Mountain Goat Monitoring
Kensington Mine, AK

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Alaska Department of Fish and Game, Douglas, AK

Presentation Outline

1. Project Background

2. Monitoring Activities
   - -Capture and Handling
   - -Habitat Selection and Movement
   - -Survival and Reproduction
   - -Population Estimation

3. Summary and Future Work

Project Background

1990-1995: Mountain Goat/Black Bear Monitoring
ADFG/Kensington Venture
(Robus and Carney 1996)

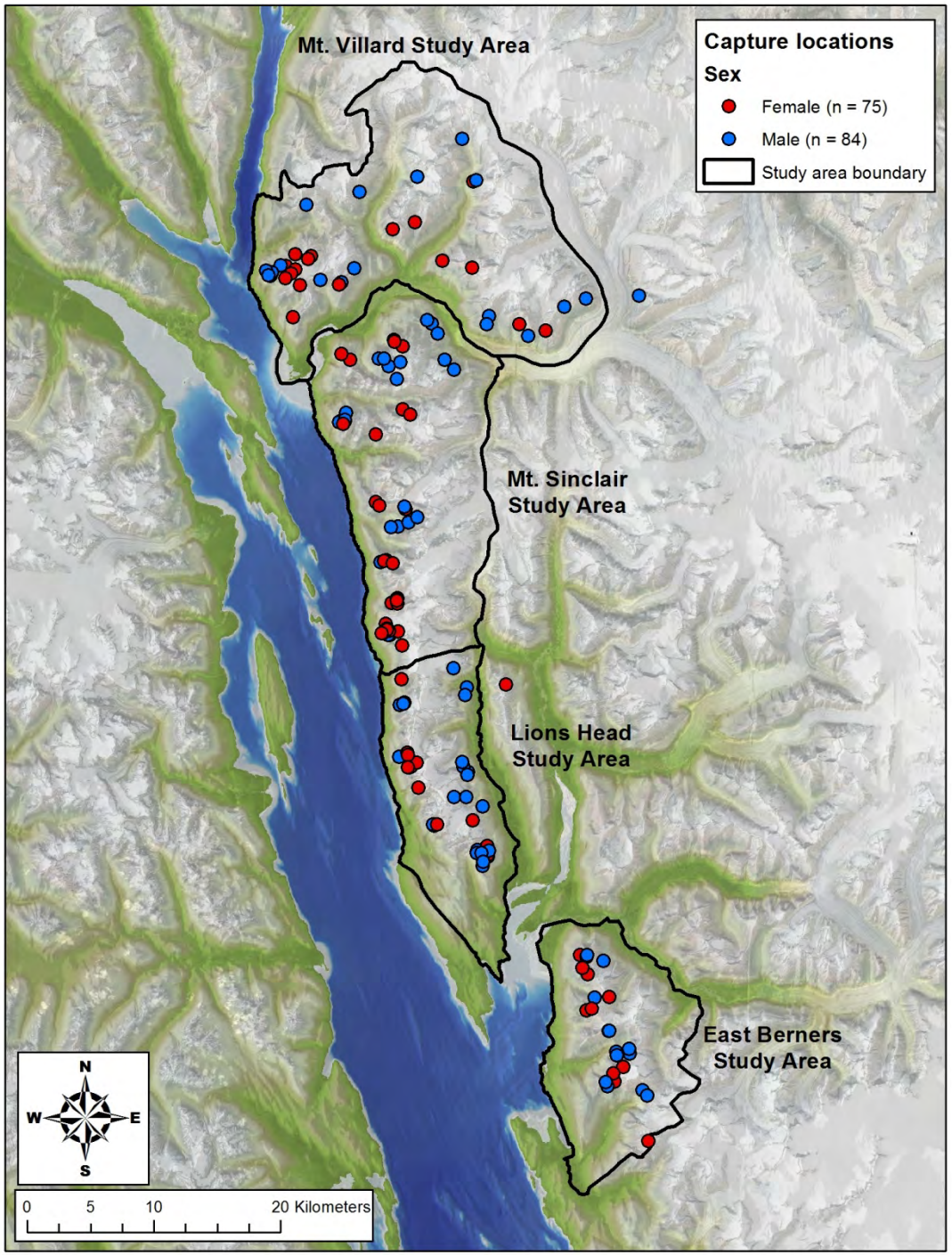
2005-2011: Mountain Goat Monitoring
ADFG/Coeur/AKDOT
(White et al. 2012)

2011-2015+: Mountain Goat Monitoring
ADFG/Coeur
(White et al. 2012)

Monitoring Activities

Project Objectives

1. Capture and Biological Sampling
2. Habitat Selection and Movement
3. Survival and Reproduction
4. Population Estimation


Mt. Villard Study Area
Capture locations
Sex
Female (n = 75)
Male (n = 84)
Study area boundary
Mt. Sinclair
Study Area
Lions Head
Study Area
East Berners
Study Area
N
W
E
S
0
5
10
20 Kilometers

Capture and Biological Sampling

1. Helicopter capture
2. GPS/VHF collar deployment
3. Morphological measures
4. Blood/Tissue/Pellets

Aerial Monitoring

1. Radio-telemetry
   - -reproduction
   - -survival

2. Population estimates

3. GPS collar downloads

Aerial Monitoring

Wildlife Research Annual Progress Report

Mountain Goat Population Monitoring and Survey Technique Development

Kevin S. White and Grey Pendleton

Alaska Department of Fish and Game
Division of Wildlife Conservation

December 2011

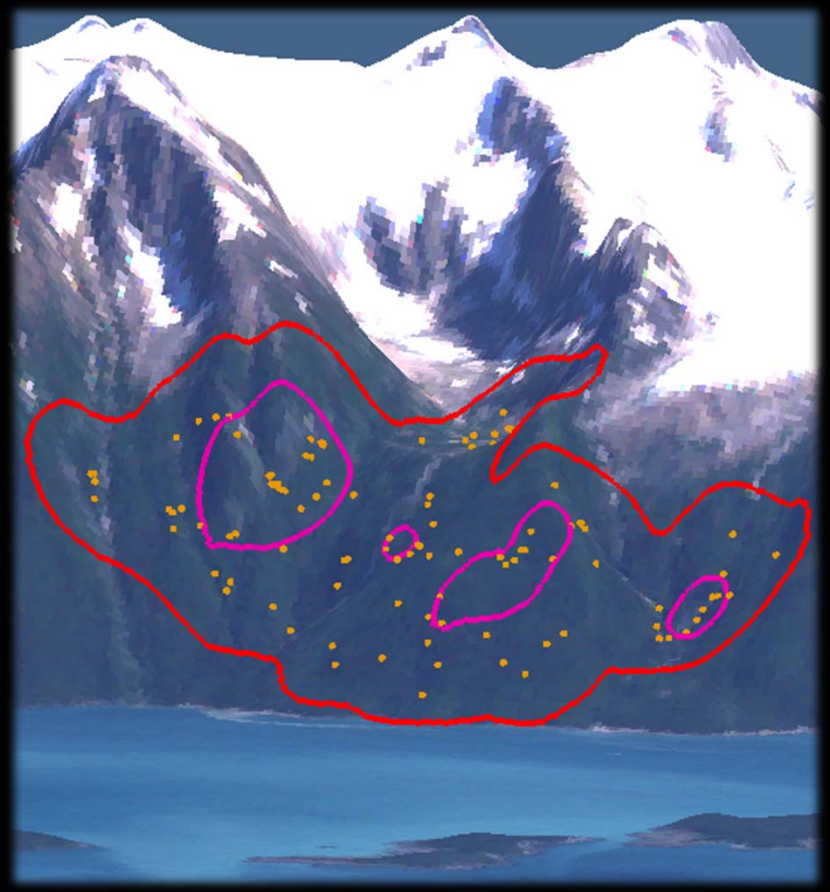
Mortalities and GPS Collar Recovery

1. Mortality site investigation

2. Recovery of released collars

GIS and Data Analysis

1. Reproduction/survival est.
2. Population estimation
3. Habitat selection modeling
4. Movement modeling



Laboratory Analyses

1. Disease status

2. Trace mineral concentration

3. Diet composition

4. Stable isotope concentration

5. Population genetics

Results

Capture and Biological Sampling

Capture/Collar Deployments: 159 (75F/84M)

<u>Disease Status:</u>

-largely disease free (15 pathogens tested)

-some exposure to Contagious Ecthyma (ORF)

Contagious Ecthyma				
Area	Negative	Positive	Total	% Positive
Berners	19	1	20	0.05
Kakuhan	38	3	41	0.07
Villard	24	0	24	0.00
Baranof	17	1	18	0.06
Cleveland	9	1	10	0.10
Klukwan	18	1	19	0.05
Total	125	7	132	0.05

Capture and Biological Sampling

Trace Mineral Status:

-no obvious signs of deficiency (posisbly Zn), but small sample sizes

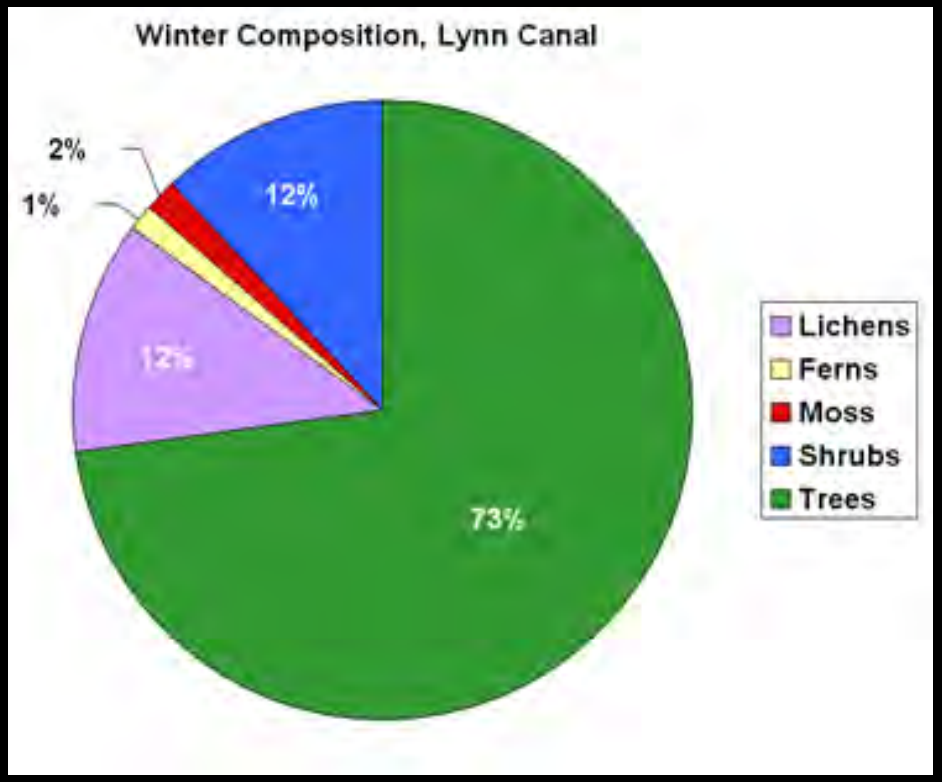
-standards for mtn goats lacking

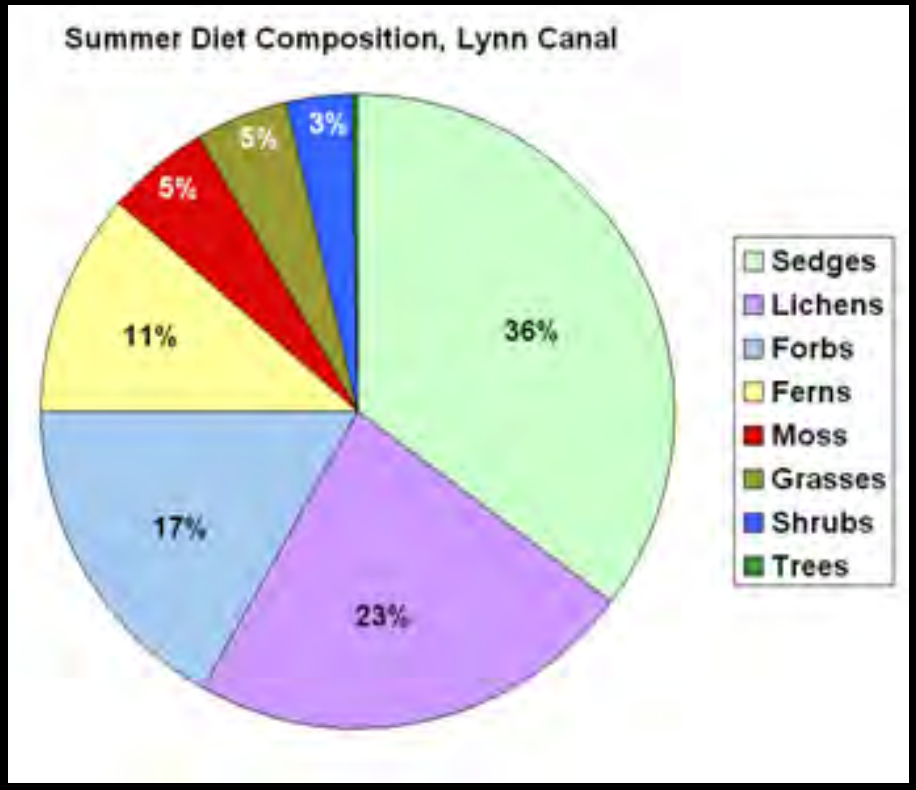
	Se			Fe			Cu			Zn			Mo			Mn		
Area	Mean	n	SE	Mean	n	SE	Mean	n	SE	Mean	n	SE	Mean	n	SE	Mean	n	SE
Baranof	0.37	12	0.01	1.95	12	0.11	1.10	12	0.06	0.76	12	0.05	<0.05	12	0.00	<0.006	12	0.00
Cleveland	0.26	5	0.01	1.71	5	0.09	0.81	5	0.03	0.70	5	0.04	<0.05	5	0.00	<0.006	5	0.00
Grandchild	0.27	2	0.08	2.86	2	0.03	1.07	2	0.05	0.77	2	0.06	<0.05	2	0.00	<0.006	2	0.00
Kakuhan	0.19	6	0.04	1.98	6	0.12	1.04	6	0.05	0.61	6	0.03	<0.05	6	0.00	<0.006	6	0.00
Haines	0.30	22	0.03	2.27	21	0.07	1.07	21	0.07	0.78	21	0.05	<0.05	21	0.00	<0.006	21	0.00
Total	0.30	47	0.02	2.11	46	0.06	1.04	46	0.04	0.74	46	0.03	<0.05	46	0.00	<0.006	46	0.00

Capture and Biological Sampling

Diet Composition:

-high quality diets in summer, poor quality in winter

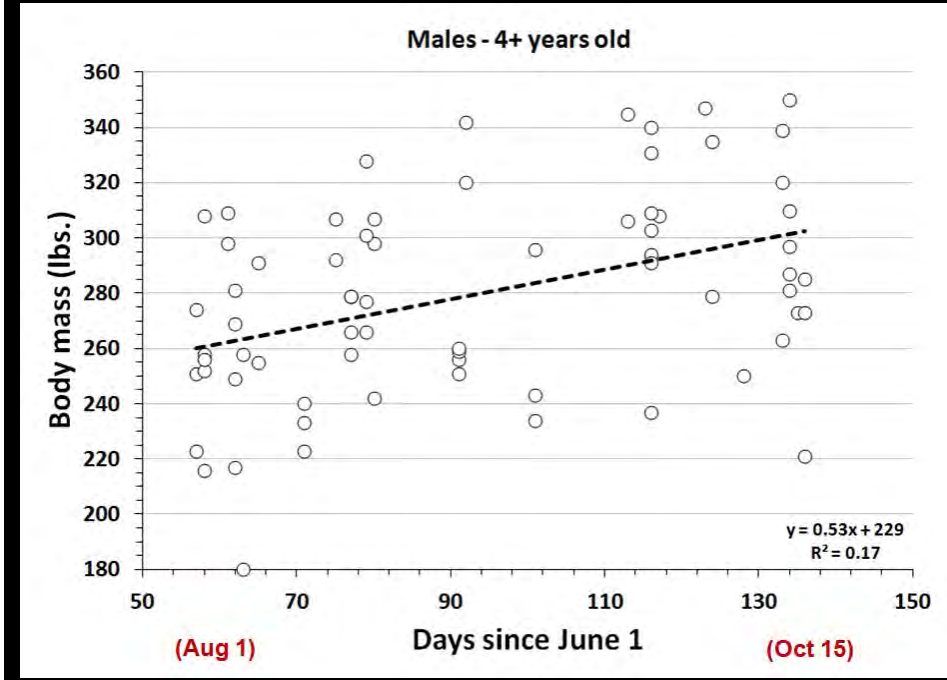


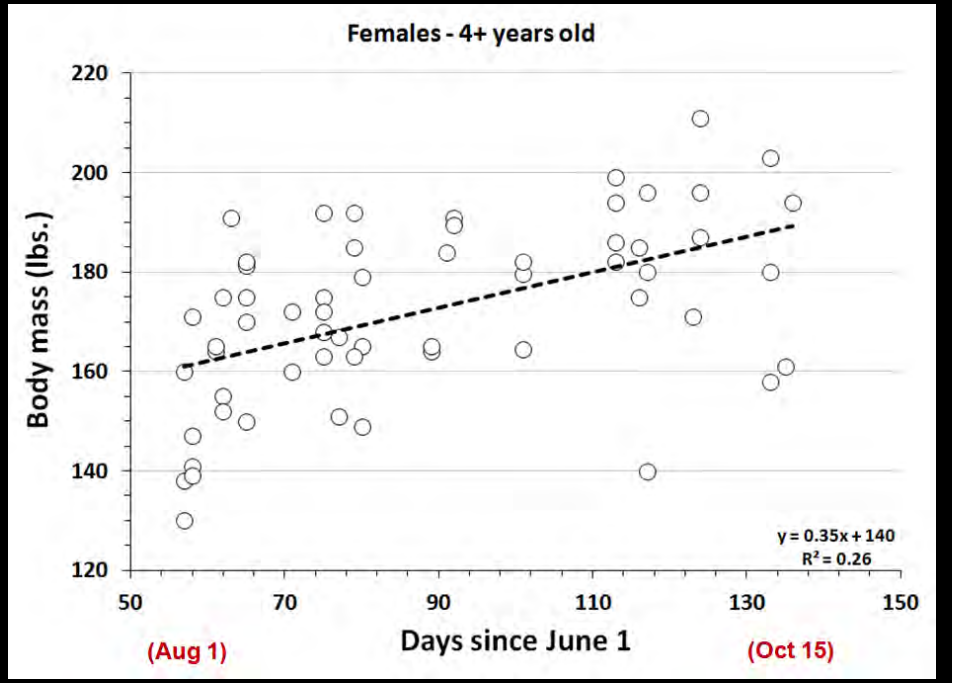


Capture and Biological Sampling

Body Mass:

-rapid weight gain during summer



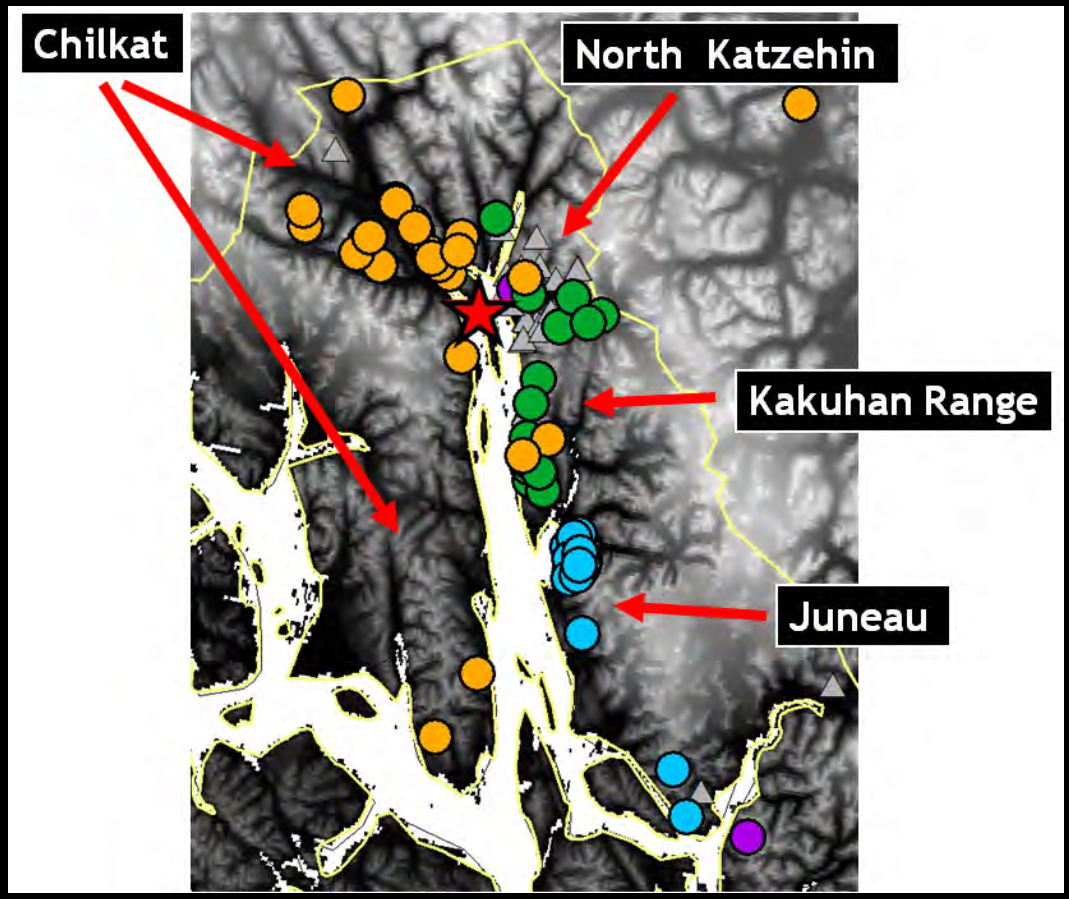


Capture and Biological Sampling

Population Genetics (Aaron Shafer-Univ of Alberta):

-high degree of genetic structuring

-distinct pops on either side of Berners Bay & Katzehin



Habitat Selection and Movement

Movement Patterns

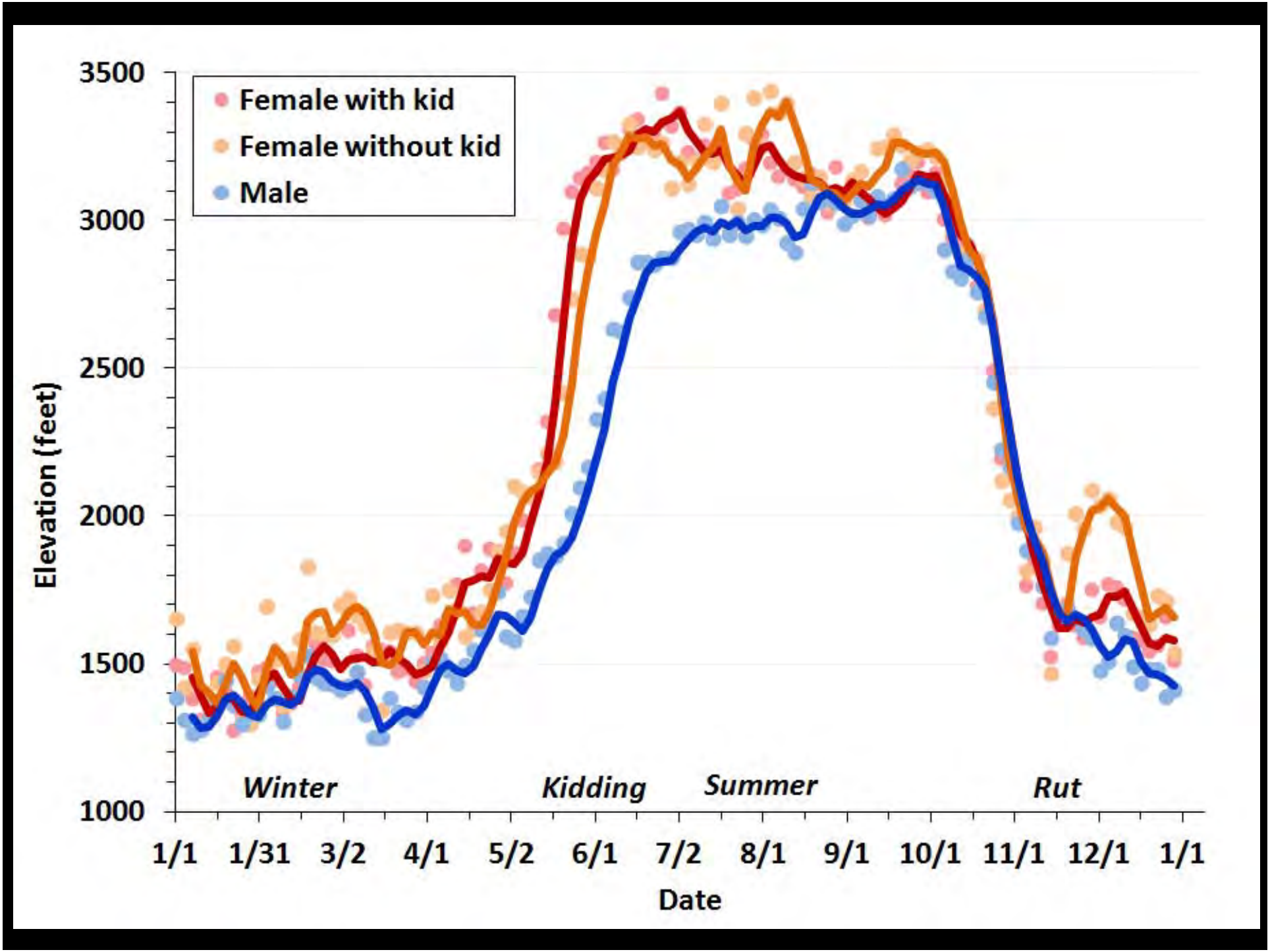
-altitudinal migrations

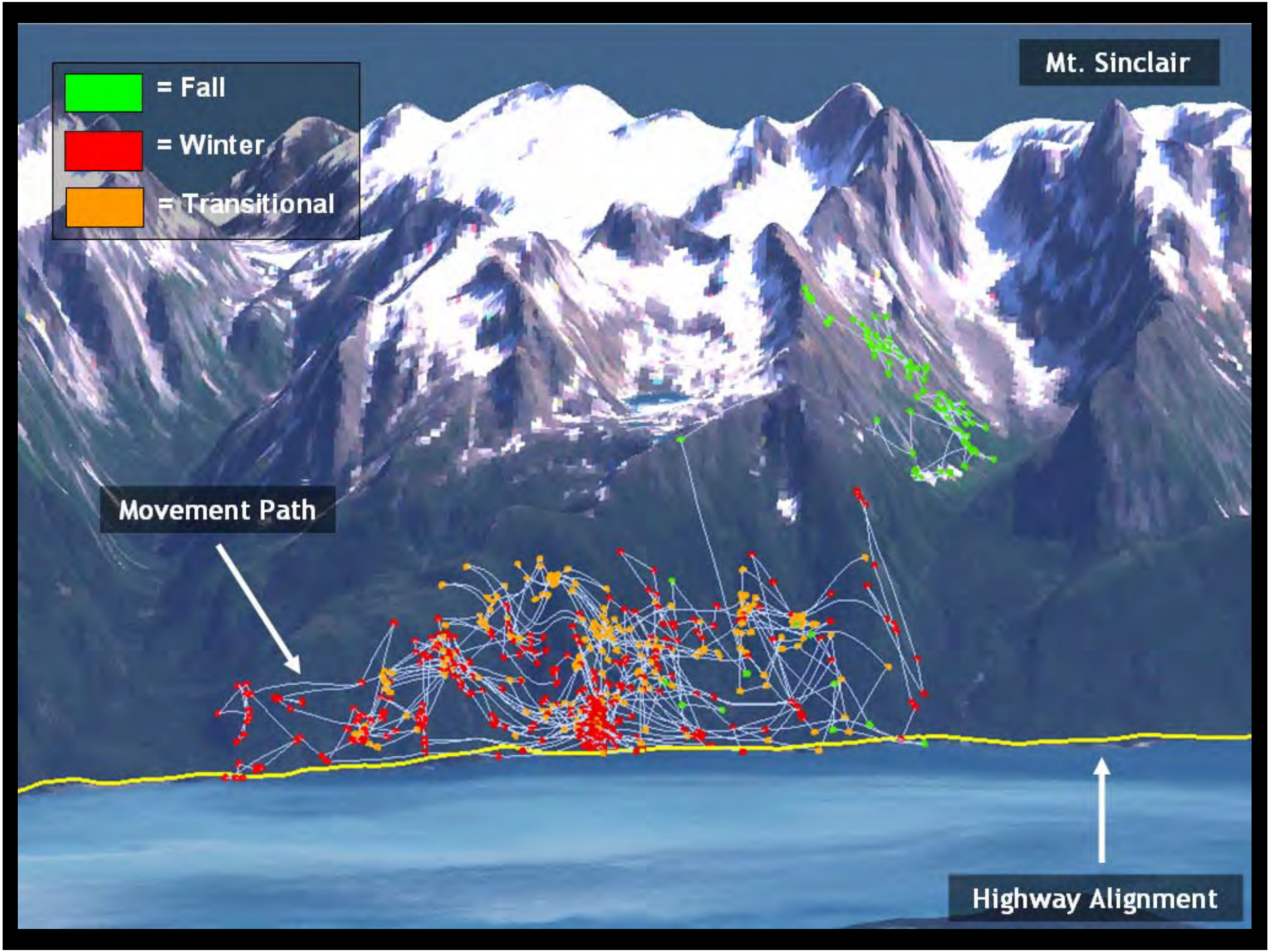
-higher movement rates in summer vs. winter

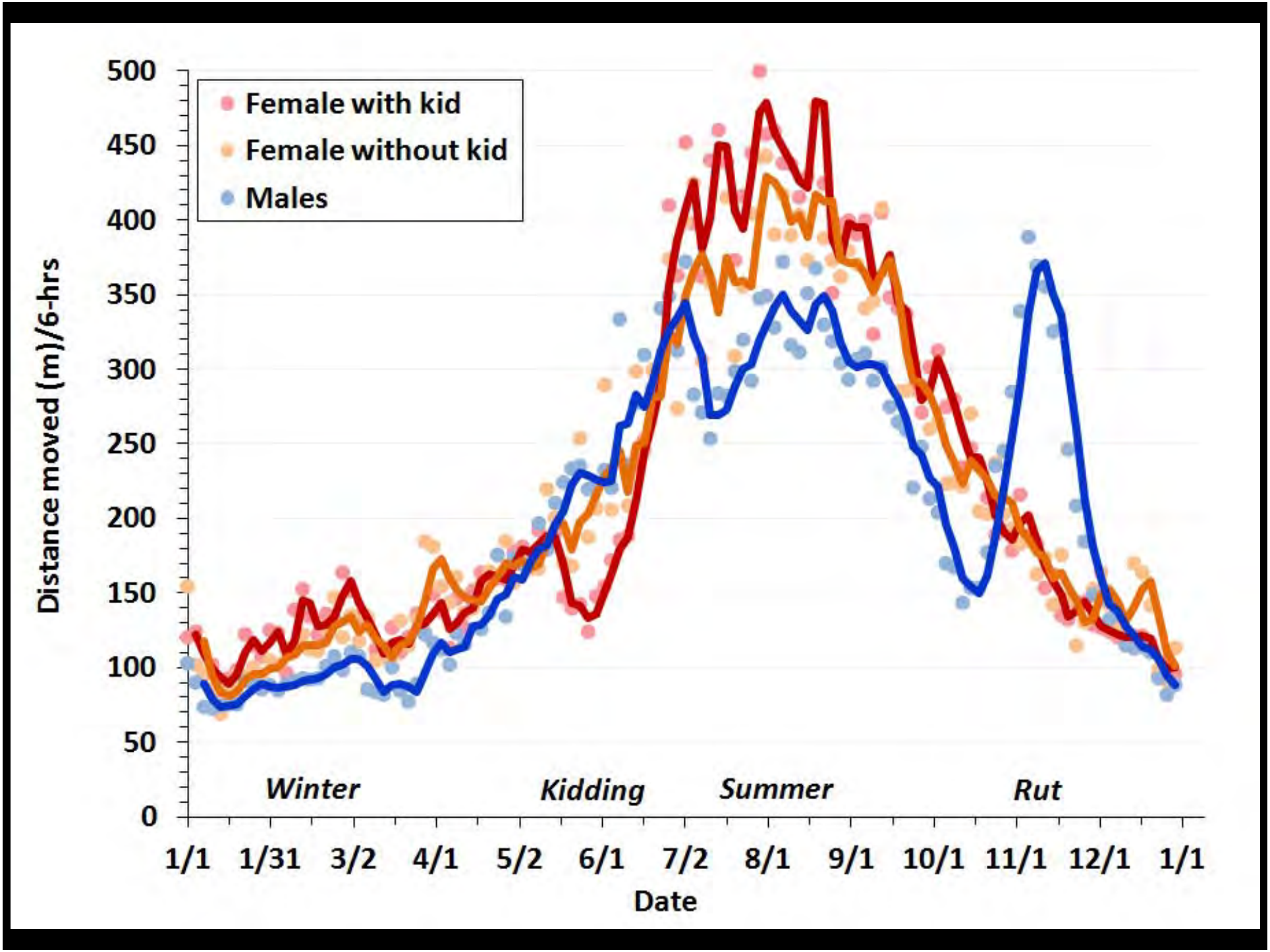
-high movement rates for males during rut

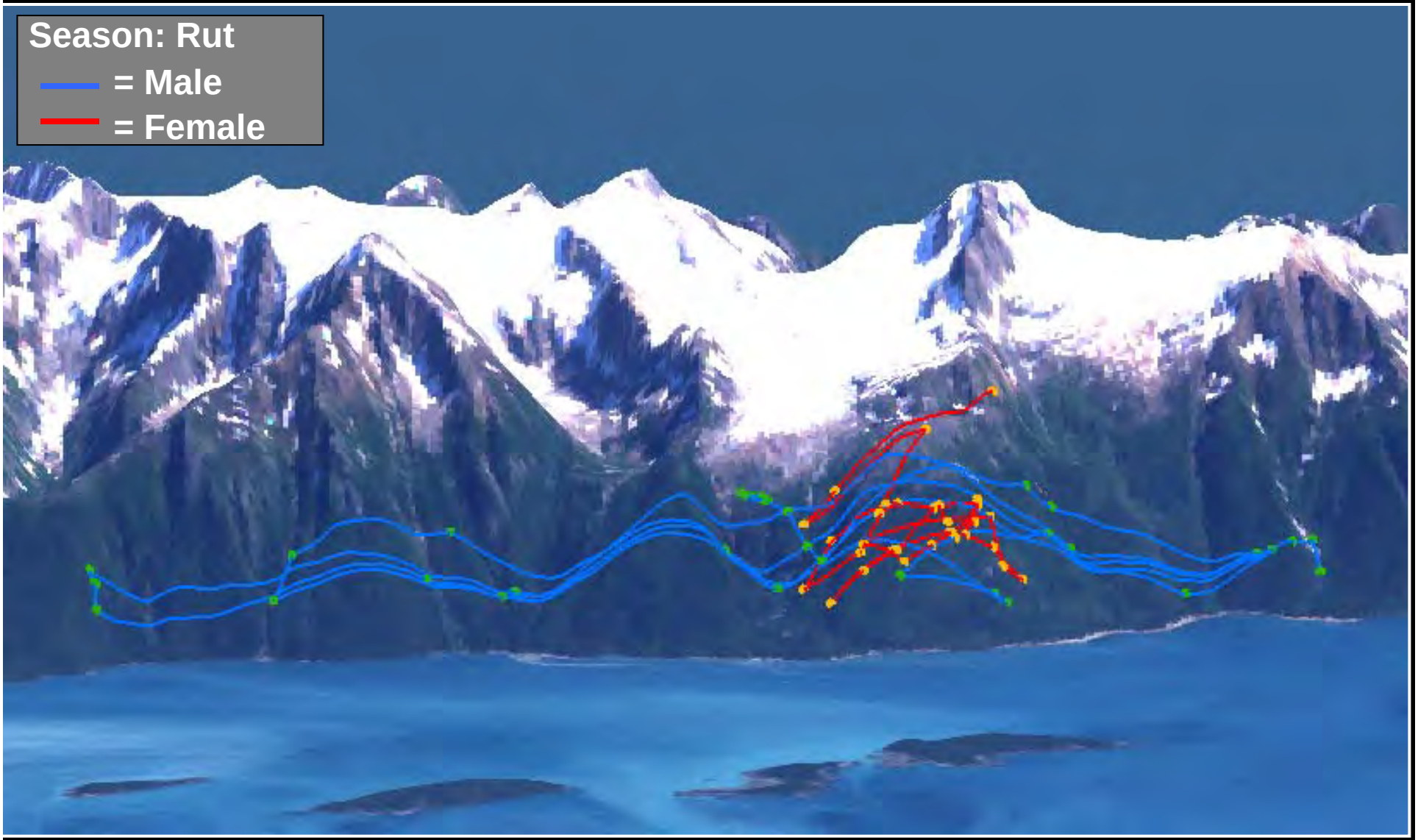
-high site fidelity, esp. for females

-very restricted movements during winter

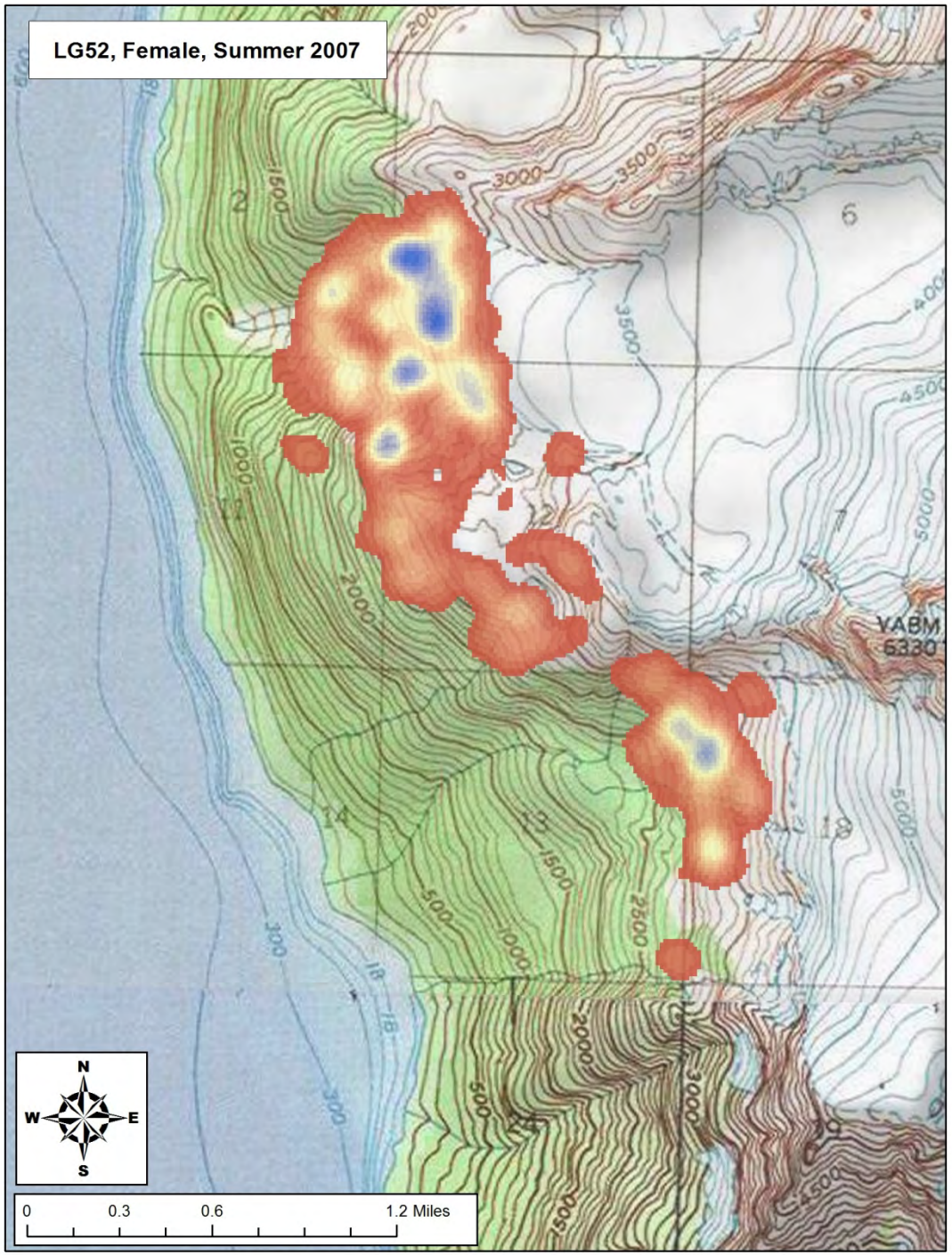

Female with kid
Female without kid
Male
3500
3000
2500
2000
1500
1000
Elevation (feet)
Winter
Kidding
Summer
Rut
1/1
1/31
3/2
4/1
5/2
6/1
7/2
8/1
9/1
10/1
11/1
12/1
1/1
Date

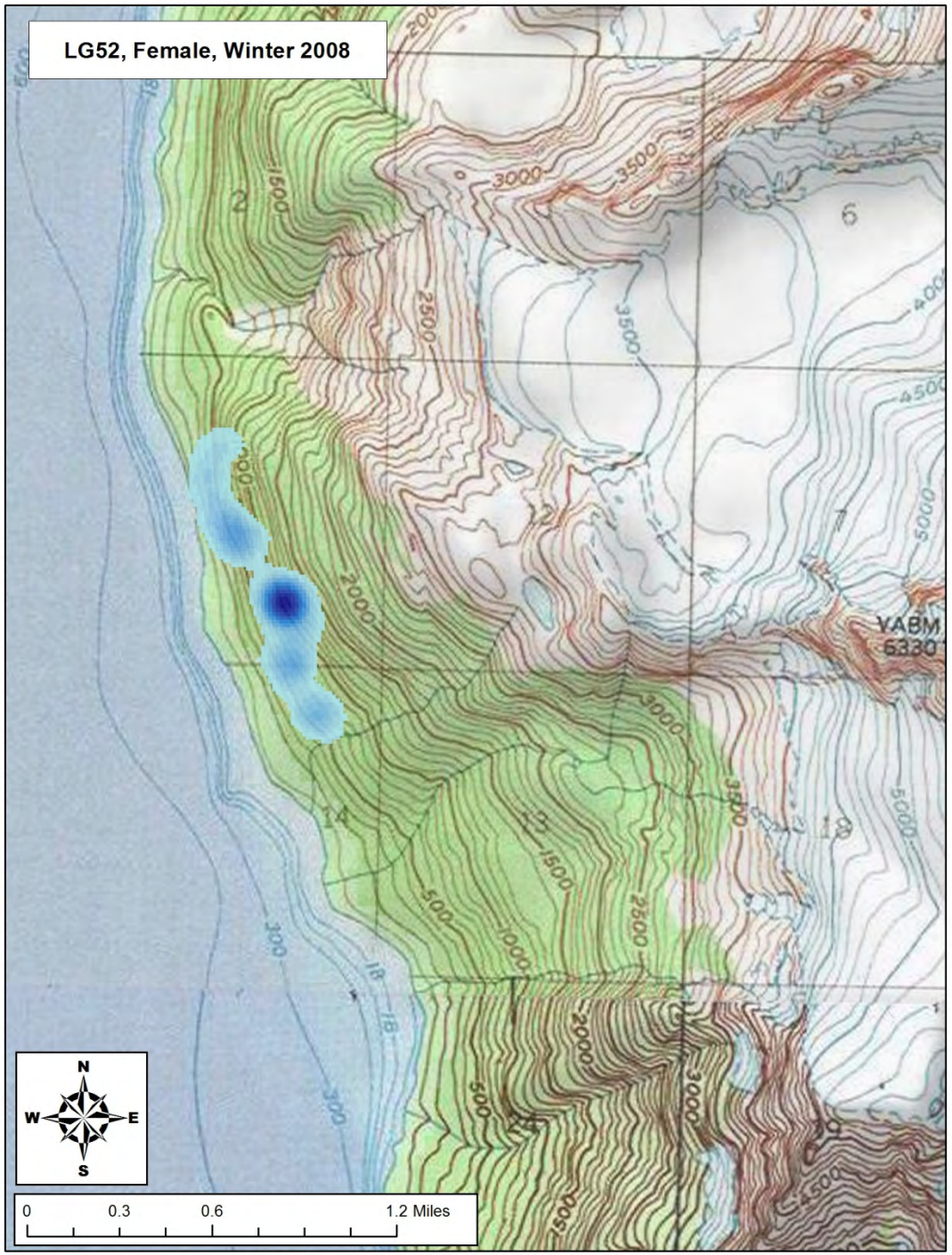

= Fall
= Winter
= Transitional
Mt. Sinclair
Movement Path
Highway Alignment


Female with kid
Female without kid
Males
Distance moved (m)/6-hrs
500
450
400
350
300
250
200
150
100
50
0
Winter
Kidding
Summer
Rut
1/1
1/31
3/2
4/1
5/2
6/1
7/2
8/1
9/1
10/1
11/1
12/1
1/1
Date

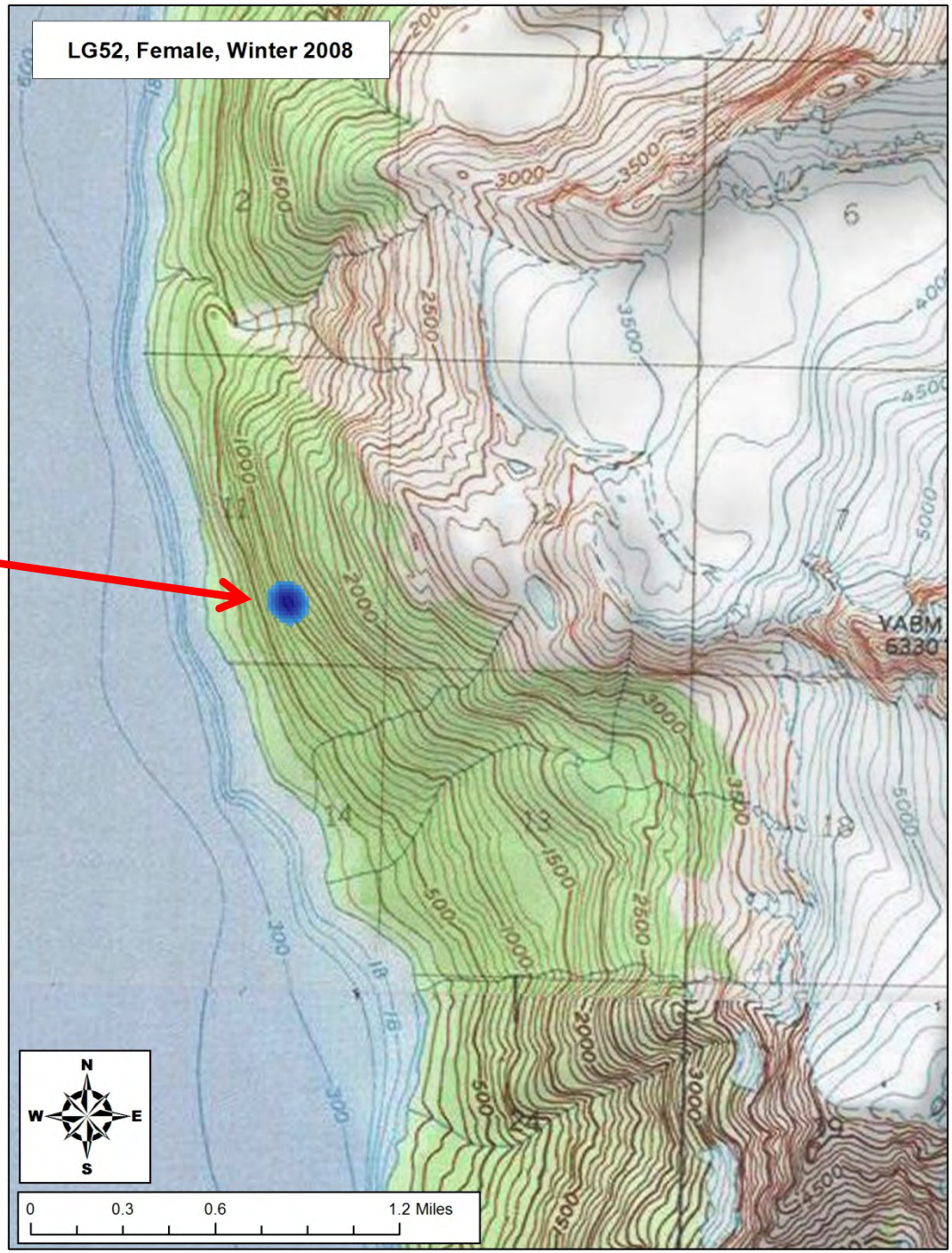

Season: Rut
= Male
= Female

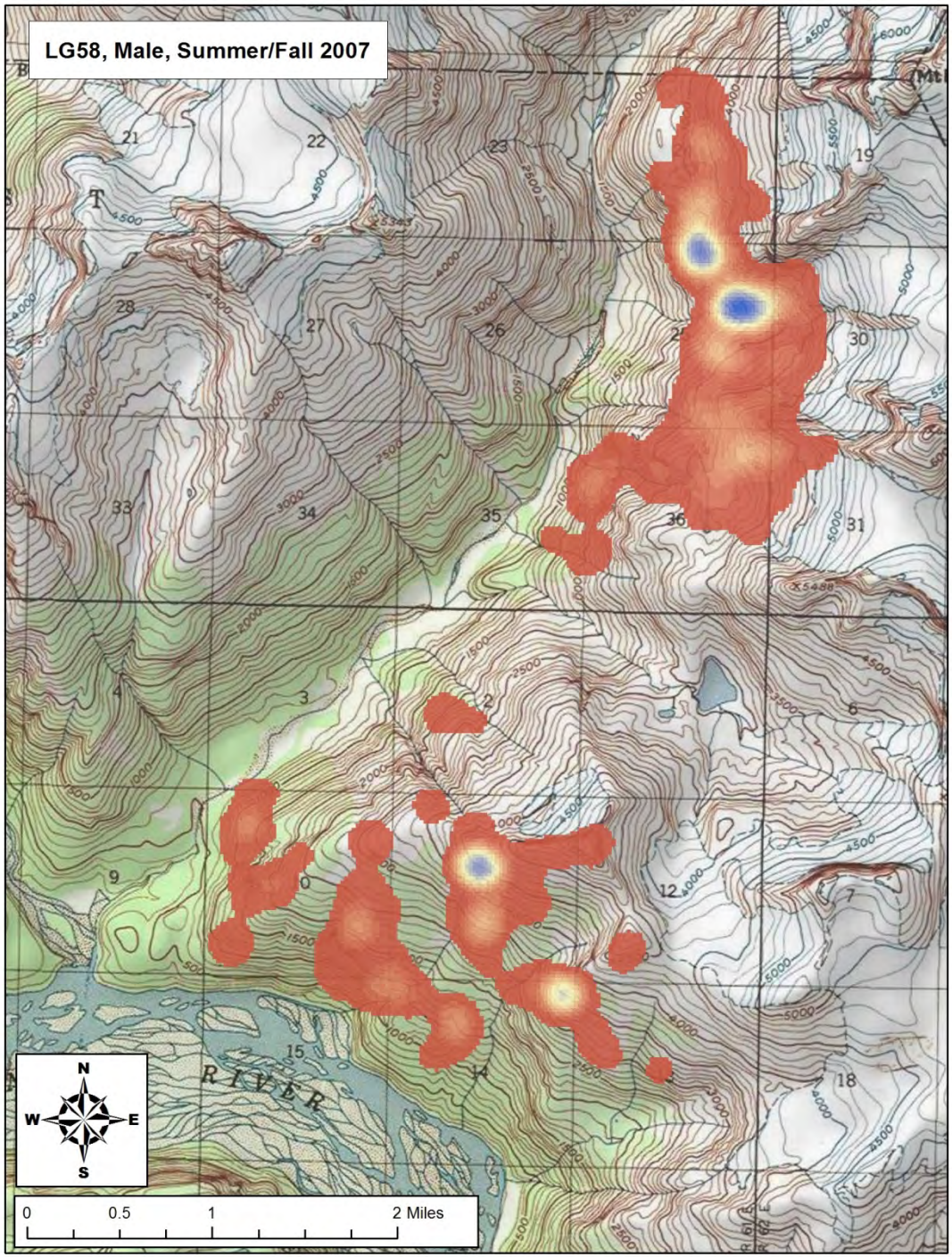
Seasonal Range Dynamics and Site Fidelity

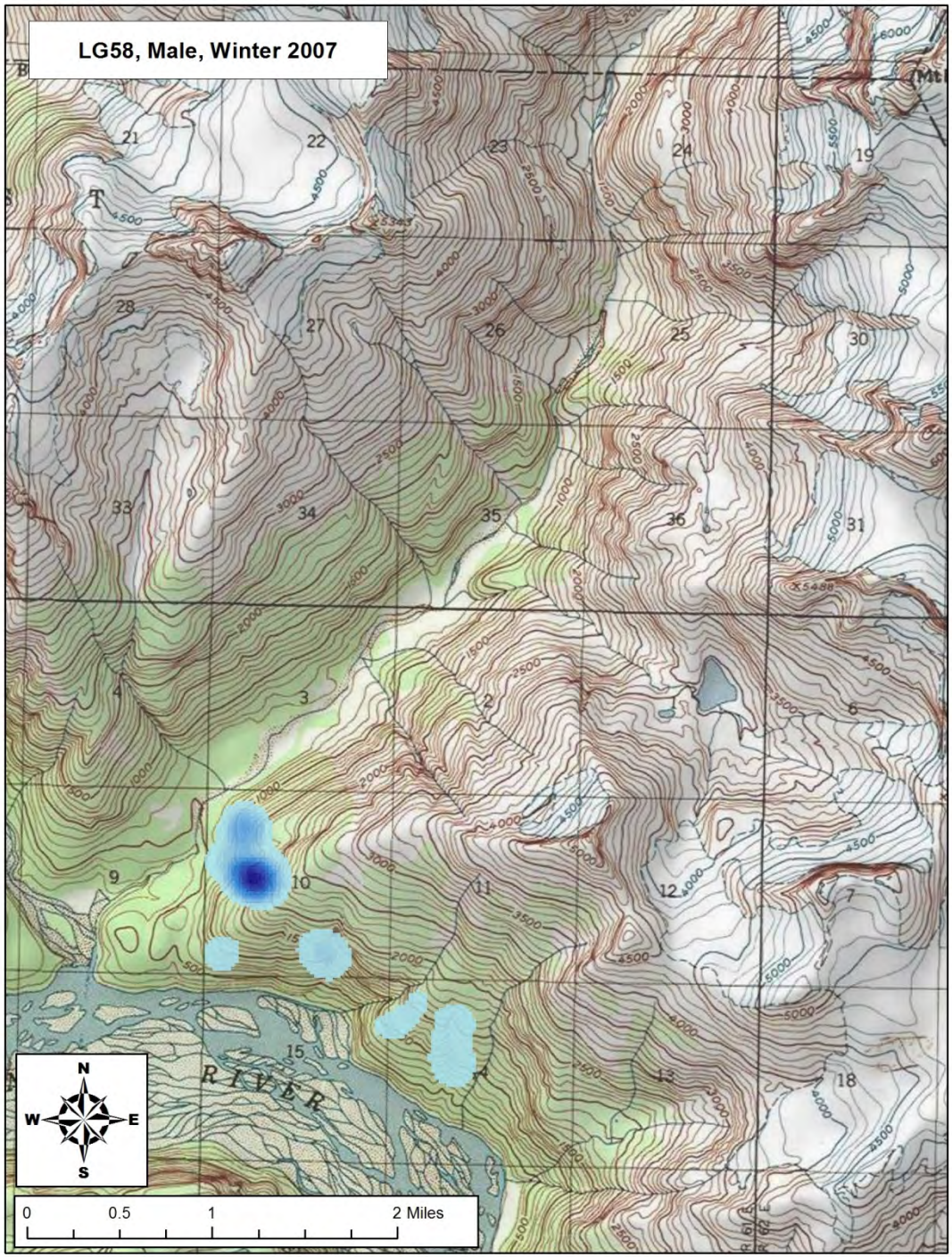

LG52, Female, Summer 2007
YABM
6330
N
W
E
S
0
0.3
0.6
1.2 Miles

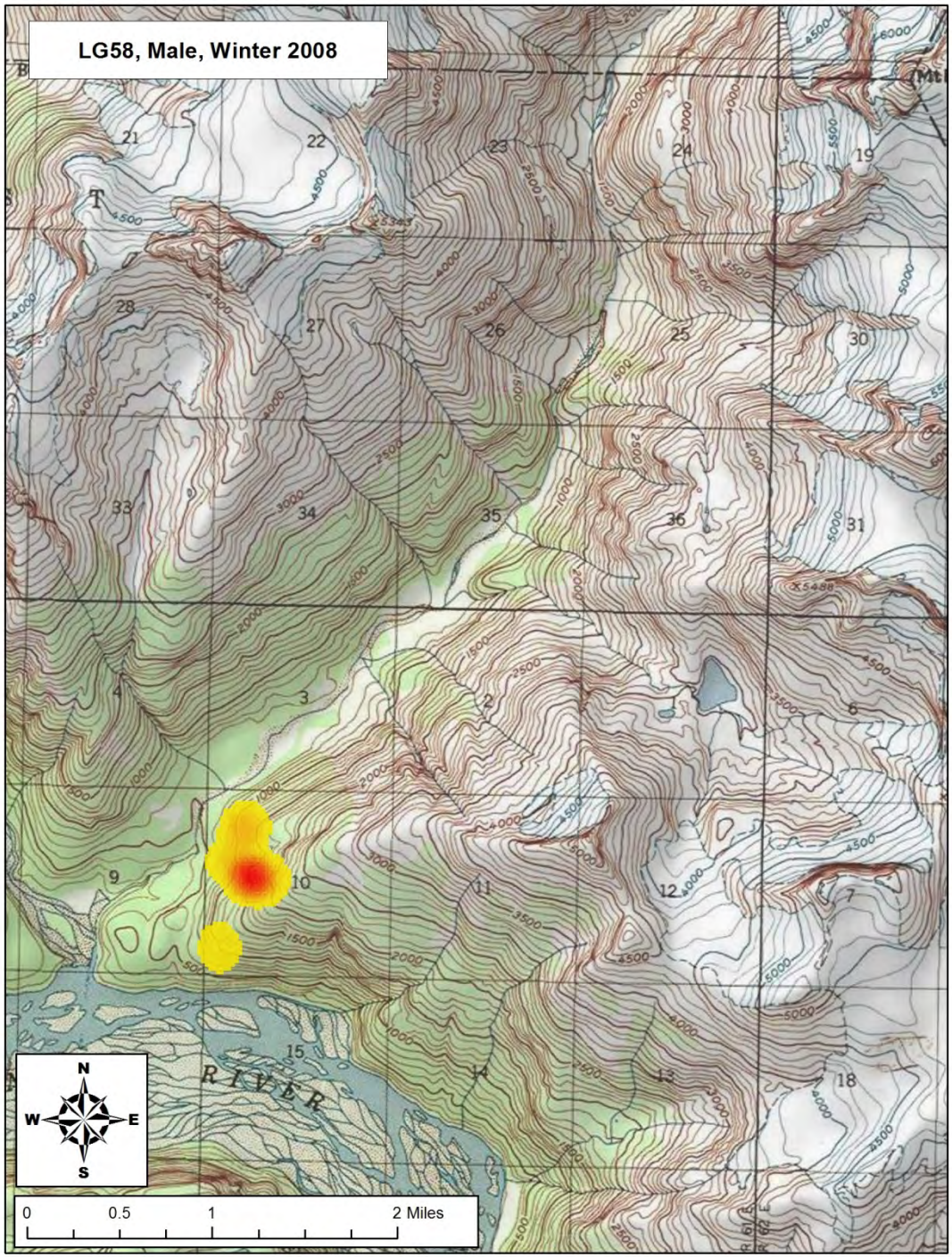

LG52, Female, Winter 2008
YABM
6330
N
W
E
S
0
0.3
0.6
1.2 Miles

60% UD =
200m diameter




LG58, Male, Summer/Fall 2007
N
W
E
S
0
0.5
1
2 Miles
RIVER


LG58, Male, Winter 2007
N
W
E
S
0
0.5
1
2 Miles
RIVER


LG58, Male, Winter 2008
N
W
E
S
0
0.5
1
2 Miles
RIVER

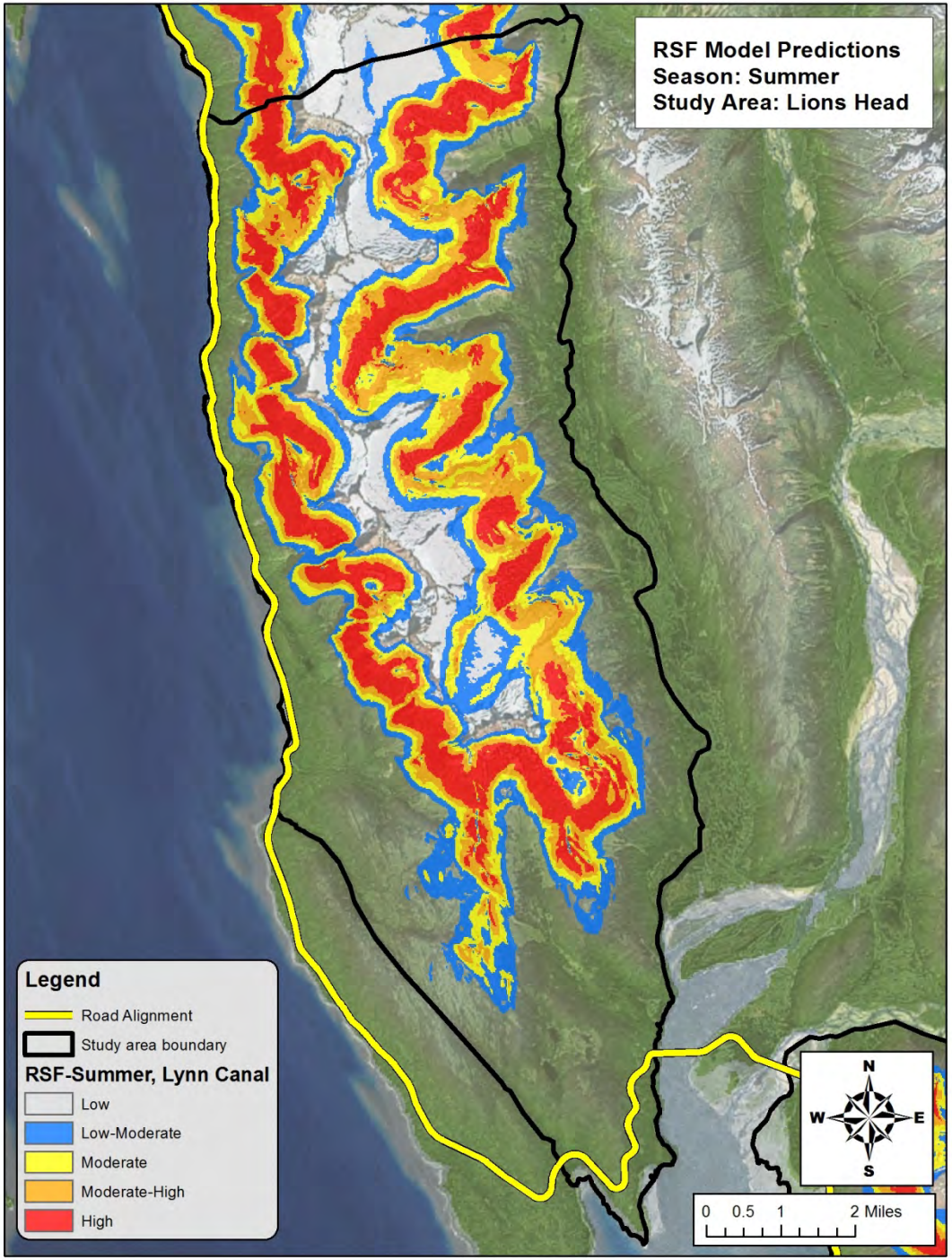
Habitat Selection and Movement

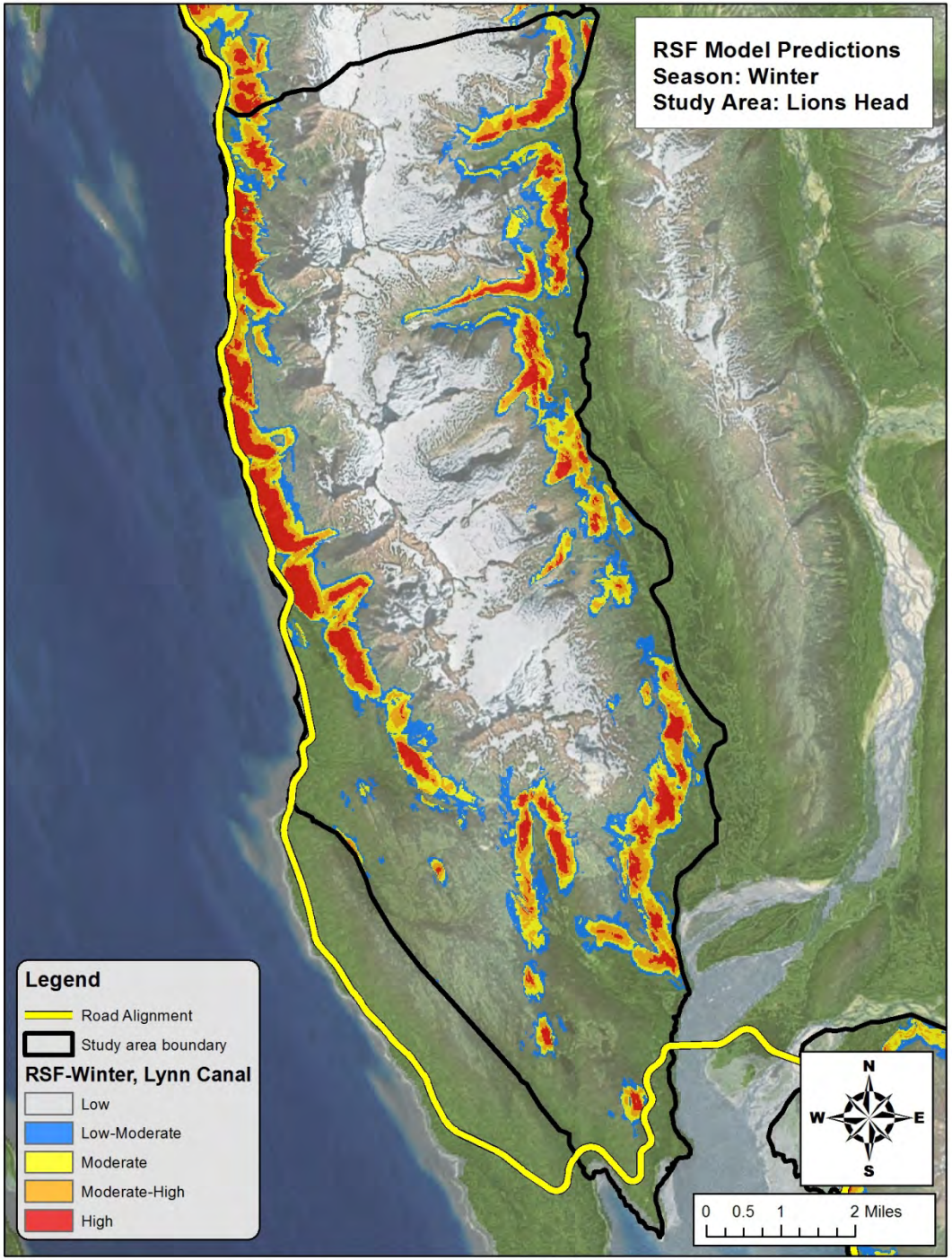
Resource Selection Modeling (RSF)

-winter range more limited than summer
-good predictive performance of models

***Key modeling relationships*:**

Escape terrain	**= closer is better**
Slope	**= moderate/steep slopes best**
Elevation	**= low in winter, high in summer**
Solar radiation	**= higher is better**
Terrain ruggedness	**= more rugged is better**


RSF Model Predictions
Season: Summer
Study Area: Lions Head
Legend
Road Alignment
Study area boundary
RSF-Summer, Lynn Canal
Low
Low-Moderate
Moderate
Moderate-High
High
N
W
E
S
0 0.5 1 2 Miles


RSF Model Predictions
Season: Winter
Study Area: Lions Head
Legend
Road Alignment
Study area boundary
RSF-Winter, Lynn Canal
Low
Low-Moderate
Moderate
Moderate-High
High
N
W
E
S
0 0.5 1 2 Miles

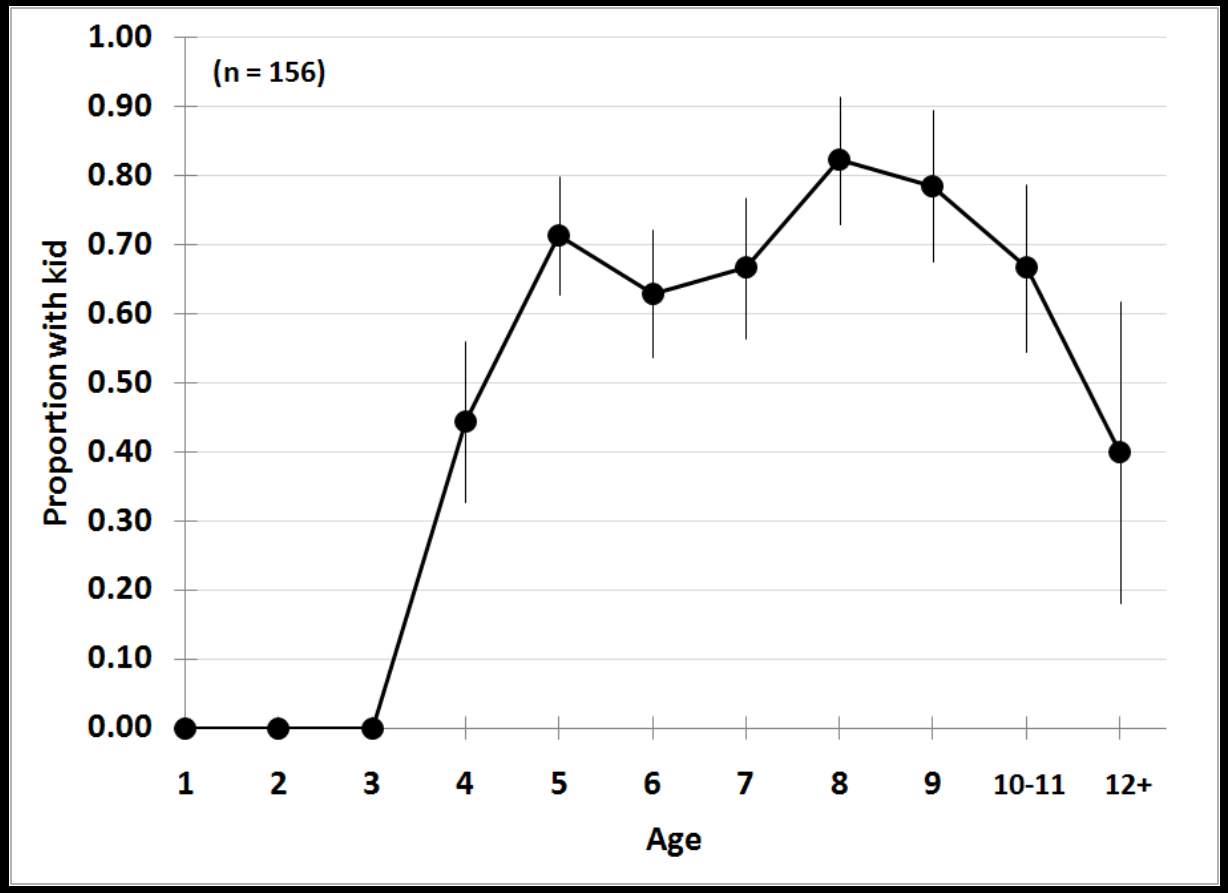
Reproduction

Reproduction/Survival

Reproduction

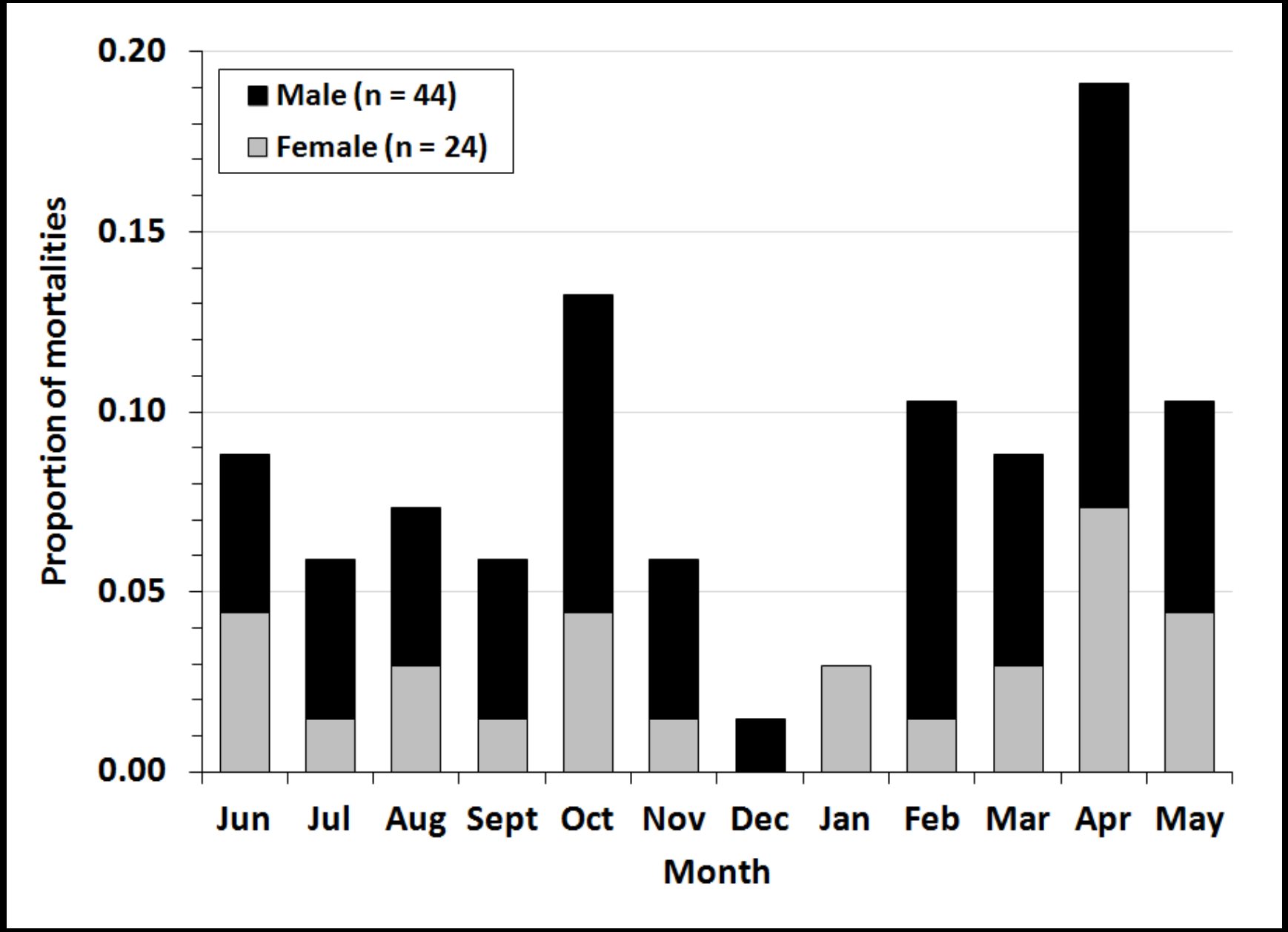
-late age of 1st reproduction, repro pauses

-low reproductive potential

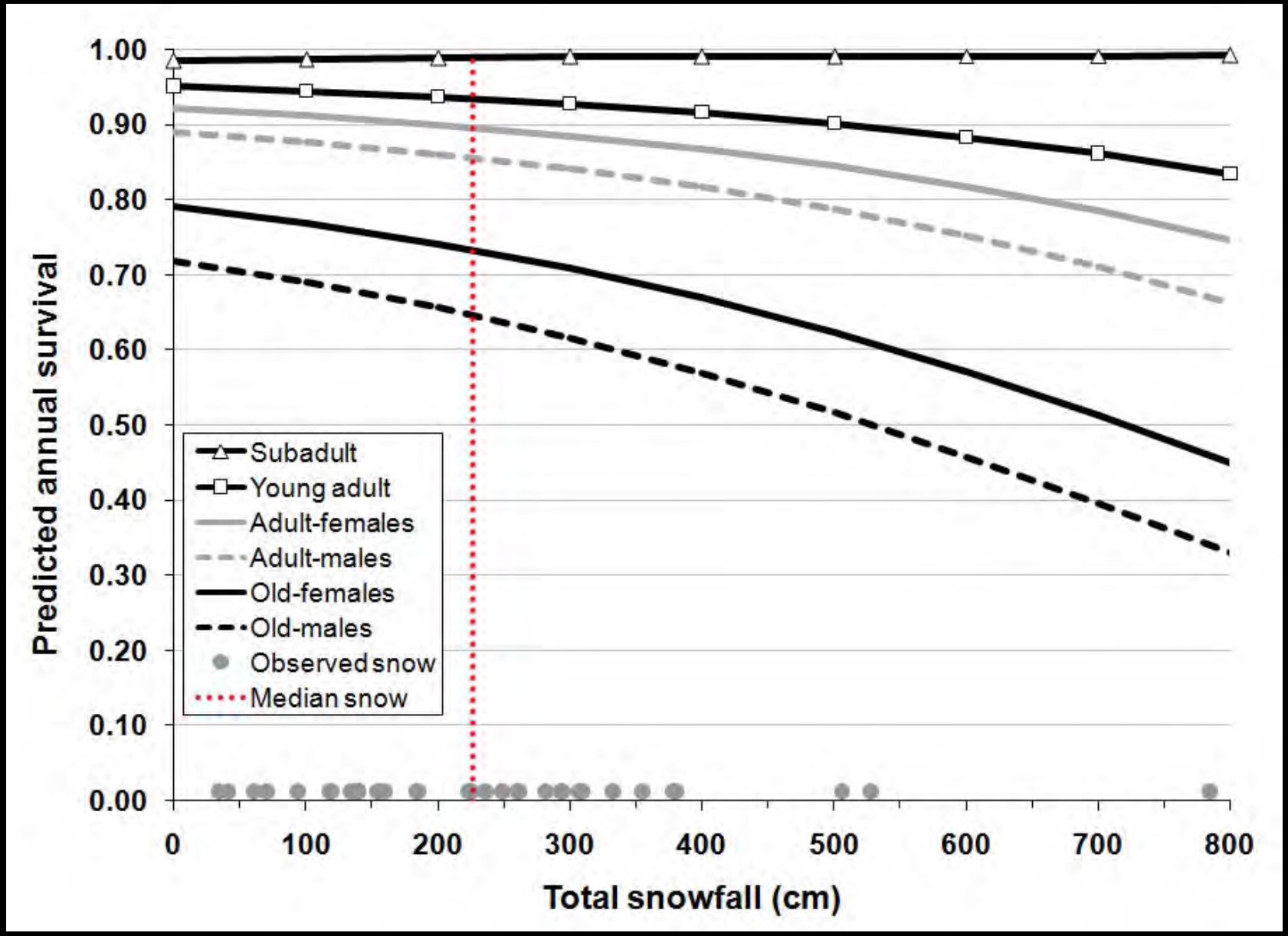


Survival

Survival: Timing of Mortality

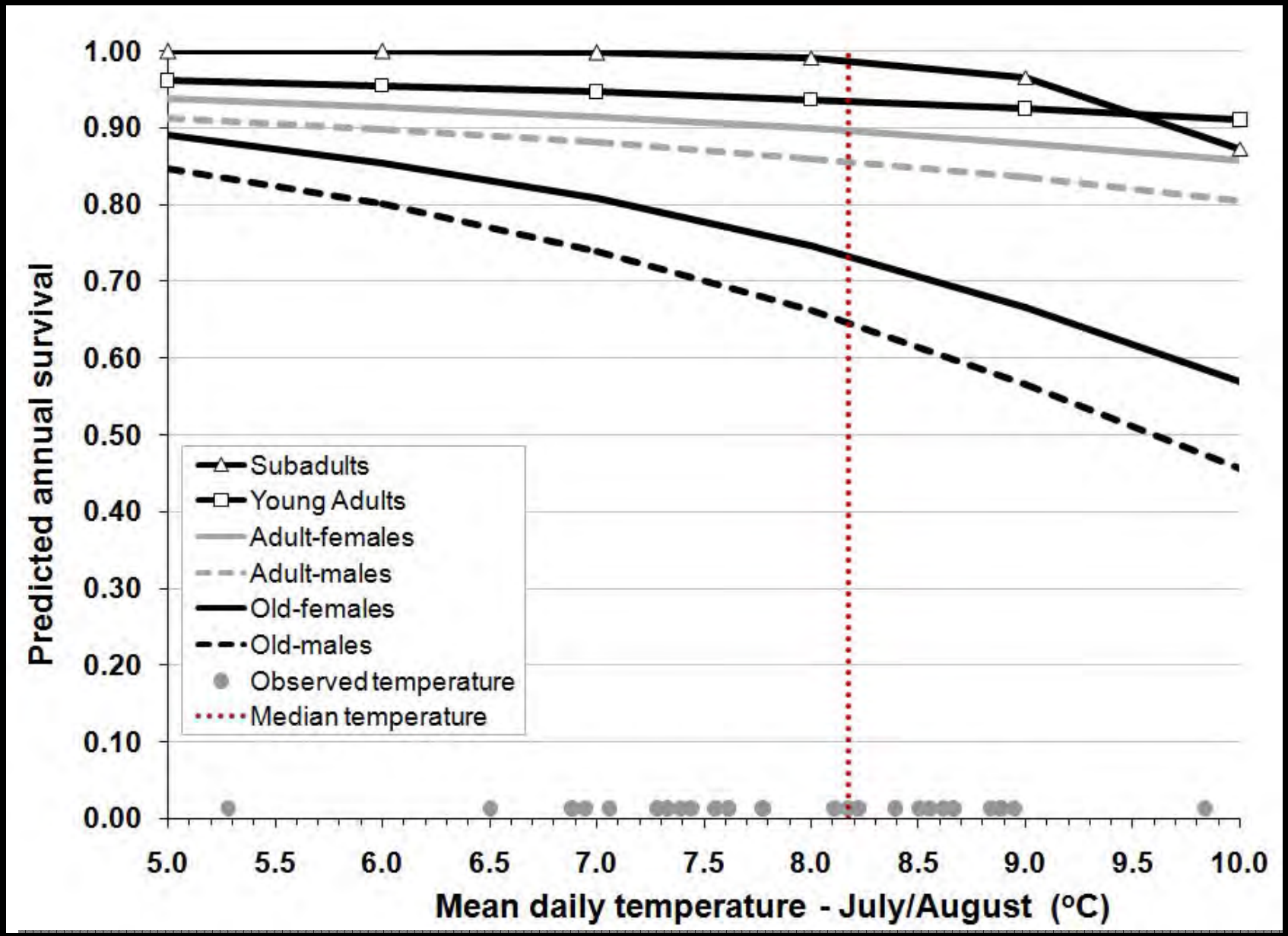


Snowfall



Age: Yearling (1-yr), Subadult (2-3), Young Adult (4-5), Adult (6-8), Old (9+)

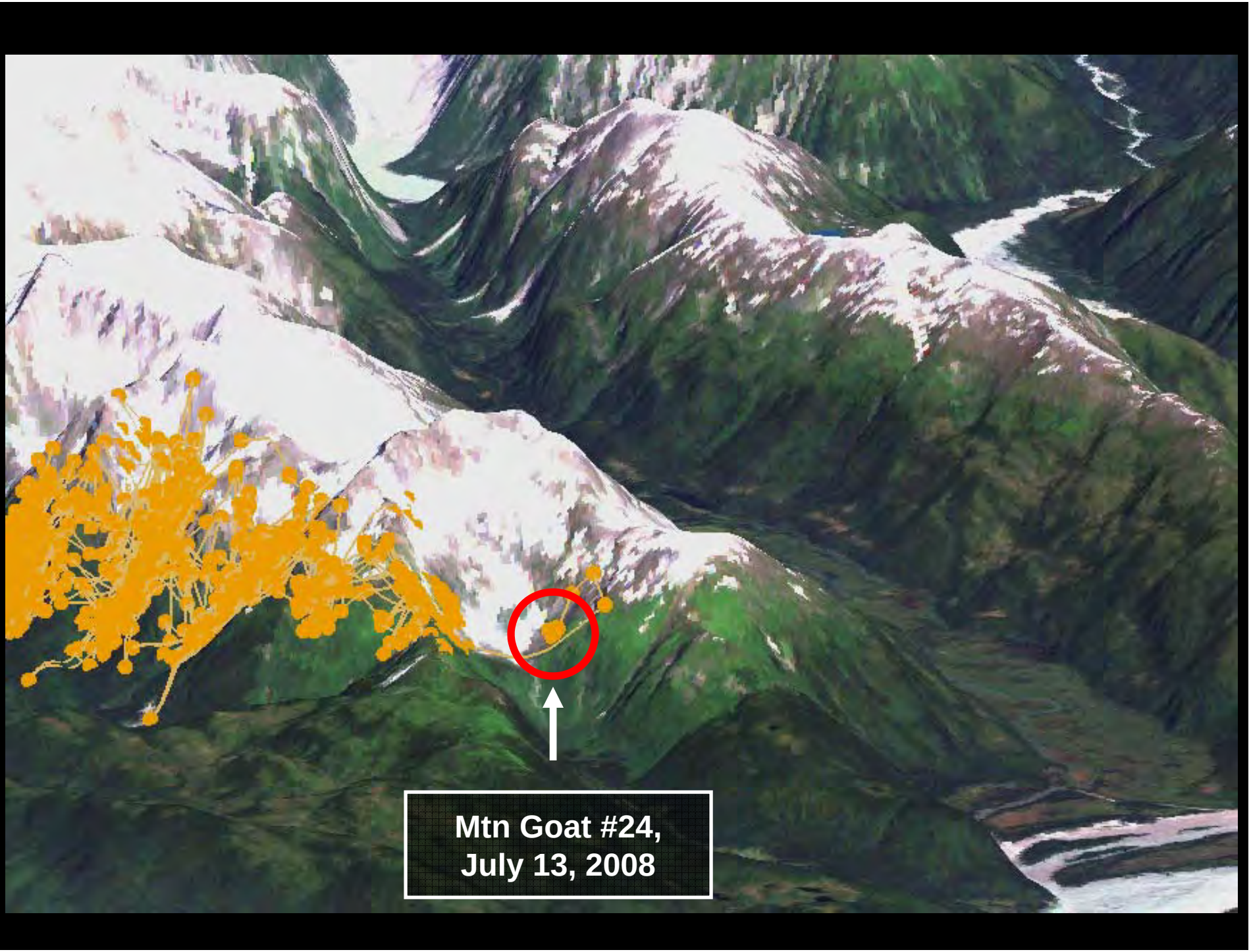
Summer Temperature (July-Aug)

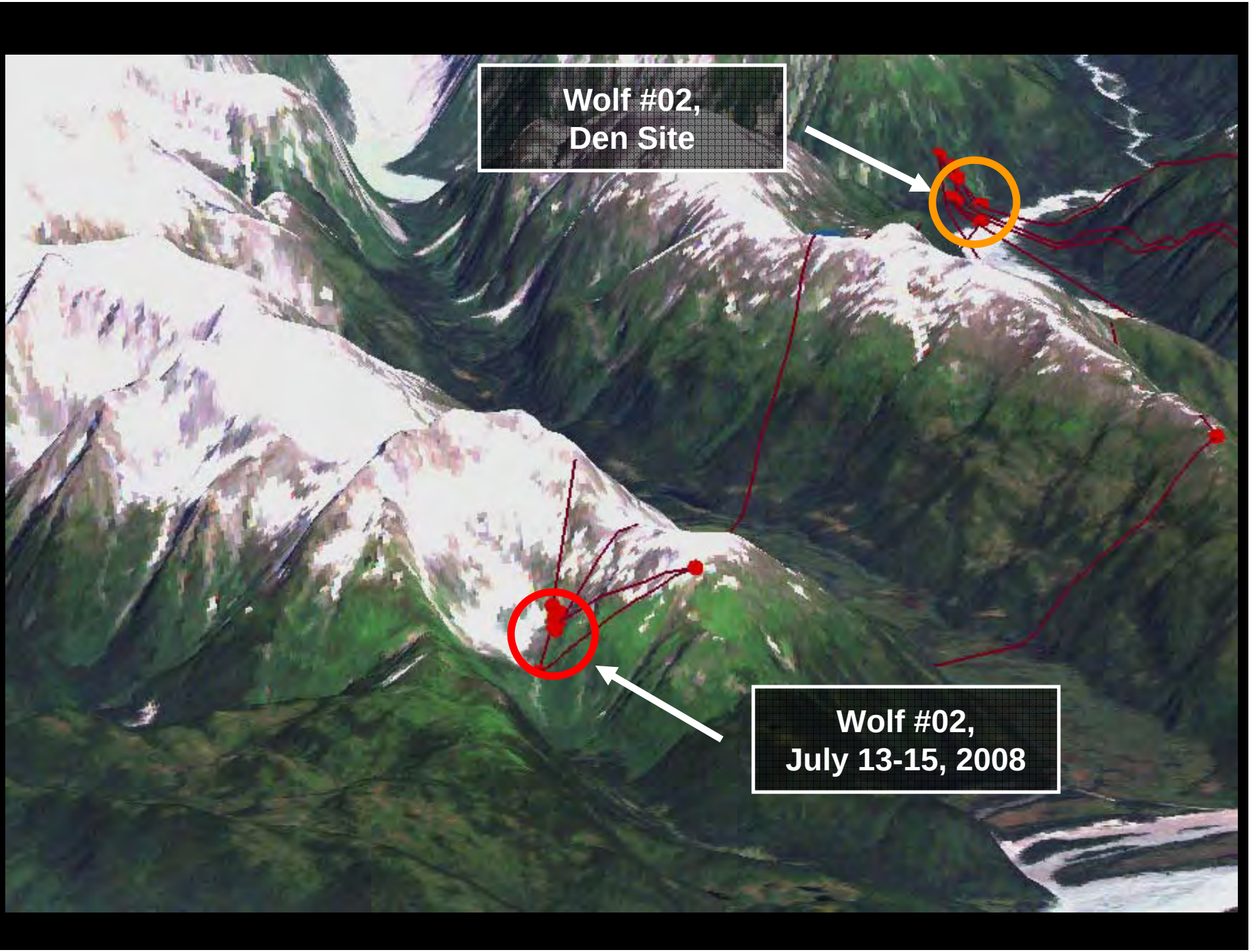


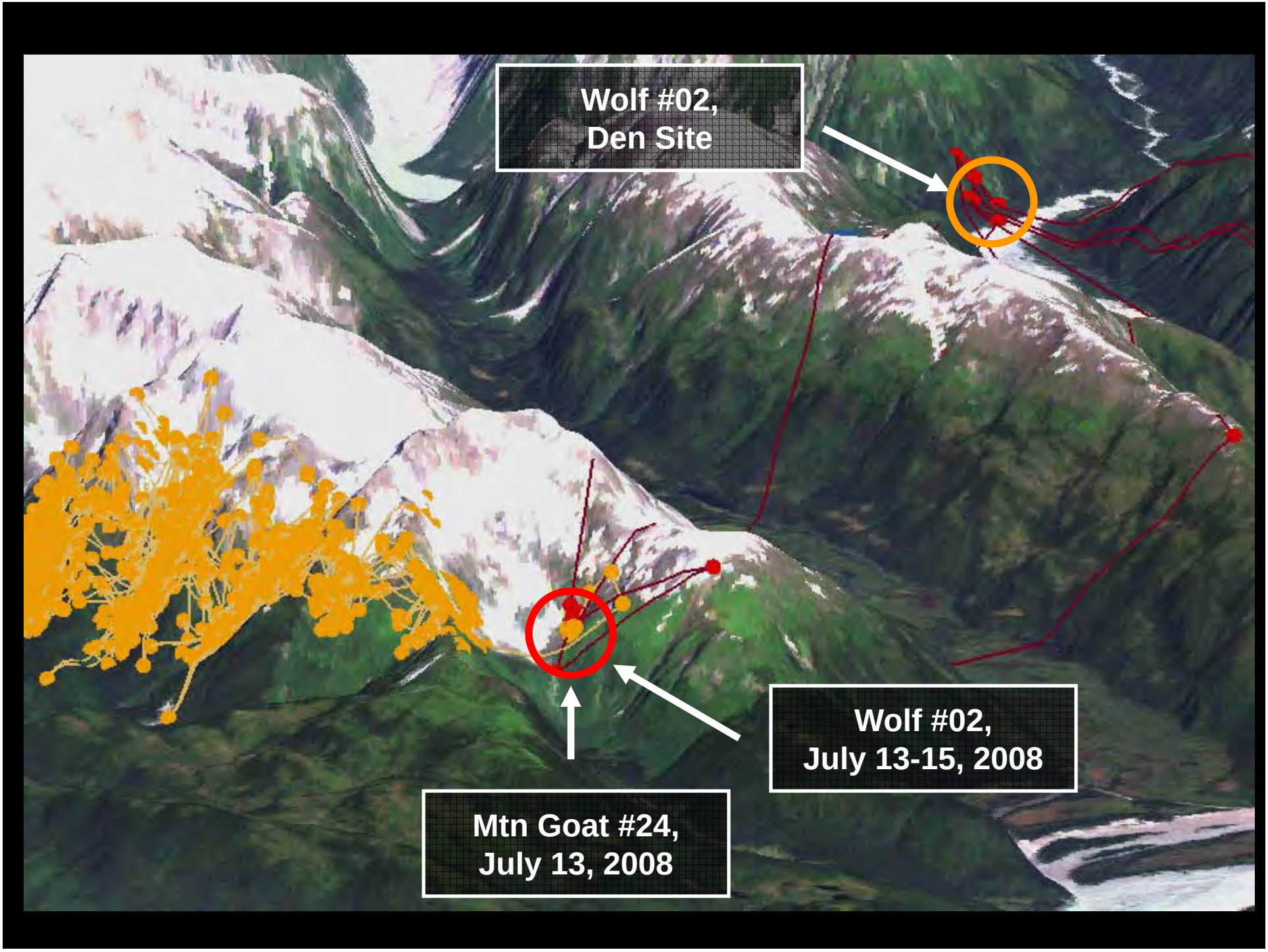
Age: Yearling (1-yr), Subadult (2-3), Young Adult (4-5), Adult (6-8), Old (9+)

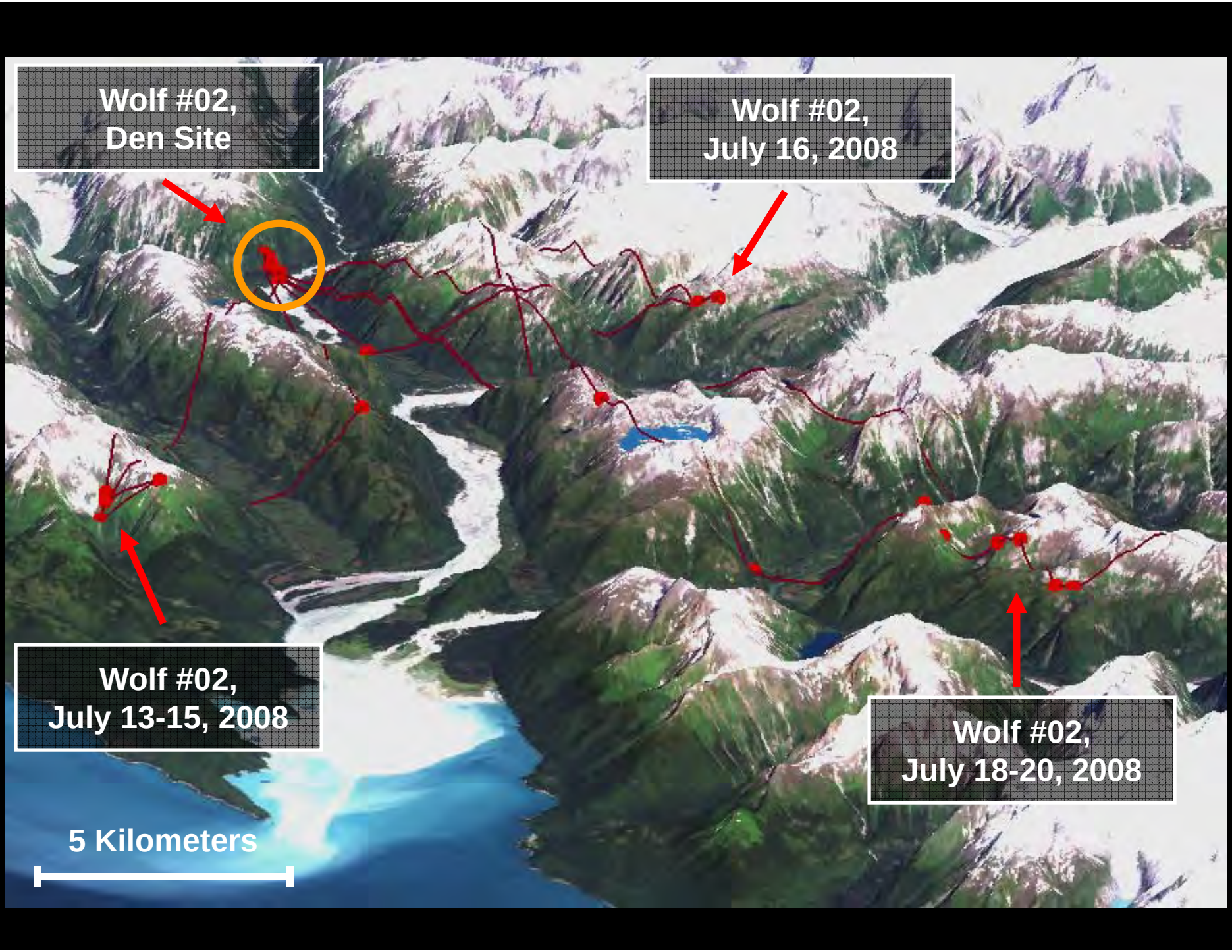
Survival: Causes of Mortality

Cause	n	Prop
unknown	17	0.25
malnutrition	15	0.22
bear	12	0.17
avalanche	11	0.16
wolf	6	0.09
predation	4	0.06
fall	2	0.03
hunter	2	0.03
	69	


Mtn Goat #24,
July 13, 2008


Wolf #02,
Den Site
Wolf #02,
July 13-15, 2008


Wolf #02,
Den Site
Wolf #02,
July 13-15, 2008
Mtn Goat #24,
July 13, 2008


Wolf #02,
Den Site
Wolf #02,
July 16, 2008
Wolf #02,
July 13-15, 2008
Wolf #02,
July 18-20, 2008
5 Kilometers

Carnivore Scavenging

Carnivore	n	Proportion
Wolverine	11	0.19
Black Bear	10	0.18
Brown Bear	3	0.05
Unk Bear	7	0.12
Wolf	8	0.14
Marten	5	0.09
Otter	1	0.02
Unk Mustelid	1	0.02
Unk Carnivore	8	0.14
None	3	0.05
	57	


Scavenger: Wolverine
Mtn Goat: LG133 (Ad M)
Date: 4/2/11
Location: Eagle Glacier
Cause of Death: Malnutrition


Scavenger: Wolverine
Mtn Goat: LG133 (Ad M)
Date: 4/2/11
Location: Eagle Glacier
Cause of Death: Malnutrition


Scavenger: Bald Eagle
Mtn Goat: LG133 (Ad M)
Date: 4/2/11
Location: Eagle Glacier
Cause of Death: Malnutrition

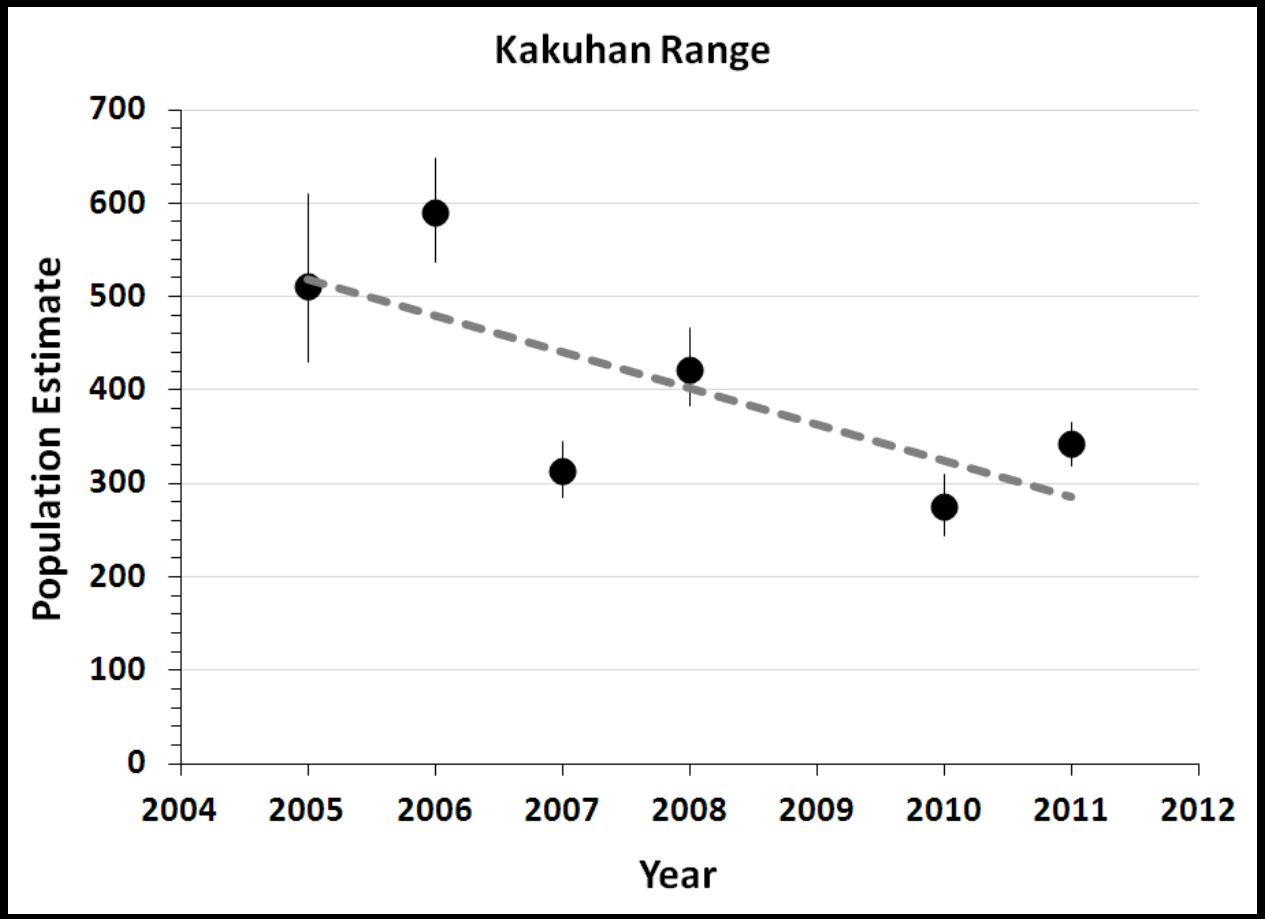

Scavenger: Brown Bear/Black Bear
Mtn Goat: KG23 (AdF)
Date: 5/29/11
Location: Four Winds Mtn.
Cause of Death: Avalanche

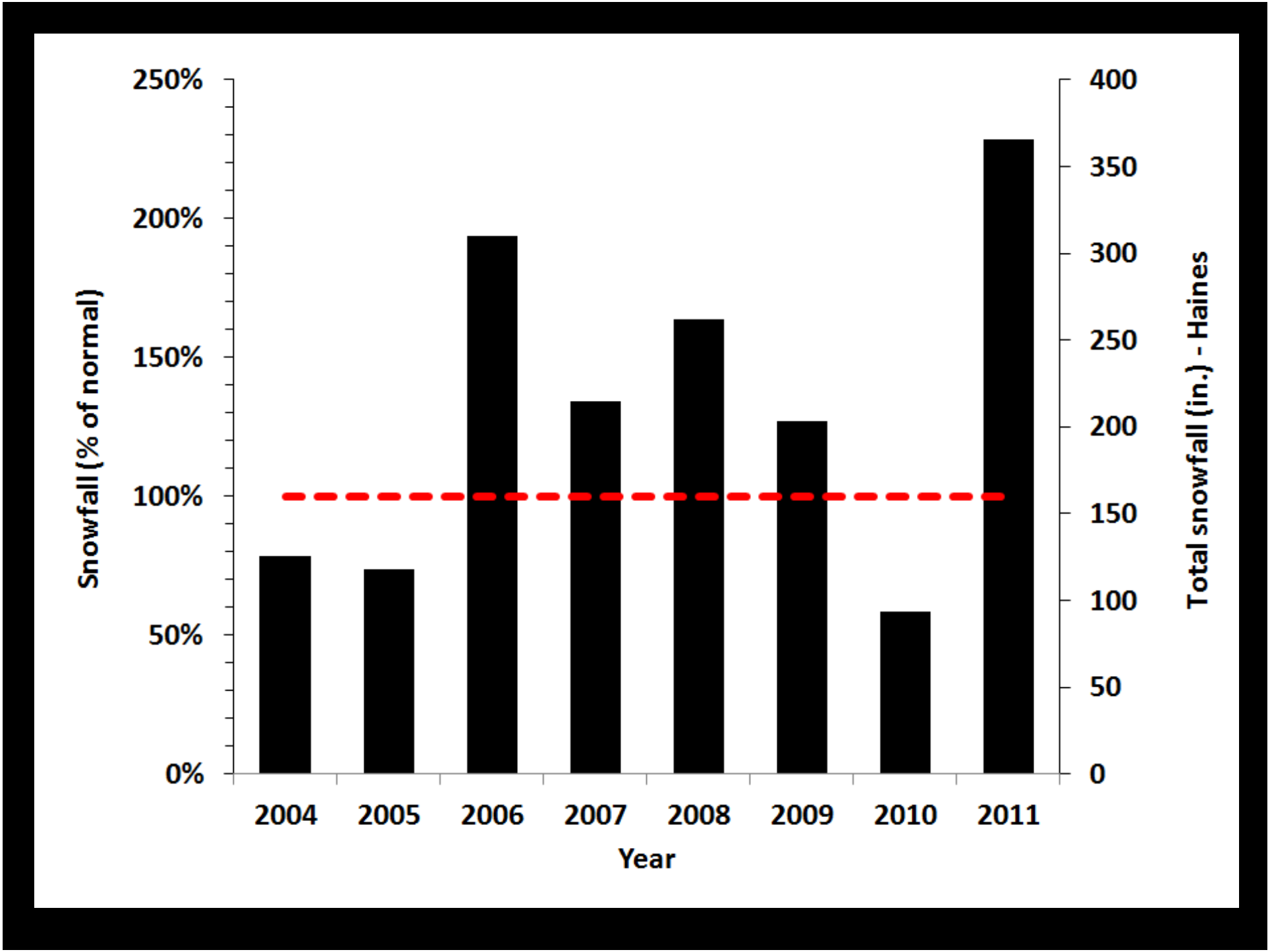
Population Estimation

Population Trends

-40% decline since 2006

-5 of 8 recent winters above average




250%
200%
150%
100%
50%
0%
Snowfall (% of normal)
400
350
300
250
200
150
100
50
0
Total snowfall (in.) - Haines
2004
2005
2006
2007
2008
2009
2010
2011
Year

Summary

-high genetic structure
-largely disease-free*
-not clearly mineral deficient
-high quality summer diet, low in winter
-rapid mass gain in summer
-relatively low survival/productivity
-significant recent decline (40%) in population abundance
-5 of 8 recent winters above average
-altitudinal migrations
-winter habitat more limited than summer
-low movement in winter vs summer/rut
-high site fidelity

Future Plans

Timeline: 2012-

Capture/Collar Deployments:

- **6-8/year (Goal: n = 40 total)**

Monitoring

- **reproduction**
- **survival**
- **population estimation**

Snow/Climate Monitoring (?)

Reporting

- **Annual Progress Reports (Nov 1 each year)**

Acknowledgements

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Fixed-wing: Lynn Bennett, Mark Morris, Jacques Norvell, Chuck Schroth, Pat Valkenburg, Doug Larsen and Mark Pakila.

Helicopter: Rey Madrid, Mitch Horton, Andy Hermansky, Eric Main, Christian Kolden, John Weeden (Temsco Helicopters), Chuck Schroth (Fjord Flying Service).

Questions?