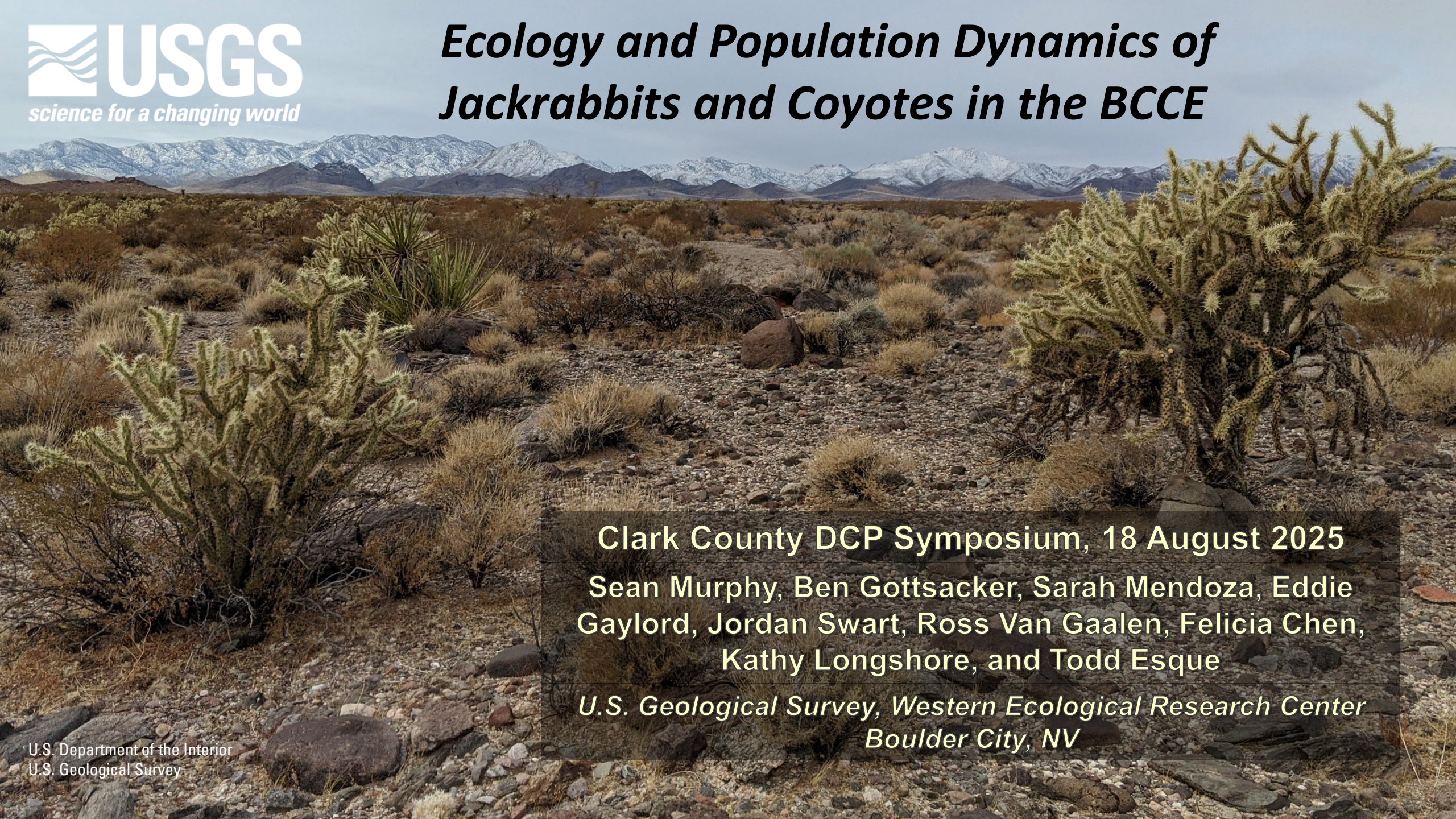

Ecology and Population Dynamics of Jackrabbits and Coyotes in the BCCE

Clark County DCP Symposium, 18 August 2025

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Goal & Research Objectives

Gain a better understanding of the predator-prey dynamics between black-tailed jackrabbits and coyotes and inform a strategy to reduce tortoise predation associated with translocations.

Objectives

- Determine coyote and black-tailed jackrabbit:
  - Demographic variation across time and space
  - Home range and habitat use patterns
  - Health status and mortality rates
- Develop reliable, cost-efficient methods for estimating density
- Synthesize black-tailed jackrabbit and predator demographics and spatial ecology

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Phase II Methods Overview

Primary components:

- Camera trap grids
- GPS/VHF collars on jackrabbits
- GPS/VHF collars on coyotes

Timeline

- Phase I: 2018 - 2021
- Phase II: Oct 2022 - end of 2026

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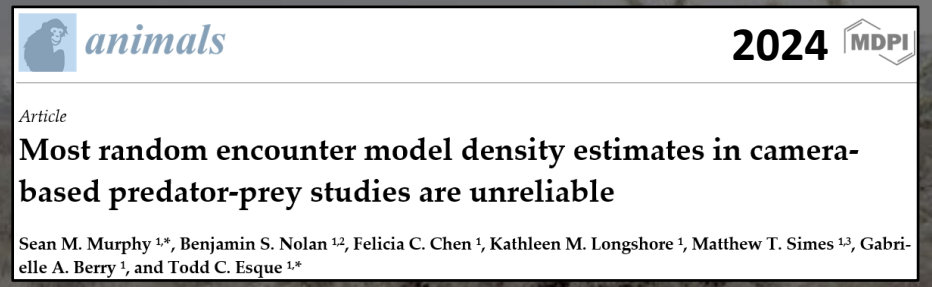
Camera Trap: From REM to gSMR

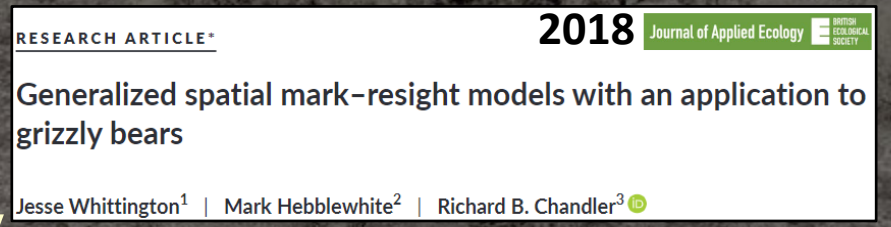
Phase I: Random Encounter Model (REM)

- Strict and violated assumptions
- Relies only on camera-trap data
- Unreliable, biased estimates



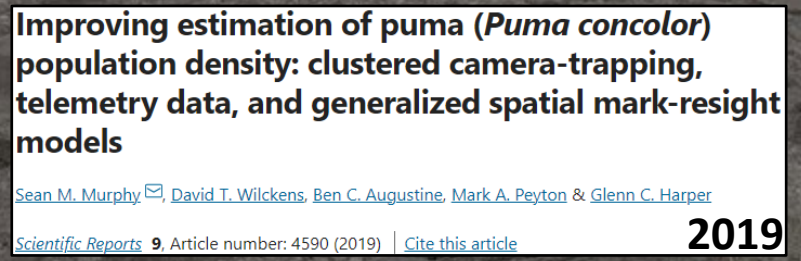
Phase II: Generalized Spatial Mark-Resight (gSMR)

- Relaxed assumptions
- Integrates all data
  (camera, live-capture, telemetry)
- Testable hypotheses linking demographics to ecology
- Unbiased estimates, can quantify reliability



Clustered Sampling Design with gSMR Models

- Accommodates irregular survey designs
- Improves accuracy over large areas with fewer cameras
- Incorporates habitat covariates to improve estimation



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Camera Trap Methods

Spacing based on mean female home range sizes.

Stations positioned to optimize detections.

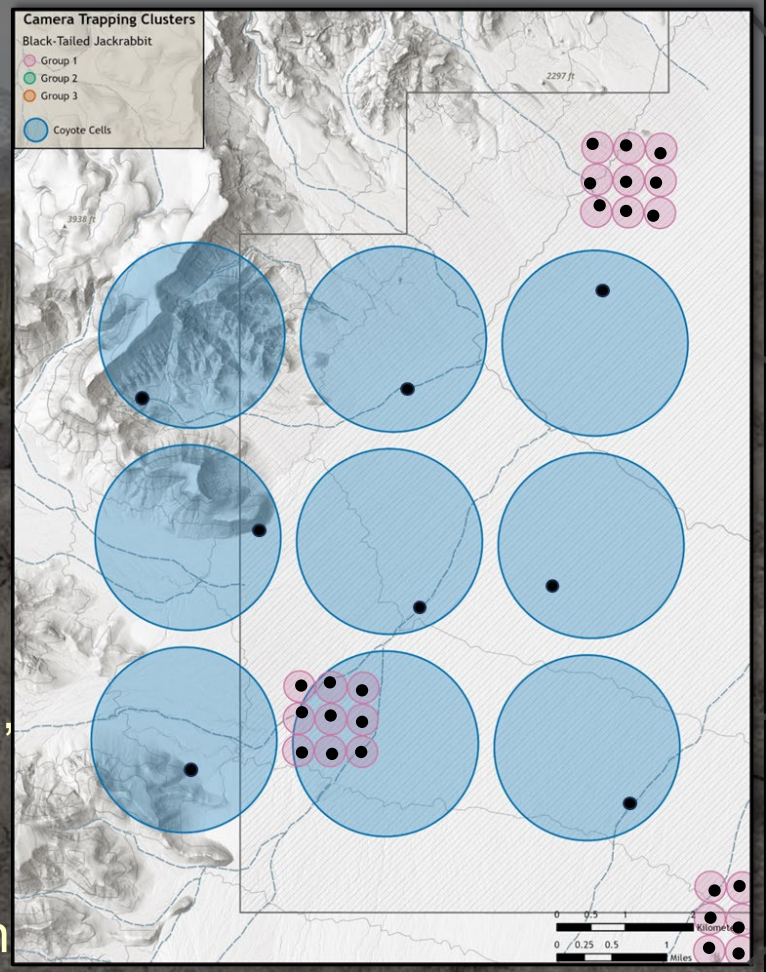
Jackrabbits: 15 clusters (135 stations/45 cameras), ~360 m intervals

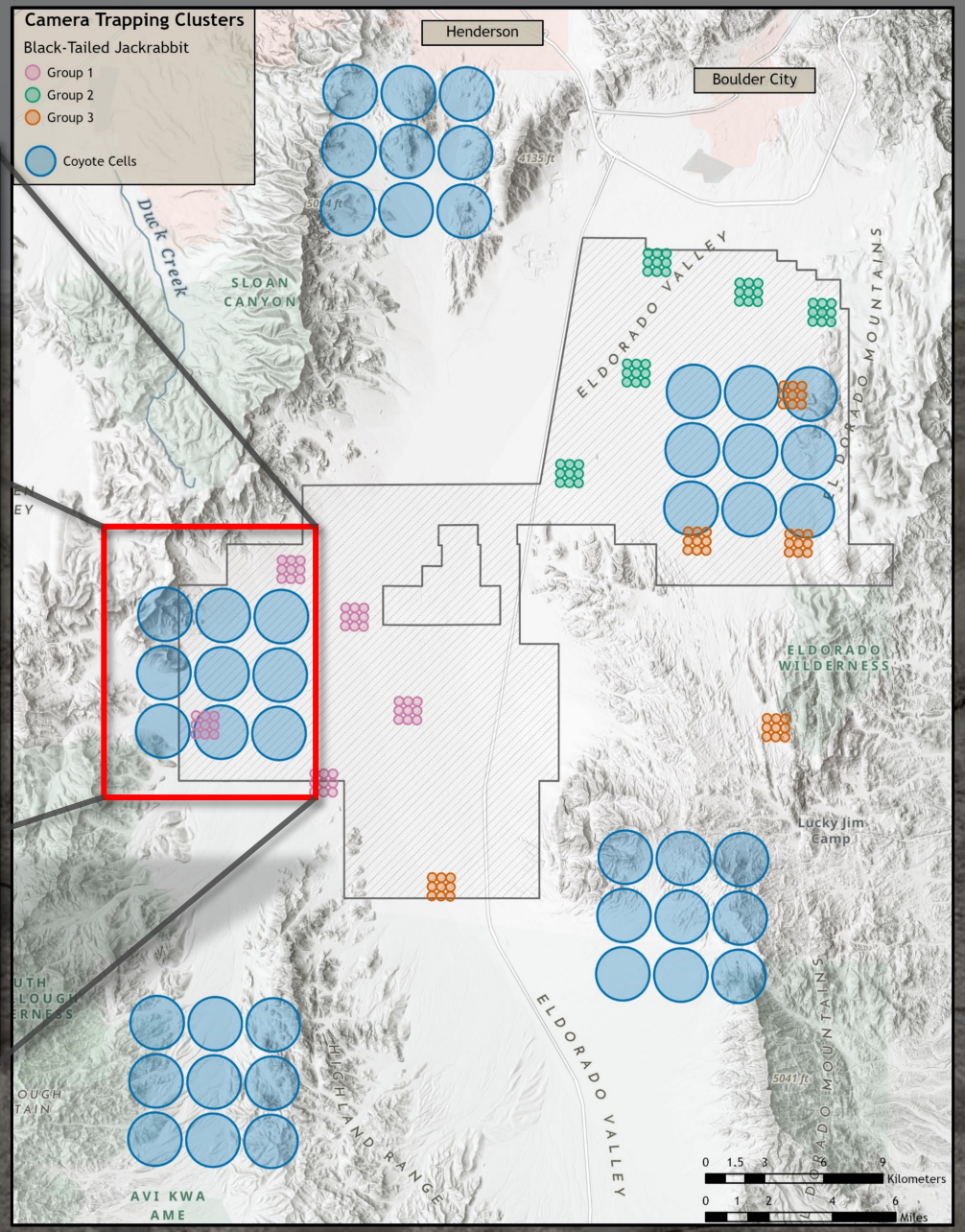
- Cameras rotated between groups every 8 weeks

Coyotes: 5 clusters (45 stations), ~2.2 km intervals

- Cameras not rotated

All cameras used to analyze both species





Group 1 Group 2 Group 3

Rabbit cells

Coyote cells

Cameras

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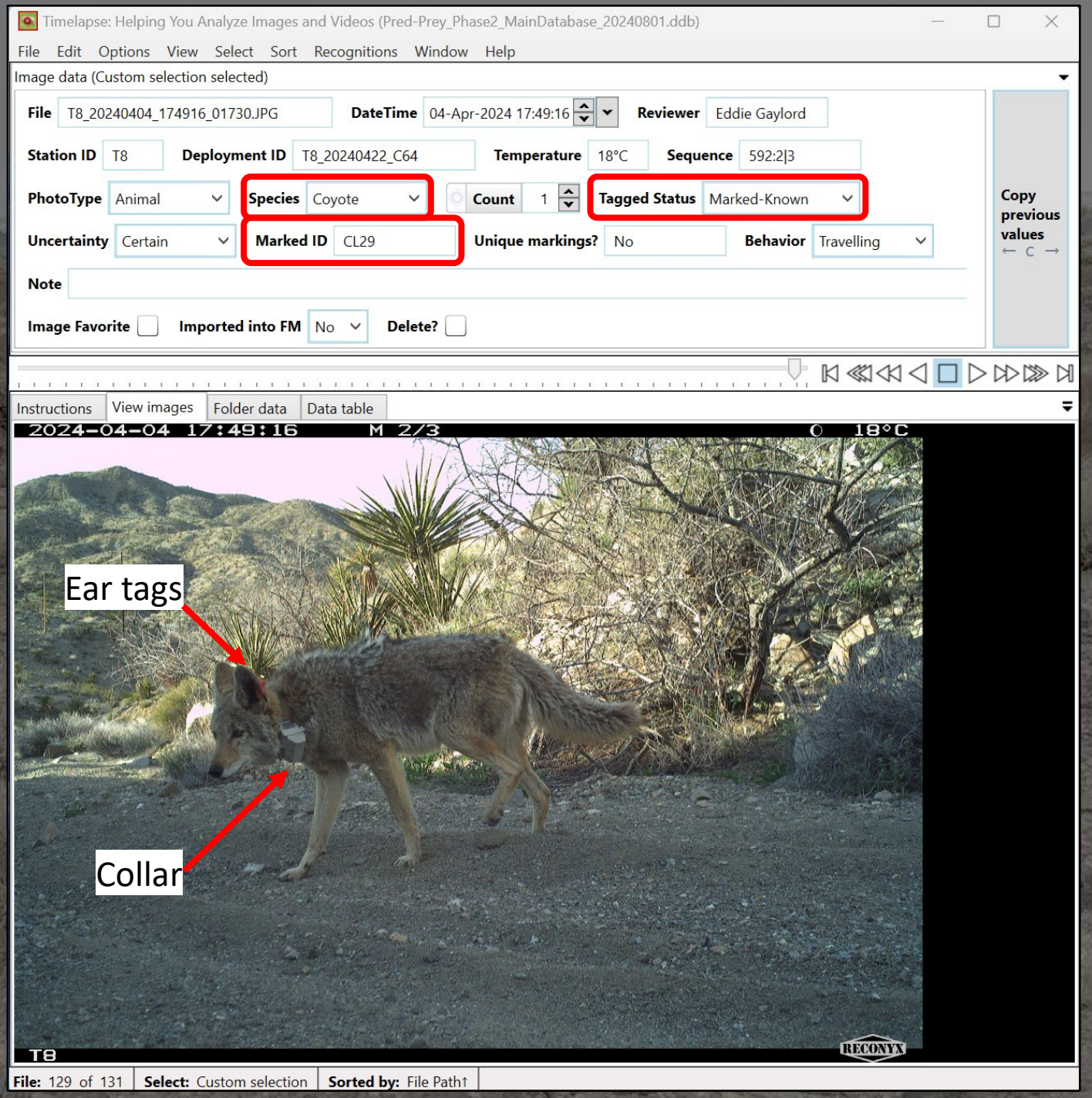
Image Processing

1. Species identified by biologists
2. For coyotes and jackrabbits only, tagged status is classified (*Unmarked, Marked-known ID, Marked-unknown ID, Unknown*)
3. Marked animals further classified by individual ID



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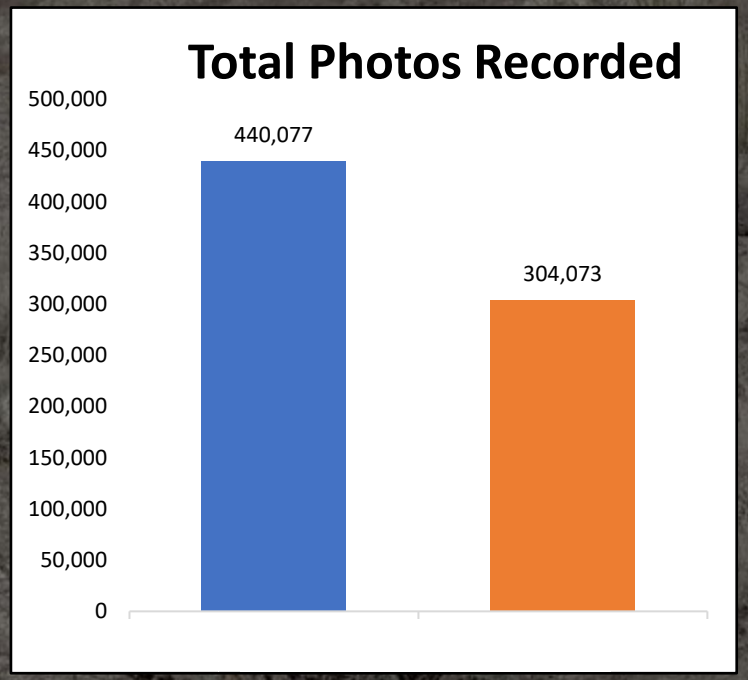
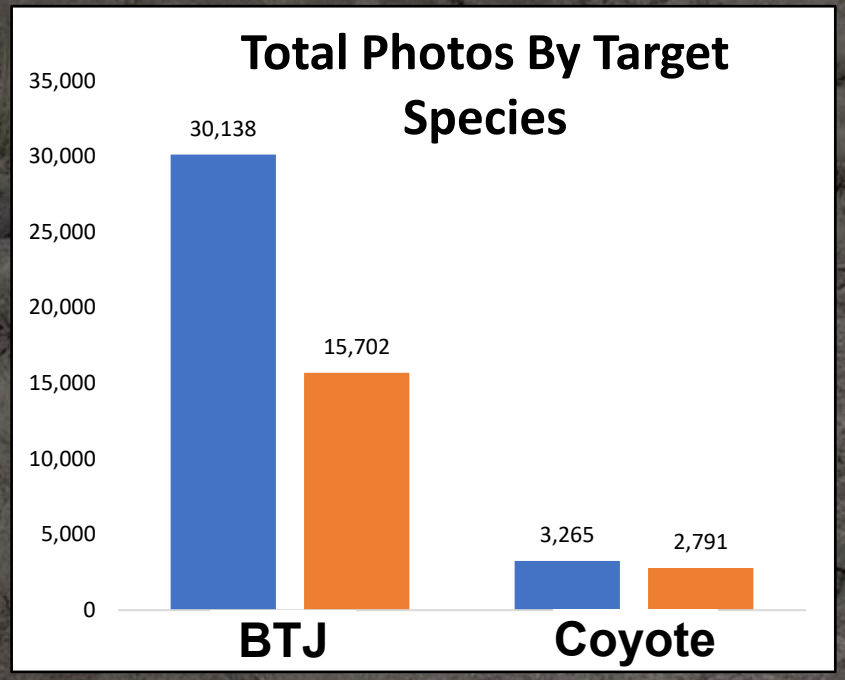
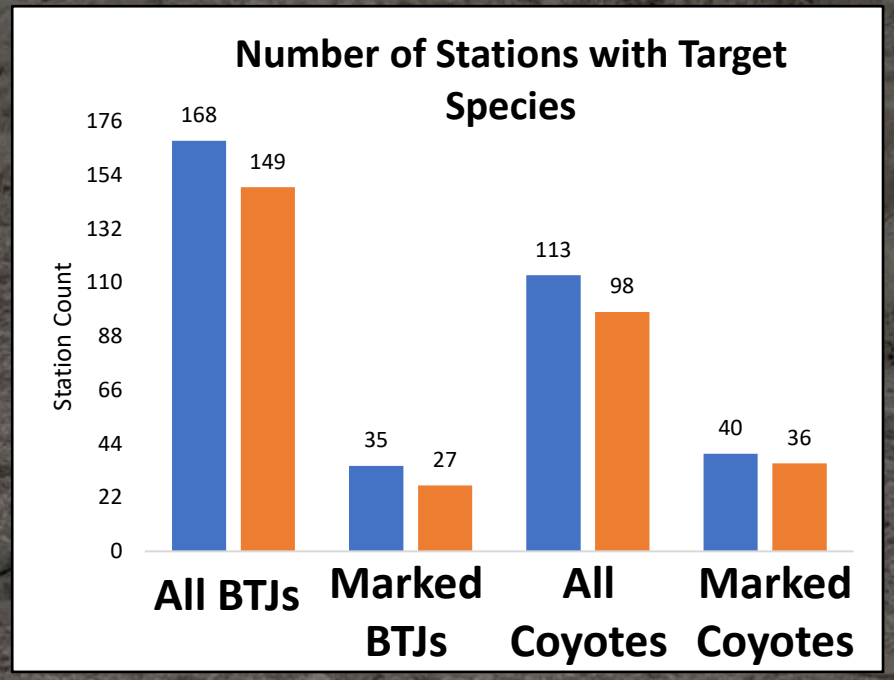
Camera Trap Results







8/1/23 - 7/31/24 8/1/24 - 7/31/25

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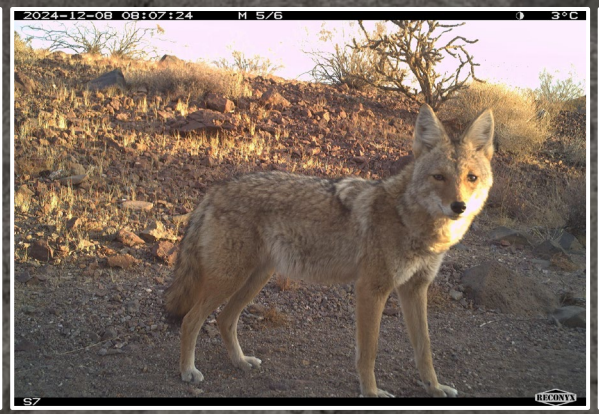
Camera Trap Results



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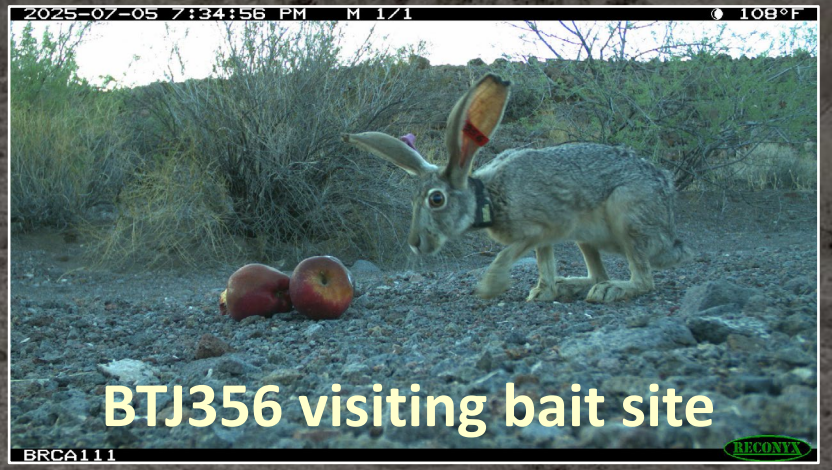
Jackrabbit Methods

Trapping

- Year round with pre-baited traps
- Animals weighed, sexed, marked with unique ear tags
- Individuals ≥ 1.75 kg fitted with GPS/VHF collar
  - 30–180-minute GPS fix interval, store on board, lasts up to 1 year

Telemetry

- Collared animals monitored at least twice/monthly



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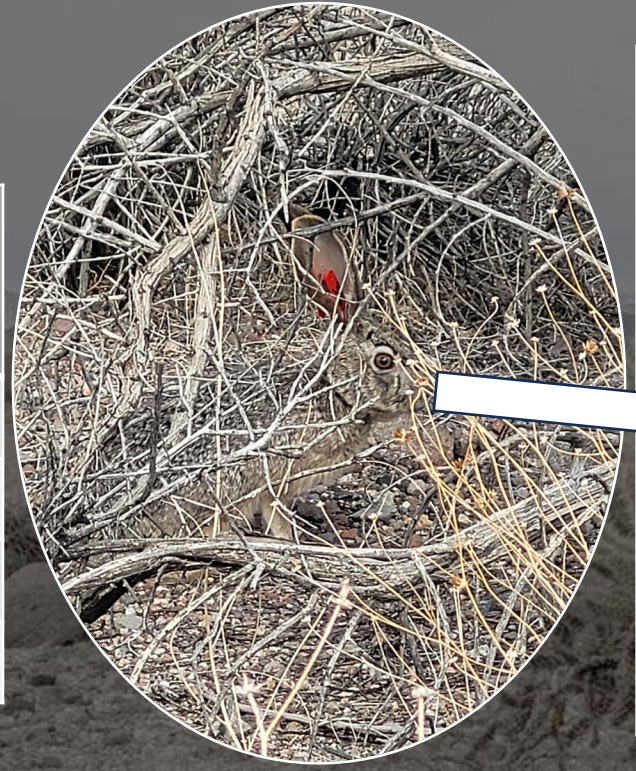
Jackrabbit Results

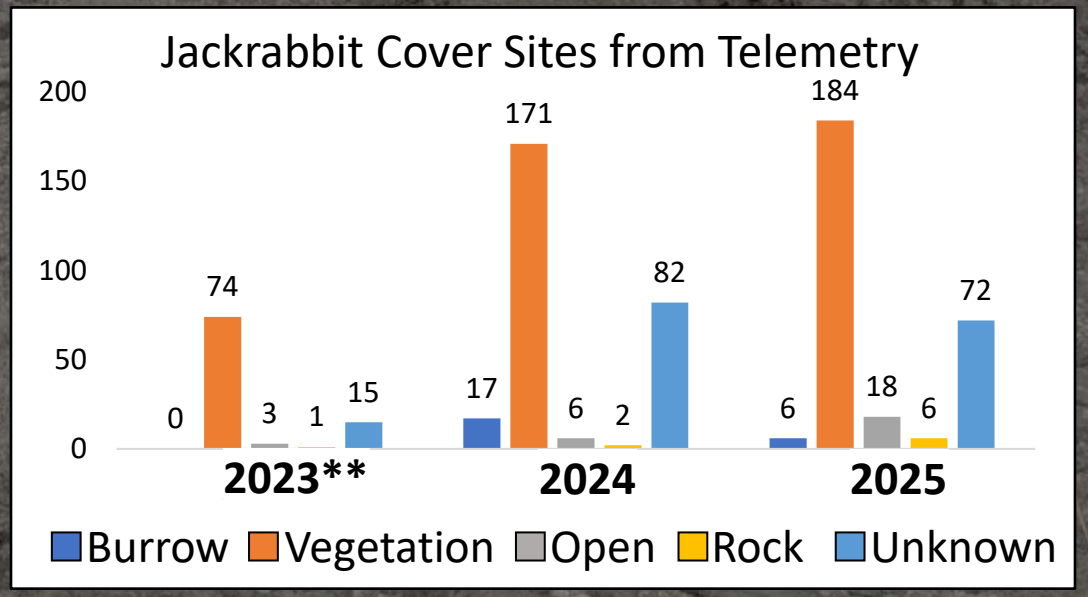
Year	No. of Days Baited	No. of Trap Nights	No. of Captures	No. of Collared Individuals
2022*	49	22	12	10
2023	304	110	71	46
2024	500	149	78	41
2025	238	47	70	31

*Phase II initiated October 19, 2022



Telemetry

Year	No. of Collared Individuals	GPS Points
2022*	16	10,164
2023	42	20,343
2024	39	26,108
2025	33	13,843



**Began collecting location data in September 2023

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Jackrabbit Results: GPS & Telemetry Locations

Collar and telemetry data for each year of Phase II.

Yellow shading represents trapping expansion in 2025 into higher elevation jackrabbit habitats thus increasing relevance to coyote movements and habitat use.

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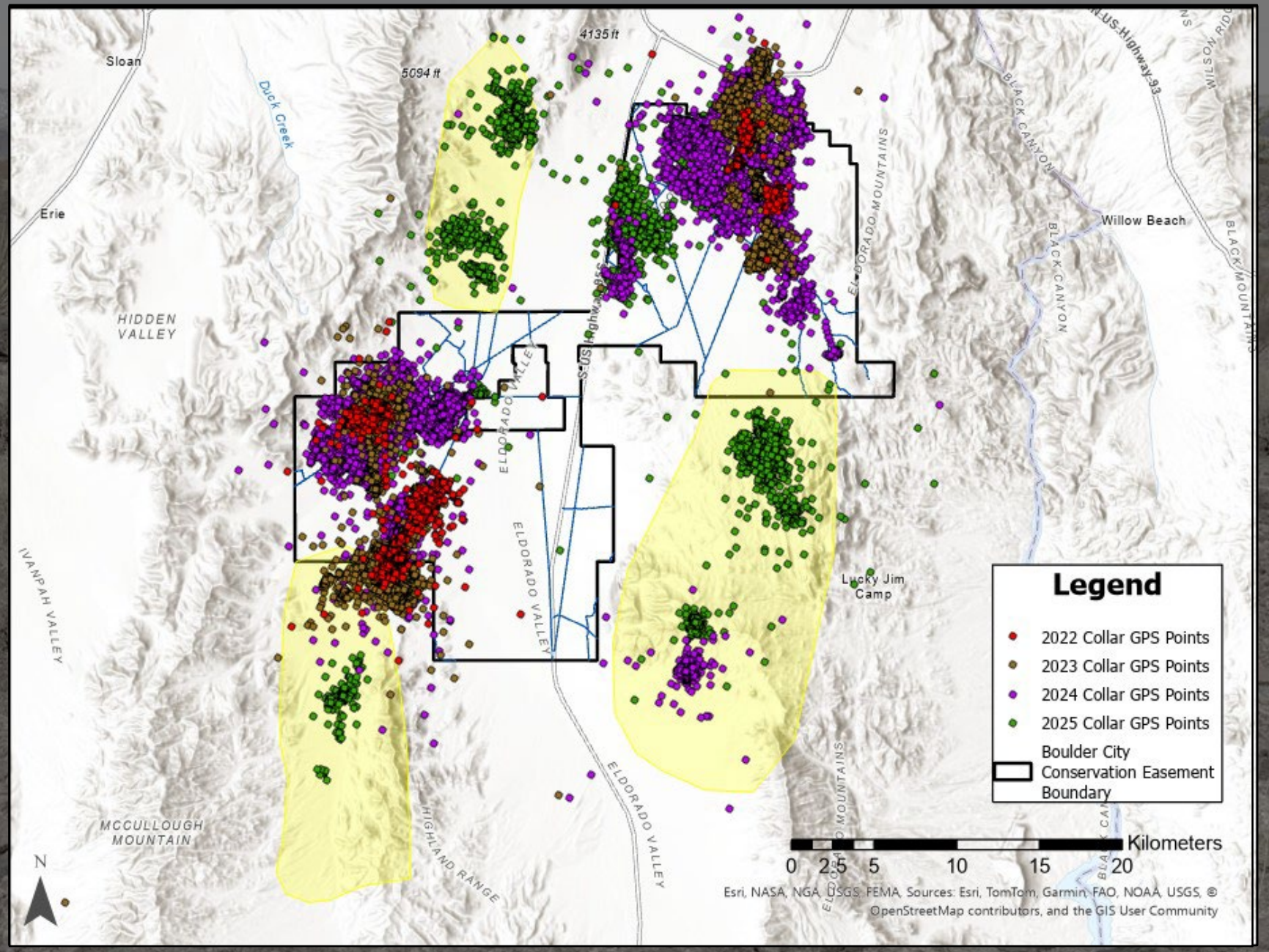
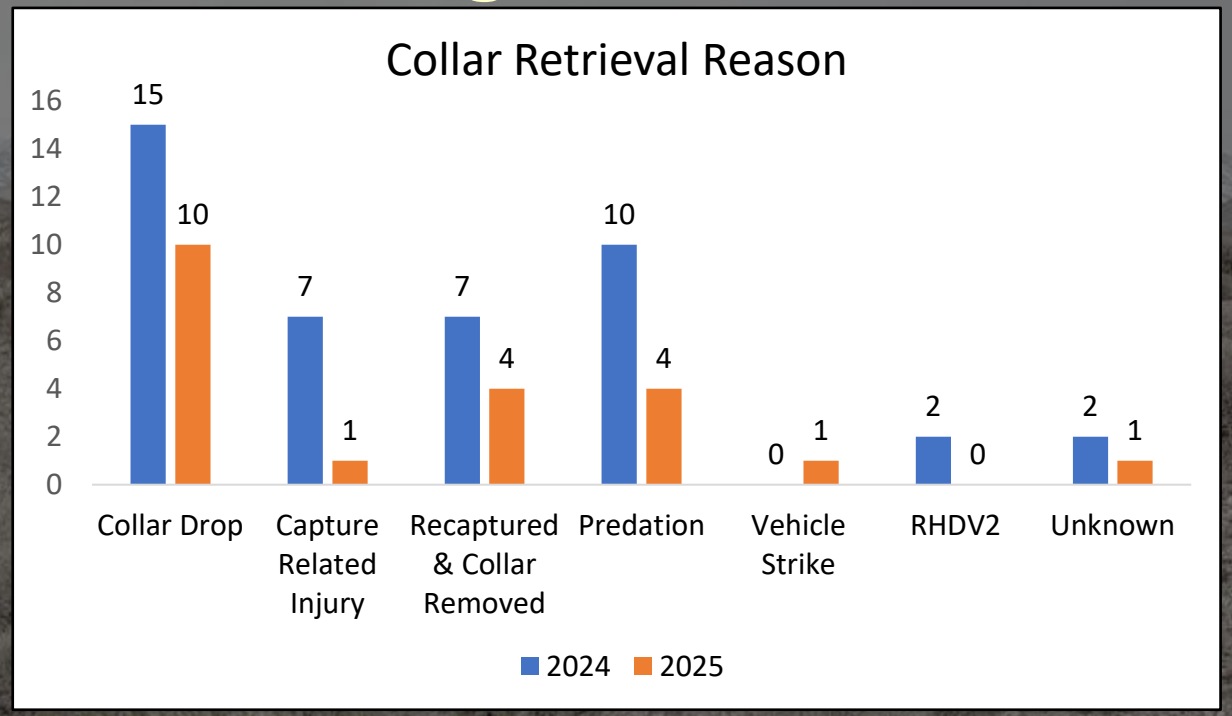
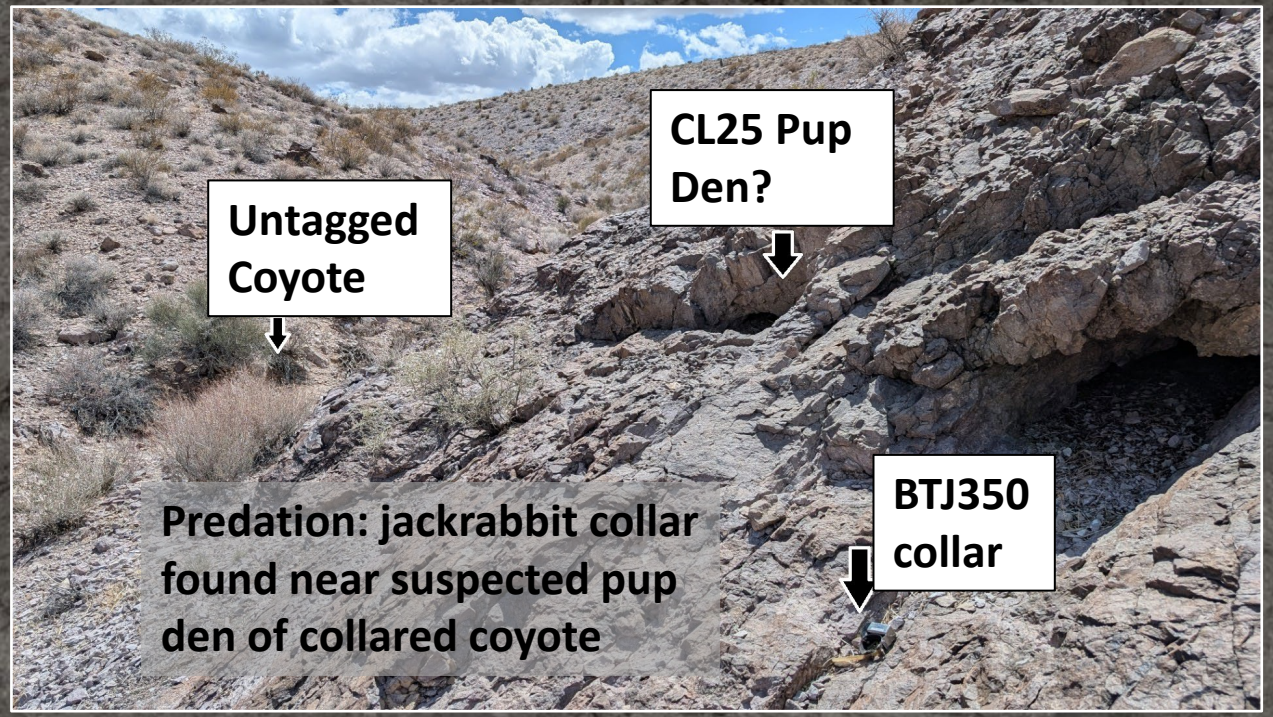
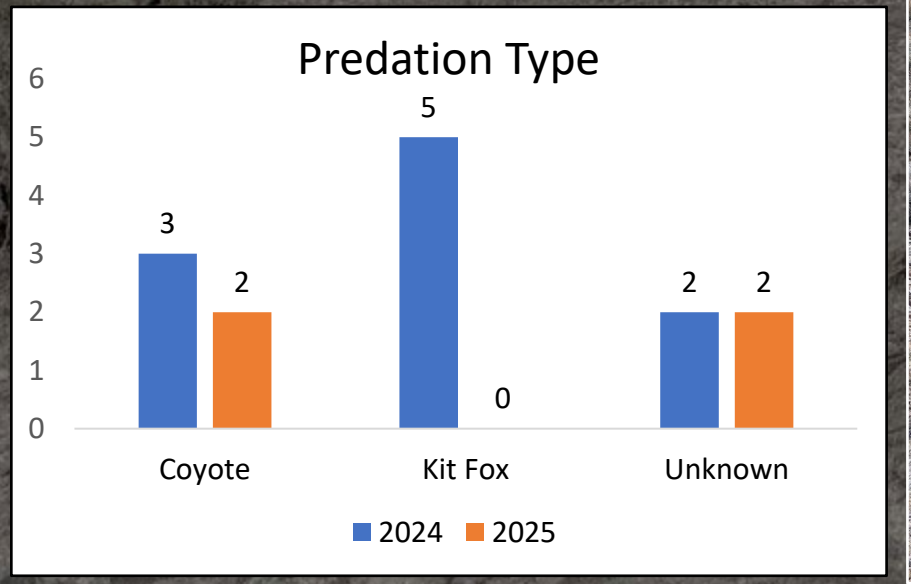


Determining Jackrabbit Mortality During Collar Retrieval







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Coyote Capture Methods

1. Site evaluation
2. Baiting– first bait event to capture:14-134 days, avg ~35 days
3. Padded foothold trap during winter months (Nov–Mar)
4. Coyotes chemically immobilized, monitor temp. and respiration
   (No ketamine/medetomidine in 2025, used Telazol, no antagonist, much longer recovery)
5. Fit with collar and ear tags
6. Process and evaluate - age/sex/health
7. Monitor until recovery

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Coyote Monitoring Methods

Collars

- GPS fix every 3 hours; lasts 1.5-2.5 years
- Location data and mortality alerts via satellite
- Automated release mechanism allows recovery of collar with complete GPS dataset

Telemetry

- Collars have VHF beacon that is active 4 hours/day
- Radio telemetry used to locate coyotes and perform status checks as needed

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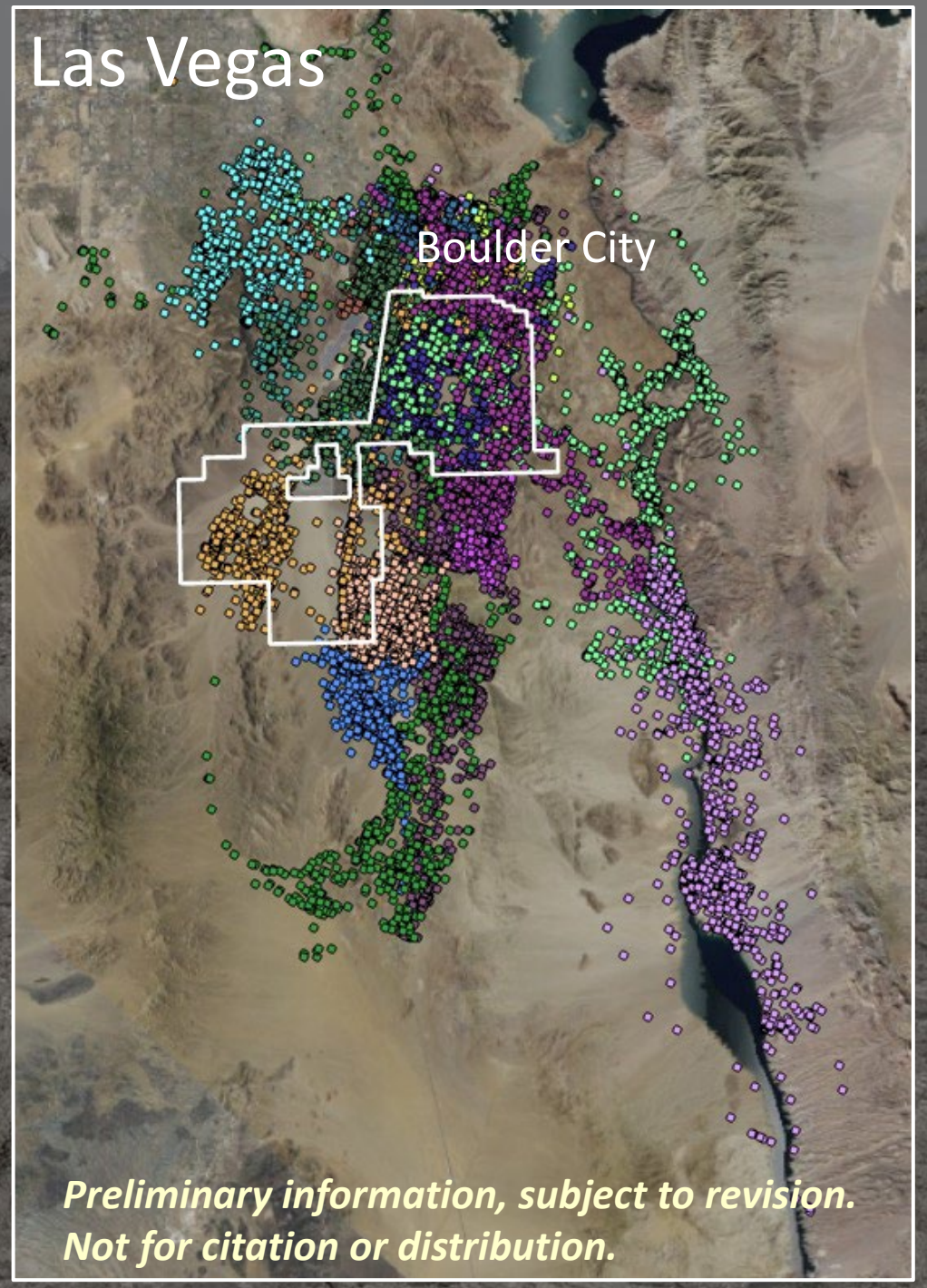
Coyote Results

Trapping

Year	No. of Days Baited	No. of Sites	No. of Traps Set	No. of Captures	No. of Individuals Collared
2022-2023	78	22	83	14 (11 sites)	12 (6M:6F)
2023-2024	106	22	64	10 (8 sites)	8 (5M:3F)
2024-2025	94	25	41	14 (10 sites)	12 (5M:7F)

Monitoring

Year	No. with Collars	GPS points	Likely cause of death			
			Vehicle	Gunshot	Trap-related	Other
2020	15	35,019				1
2021	25	36,697	2	2		
2022	15	41,341				
2023	23	68,202	2			
2024	26	48,436	3	1	1	
2025	21	23,871	0	0	0	5



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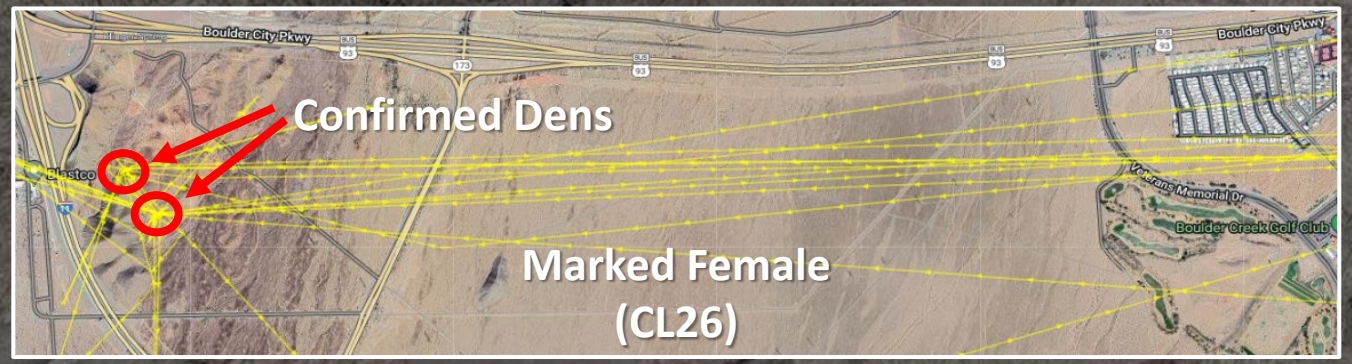
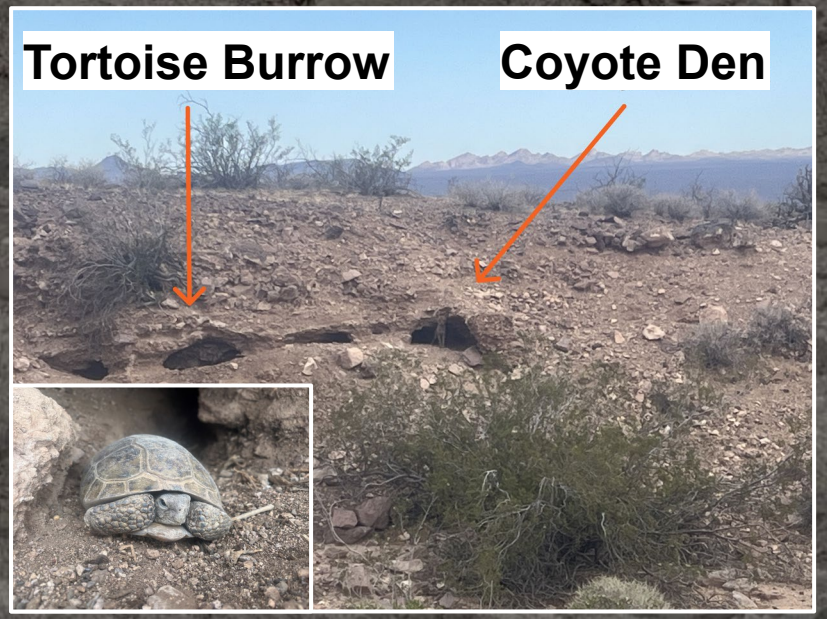
Coyote Dens

- **GPS satellite data**: Identify point clusters & frequented areas
- **In field**: Search for occupied dens, observe coyote behavior, detect pup sign (tracks and scat), place den cameras
- 5 potential dens checked, 4 confirmed as active (10 confirmed in 2024)
- 3 litters confirmed, at least 5 pups seen (7 litters; 21 pups in 2024)





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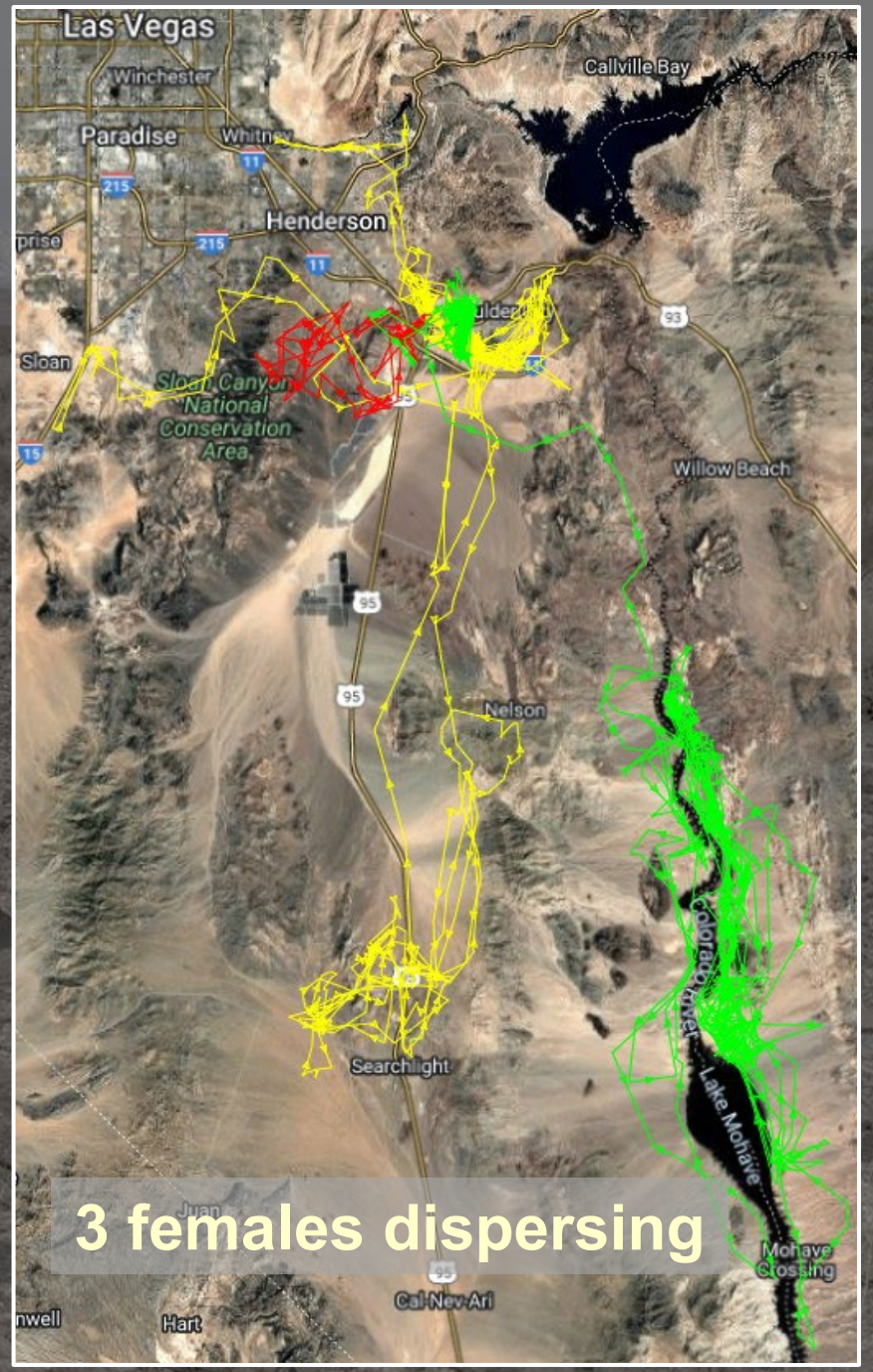
Coyote Tales



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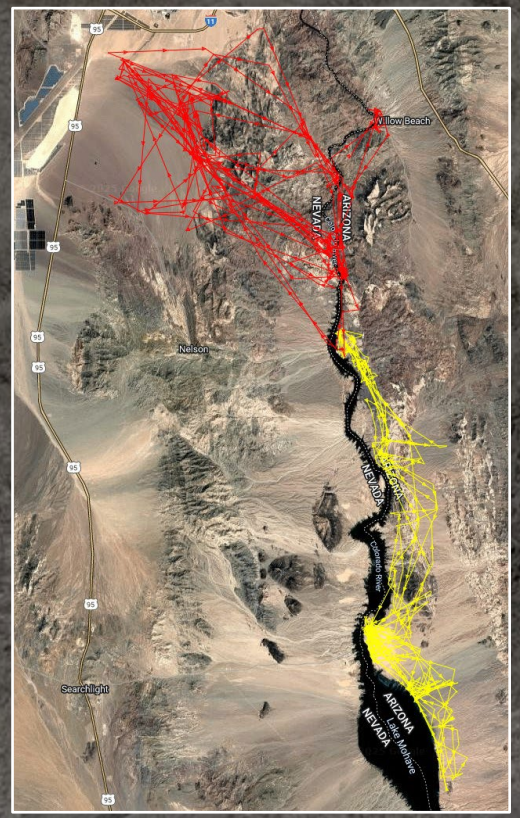
Coyote Tales

River swimmers



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Future Work / Predation Impact on Tortoises

1. Entering final year of data collection
2. Data reduction, analyses, and final reporting on:

Space use

- Jackrabbit and coyote spatial ecology
- Effects of coyote predation on jackrabbit habitat selection
- Coyote den site selection
- Landscape-scale spatial risk of coyote predation to desert tortoises

Demographics

- Spatially explicit density, abundance, and pop. growth for coyotes and jackrabbits
- Survival and cause-specific mortality

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Photo by Sarah Mendoza