A Review of Mule and Black-tailed Deer Population Dynamics

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Background

- Role of predation in mule deer dynamics is controversial
- Still controversial because drivers of mule deer dynamics are not clear
- Resolving controversy requires understanding the interaction of all limiting factors (forage, weather & predation) and their effect on key vital rates:
  - Adult female survival
  - Juvenile survival and recruitment
  - Fecundity

Background

What we know from other ungulates:

- High and stable adult female survival
- Variable juvenile survival and recruitment
- Fecundity can be variable
- Senescent effects on survival and fecundity
- (Gaillard et al. 1998, 2000)

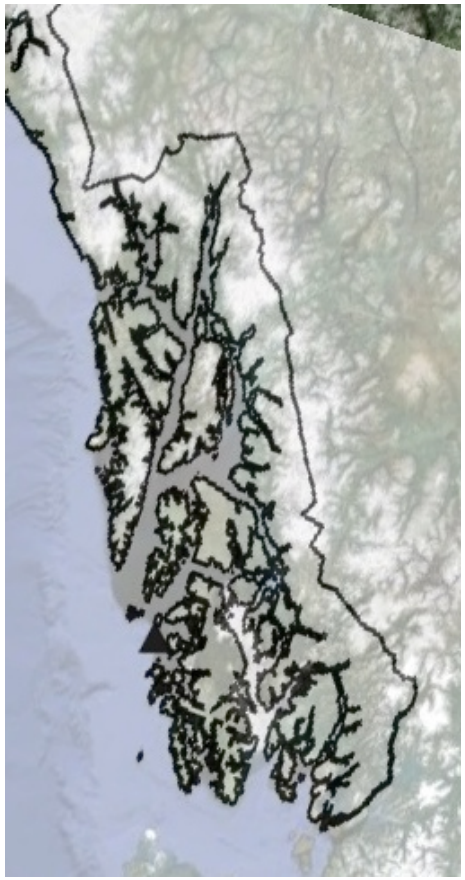
Background

- No predictive understanding of mule deer dynamics
- Fluctuations have surprised managers and hunters
- Do mule and black-tailed deer match patterns of other ungulates?
- How do predation, forage and weather affect these vital rates and dynamics?

Methods

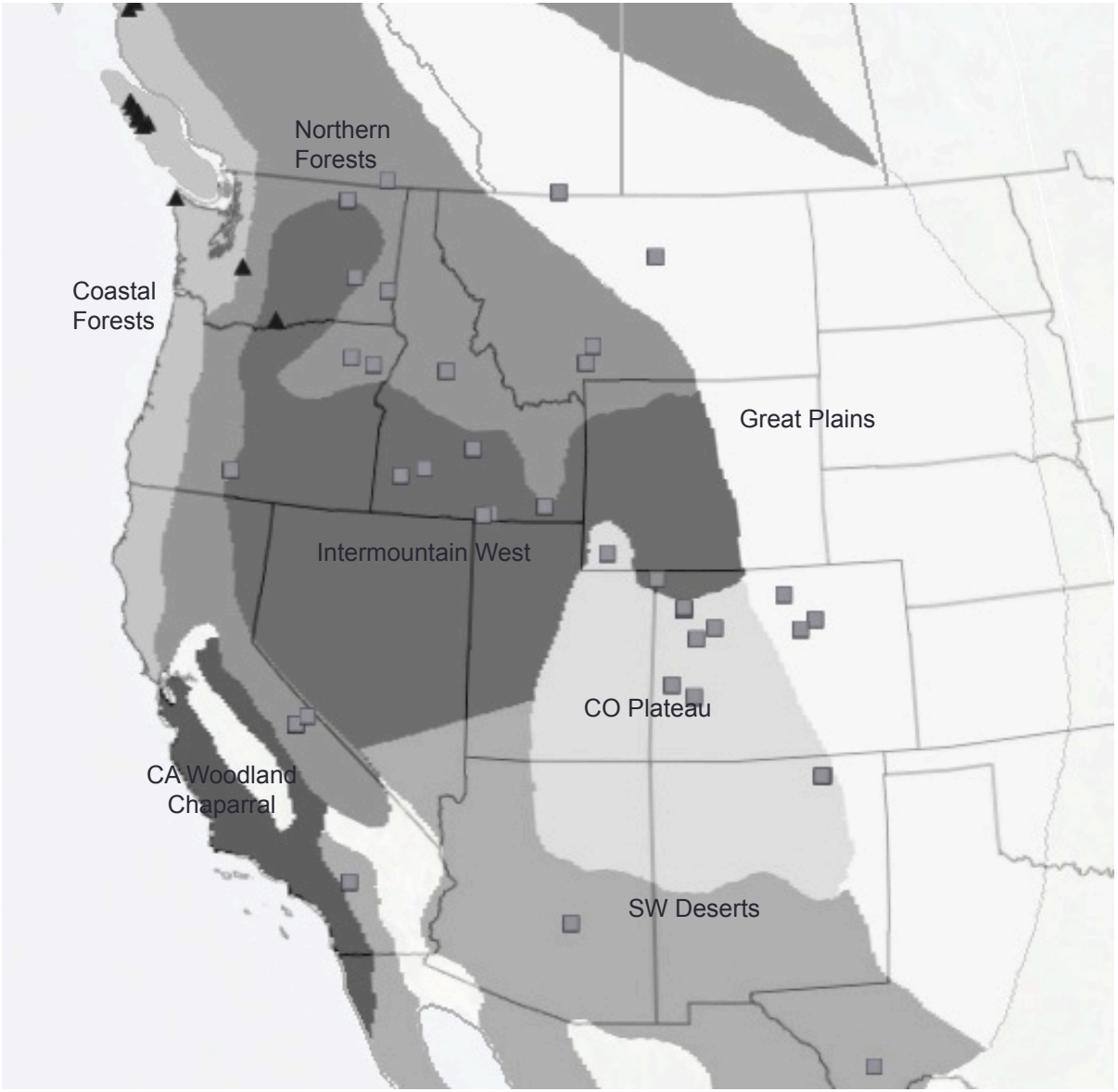
- We searched literature and government reports & reviewed survival and cause of mortality studies
- Adult female and fawn survival
  - 0 to 6 months
  - 6 to 12 months
  - 0 to 12 months
- Factors affecting survival
  - Predation, malnutrition, and weather
  - Interactions

Research Geography



Research Geography

Studies by Ecoregion



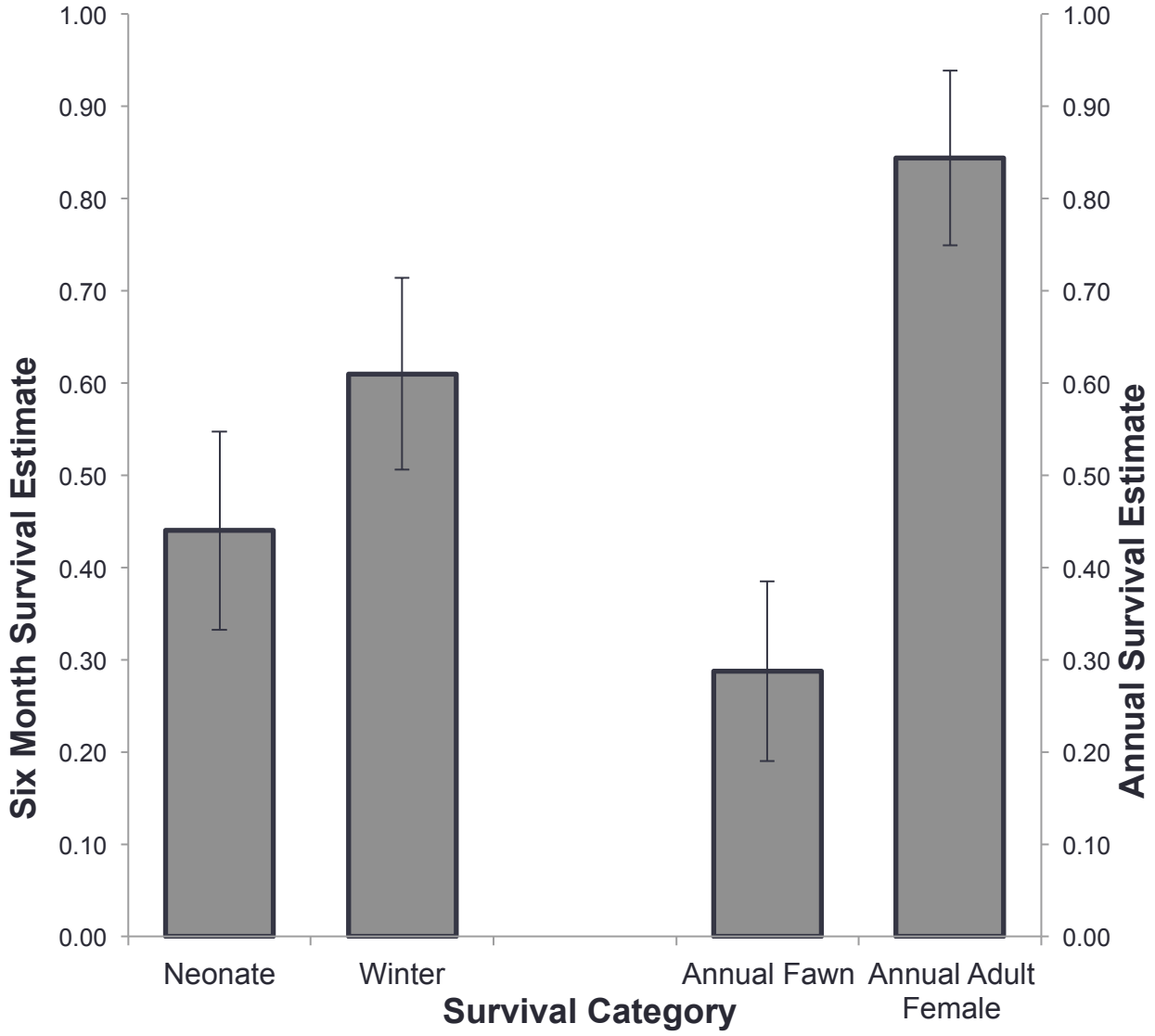
Avg. Survival Rates

Adult survival
0.84 ± 0.09

Adult survival similar to other ungulates

Fawn survival
0-12 Months
0.29 ± 0.10

Fawn survival lower and more variable



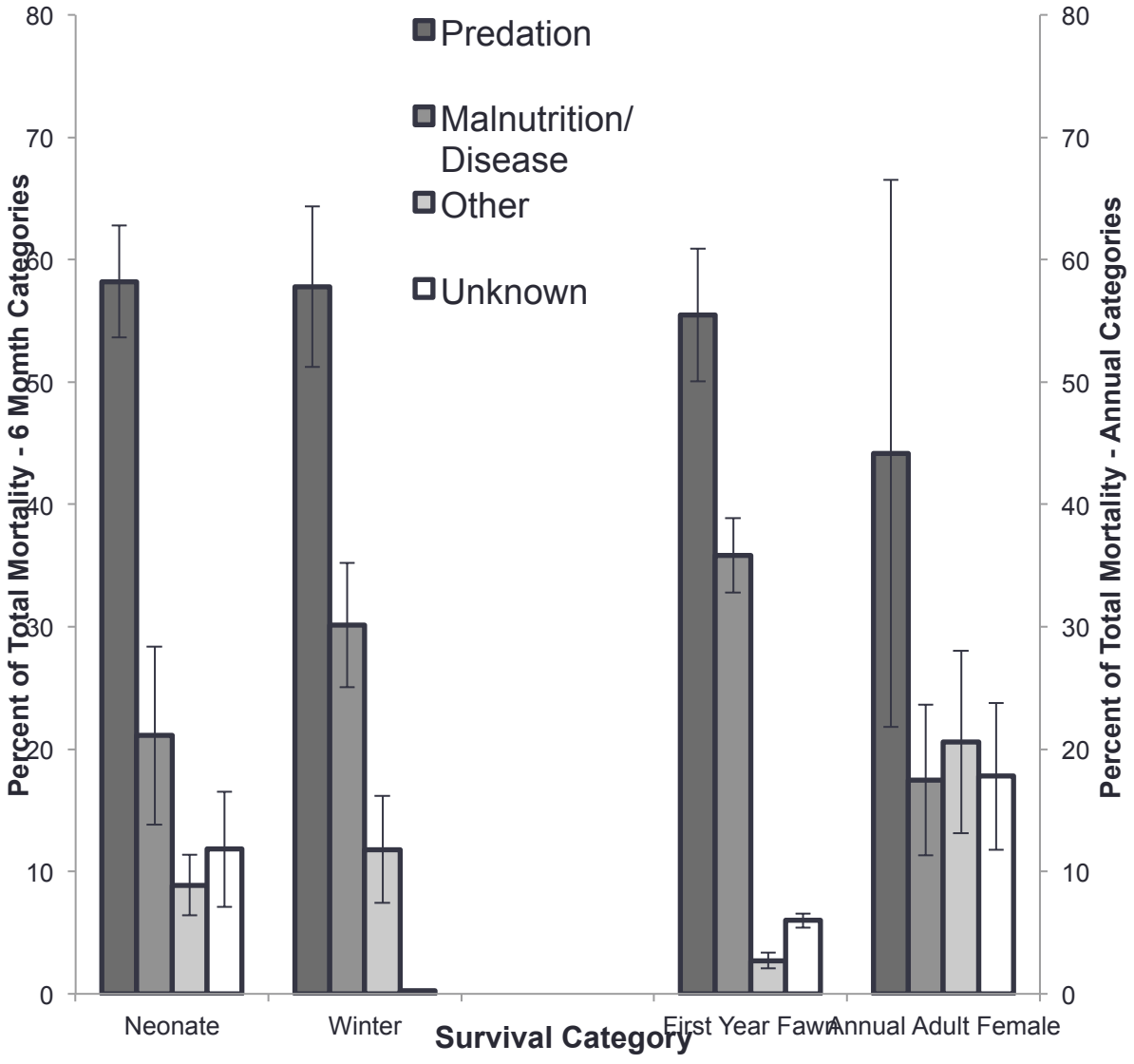
Proximate Cause of Mortality

Main Adult Predators

- Mtn. Lions
- Wolves (BC)

Diverse Fawn Predators

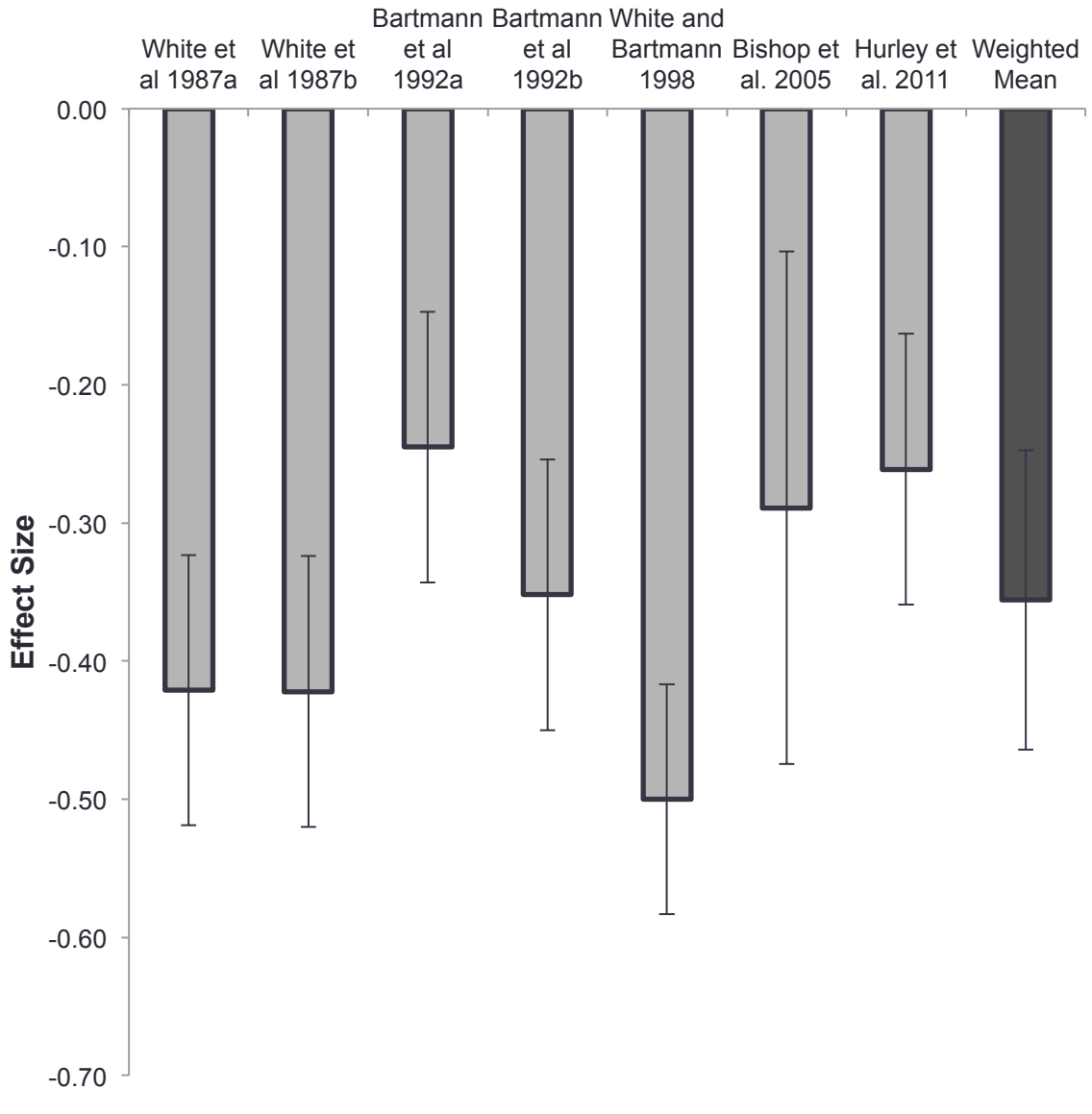
- Coyotes
- Mtn. Lions-Bobcats
- Wolves
- Bears



Weather Effects on Survival

Harsh Weather Matters

Effect size is the reduction in mean survival during harsh weather



Predation and Nutrition and Weather

- Little evidence for just predator regulation
  - 1 in 5 large scale removals found increase (see table)
  - Coyote removals did not increase deer
  - Compensatory mortality in mtn. lion removal
  - 9 year study found ↑ survival ≠ ↑ growth (Hurley et al. 2011)

Predation Studies

Study	Study Type	Predator	Years	Spatial Scale (km^2)	Predation Additive or Compensatory	Short Term Pop. Δ	Long Term Pop. Δ
Atwood et al. 2007	Predator Colonization	Wolf	3	680	Unknown	↓ Predation risk	Unknown
Bartmann et al. 1992	Predator Removal	Coyote	7	140	Compensatory	None	Not measured
Brown 2009	Predator Removal	Coyote	2	10,518	Unknown	None	Not measured
Harrington & Conover 2007	Predator Removal	Coyote	2	1,900	Additive?	↑ Density ≅ Fawn:Doe ratio	Not measured
Hatter & Janz 1994	Predator Removal	Wolf	20	2,400	Additive	↑ Population	Stable at higher level
Hurley et al. 2011	Predator Removal	Coyote	6	14,700	Compensatory	↑ Fawn Survival (only in certain conditions)	No change in growth rate
Hurley et al. 2011	Predator Removal	Mtn. Lion	6	14,700	Compensatory	↑ Survival ↑ Fawn:Doe ratio	No change in growth rate

Predation and Nutrition and Weather

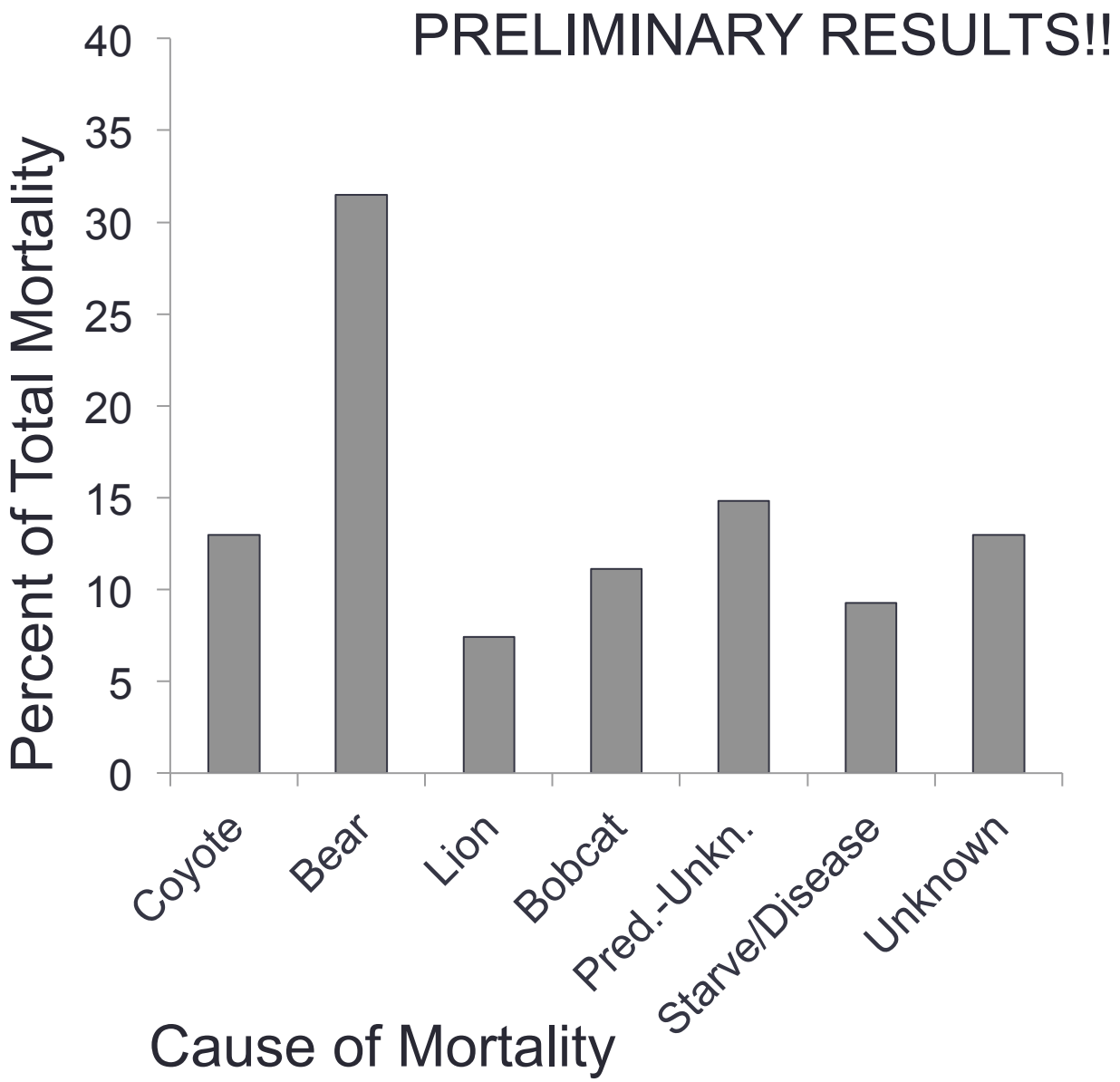
- Nutrition status can affect all mortality rates
  - 4 year supplemental feeding study in Colorado (Bishop et al. 2009)
  - Increased nutrition reduced predation mortality in adults and fawns

Multi-prey and Multi-Predator Systems

- Fawn predation sensitive to alternate prey
  - Changes in microtine rodent/lagomorph prey affects coyote predation (Hamlin et al. 1984; Lingle 2000; Hurley et al. 2011)
- Adult predation changes with food web
  - Increasing white-tailed deer leads to increased mule deer mortality (Robinson et al. 2002, Cooley et al. 2008)
  - Wolf recolonization leads to elk habitat shift and reduction in mule deer predation risk from mtn. lions. (Atwood et al. 2007, 2009)

Mendocino Cause of Fawn Mortality

Higher Bear and Felid predation than other research (so far)



Possible Patterns driving Mule Deer Dynamics

1. Weather and Nutrition Driven accentuated by Predation

2. Nutrition drives Adult vital rates – Nutrition-Predation interaction controls Fawn Recruitment

3. Human caused Changes Shifting the Food Web
   - Changes in landscape or species composition

Recommendations for Future Study

1. Gather and report data to calculate population growth rates (λ)
   - Fecundity and birth to recruitment needed
2. Age class specific survival is needed
   - What vital rates drive dynamics?
3. Multi-prey multi-predator community studies
4. University and management agency collaboration

Thanks

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