

**Population and demographic trends of  
ferruginous pygmy-owls in northern Mexico  
and implications for recovery in Arizona**

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# *Objectives*

- Describe population and demographic trends
- Assess factors associated with trends
- Discuss implications for recovery in Arizona



# *Parameters*

## Population

- Abundance
- Occupancy

## Demographic

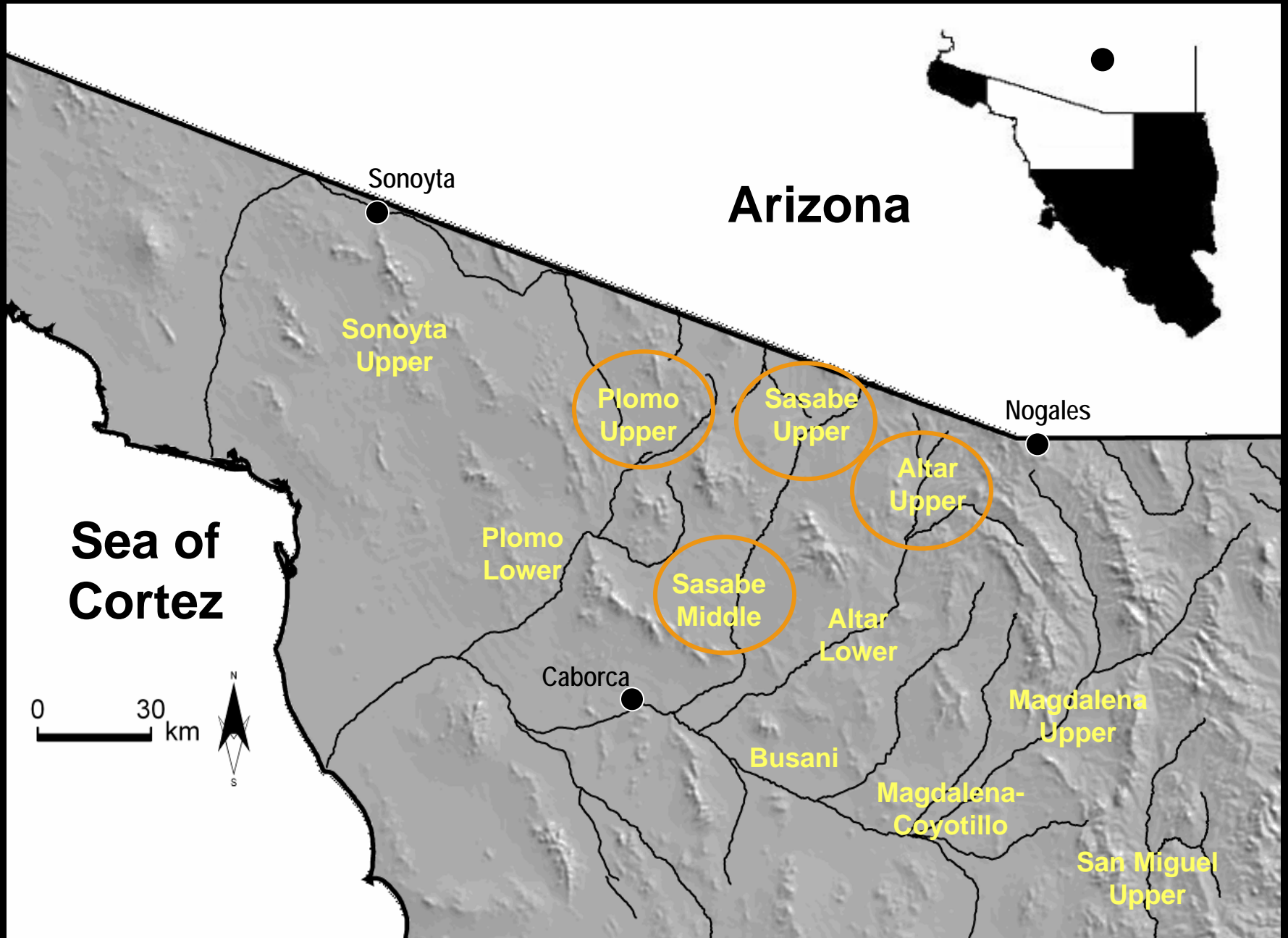
- Nest Success
- Clutch Size
- Brood Size

## Factors associated with trends

- Rainfall
- Prey
- Vegetation
- Land Use



# Study Area



# *Vegetation Communities*

Arizona Upland

Lower Colorado River Valley

Plains of Sonora

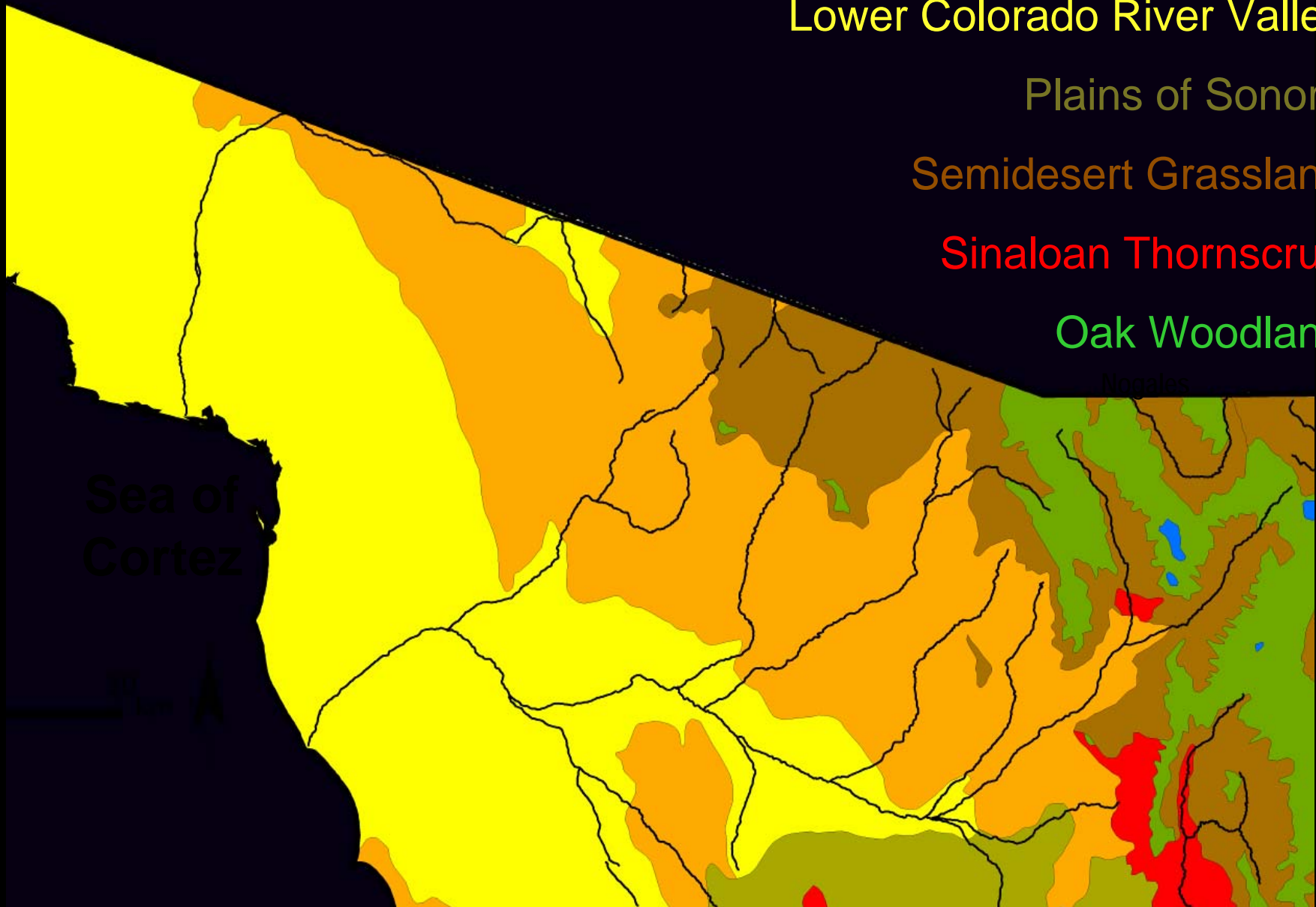
Semidesert Grassland

Sinaloan Thornscrub

Oak Woodland

Nogales

Sea of Cortez



## *Design and Methods*

- Random and nonrandom site selection
- Repeated measures
- Broadcast surveys  
1 visit/year/site
- Nest monitoring  
2-6 visit/year/nest



# *Effort*

- Abundance - 8 years  
123 stations/year (54 km)
- Occupancy – 6 years  
51-102 territories/year
- Demographics – 7 years  
29-77 nests/year



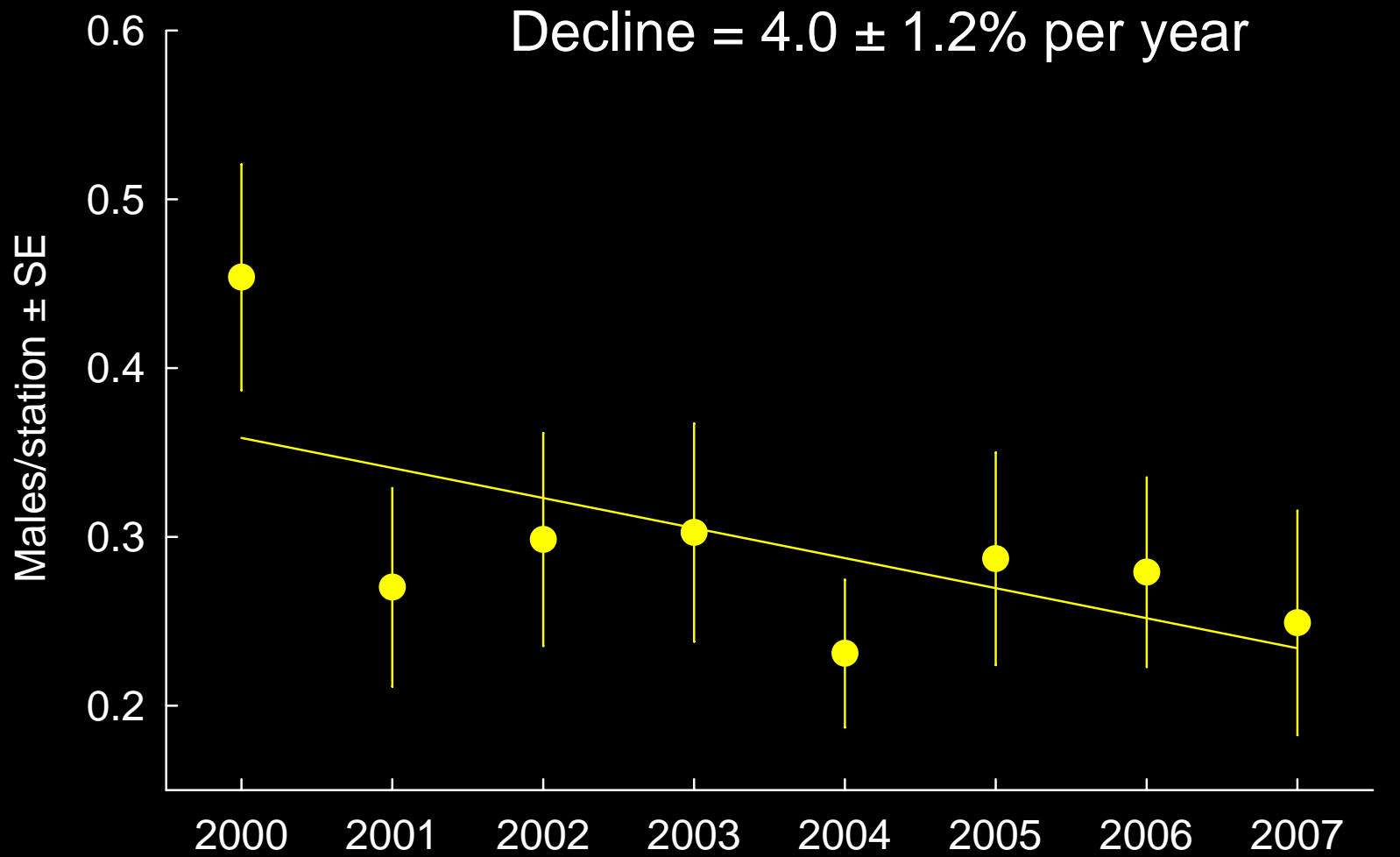
# *Analyses*

## Trends across time

- Generalized linear models
- Year = fixed effect
- Site = random effect
- Year  $\times$  region interaction
- Quadratic and linear terms

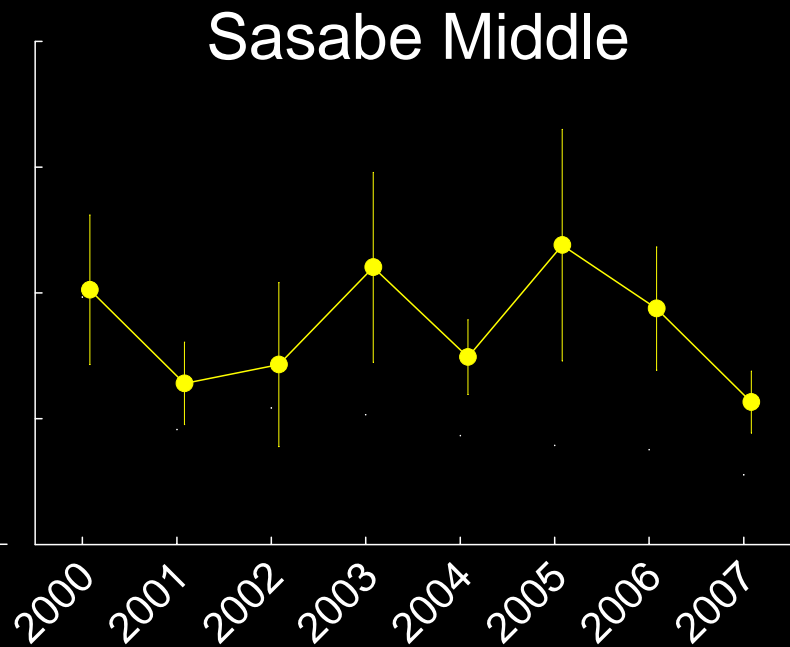
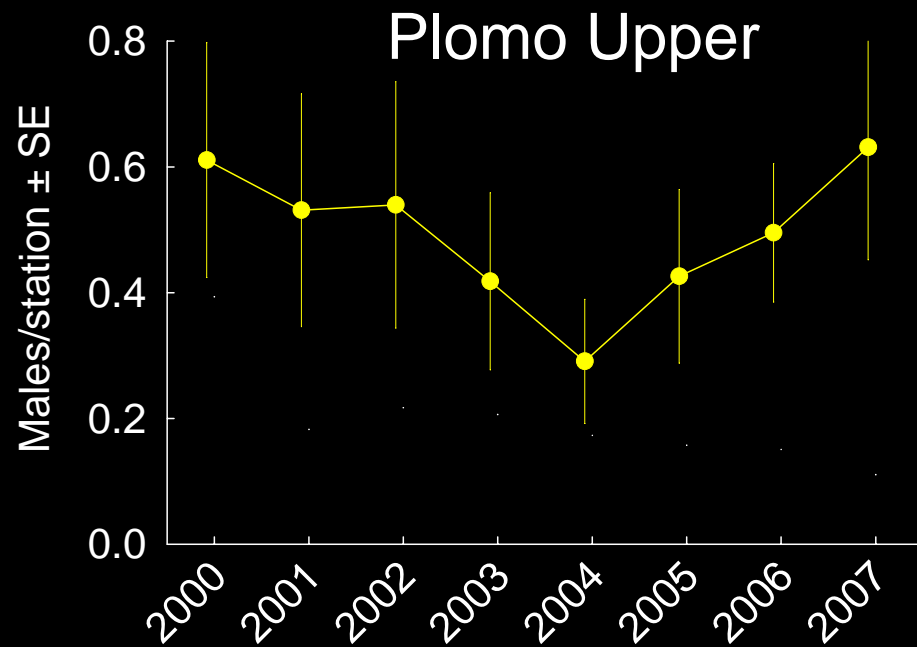
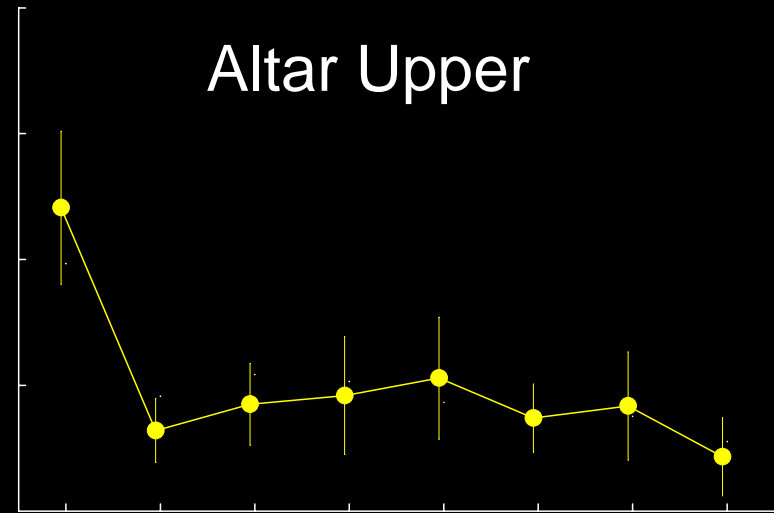
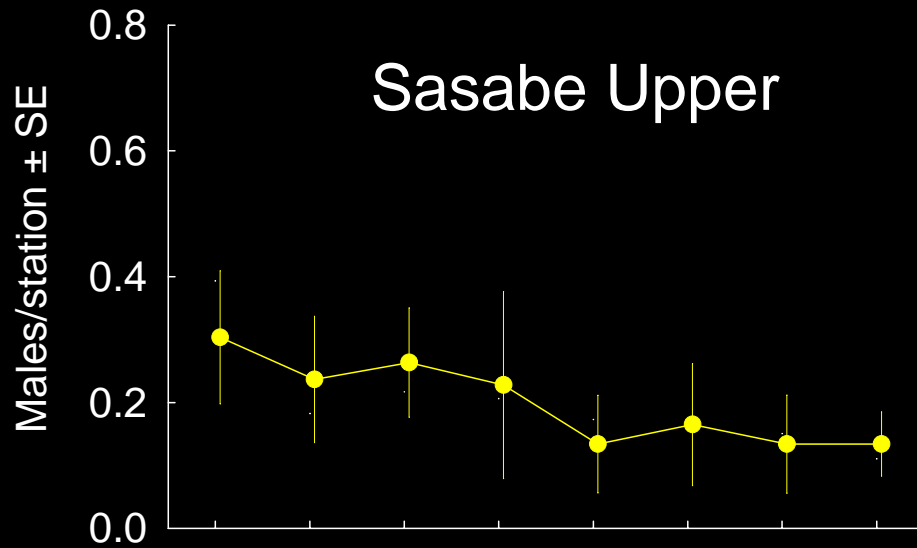


# *Trends in Abundance I*

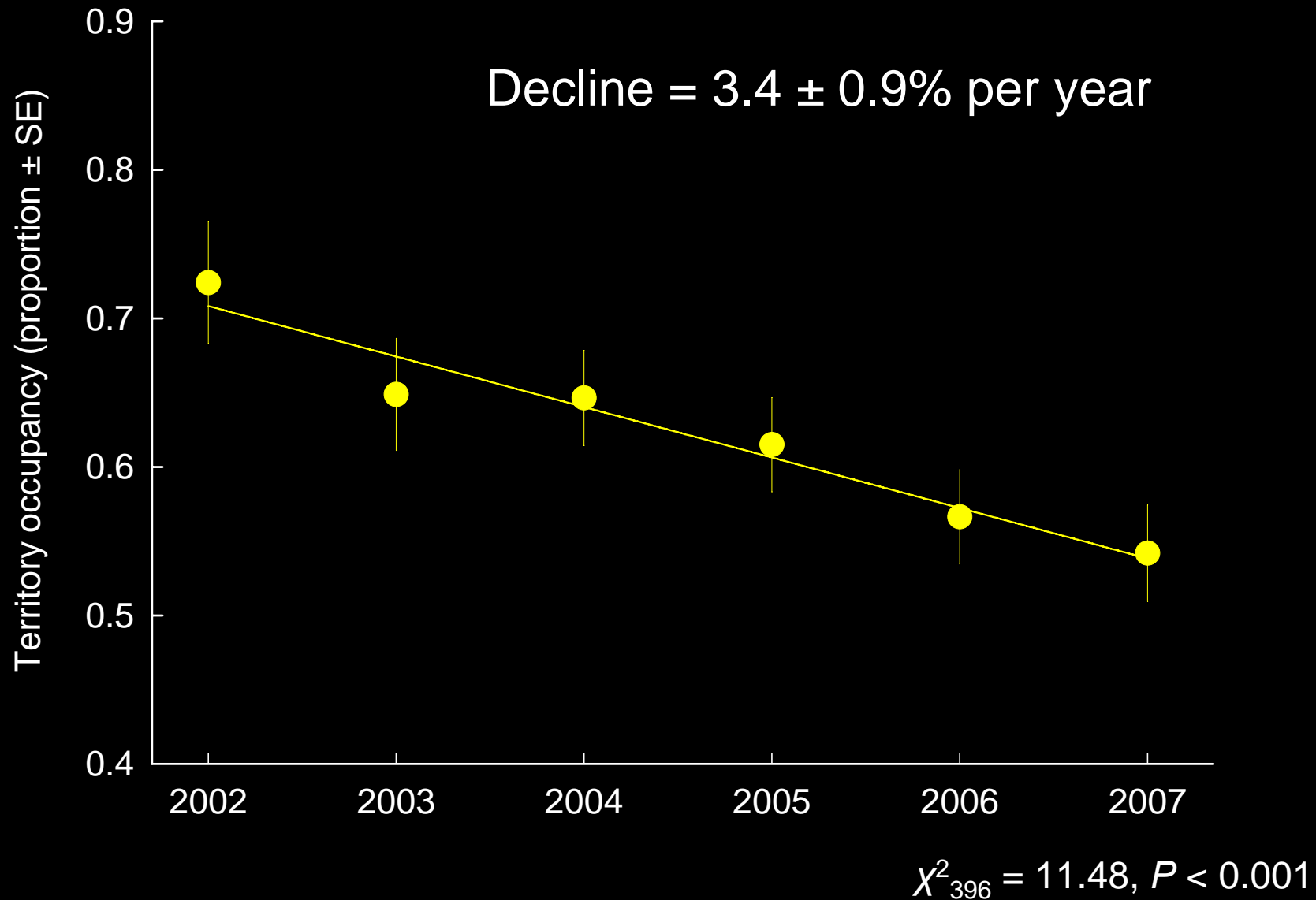


$t_{125} = 3.27, P = 0.001$

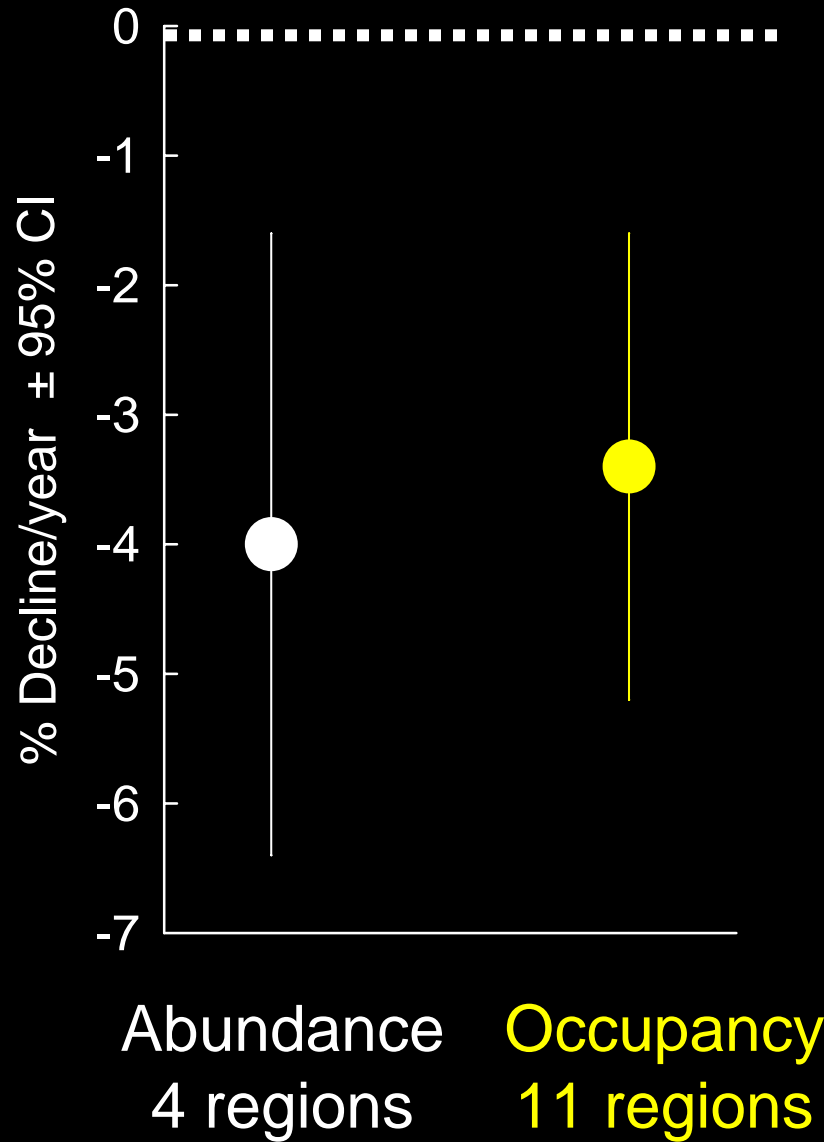
# Trends in Abundance II



# *Trends in Occupancy II*

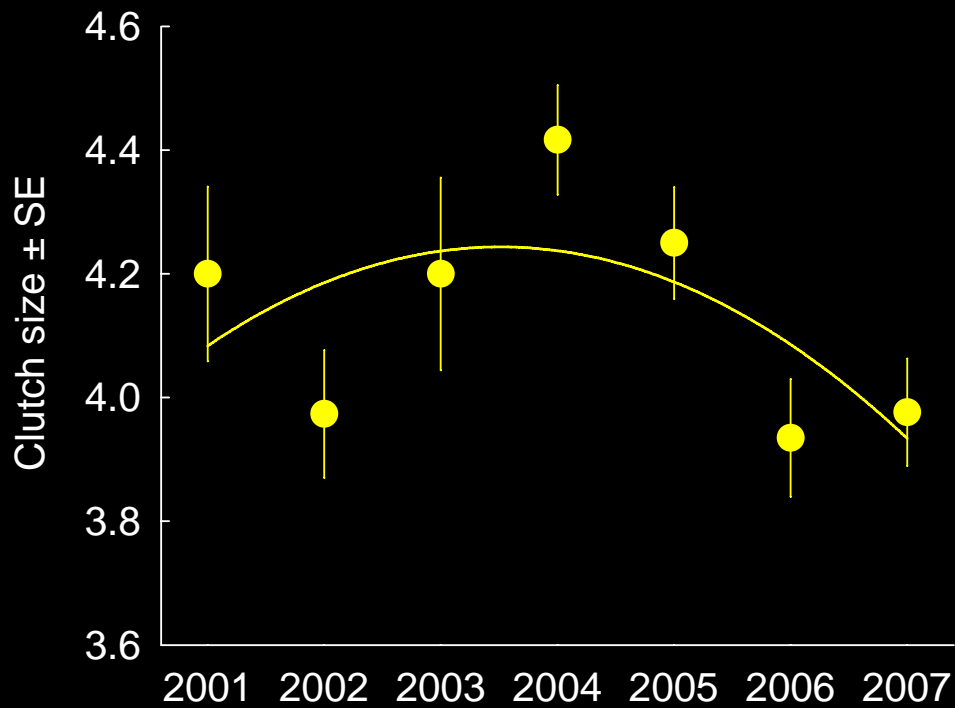


# *Trends in Abundance vs. Occupancy*



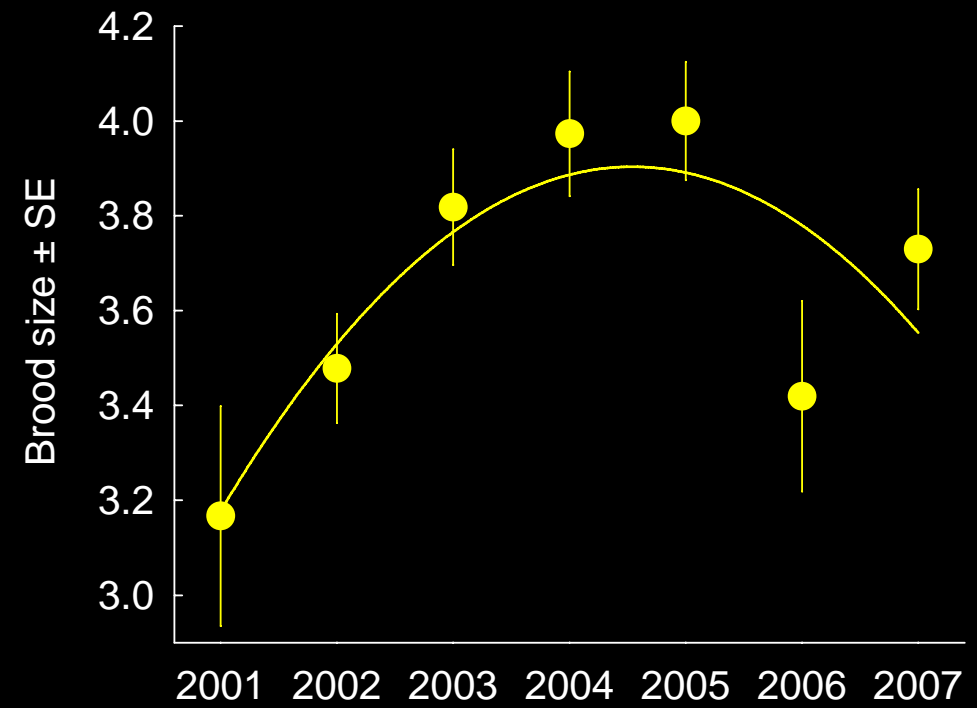
# Demographics I

## Clutch Size



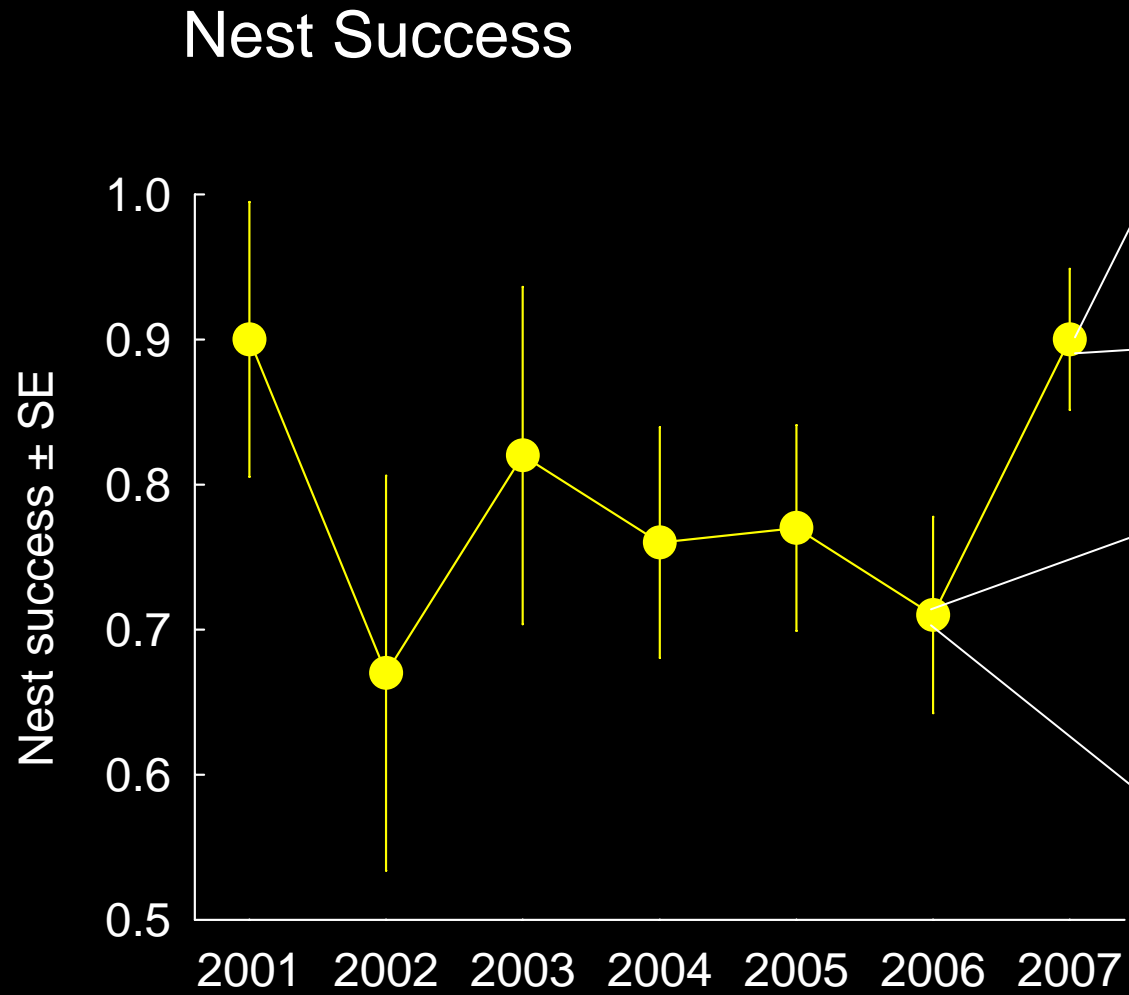
$P = 0.010$

## Brood Size



$P = 0.001$

# Demographics II



# *Factors Associated with Trends*

## Rainfall

- Weather stations

## Prey availability

- Lizard density

## Vegetation

- Height and volume
- Woodland cover
- Width of riparian vegetation
- Cavity abundance

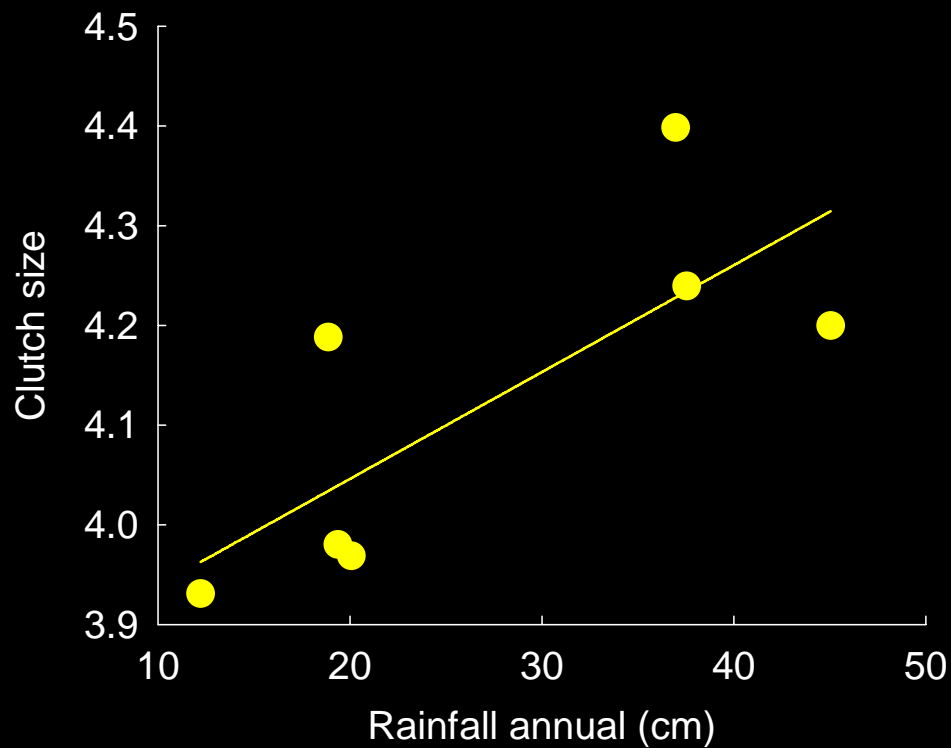
## Land Use

- Intensity ranks



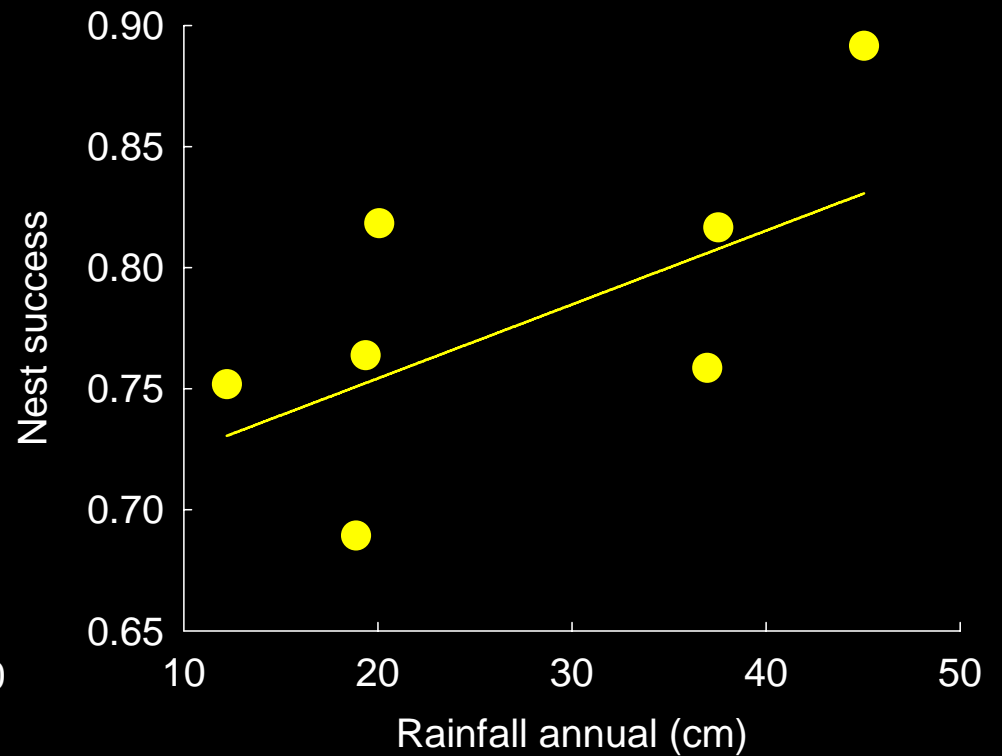
# Demographics and Rainfall I

## Clutch size



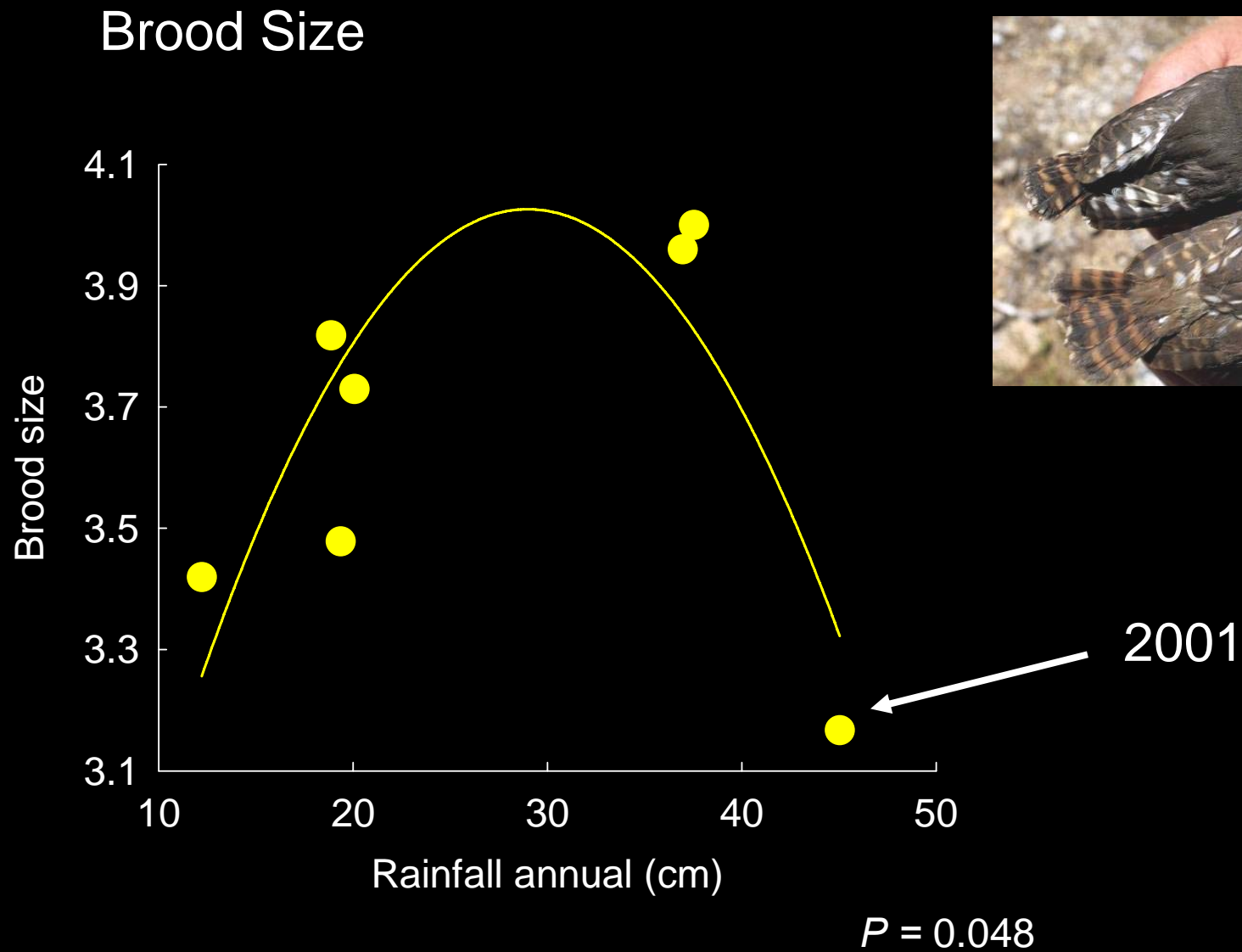
$P = 0.048$

## Nest success



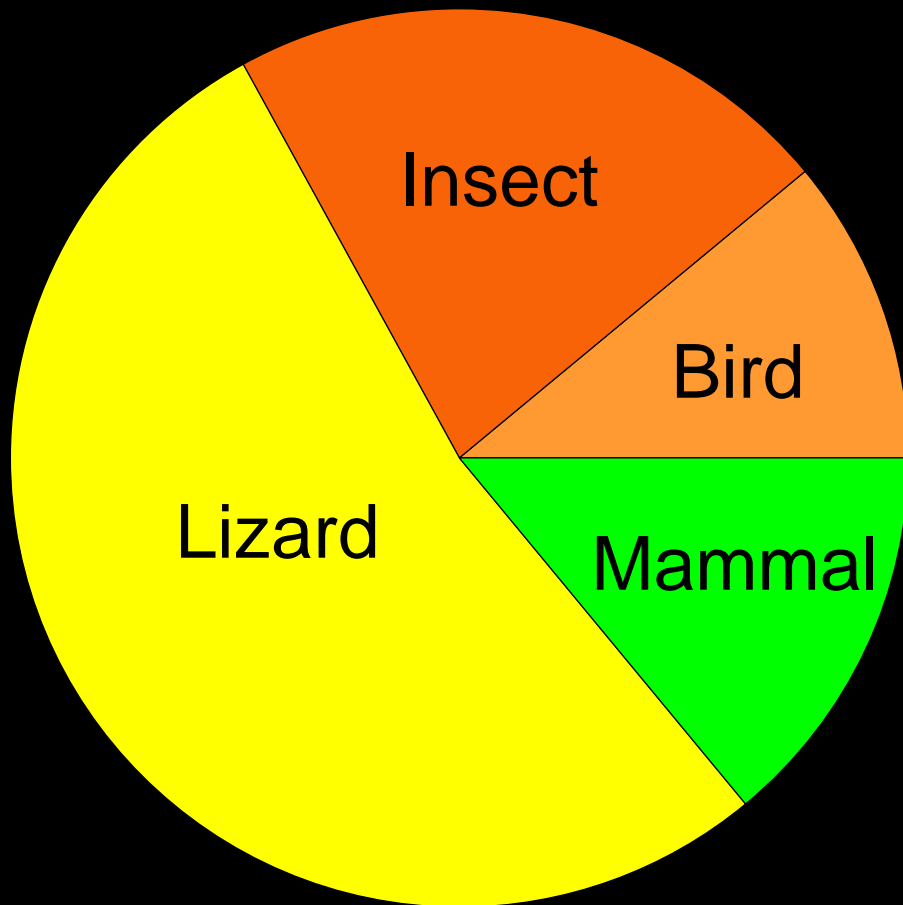
$P = 0.10$

# Demographics and Rainfall II



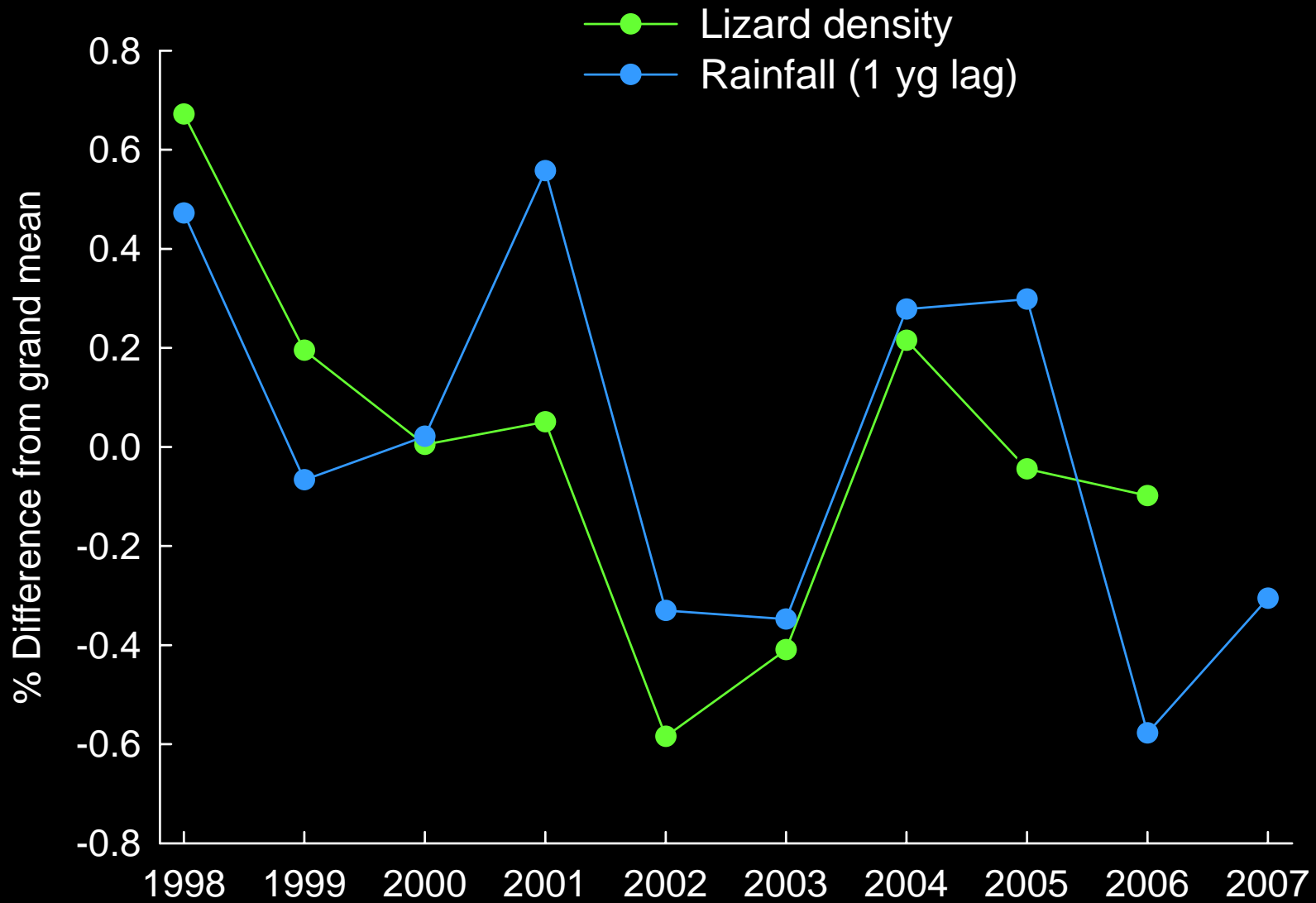
# *Factors Associated with Trends - Prey*

Prey Use

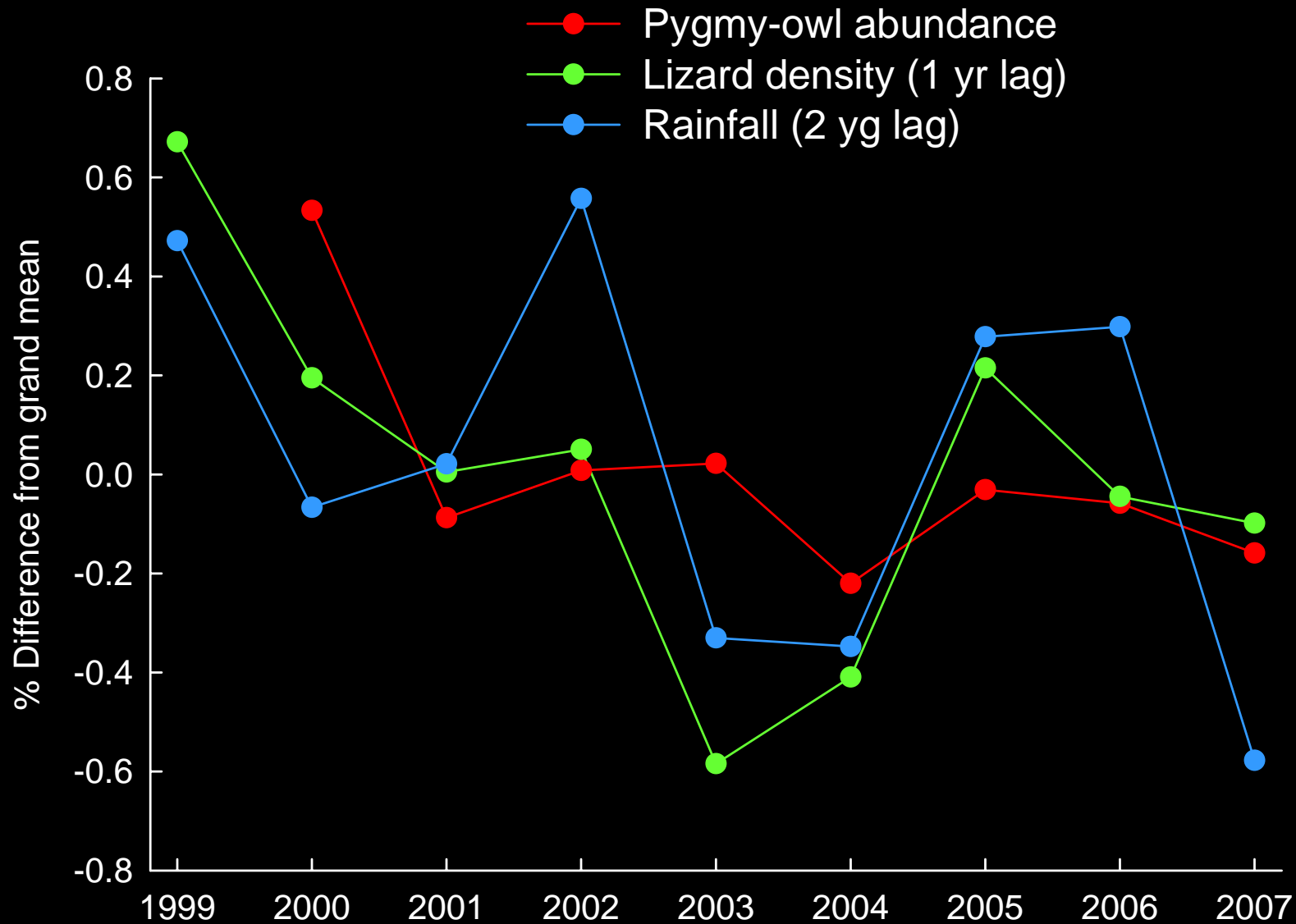


$n = 150$

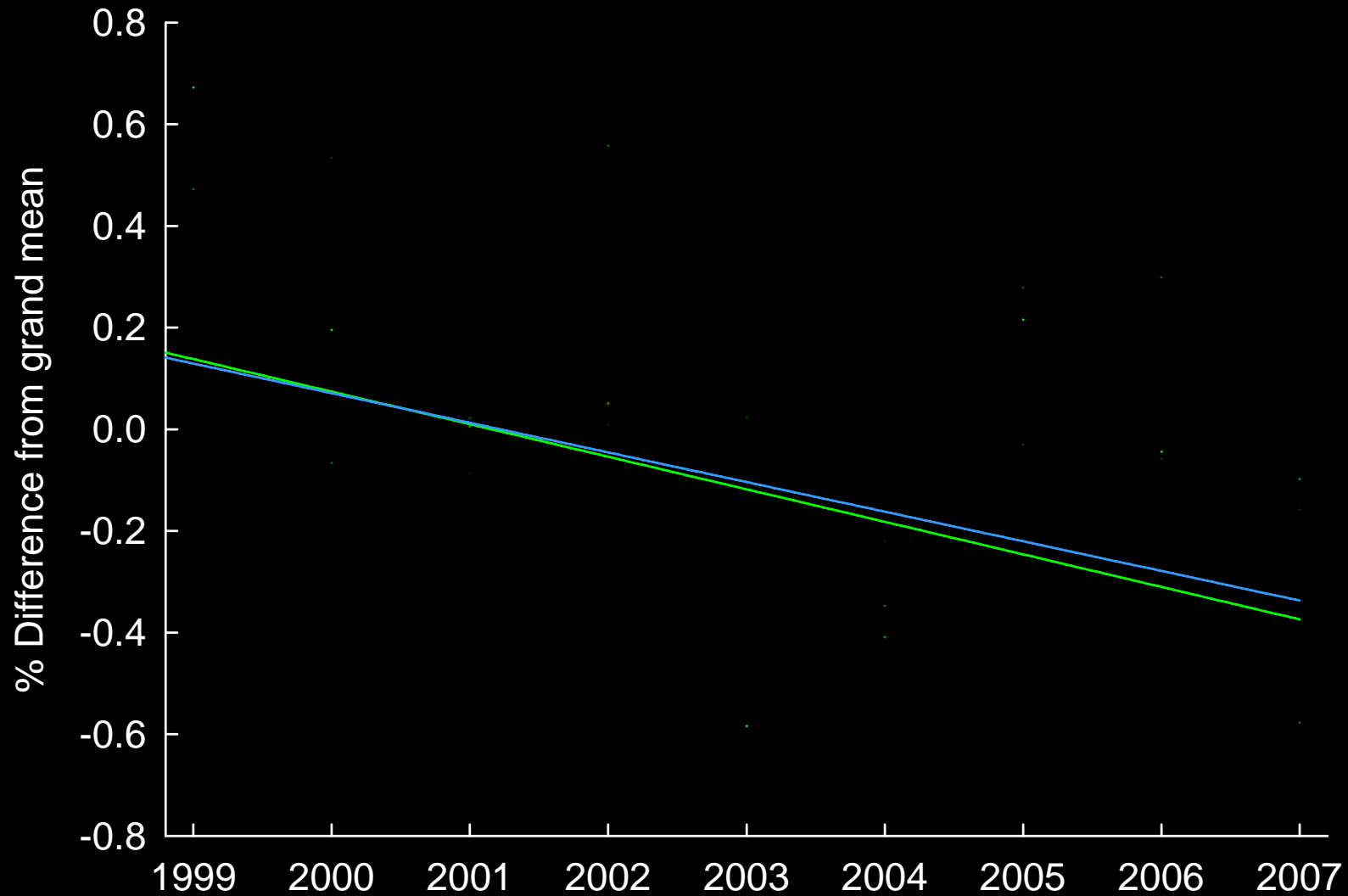
# *Rainfall and Prey*



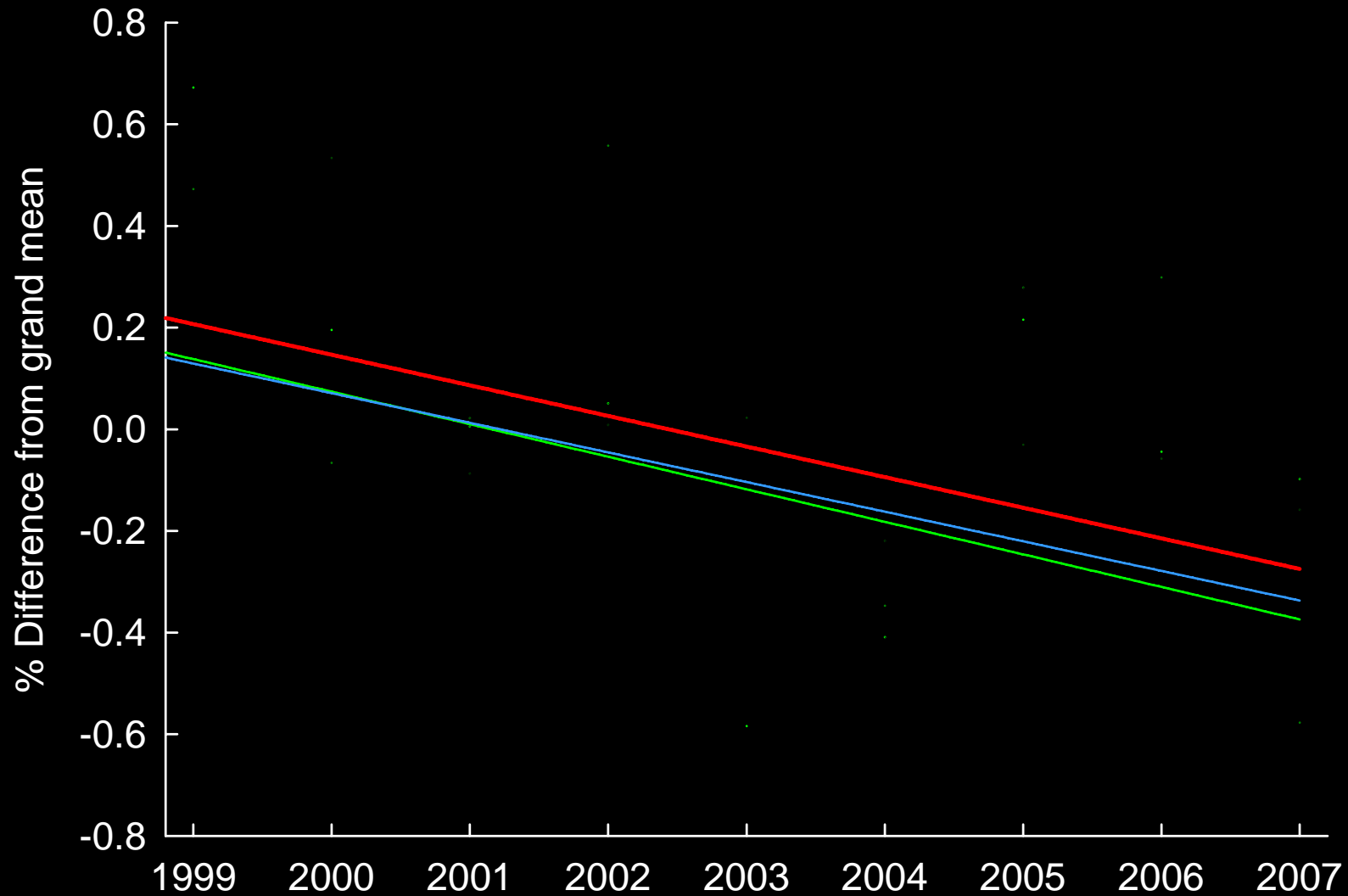
# *Rainfall, Prey, and Owl Abundance I*



# *Rainfall, Prey, and Owl Abundance II*

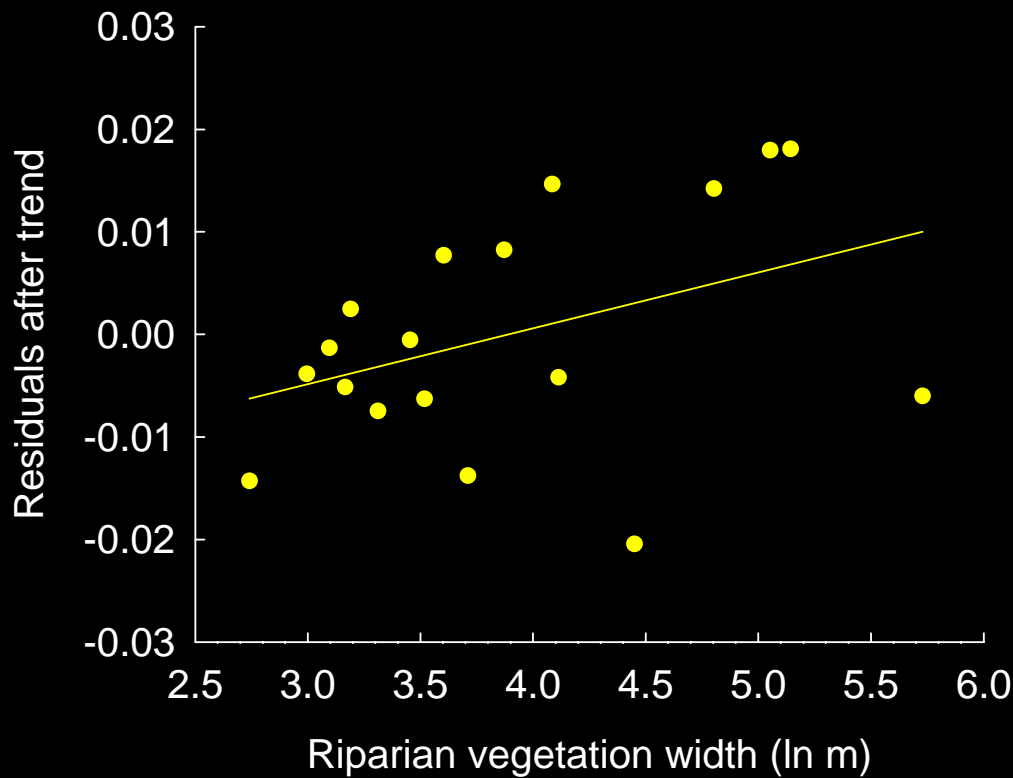


# *Rainfall, Prey, and Owl Abundance II*

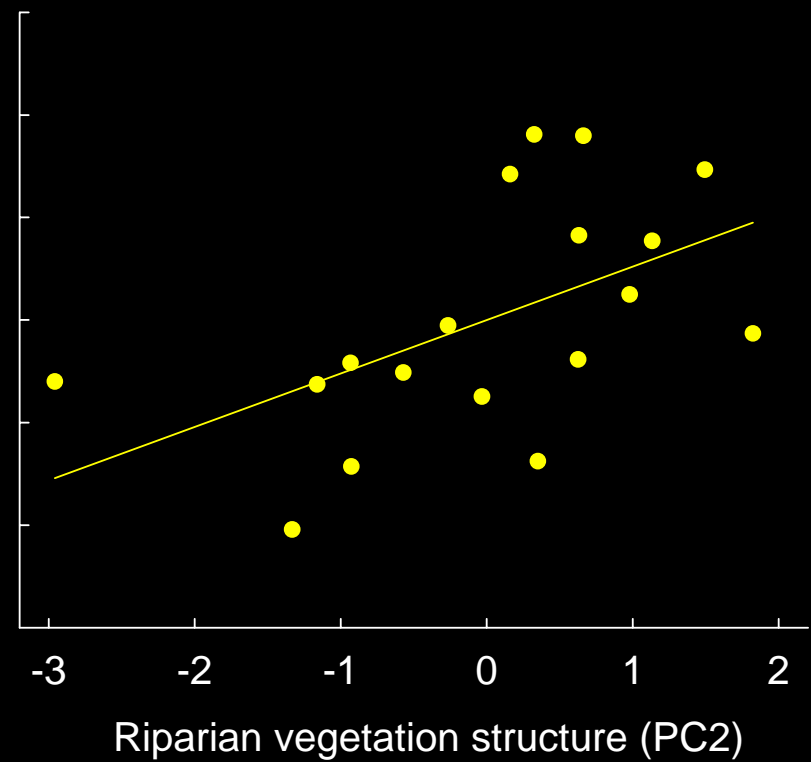


# *Trends in Abundance and Vegetation*

Variation remaining after trend in abundance



$P < 0.001$



$P = 0.012$

# *Conclusions*

- Populations have declined
- Demographics variable; no systematic decline
- Rainfall and prey likely important drivers
- Decline greater in lower quality environments



N. Smith

# *Recovery Implications*

- Drought poses recovery challenge
- High-quality habitat will buffer declines
- Factors associated with high-quality habitat must be elucidated
- High-quality habitat must be identified, created, and preserved



# *Acknowledgements*

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