Twenty-three years of raptor studies in Nevada

Joe Barnes

Formerly U.S. Fish & Wildlife Service; Nevada Dept. of Wildlife

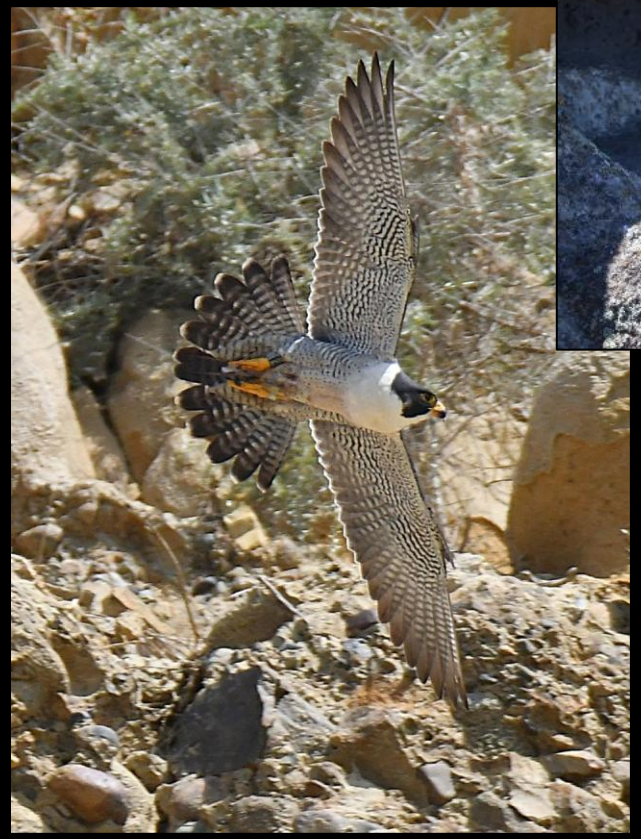
19 September 2026

Background

- Education
  - ❖ Bachelors of Science in Biology (1997) – Baldwin Wallace University (Ohio)
  - ❖ Masters of Science with Peregrine Ecology emphasis (2011) – University of Nevada, Las Vegas
- Employment
  - ❖ Fisheries Biologist (1997-2004)
    - Alaska, Indian Ocean, Hawaii, Washington
  - ❖ Wildlife Biologist (2004-present) – raptor specialist
    - Lake Mead NRA – National Park Service
    - Channel Islands, CA
    - Nevada Dept. of Wildlife
    - U.S. Fish & Wildlife Service

Peregrine Falcons

- Endangered federally from 1970–1999
- Apex predator specializing on birds
- Long-lived & highly territorial with high site fidelity
- Susceptible to contamination through diet
  - Bioaccumulation
  - Biomagnification
- Recent steep global declines
  - Likely influenced by avian flu (HPAI)



Methods

- Breeding Population Surveys
  - 4-hour Passive Monitoring
  - Call-broadcast/Exploratory

Methods

- Breeding Population Surveys
  - 4-hour Passive Monitoring
  - Call-broadcast/Exploratory
- Mark-recapture/Tissue Sampling
  - Banding
  - Feathers
  - Blood

Methods

- Breeding Population Surveys
  - 4-hour Passive Monitoring
  - Call-broadcast/Exploratory
- Mark-recapture/Tissue Sampling
  - Banding
  - Feather
  - Blood

Methods

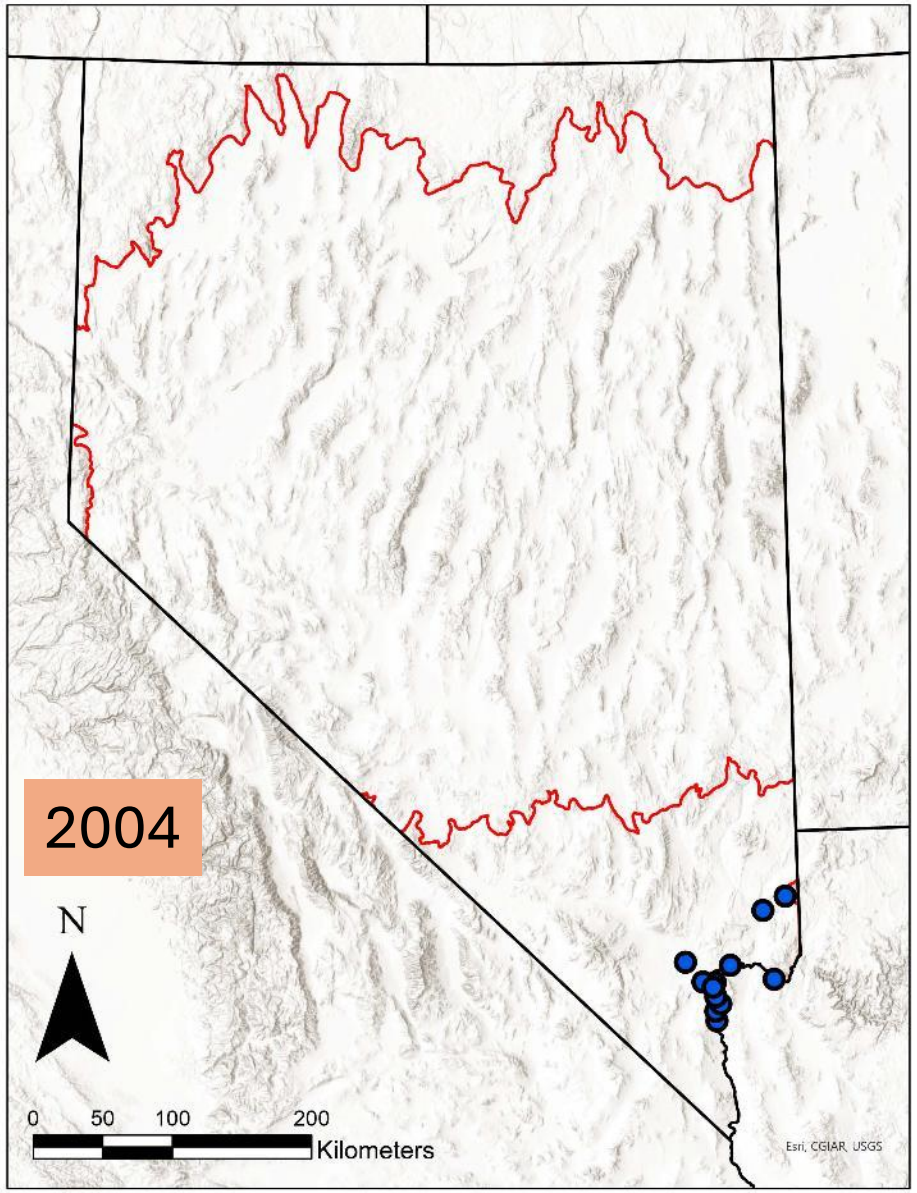
- Breeding Population Surveys
  - 4-hour Passive Monitoring
  - Call-broadcast/Exploratory
- Mark-recapture/Tissue Sampling
  - Banding
  - Feather
  - Blood
- Diet
  - Collect Prey Remains
  - Direct Observation

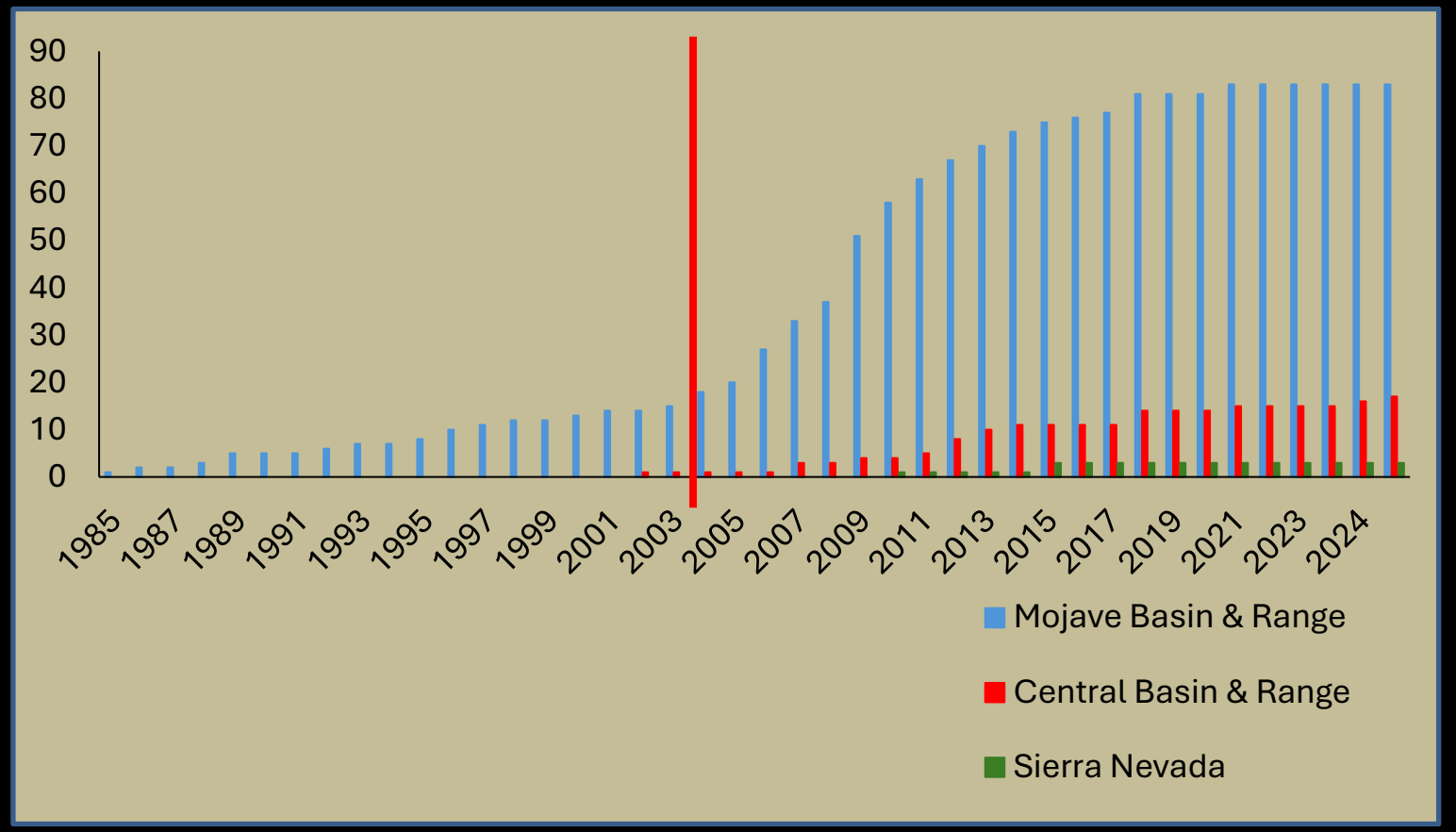
Historical Records in Nevada

- Five known territories in northern Nevada – all abandoned by mid-1950s
- Returned as a breeding species in 1985 in southern Nevada

Derived from Alcorn 1988

Known Territories

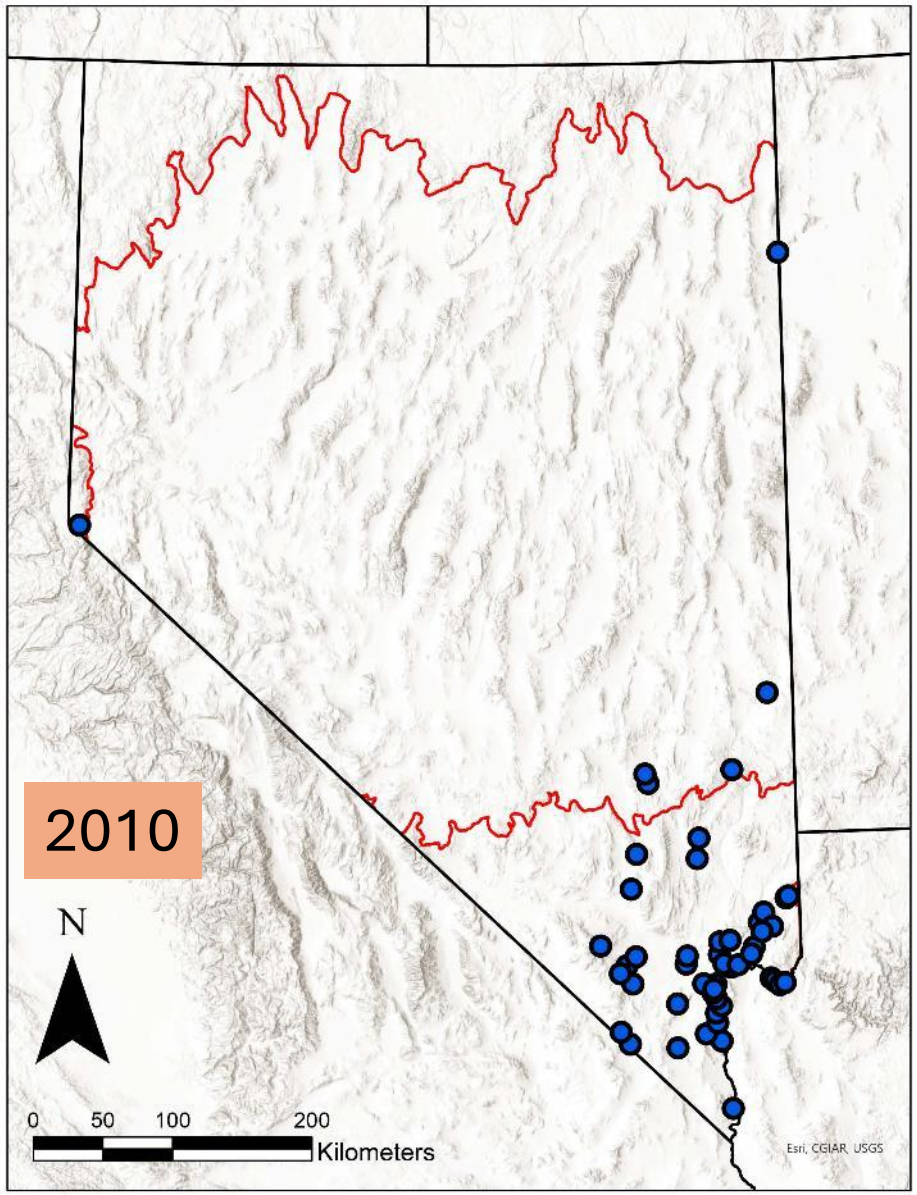


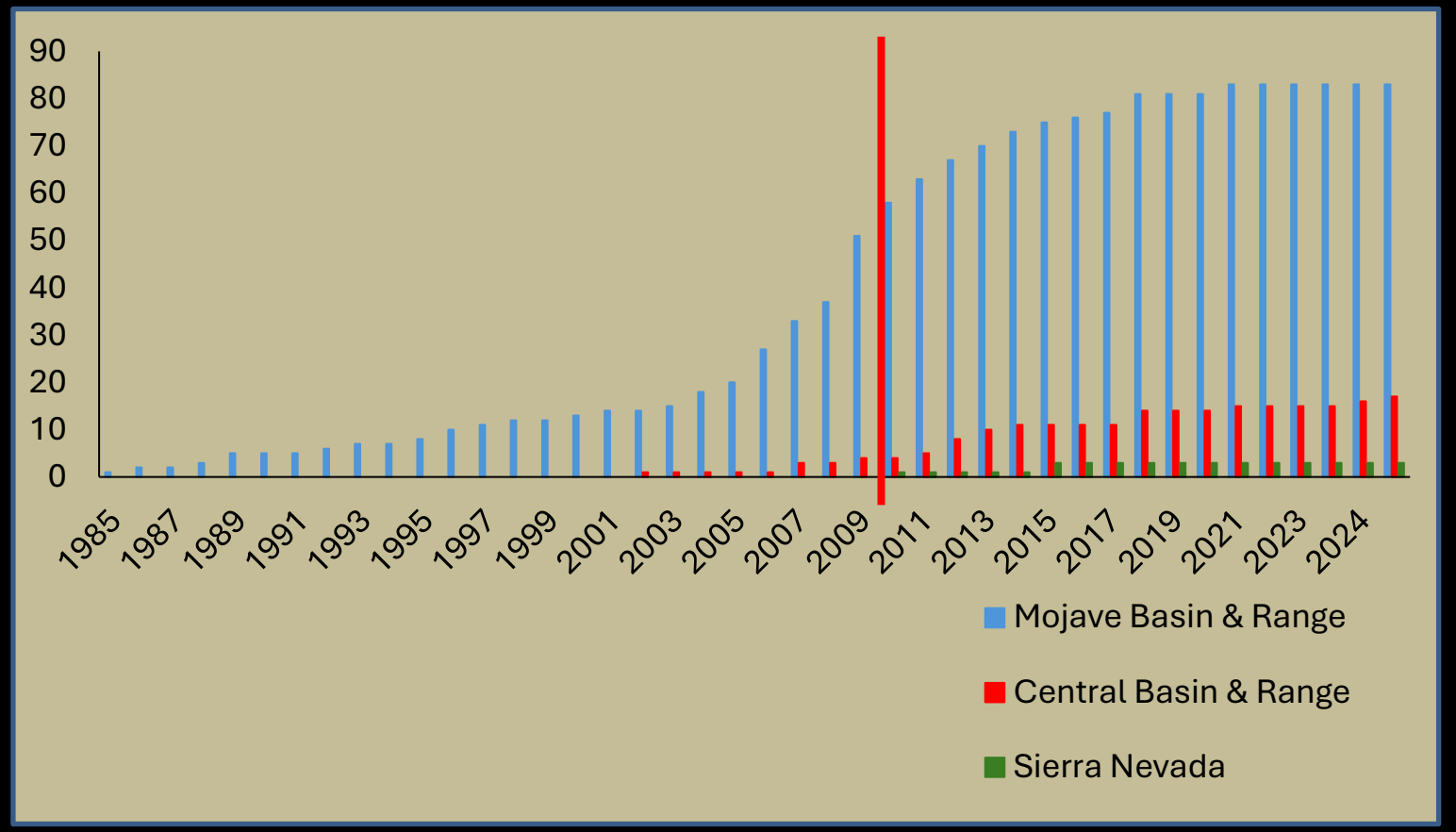


Territories by Level III Ecoregion: 2004

- Mojave Basin & Range = 18
- Central Basin & Range = 1
- Sierra Nevada = 0

Known Territories

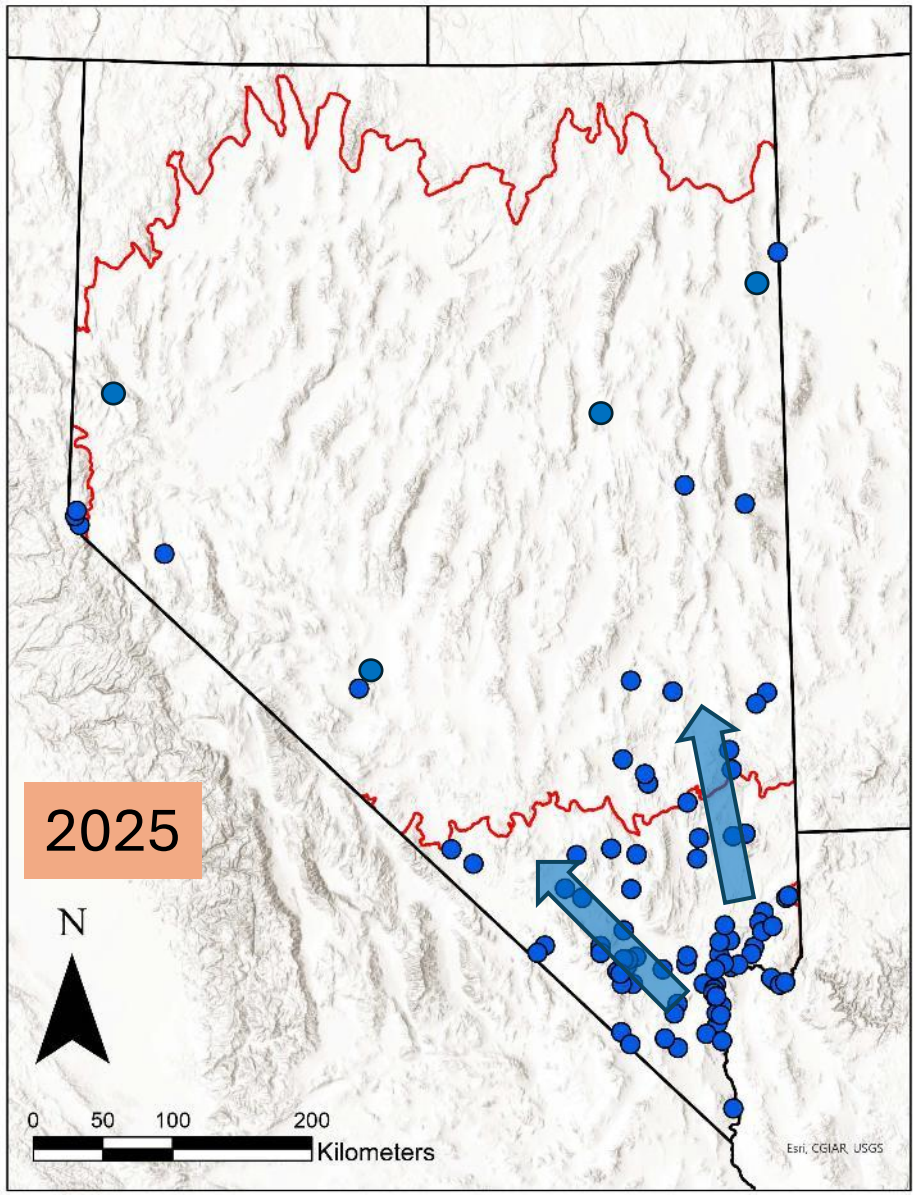


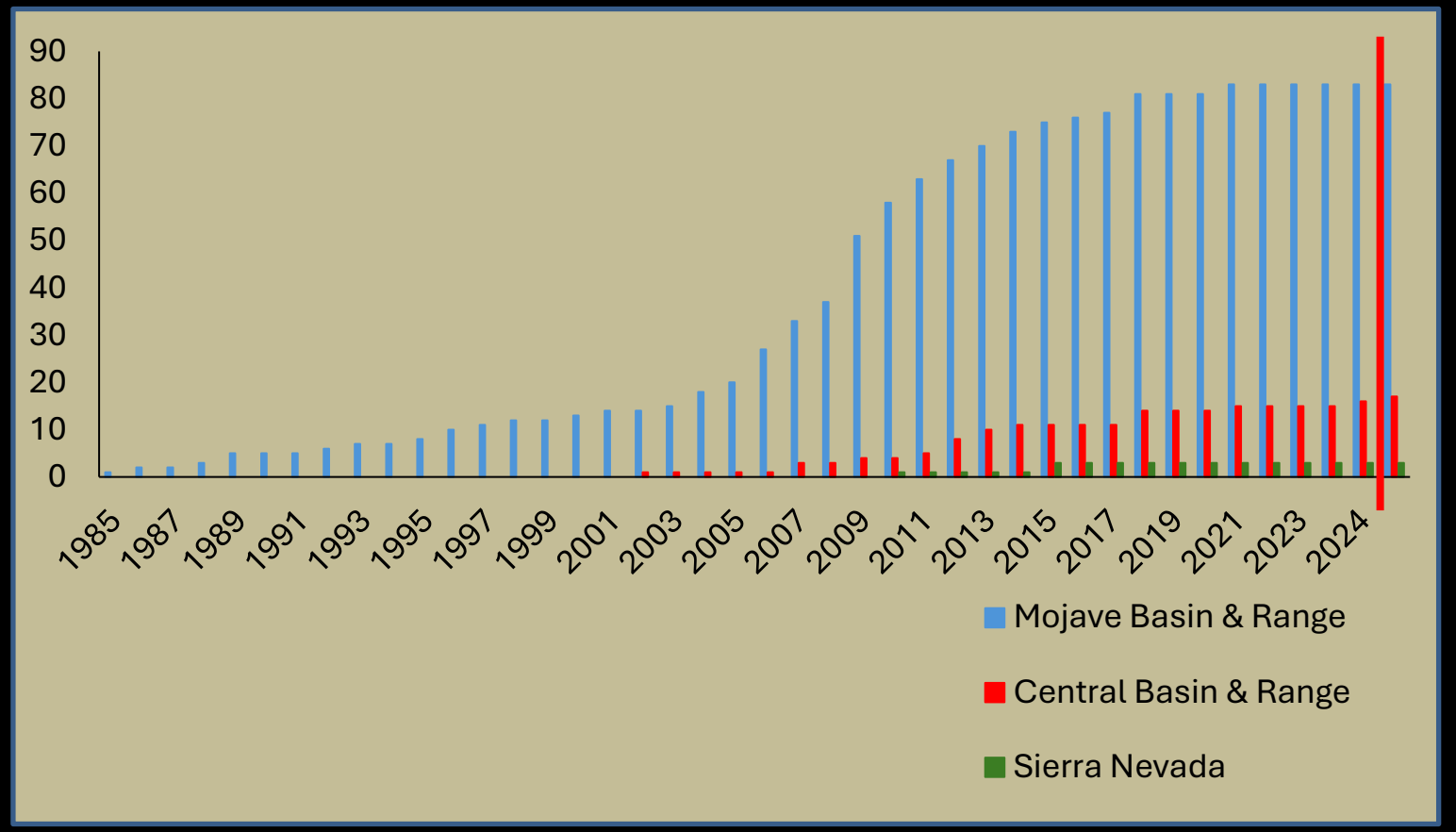


Territories by Level III Ecoregion: 2010

- Mojave Basin & Range = 58
- Central Basin & Range = 4
- Sierra Nevada = 1

Known Territories



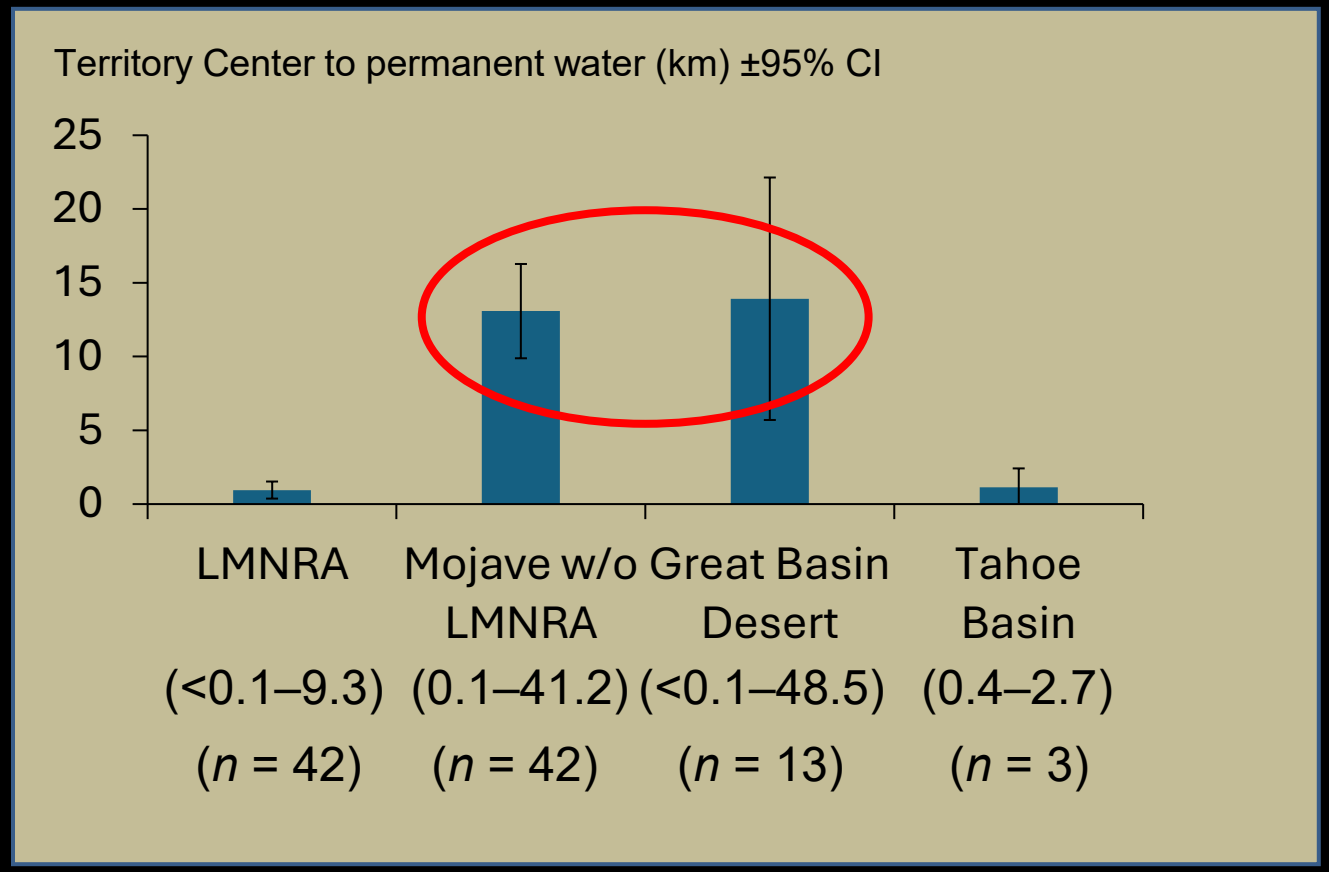


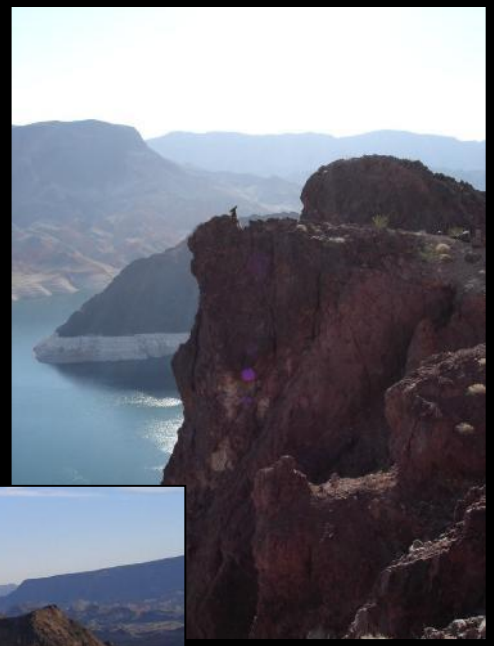
Territories by Level III Ecoregion: 2025

- Mojave Basin & Range = 83
- Central Basin & Range = 17
- Sierra Nevada = 3

Eyrie Characteristics

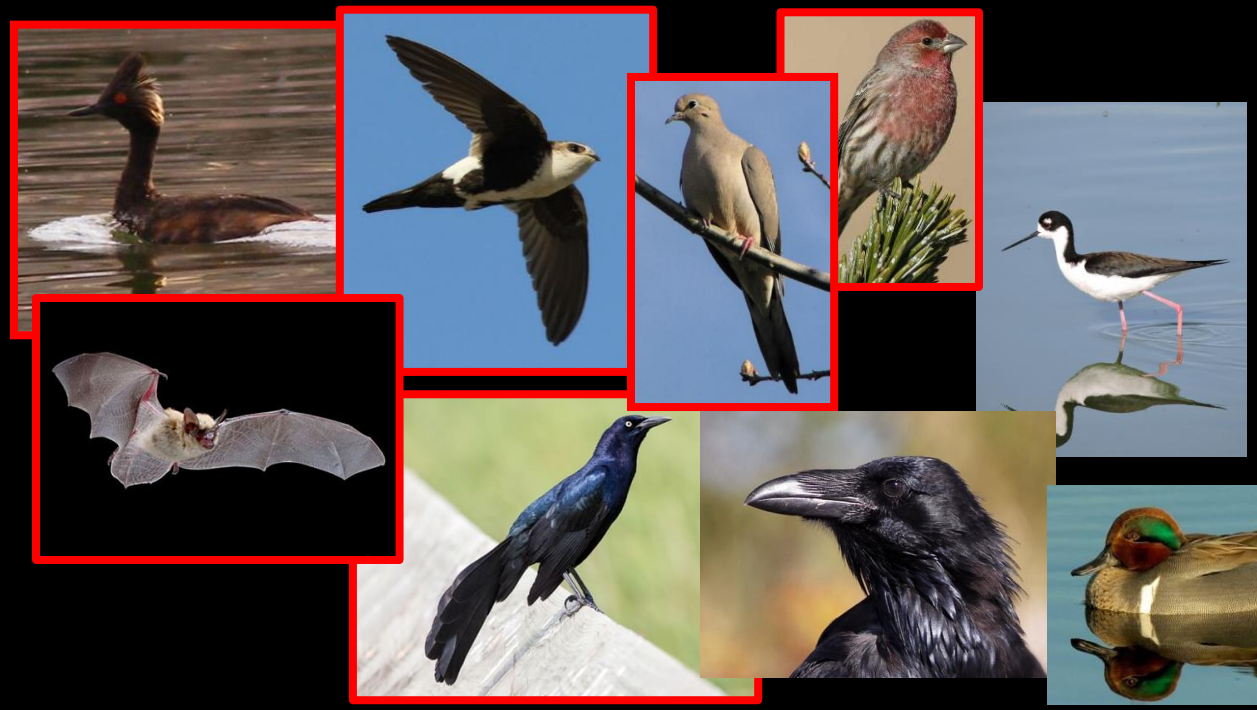
- Distance to Water

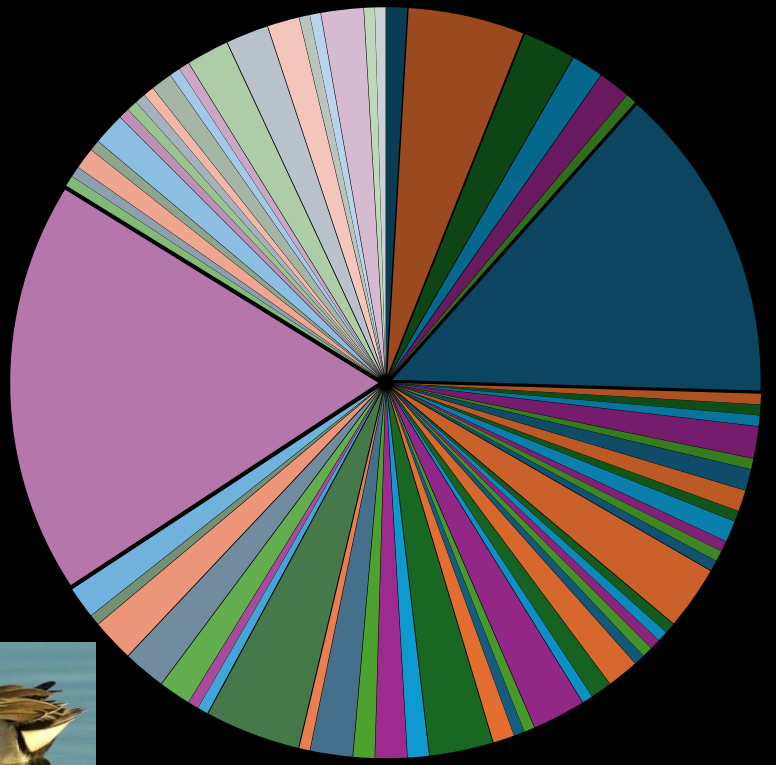




Prey Base: prey remains & hunting observations

- Mojave Desert (*n* = 941)
  - 101 distinct prey types
- Great Basin Desert (*n* = 124)
  - 40 distinct prey types
- Tahoe Basin (*n* = 66)
  - 26 distinct prey types
- Combined total = **117 species of prey** (*n* = 1,131)





American Avocet
American Coot
Black-necked Stilt
Cinnamon/Blue-winged Teal
Double-crested Cormorant
Dowitcher spp.
Eared Grebe
Forster's Tern
Green-winged Teal
Green Heron
Gull Unid
Killdeer
Least Sandpiper
Long-billed Curlew
Marbled Godwit
Phalarope spp.
Red-breasted/Common Merganser
Red Phalarope
Red-necked Phalarope
Ring-billed Gull
shorebird spp.
Tern Unid.
White-faced Ibis
Yellowlegs Unid.
Abert's Towhee
American Kestrel
Blackbird spp.
Black-throated Sparrow
Brewer's Blackbird
Brown-headed Cowbird
Cactus Wren
Canyon Wren
Cliff Swallow
Common Raven
Dove spp.
European Starling
Gambel's Quail
Gnatcatcher spp.
Great-tailed Grackle
Green-tailed Towhee

Prey Composition: Territories Near vs. Far from water

Data pooled: 2004-2010

	Prey Attempts	
	Near	Far
Number of Individuals	126	41
Aquatic Birds (%)	46.8	17.1
Overall Mean Prey Mass (g)	229.8	74.4

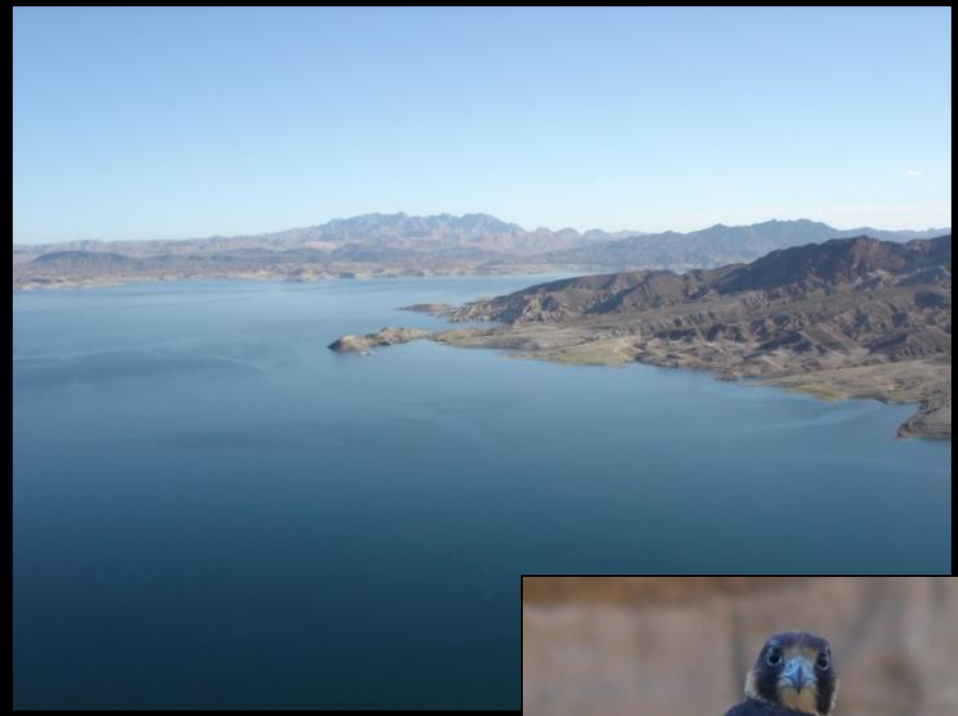
- Near < 640 m, Far ≥ 640 m

Reproductive Output: distance to water

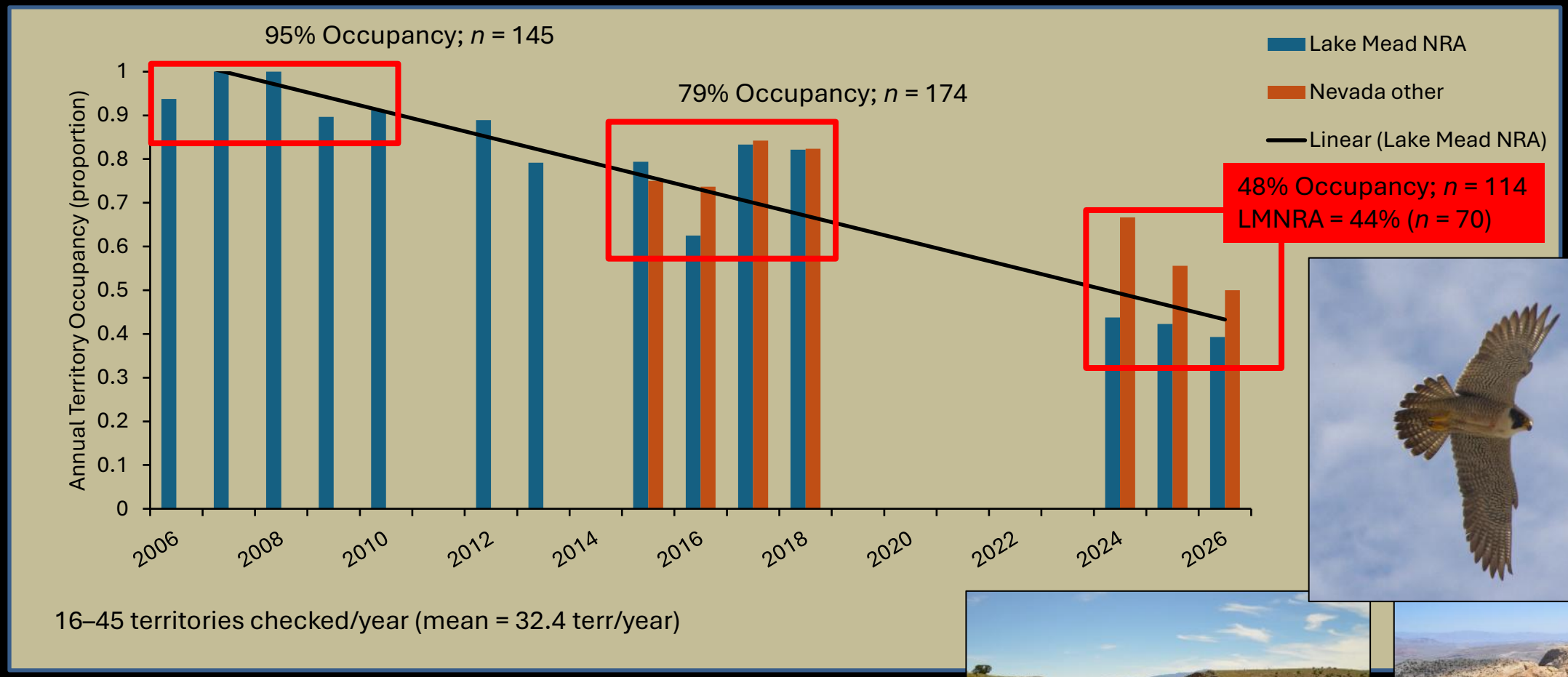
Lake Mead NRA: 2006–2010

Breeding Effort	Overall	Near*	Far*
Breeding Attempts	93	62	19
Success Rate	0.72	0.81	0.42
Young/Attempt	1.8	2.1	0.9
Total Young	173	131	17

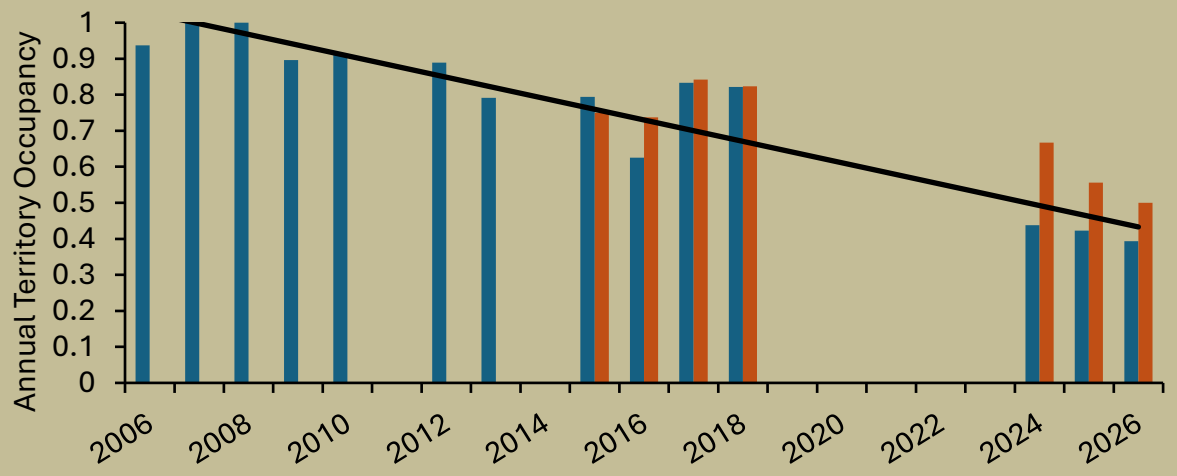
* Near ≤ 640 m; Far > 640 m

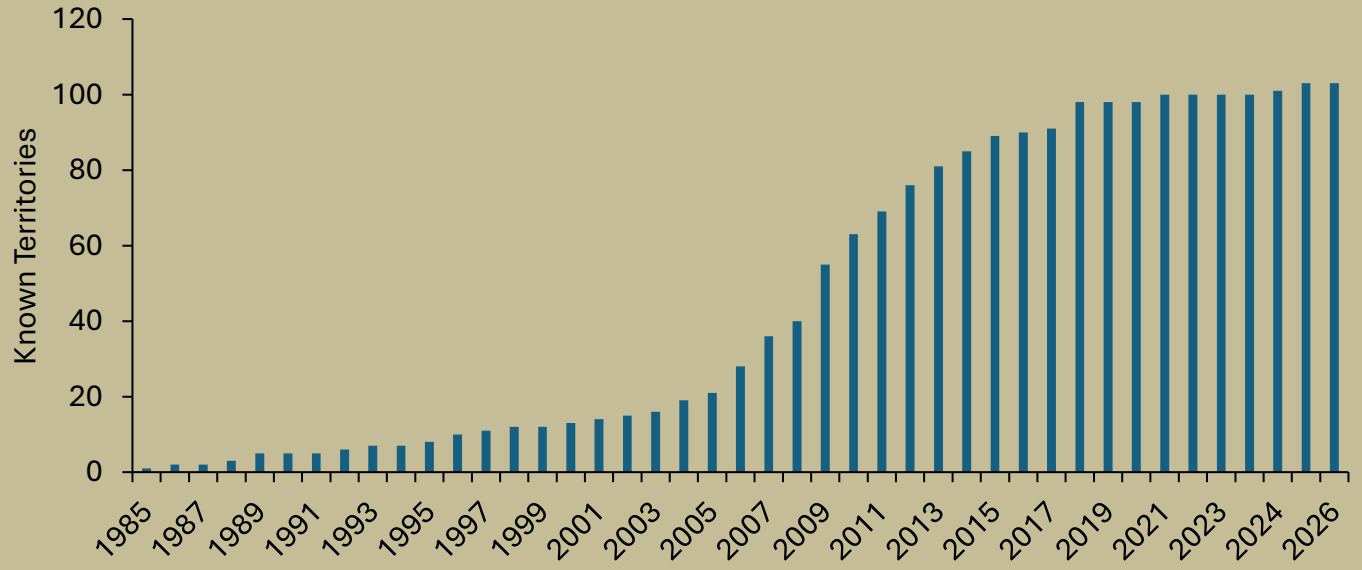


Annual Territory Occupancy



Effective Population Size





2026 Extrapolation

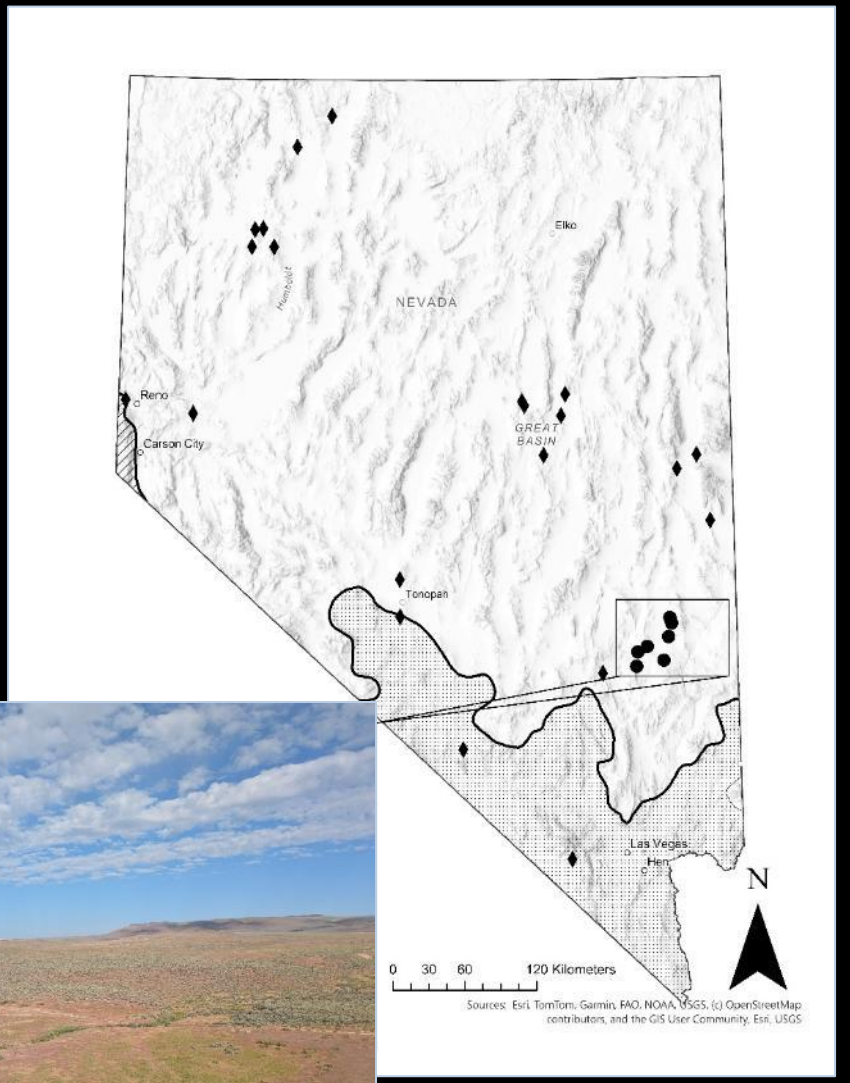
- Known Territories: 103
- Occupancy:
  - LMNRA: 0.39 (*n* = 28)
  - Other: 0.5 (*n* = 14)
- **Estimated Extant Territories: 43**

Golden Eagles

- Apex predator specializing on mammals
- Protected under the Bald & Golden Eagle Protection Act
- Vulnerable to human disturbance and habitat loss
- Long-lived & highly territorial with high site fidelity
- Arrival of Rabbit Hemorrhagic Disease (RHDV2) in 2020 impacting their primary prey

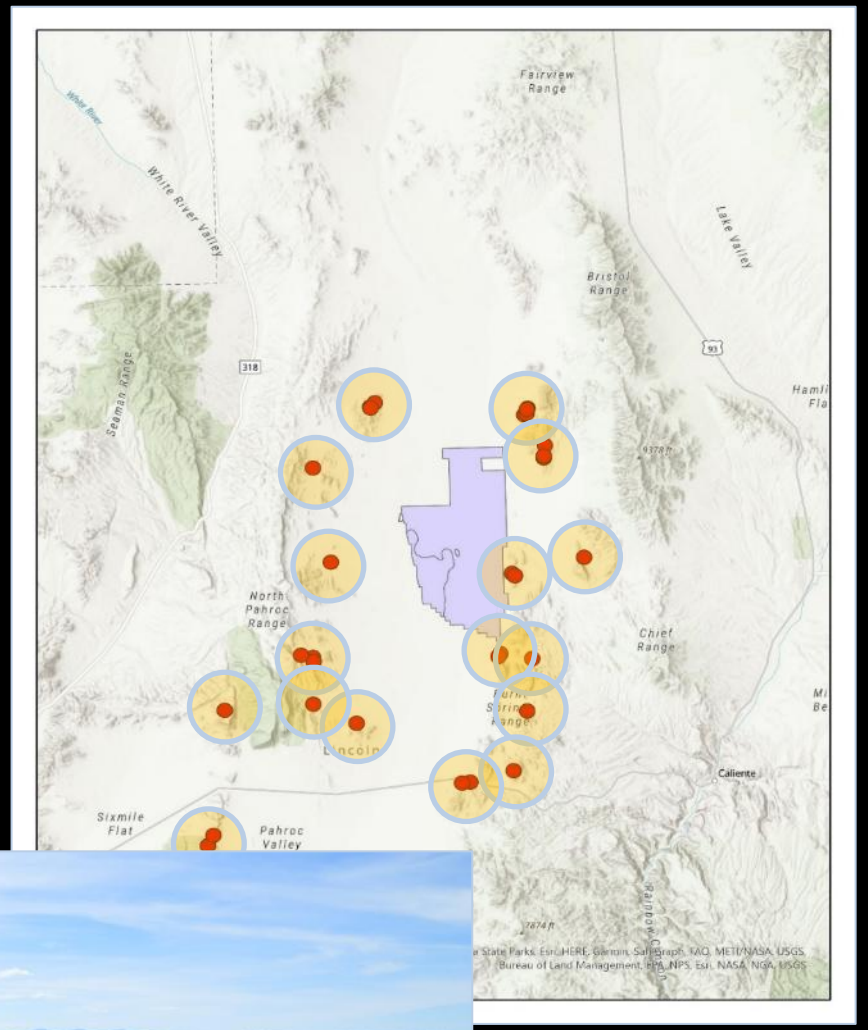
Study Area: Statewide

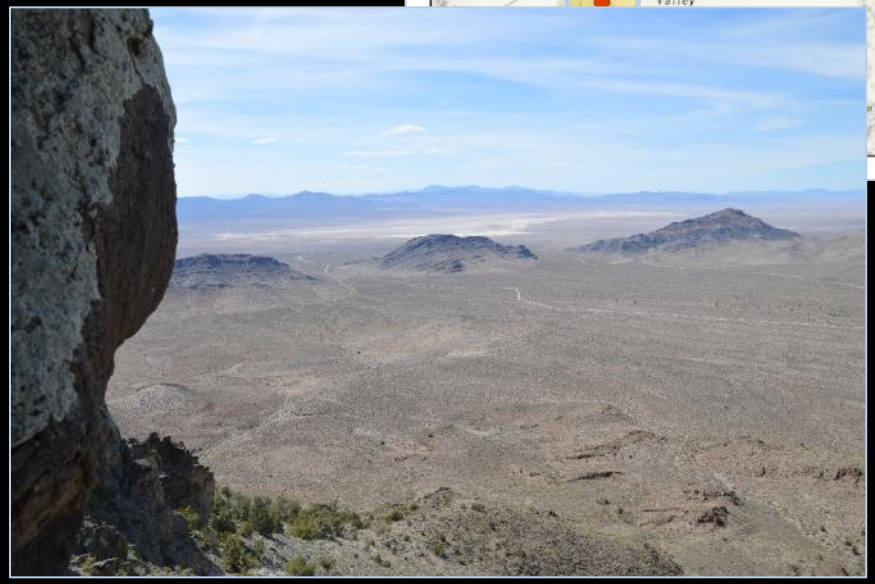
- Secondary study areas: 2015–2024
- Primarily Great Basin Desert
- Occupancy at 28 golden eagle territories assessed opportunistically
- 4 targeted territories selected for transmitter deployment on adult territory holders



Study Area: Dry Lake Valley (DLV)

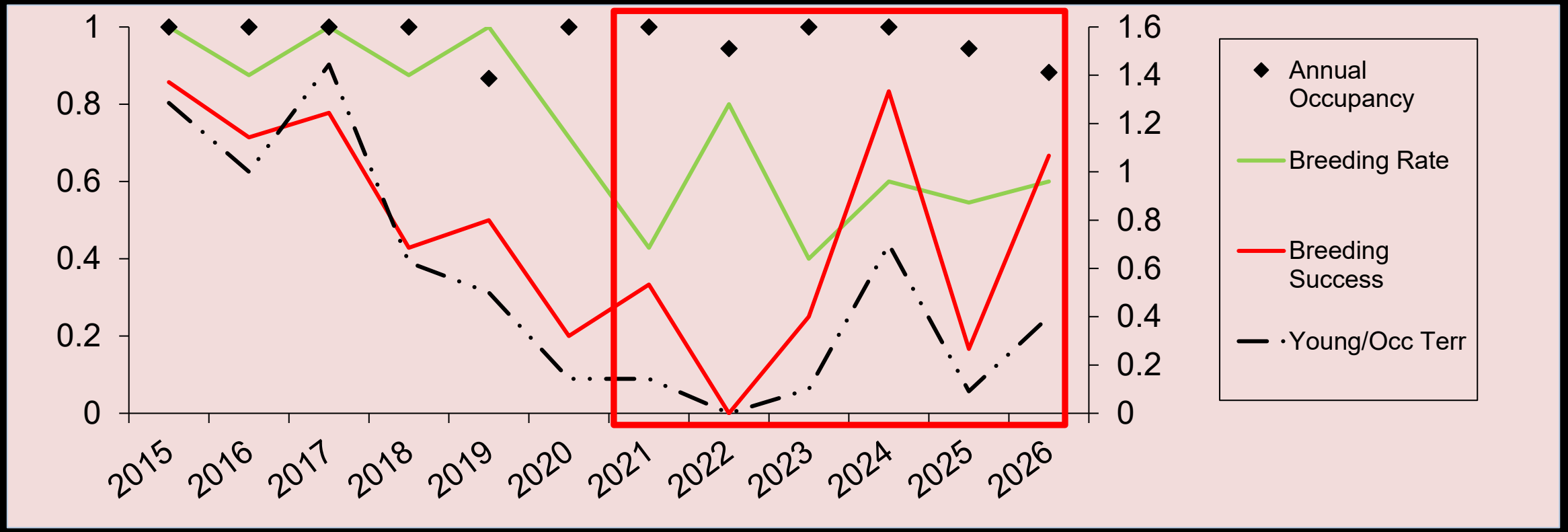
- Primary study area: 2014–2026
- 930 km^2 study area
- Mojave Desert/Great Basin Desert Ecotone
- 101 km^2 designated Dry Lake North Solar Energy Zone (9.2x18.7 km^2)
- 18 golden eagle territories
- Annual territory monitoring, banding/transmitters (*n* = 78/47 individuals), and breeding season diet





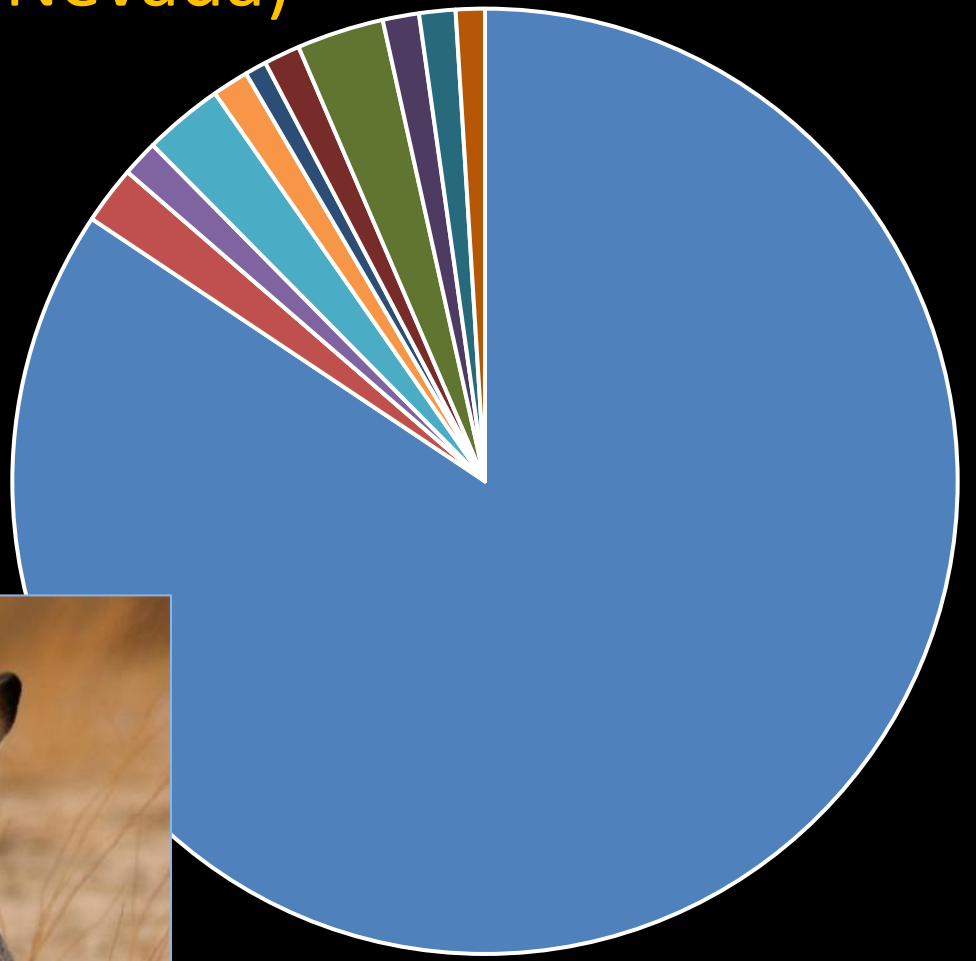
Results: Annual Territory Occupancy & Breeding Success (DLV)

- Pooled Means (18 nesting territories)
  - Breeding Success (*n* = 76): 50% (0–85.7%/year)
    - 2015–2020 (*n* = 43): 60.5%
    - 2021–2026 (*n* = 33): 29.6%
  - Productivity: 0.51 Young/Occ Terr (0–1.44/year)
    - 2015–2020 (*n* = 47): 0.85
    - 2021–2026 (*n* = 58): 0.24



Results: Breeding Season Diet (Nevada)

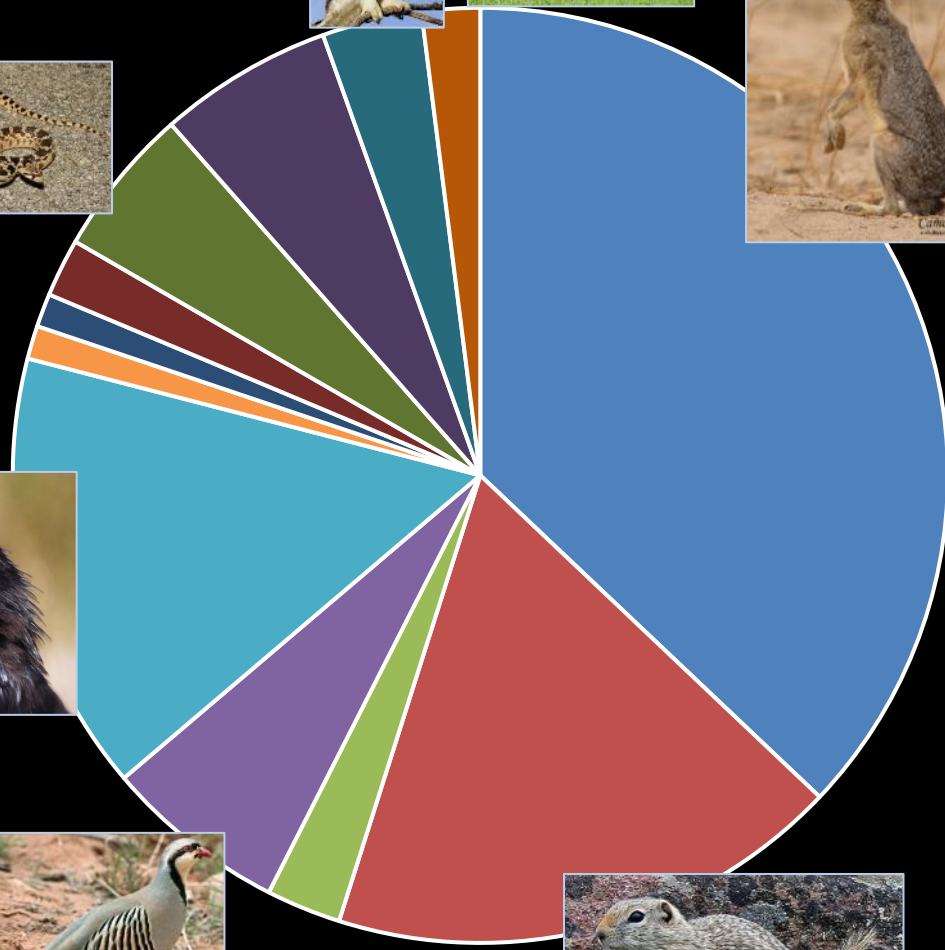
- Prior to RHDV2 2014–2020 (*n* = 408)
  - Leporidae composition: 84.3%
    - Black-tailed jackrabbit: 73%
  - Mammalia composition: 89.0%
  - Reptilia: 2.9%
  - Aves: 7.1%



45 Total Species 2014–2026

Results: Breeding Season Diet (Nevada)

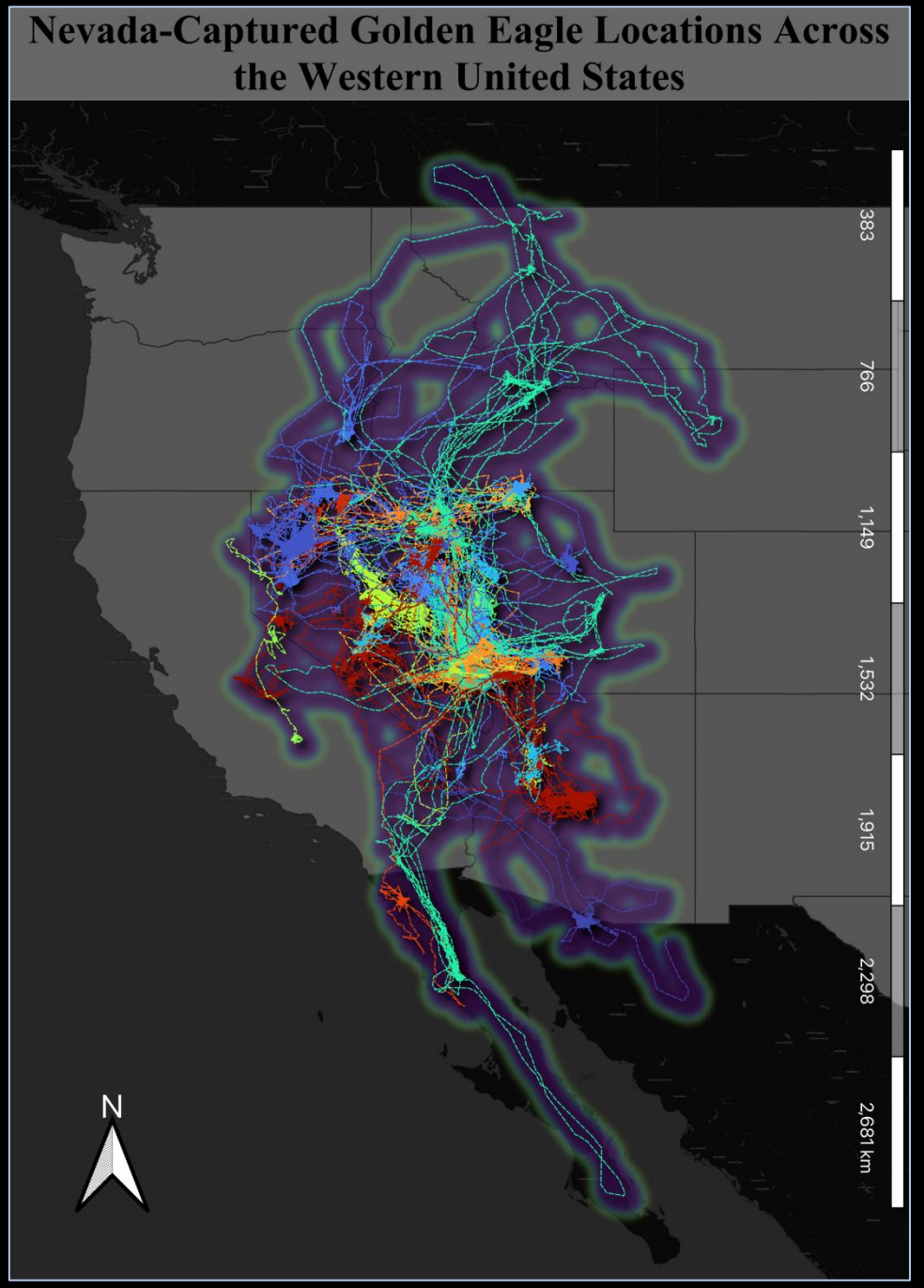
- Following RHDV2 2021–2026 (*n* = 343)
  - Leporidae composition: 37.6%
    - Black-tailed jackrabbit: 32.1%
  - Sciuridae composition: 18.1%
  - Corvidae: 15.5%
  - Galliformes: 6.4%
  - Reptilia: 5.2%
  - Aves composition: 31.2%



45 Total Species 2014–2026

Results: Telemetry & Survival

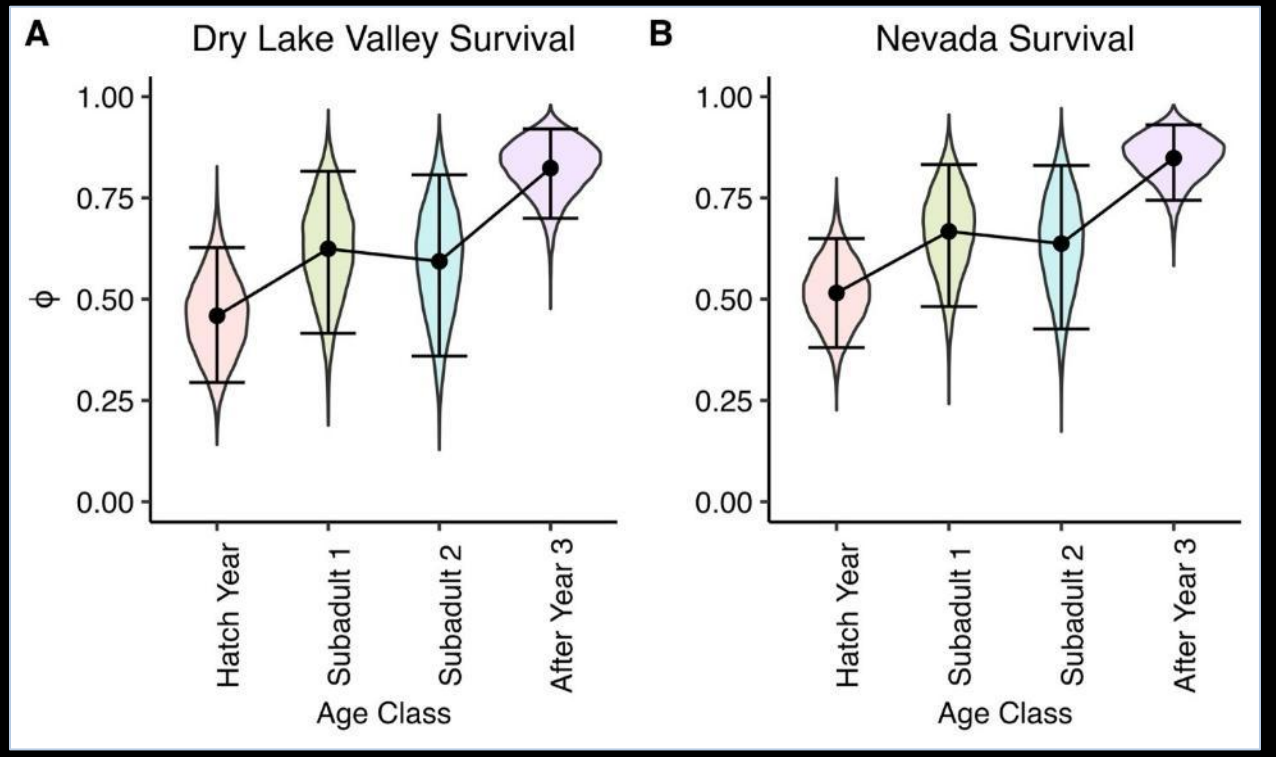
- 43 transmitters on individuals & 4 band-only
- 18 individuals were captured within Dry Lake Valley
- 29 individuals captured statewide
    - 38 nestlings/HY
    - 2 SA2
    - 7 adults/AY3
- Individuals tracked 15–2,041 days ($\bar{x}$ = 629 days)



Results: Survival Analysis

- Recovery rates for transmitters = 0.96
- Probability of transmitter failure = 0.18
- Survival by Age-Class
  - HY: DLV = 0.46; Nevada = 0.52
  - SA1: DLV = 0.62; Nevada = 0.67
  - SA2: DLV = 0.59; Nevada = 0.64
  - AY3: DLV = 0.82; Nevada = 0.85

Golden et al. 2025. Estimating survival & pop trajectories of GOEAs in NV



With 90% credible intervals

- West-wide mean annual survival (1997–2016; 95% CI):
  - HY (*n* = 2,948): 0.73 (0.7–0.77)
  - SA1 (*n* = 125): 0.87 (0.83–0.91)
  - SA2 (*n* = 31): 0.92 (0.88–0.91)
  - AY3 (*n* = 536): 0.94 (0.9–0.98)

Millsap et al. 2022

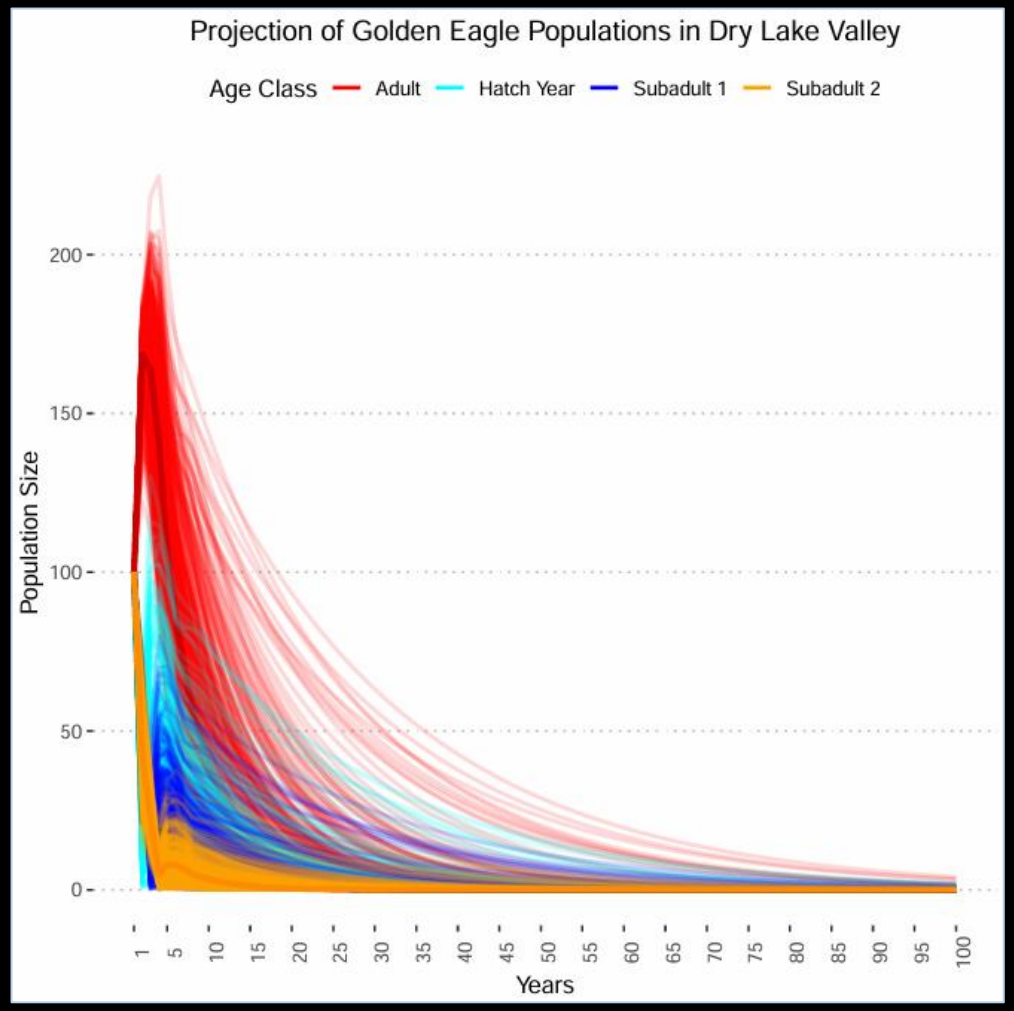
Results: Population Viability Analysis

- DLV: $\lambda = 0.88$; 90% BCI: 0.75, 1; $P(\lambda < 1) = 0.94$
- Nevada: $\lambda = 0.91$; 90% BCI: 0.81, 0.98; $P(\lambda < 1) = 0.98$
- Elasticity Analyses: AY3 survival = 0.9; all other parameters = 0.05

- West-wide estimated population growth:
  - $\lambda = 1.0$ (0.96 – 1.05); 1997–2016

Millsap et al. 2022

Results: Population Viability Analysis



Acknowledgments

Lake Mead NRA (NPS)
- Ross Haley
- Kent Turner

Nevada Dept. of Wildlife
- Jennifer Newmark

Special Thanks
- Thomas Leeman
- Dr. Jef Jaeger
- Mitch Urban
- Dr. Bryan Sigel
- Dr. Shawn Gerstenberger
- Emily Barnes
- N. John Schmitt
- Jeff Johnson
- Moira Kolada
- Anna Johnson
- Sue Fox
- Beth Wolff
- Lisa Ozborn

- U.S. Fish and Wildlife Service
- Public Lands Institute
- Nevada Department of Wildlife
- Bureau of Land Management
- Department of Environmental and Occupational Health, UNLV

joesenrab@gmail.com
Cell: 702-283-3523