Unit 21E, application of a single control method (on wolves) simplifies understanding of system response that is inherent to adaptive management (National Research Council 1997). Future control programs may be able to utilize control of multiple predators once a better understanding If the first moose survey following at least a 4-year aerial control of wolves in Unit 21E produces an estimated moose density of fewer than 0.9 observed moose/mi^2 based on the decision framework, and nutritional indicators continue to suggest that habitat is not limiting moose population growth, the Department should take action to reduce bear predation if effective methods are identified. Any techniques to control bear predation that are shown to be successful

in other areas should be considered for Unit 21E. In addition, the Federal Subsistence Board could approve antlerless hunts that could remove some calves and breeding-age cows during a program intended to grow the moose population.

Habitat restoration and enhancement.

Currently planned habitat assessment work will include further evaluation of winter snow conditions and vegetation mapping of the portion of Unit 21E containing quality moose browse. The Department should continue working with village corporations and other landowners to revise fire management guidelines to provide for a natural fire regime to the greatest degree possible, while protecting homes and property. Habitat manipulations such as willow crushing and prescribed burns should also be considered to maintain quality habitat.

Recommended changes in hunting and trapping regulation to help reduce predation.

Wolf and bear hunting regulations were revised when the YIMMP was adopted to increase opportunities to harvest predators. The BOG should continue to waive the $25 resident tag fee for grizzly bears in Unit 21E and support other regulation proposals that will increase opportunities to harvest species that prey on moose.

RECOMMENDED BOARD OF GAME ACTIONS

The BOG should review Version 3 of this Adaptive Plan for Intensive Management of Moose in Game Management Unit 21E and also consider the GASH AC proposal to establish a wolf predation control area implementation plan in Unit 21E (Proposal 238). The Department recommends BOG endorsement of this AM plan and adoption of a Unit 21E wolf predation control area (5 AAC 92.125), as requested in Proposal 239.

The next moose population estimation survey in Unit 21E is scheduled for March 2009. If that or subsequent surveys or other productivity data indicate the moose population is in decline, the Department, if authorized, will implement wolf control beginning in winter 2010-2011..

Appendix B provides a review of the requirement for IM of moose in Unit 21E according to the state IM laws. Recommendations for several determinations or "findings" to be made by the BOG are identified in Appendix B and listed below. These findings will help to create a clear public record of the legal requirement for IM of moose in Unit 21E (please note: changes have been proposed to the IM laws and if changes occur it may change the need or requirements for points that must be included in the BOG regulatory actions or findings). The final BOG findings should include the points listed below and any additional points recommended by the Department of Law or points that the BOG feels are important to include in the public record of the decision.

Recommended Board of Game Finding 1: Depletion or reduced productivity of the moose population in Unit 21E has occurred when compared with the IM objectives [AS 16.05.255(e)(2)].

Recommended Board of Game Finding 2: Depletion or reduced productivity of the moose population in Unit 21E has occurred, and may result in a significant reduction in the allowable harvest. [AS 16.05.255(e)(2) and 5 AAC 92.106(4)].

Recommended Board of Game Finding 3: Increasing the abundance and productivity of the moose in Unit 21E is feasible and achievable using recognized and prudent management techniques [AS 16.05.255(e)(3)].

Recommended Board of Game Finding 4: IM as described in this plan would not be: 1) ineffective based on scientific information; 2) inappropriate due to land ownership patterns, or; 3) against the best interest of subsistence users.

IMPLEMENTATION, EVALUATION, AND MODIFICATION OF THE ADAPTIVE PLAN

This Adaptive Plan should remain in place as long as it serves as a useful guide to actions that will help to maintain or increase the moose population and harvest opportunities in Unit 21E. The plan may need to be adapted as additional information and experience is gained. If a need arises in the future, the plan will be updated in consultation with the GASH AC and others and will be brought back before the BOG for review and approval. If the BOG adopts regulations to authorize an aerial wolf predation control program in Unit 21E as recommended in this plan, the program should be authorized for an initial period of 5 years the end of which would coincide with the March 2014 meeting of the BOG. During this time DWC staff will provide updates on the aerial wolf control program and status of the moose population at the appropriate meetings, and the time frame or other aspects of the wolf predation control program can be revised as needed.

The 2005 density estimate for moose in Unit 21E will be used as a management objective for this Adaptive Plan. Every 3 years (survey conditions permitting) a population estimate (GSPE survey) will be accomplished. If any late winter population estimate in the moose survey area is less than a critical value that ensures a high probability of the true population density being less than 0.9 observed moose/mi^2, the recommendation would be to implement an aerial wolf control program in the MMA within Unit 21E If a wolf predation control program is initiated, the decision to end wolf control would be recommended when a late winter population estimate in the moose survey area is greater than a critical value that ensures a high probability of the true population density being greater than 1.0 observed moose/mi^2.

Periodic predation control will likely be required on a long term basis because hunting and trapping alone in Unit 21E are unlikely to maintain wolves at a low enough level to prevent wolf populations from expanding in response to an increased moose population. A wolf predation control implementation plan is recommended to remain in place for 5 years to begin with; however, some predation control will likely be a long term management requirement to maintain increased harvest yield. The term of subsequent renewals, if any, should be aligned with BOG cycles.

Table 4. Biological risk factors[a] in decisions on whether to start or end predation control for increased prey abundance based on results of population survey that has uncertainty in measuring the true but unknown prey abundance.

Option	Start predation control				End predation control			
Decision	Yes		No		Yes		No	
Prey abundance estimated from survey greater than management objective (true but unknown abundance)?	Yes	No	Yes	No	Yes	No	Yes	No
Risk factor (consequence of incorrect decision based on survey estimate)	Continued prey population growth (decline in nutritional condition)[b]	None[c]	None	Continued low prey abundance and delayed recovery[d]	None	Continued low prey abundance and delayed recovery	Continued prey population growth (decline in nutritional condition)	None

[a]Risk defined in context of prey; assumes predator population will recover when predation control ends.
[b]Adequate harvest across all age and sex classes of moose could prevent continued population growth and potential range damage. However, risk occurs if access for hunts is poor or the level of harvest in accessible areas is constrained (e.g., authority of Fish and Game Advisory Committees to prohibit antlerless harvest) to limit competition or maintain the quality experience of the hunt.
[c]Risk defined as "none" assumes that the moose density at the management objective is sustainable for the present condition of habitat in the survey area.
[d]Biological risk has management implication of prolonged low yield of sustainable prey harvest.

The moose population will be monitored annually through spring twinning surveys and fall composition surveys. Ratios of calves: 100 cows, bulls: 100 cows, twinning rates, and yearlings as a percentage of the population will be examined to assess predation, habitat quality, and effects of harvest. If feasible, a moose movement study will occur to improve understanding of transient vs. resident portions of the population. Following any predation control, the nutritional status of the moose population and indices of moose browse condition will continue to be monitored to document how increases in moose density may influence productivity and to gauge potential to allow increased harvest or antlerless harvest.

CONCLUSIONS

This Adaptive Plan outlines a comprehensive approach to maintain and increase the moose population and harvest levels in Unit 21E. The plan considers moose population size, moose harvest, moose habitat, predation on moose and public information and education. The plan outlines biological information that is needed to evaluate the need for and potential effectiveness of wolf control and the resources needed by the DWC to implement the program. An adaptive approach should be used for the entire management program whereby objectives and methods are periodically reviewed and may be changed based on updated information. As additional information is gained or if changes take place in the moose population or other factors, the plan should be modified to fit the changing circumstances. The Department will work with the GASH AC, the BOG, and other members of the public to monitor and evaluate the plan and revise the management program annually if needed.

This AM Plan is designed to be proactive in nature. The intent is to be able to respond to a detectable decline in the moose population in Unit 21E in a timely fashion, by first completing the necessary administrative and regulatory steps that would otherwise delay management action. The analysis in this Adaptive Plan demonstrates that the moose population and harvest in Unit 21E are below the IM objectives. Pursuant to the IM laws, the BOG should adopt or schedule for adoption regulations to provide for IM of moose in Unit 21E. Adoption of the recommended regulation to authorize an aerial wolf predation control program in a portion of Unit 21E, combined with other recommendations in this plan, are the best methods available to provide for intensive management of moose in Unit 21E.

LITERATURE CITED

Adams, L.G., R.O. Stephenson, B.W. Dale, R.T. Aghook, and D.J. Demma. 2008. Population dynamics and harvest characteristics of wolves in the central Brooks Range, Alaska. Wildlife Monographs 170:1-25.

Alaska Department of Fish and Game. 2002. Units 19A, 21A, and 21E. Pages 294–322 *in* C. Healy, editor. Moose management report of survey and inventory activities 1 July 1999–30 June 2001. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska. < http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/mo02mt_int.pdf> Accessed 7 January 2009.

Alaska Department of Fish and Game. 2005. Units 19A, 21A, and 21E. Pages 218–222 *in* C. Brown, editor. Black bear management report of survey and inventory activities 1 July 2001–30 June 2004. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska. < http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/05blbweb.pdf> Accessed 12 January 2009.

Alaska Department of Fish and Game. 2006. Units 21A and 21E. Pages 188–198 *in* P. Harper, editor. Wolf management report of survey and inventory activities 1 July 2001–30 June 2004. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska. < http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/05blbweb.pdf> Accessed 12 January 2009.

Alaska Department of Fish and Game. 2007. Units 19A, 21A, and 21E. Pages 195–211 *in* P. Harper, editor. Brown bear management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game. Project 1.0. Juneau, Alaska. < http://www.wildlife.alaska.gov/pubs/techpubs/mgt_rpts/07_brbear.pdf> Accessed 12 January 2009.

Boertje, R.D., M.A. Keech, D.D. Young, K.A. Kellie, and C.T. Seaton. In press. Managing for elevated yield of moose in interior Alaska. Journal of Wildlife Management, Vol. 73.

Boertje, R.D., K.A. Kellie, C.T. Seaton, M.A. Keech, D.D. Young, B.W. Dale, L.G. Adams, and A.R. Aderman. 2007. Ranking Alaska moose nutrition: Signals to begin liberal antlerless harvests. Journal of Wildlife Management 71:1494-1506.

Brown, C., R.J. Walker, and S.B. Vanek. 2004. The 2002-2003 harvest of moose, caribou, bear, and wolves in the lower-middle Yukon River communities of Grayling, Anvik, Shageluk, and Holy Cross. Technical Paper 281. Alaska Department of Fish and Game, Division of Subsistence. 38 p. <http://www.subsistence.adfg.state.ak.us/TechPap/tp281.pdf> Accessed 15 January 2005.

Brown, C., and D. Koster. 2005. The 2003-2004 harvest of moose, caribou, bear, and wolves in the lower-middle Yukon River communities of Grayling, Anvik, Shageluk, and Holy Cross. Technical Paper 298. Alaska Department of Fish and Game, Division of Subsistence. 46 p. <http://www.subsistence.adfg.state.ak.us/TechPap/tp298.pdf> Accessed 15 January 2005.

Coady, J.W. 1974. Influence of snow on behavior of moose. Naturaliste canadien 101:417-436.

Gasaway, W.C., R.D. Boertje, D.V. Grangaard, D.G. Kelleyhouse, R.O. Stephenson, and D.G. Larsen. 1992. The role of predation in limiting moose at low densities in Alaska and Yukon and implications for conservation. Wildlife Monographs 120:1–59.

Gasaway, W. C., S. D. DuBois, D. J. Reed, and S. J. Harbo. 1986. Estimating moose population parameters from aerial surveys. Biological Paper 22, University of Alaska Fairbanks.

<http://winfonet.alaska.gov/sandi/moose/surveys/documents/ua_biology_papers_nr_22.pdf> Accessed 8 Sep 2008.

Hayes, R.D., R. Farnell, R.M.P. Ward, J. Carey, M. Dehn, G.W. Kuzyk, A.M Baer, C.L. Gardner, and M. O'Donoghue. 2003. Experimental reduction of wolves in the Yukon: ungulate responses and management implications. Wildlife Monographs 152:1-35.

Keech, M. A. 2005. Factors limiting moose at low density in Unit 19D East, and response of moose to wolf control. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Final Research Performance Report. Grants W-27-5 and W-33-1 through W-33-3. Project 1.58. Juneau, USA. <http://www.wildlife.alaska.gov/pubs/techpubs/research_pdfs/mo-19d-wolf05.pdf> Accessed 5 January 2009.

National Research Council. 1997. Wolves, bears, and their prey in Alaska: biological and social challenges in wildlife management. National Academy Press, Washington, D.C. 207 p.

Osborne, T.O., T.F. Paragi, J.L. Bodkin, A.J. Loranger, and W.N. Johnson. 1991. Extent, cause, and timing of moose calf mortality in western Interior Alaska. Alces 27:24–30.

Paragi, T.F., C.T. Seaton, and K.A. Kellie. 2008. Identifying and evaluating techniques for wildlife habitat management in Interior Alaska: moose range assessment. Alaska Department of Fish and Game, Division of Wildlife Conservation. Federal Aid in Wildlife Restoration. Final Research Technical Report. Grants W-33-4, 5, 6, & 7. Project 5.10. Juneau, Alaska. <http://www.wildlife.alaska.gov/pubs/techpubs/research_pdfs/hab-mgt08final.pdf> Accessed 30 December 2008.

Regelin, W.L., P. Valkenburg, and R.D. Boertje. 2005. Management of large predators in Alaska. Wildlife Biology in Practice 1:77-85.

Seaton, C. T. 2002. Winter foraging ecology of moose in the Tanana Flats and Alaska Range Foothills. Thesis, University of Alaska Fairbanks. 102 p. <http://www.birding.alaska.gov/pubs/techpubs/propubs/seaton_thesis.pdf> Accessed 5 January 2009.

YIMMP. 2006. Yukon-Innoko Moose Management Plan. Report by the Alaska Department of Fish and Game in cooperation with the Yukon-Innoko Moose Management Working Group. 32 p. <http://wildlife.alaska.gov/management/planning/planning_pdfs/yukon_innoko_plan.pdf > Accessed 13 January 2009.

Walters, C.J. 1986. Adaptive management of renewable resources. Blackburn Press, Caldwell, New Jersey. 374 p.

APPENDIX A: STATISTICAL BASIS FOR MANAGEMENT DECISIONS

Statistical hypothesis tests allow us to address the risks associated with making decisions based upon survey estimates and to define *critical values* against which field measurements will be directly compared. For moose abundance, this approach allows us to objectively assign risk levels to decisions based on the field estimate of abundance, given that we can never know the true moose abundance in a large area. For example, using these tests we can answer the question: "If the true abundance of moose is less than our management objective (by some amount), what is the probability (chance) that our estimated population size, when compared to the critical value, will result in a recommendation to take a management action?" Defining the level of risk is a matter of saying what chance you are willing to accept of making an incorrect decision (e.g., concluding a management action is warranted when in fact it is not, or vice versa). One hypothesis test (and associated risk:action relationship) will be used to decide whether or not to start predator control and second hypothesis test will be used to decide when to end predator control, should it be initiated.

To form hypotheses tests (in this case t-tests) and define the risk:action relationship, we need to define a null hypothesis and make an assumption about the precision of future survey estimates. The test to *start* predation control assumes that the true abundance is 4500 moose (0.9 observed moose/mi^2) or less; 4500 moose is the management objective described in the Yukon-Innoko Moose Management Plan and is similar to the 2005 estimate. The hypothesis test also assumes that a management action is required to increase a low population, thus placing the burden on subsequent survey results to demonstrate (with a high degree of confidence) that the true abundance is greater than assumed and that predation control should not begin. The test to *end* predation control assumes that the true abundance is higher than a management objective of 5000 moose (similar to the 2000 abundance estimate, approximately 1.0 observed moose/mi^2) and that predation control will continue. This test places the burden on subsequent surveys to demonstrate (with a high degree of confidence) that the true abundance is greater than 5000 before ending predation control. For both tests we based our expected sample sizes and the level of uncertainty in future moose surveys on our survey design and results for past surveys in Unit 21E. We describe the level of uncertainty in surveys as *relative precision*, which can be thought of as an interval equal to +/- some proportion of the population estimate. We expect to achieve a relative precision of 20% at the 90% confidence level, but also presented risk:action relationships for 15 and 25% relative precision for comparison (Table A1). If the relative precision of a moose survey is greater than 0.25 at the 90% confidence level (i.e., less precise), additional consultation with a biometrician is required to interpret the decision framework presented in Table A1.

The proposed decision framework (Table A1) needs further explanation. At a relative precision of 20%, the critical value (in terms of number of moose) for starting predation control against which the survey estimate is compared is 5648 (meaning survey estimates less than 5648 will start predation control). For ending predation control the critical value is 6275 (meaning survey estimates greater than 6275 will end predation control). Note that the exact critical value (number of moose) will depend on the survey estimate's relative precision (not yet known). Critical values at 15 and 25% relative precision are presented for comparison. The following examples will demonstrate how to interpret Table A1 for surveys having a relative precision of 0.20 at the 90% confidence level. For starting predation control, if the true abundance was equal

to the management objective of 4500, there would be a 95% chance that a survey estimate would be *less than* critical value of 5648 and lead to the initiation of predator control (i.e., only a 5% chance of incorrectly delaying predator control). If the true abundance is 5500 there would be a only a 57% chance that a survey estimate would be *less than* the critical value and result in starting predator control. For ending predation control, if the true abundance was equal to the management objective of 5000, there would be a 5% chance that a survey estimate would be *greater than* critical value of 6275 and lead to the end of predator control (i.e., a 5% chance of prematurely ending predator control). If the true abundance is 5500 there would be an 18% chance that a survey estimate would be *greater than* the critical value and result in the end predator control.

If this decision framework had been in place starting in 2000, both the 2000 and 2005 abundance estimates would have warranted starting predation control because they did not exceed the critical values 5185 and 5440, respectively (these critical values correspond to the exact relative precision of each survey estimate). For comparison, if this decision framework had been in place in 2000 and predation control had already been underway, both the 2000 and 2005 abundance estimates would have failed to end predation control because they did not exceed the critical values of 5761 and 6044, respectively.

The decision framework for starting predation control (Table A1) illustrates that as the true (but unknown) population increases under various scenarios (alternative hypotheses), there is an increasing chance that the survey estimate will exceed the critical value, therefore a decreasing chance of starting predation control. The decision framework to end predation control also illustrates that there is an increasing chance of ending predation control once it had started as the true (but unkown) population increases. As relative precision of surveys decreases in this framework (resulting in larger critical values), larger survey estimates are required to decide *not* to start predation control or to decide to end predation control once it had started.

Table A1. Probability of taking actions to start or end predation control depending on a true (*but unknown*) moose population size and the uncertainty of population estimates in a 5070 mi^2 survey area in Game Management Unit 21E. The separate decision frameworks are based on statistical hypothesis tests that provide a critical value against which a population survey estimate is directly compared to determine if a management action is warranted. Consequences of incorrect decisions are defined in Table 4. Probabilities of taking an action are presented for three levels of relative survey precision (0.15, 0.20, 0.25) at the 90% confidence level of moose abundance estimates.

			Decision framework for action to start predation control for a management objective of 4500.			Decision framework for action to end predation control for a management objective of 5000.		
Scenario of *true but unknown* population size	Observed moose density for scenario (no./mi^2)	Observed moose density corrected for sightability (no./mi^2)[a]	Probability of starting predation control at a given [*survey precision*] and (*critical value*).			Probability of ending predation control at a given [*survey precision*] and (*critical value*).		
			[*0.15*] *(5309)*	[*0.20*] *(5648)*	[*0.25*] *(6032)*	[*0.15*] *(5899)*	[*0.20*] *(6275)*	[*0.25*] *(6702)*
4000	0.8	1.0	1.00	1.00	0.99	0.00	0.00	0.00
4500	0.9	1.1	0.95	0.95	0.95	0.00	0.01	0.01
4673[b]	0.9	1.2	0.89	0.91	0.92	0.01	0.01	0.02
5000	1.0	1.2	0.71	0.80	0.84	0.05	0.05	0.05
5151[c]	1.0	1.3	0.61	0.73	0.79	0.09	0.08	0.07
5500	1.1	1.4	0.37	0.57	0.68	0.25	0.18	0.15
6000	1.2	1.5	0.14	0.35	0.51	0.56	0.39	0.29
6500	1.3	1.6	0.05	0.20	0.36	0.80	0.59	0.44
7000	1.4	1.7	0.01	0.10	0.25	0.93	0.75	0.58
7500	1.5	1.9	0.00	0.05	0.17	0.98	0.86	0.70
8000	1.6	2.0	0.00	0.03	0.11	0.99	0.92	0.79
8500	1.7	2.1	0.00	0.01	0.08	1.00	0.96	0.85
9000	1.8	2.2	0.00	0.01	0.05	1.00	0.98	0.89

[a]Observed density multiplied by Sightability Correction Factor of 1.25 (see text for discussion).
[b]Estimated population size in March 2005 (with relative survey precision at the 90% confidence level of 0.17).
[c]Estimated population size in March 2000 (with relative survey precision at the 90% confidence level of 0.13).

APPENDIX B: STATUS OF MOOSE IN UNIT 21E UNDER THE INTENSIVE MANAGEMENT LAWS

1. Board of Game determination that consumptive use of the big game prey population is the preferred use [AS 16.05.255(e)(1)].

- The BOG has made a positive finding that the moose population in Unit 21E is important for providing high levels of harvest for human consumptive use [5 AAC 92.108].

2. Status of the population in relation to the IM population and harvest objectives

The March 2005 estimate of the moose population in Unit 21E was 7,000 – 9,000. The upper end of this population estimate corresponds to the lower end of the IM population objective. Therefore, it is likely that the population is below the IM population objective. The estimated allowable harvest of moose in Unit 21E based on the 2005 population estimate and using a 4% harvest rate is 280 – 360 moose. The estimate of the current average harvest in Unit 21E is 340 moose, near the upper end of the range of the allowable harvest. A significant increase in the moose population would be necessary before harvest levels could be increased to achieve the IM harvest objective.

Table 5 identifies the IM population and harvest objectives (6-10% of population) for moose in Unit 21E and the most recent estimates of the population size and total harvest.

Table 5. Intensive management objectives vs. the current estimate of the moose population and harvest.

Intensive Management Objectives for Moose in Unit 21E (5 AAC 92.108)	Current Estimated Moose Population and Harvest (reported and unreported) for Unit 21E
Population: 9,000 – 11,000 moose Harvest: 550 – 1,100 moose	Population: 7,000 – 9,000 Estimated Harvest: 340

3. Board of Game determination that depletion of a big game prey population or reduced productivity of a big game prey population has occurred [AS 16.05.255(e)(2)].

- The biologically acceptable harvest of moose in Unit 21E is less than the IM harvest objective; and the population of the moose in Unit 21E is less than the IM population objective.

Recommended Board of Game Determination 1: Depletion or reduced productivity of the moose population in Unit 21E has occurred when compared with the IM objectives.

4. Board of Game determination whether a finding that depletion of a big game prey population or reduced productivity has occurred may result in a significant reduction in the allowable human harvest of the population [AS 16.05.255(e)(2) and 5 AAC 92.106(4)].

   The state winter antlerless moose season in Unit 21E was closed in 2003-04 season based on a recommendation from the Grayling, Anvik, Shageluk, Holly Cross Advisory Committee (GASH AC). The committee judged this action necessary to reduce the take of cows and maintain the productivity of the moose population. A proposal was passed by the BOG at their spring 2006 meeting to reduce the nonresident moose season by 5 days and establish a drawing permit hunt to prevent an increase in the level of nonresident hunting. Additional reductions in harvest will be required if the moose population declines.

   Recommended Board of Game Determination 2: The finding that depletion or reduced productivity of the moose population in Unit 21E has occurred, which may result in a significant reduction in the allowable harvest.

5. Board of Game determination that 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)].

   Without an effective aerial wolf control program, sufficient to reduce predation on moose, IM objectives are not likely to be achieved. If private pilots, in addition to ground-based trapping and hunting, can sufficiently reduce wolf numbers, overwinter survival of moose should improve. This expectation is supported by data from moose mortality and predator/prey studies conducted in Alaska and similar areas in Canada. If the addition of aerial control does not achieve the desired level of wolf reduction, the desired results could be achieved using state employees shooting wolves from helicopters.

   Recommended Board of Game Determination 3: Increasing the abundance and productivity of the moose in Unit 21E is feasible and achievable using recognized and prudent active management techniques.

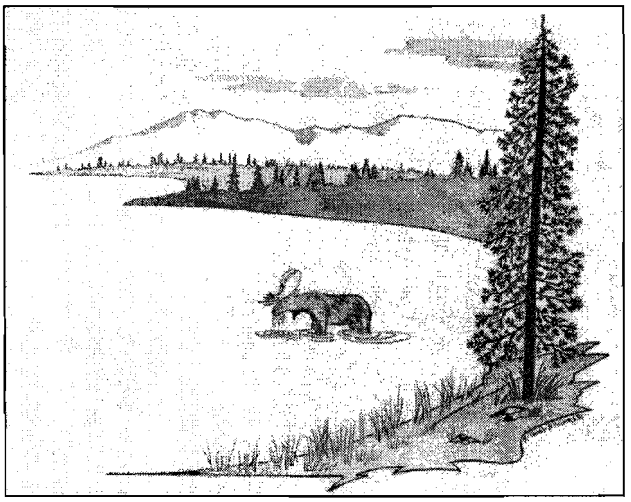
6. The Board of Game may not significantly reduce taking of the big game prey species unless it has adopted or scheduled for adoption regulations that provide for intensive management to increase the take of the population consistent with the population and harvest objectives [AS 16.05.255(f)].

   Reductions in the taking of moose in Unit 21E have occurred. The most significant reduction has been the elimination of the winter antlerless moose season which provided opportunity for Alaska resident harvest of moose. In addition a reduction in the nonresident season was adopted. Intensive management, including aerial wolf predation control, may be effective in helping to increase the moose population, based on available scientific information and the management experience of the department. USFWS lands compose 11% of the area within the northeastern and southern portions of Unit 21E. Certain IM options such as aerial wolf predation control would likely not be allowed on USFWS lands. Therefore, these lands have been excluded from the proposed GASH MMA. Native landowners have expressed support

for an IM program, and use of their lands would be essential for an aerial control program. IM would help increase the number of moose available for subsistence and other uses and be in the best interest of consumptive moose users. The BOG has not declared that a biological emergency exists, nor has it taken emergency action to protect or maintain the moose population in Unit 21E. The BOG has not adopted or scheduled for adoption regulations to provide for IM for moose in Unit 21E.

Recommended Board of Game Determination 4: IM as describe in this plan would not be: 1) ineffective based on scientific information; 2) inappropriate due to land ownership patterns, or; 3) against the best interest of subsistence users.

Recommended Board of Game Action: Endorse this AM plan and adopt a Unit 21E wolf predation control area (5 AAC 92.125), as requested in Proposal 239.



Drawing by Michael Williams, Beaver