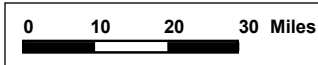
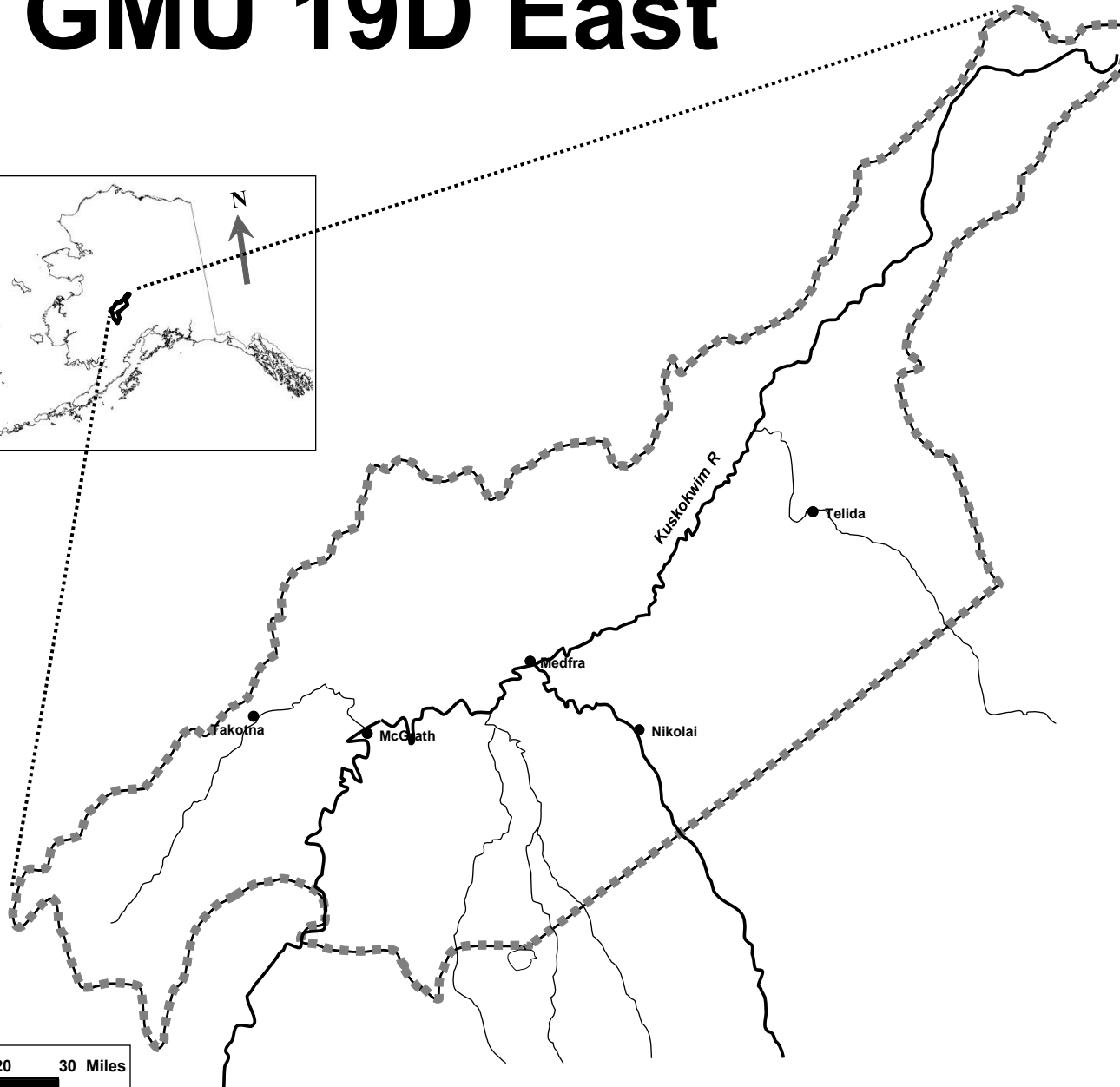
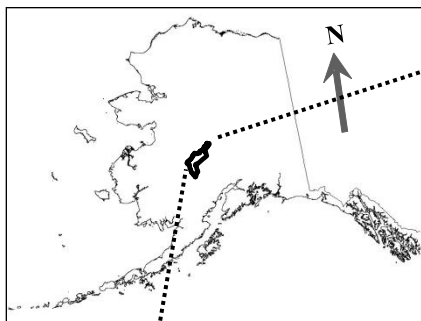


# Long-Term Effects of Short-Term Bear Removals & Sustained Wolf Control on Moose Demography Near McGrath, Alaska



# GMU 19D East



# Background: GMU19D East

- Moose numbers low in 1970's-1990's
- Intensive moose research began in 2001
- Black bears primary moose calf predators
  - Keech et al. (2011)
- Predator reductions
  - Black bears – 96% (translocation, 2003-04)
  - Grizzly bears – 50% (translocation, 2003-04)
  - Wolves  $\geq 65\%$  of pre-control abundance (lethal, 2004-present)
- Moose ~doubled 2001-2010 in MMA
- Short-term positive response to removals

# Longer Term Effects?

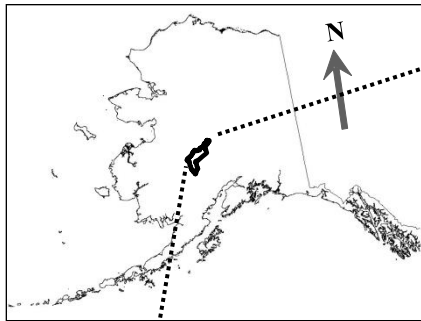
- Short-term response
- Longer-terms effects not well understood
- Sustained higher density moose pop?
- Long-term response in GMU 20A
- Important differences b/t 20A & 19D
  - Wolves vs. bears
  - Weather



# Factors Influencing Moose

- Top-Down = Predation
  - Black Bears at pre-removal density (2010)
  - Predation at higher density?
- Bottom-up = Food Resources
  - Density dependent food competition
  - Reproductive indices, body weight, browse
- Climatic factors
  - Snow depth – winter calf survival
  - Temperature

# Study Area



**19D East (8,513 mi<sup>2</sup>)**

**Bear control area (528 mi<sup>2</sup>)**  
ADF&G removed 96% of black bears & 50% of grizzly bears during 2003-04

**Original wolf control zone (3,210 mi<sup>2</sup>)**  
Wolves reduced annually since 2004

**Moose Management Area (1,118 mi<sup>2</sup>)**

0 10 20 30 Miles

# Research Objectives 2013-2017

- Moose population dynamics
- Nutritional status
- Predator population estimation



# Moose Population Dynamics

- Estimate moose numbers, composition, population growth (MMA)
  - Aerial moose surveys
- Stage-specific survival rates and evaluate factors influencing survival (BCA)
  - Radio-collaring calves, yearlings, adults
- Cause-Specific Mortality (BCA)
  - Visit mortality sites to determine cause
  - ID species and sex of predators using DNA
- Reproduction: twinning & parturition (BCA)



# Nutritional Status

- Browse removal rates (MMA)
- Condition of calves and yearlings by comparing weights (BCA)
- Reproduction: parturition and twinning rate (BCA)



# Predator Populations

- Wolf surveys in original wolf control zone
  - Search entire area (3210 mi<sup>2</sup>) at high intensity ( $\geq 0.8$  min/mi<sup>2</sup>)
- Mark-resight black bear surveys in BCA
  - Telemetry used to estimate sightability
  - Aerial survey in May
- Estimate population predator abundance



# Summary

- Estimate population abundance, composition, demographic parameters, and population growth of moose
- Relate moose population dynamics to predator populations, density dependence, and climate
- Results will allow for better management of moose in GMU19D East and provide insight into forces influencing moose populations

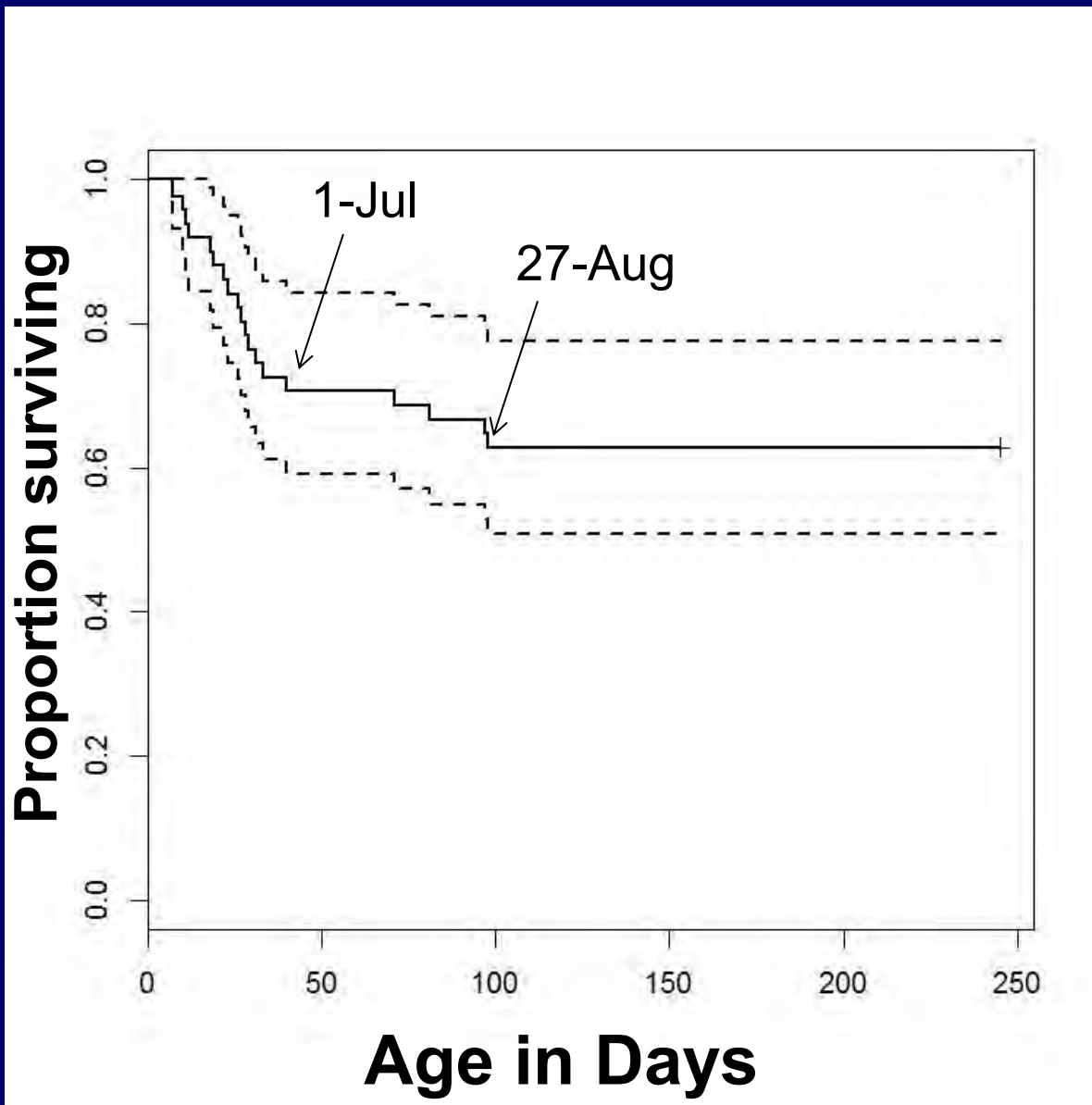
# Preliminary Data 2013

- Calf captures
- Bear captures
- Calf mortality
  - Survival rates
  - Cause specific mortality
  - Sex of bear predators
- Twinning rate
- Calf weights



# Calf Survival 2013 ( $n = 51$ )

Data	$\hat{s}$	95% CI	$n$
All Calves	0.63	(0.51, 0.78)	51
Singles	0.69	(0.55, 0.87)	33
Twins	0.54	(0.35, 0.81)	18



**Calf Survival 2013 ( $n = 51$ )**

# Calf Survival

Year	Summer Survival (%)	Annual Survival (%)
2001	37	33
2002	36	27
2003	62	52
2004	79	40*
2005	54	42
2006	73	63
2007	45	35
2010	57	39
2013	63	63**

\* Deep-snow winter, \*\* Survival to Jan 27

# Causes of Mortality 2013

19 of 51 radiocollared calves died

Cause	% of calves	<i>n</i>
Black Bear	19.6	10
Grizzly Bear	2.0	1
Unk. Bear	5.9	3
Unk. Predator	2.0	1
Unk. Natural	3.9	2
Unknown	3.9	2
Survived	62.7	32



# Summer-Fall Calf Mortality

Year	Black Bear %	Grizzly Bear %	Wolf %	Unknown Predation %
2001	39	6	14	
2002	31	12	20	
2003	15	8	10	
2004	6	0	10	
2005	25	6	4	
2006	12	6	2	
2007	13	26	9	
2010	24	9	7	
2013	20	2	0	8

# Bear Predation By Sex

Year	Black bear		Grizzly bear	
	Male	Female	Male	Female
2001	6	3	2	0
2002	7	8	1	4
2003	4	4	1	0
2004	1	0	0	0
2005	4	2	1	1
2006	2	1	1	0
2007	1	3	3	1
2010	5	2	0	1
2013	5	2	0	0
<b>Total</b>	<b>35</b>	<b>25</b>	<b>9</b>	<b>7</b>

# Condition Indices 2013

Year	Twinning rate ( <i>n</i> )	Calf weight $\leq$ 3 days in kg	
Year	uncollared	Singles ( <i>n</i> )	Twins ( <i>n</i> )
2001	----	19.6 (19)	17.4 (13)
2002	39% (46)	18.9 (16)	17.4 (38)
2003	36% (22)	19.4 (23)	16.4 (18)
2004	39% (31)	20.2 (23)	16.2 (26)
2005	50% (30)	18.3 (20)	15.4 (32)
2006	35% (29)	17.5 (15)	15.2 (30)
2007	50% (30)	18.8 (14)	16.4 (23)
2008	----	----	----
2009	26% (87)	----	----
2010	29% (45)	18.2 (17)	15.6 (14)
2011	37% (38)	----	----
2012	34% (31)	-----	----
<b>2013</b>	<b>22% (55)</b>	<b>19.6 (14)</b>	<b>16.9 (14)</b>

# Expected Results/Benefits

- Provide annual predator/prey data for adaptive management
- Evaluate whether GMU19D East predator reductions successful over longer period
- Inform moose management in other areas of Interior, esp where black bears are major predator of moose calves

