Predator and Prey Dynamics in the Boulder City Conservation Easement

The Ecology and Population Dynamics of Black-tailed Jackrabbits (*Lepus californicus*) and Coyotes(*Canis latrans*) with Implications for the Desert Tortoise.

Matthew Simes, Benjamin Nolan, Kathleen Longshore, Todd Esque

United States Geological Survey, Western Ecological Research Center, Henderson, Nevada 89074, USA

USGS science for a changing world

Background

Impact of coyote predation on desert tortoises in the BCCE?

- Esque et al. (2010): proximity to anthropogenic resources and lack of prey influenced coyote predation of desert tortoises, especially during drought.

- Coyote density correlated with abundance of black-tailed jackrabbits.

- No estimates of abundance, density, or habitat use for coyotes or jackrabbits in the Mojave Desert.

Objectives

Major Goals:

- **<u>Objectives 1,2,3</u>: Investigate ecology of coyotes and black-tailed jackrabbits in the Mojave Desert.**
  - Variability in demographics, abundance
  - Habitat use patterns, home ranges, and movement patterns.
  - Health status, and mortality rates.

- **<u>Objective 4:</u> Methods for cost effective, reliable estimates of predator and prey populations in the BCCE.**

- **<u>Objective 5:</u> Collaborative synthesis of coyote, jackrabbit, and desert tortoise population dynamics in the BCCE to inform management decisions.**

Methods: spotlight surveys, camera traps, GPS/VHF collars

To observe seasonal and inter-annual variation of predator and prey demographics and assess survey methods:

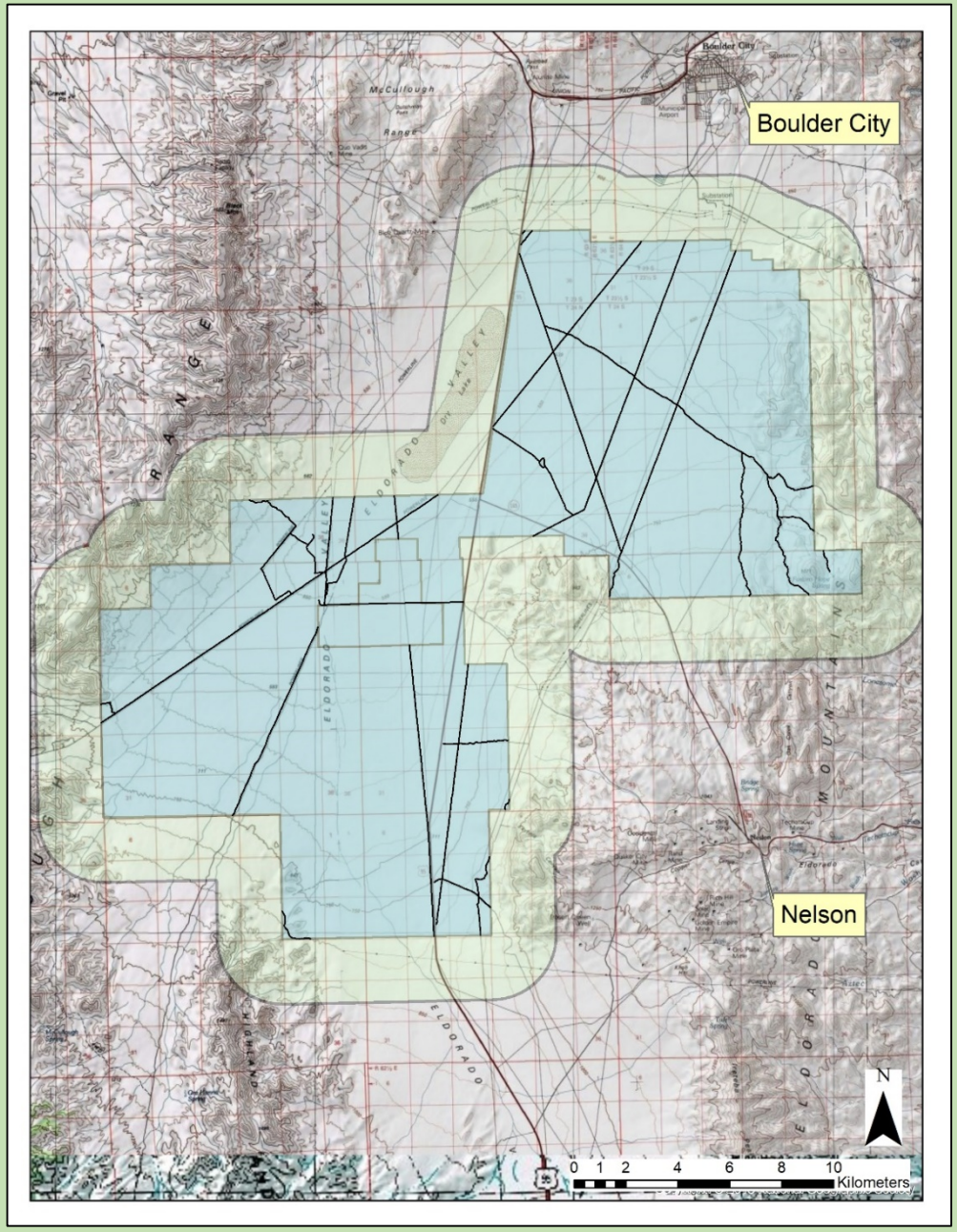
- **Monthly spotlight line transects to monitor prey and predator abundance in BCCE.**
- **Cameras in random grids, washes or other travel corridors, and baited sites for trapping or seasonal community observations.**
- **GPS Radio telemetry of jackrabbits and coyotes in BCCE.**

*All data and conclusions presented herein are preliminary in nature, and subject to revision.

Study Site

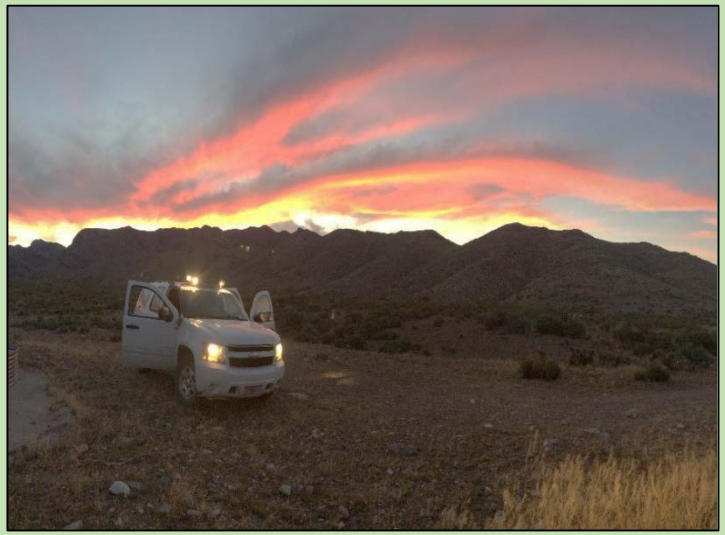
The Boulder City Conservation Easement (BCCE) Established in 1995 as partial mitigation for the take of desert tortoise and it's habitat.

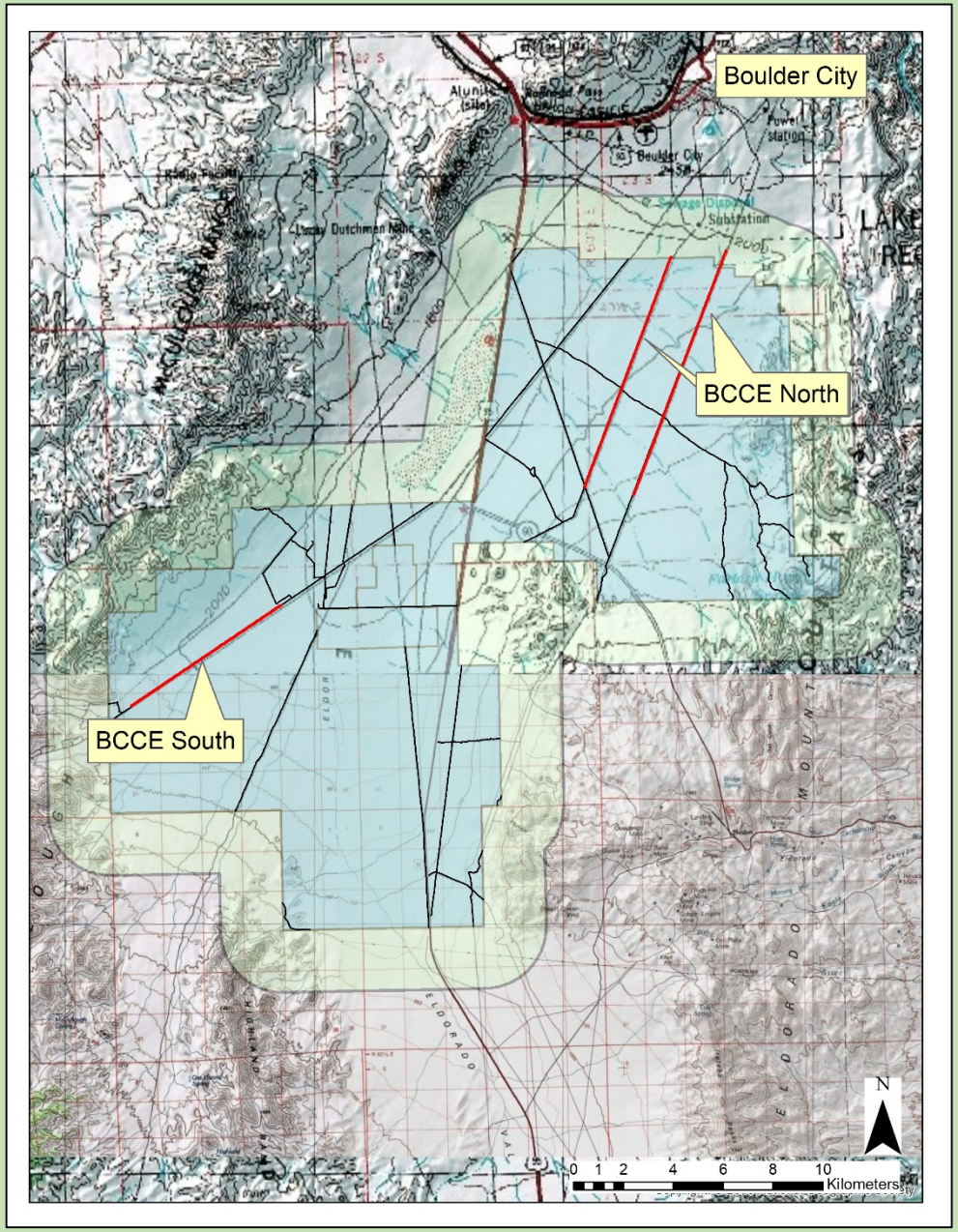
- ~86,500 acres in the Eldorado Valley south of Boulder City, Nevada.
- Currently managed under the Multiple Species Habitat Conservation Plan (MSHCP) for desert tortoise conservation.



Spotlight transect methods for measuring prey abundance

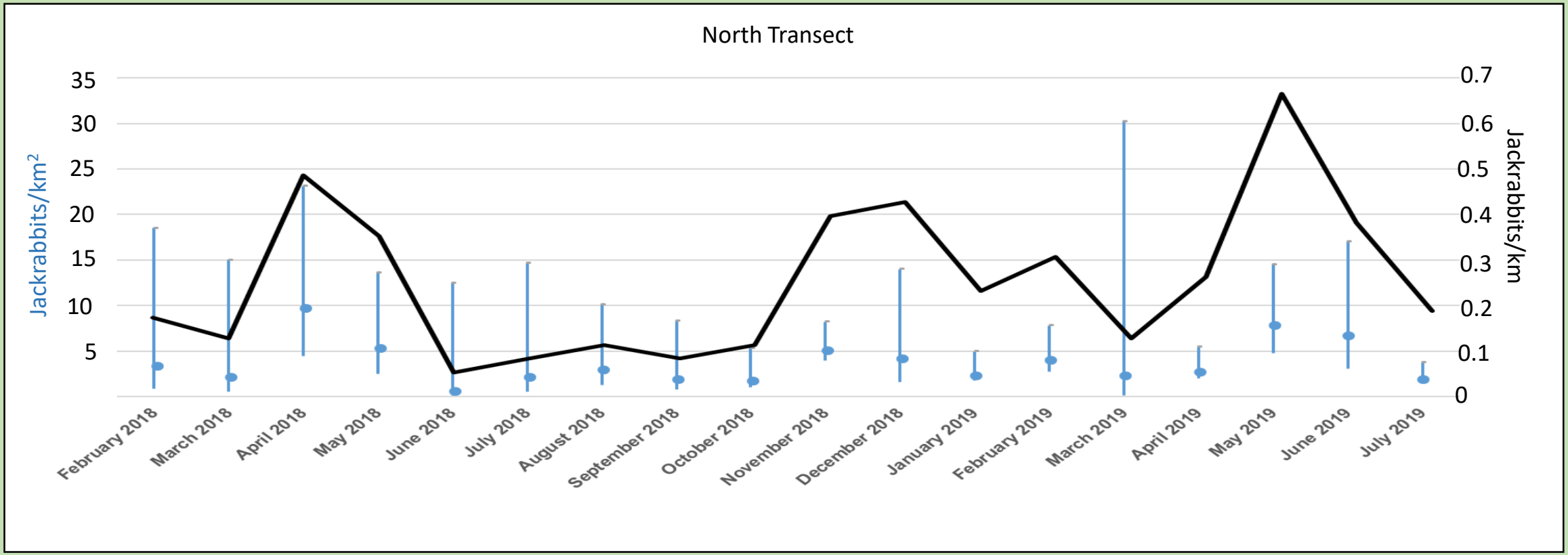
- **Transects scheduled during full moon for consistency in surveys**
  - 30 min after sunset
  - 5 to 7 km/hr.
  - GPS location & perpendicular distance of animals measured using a laser rangefinder.





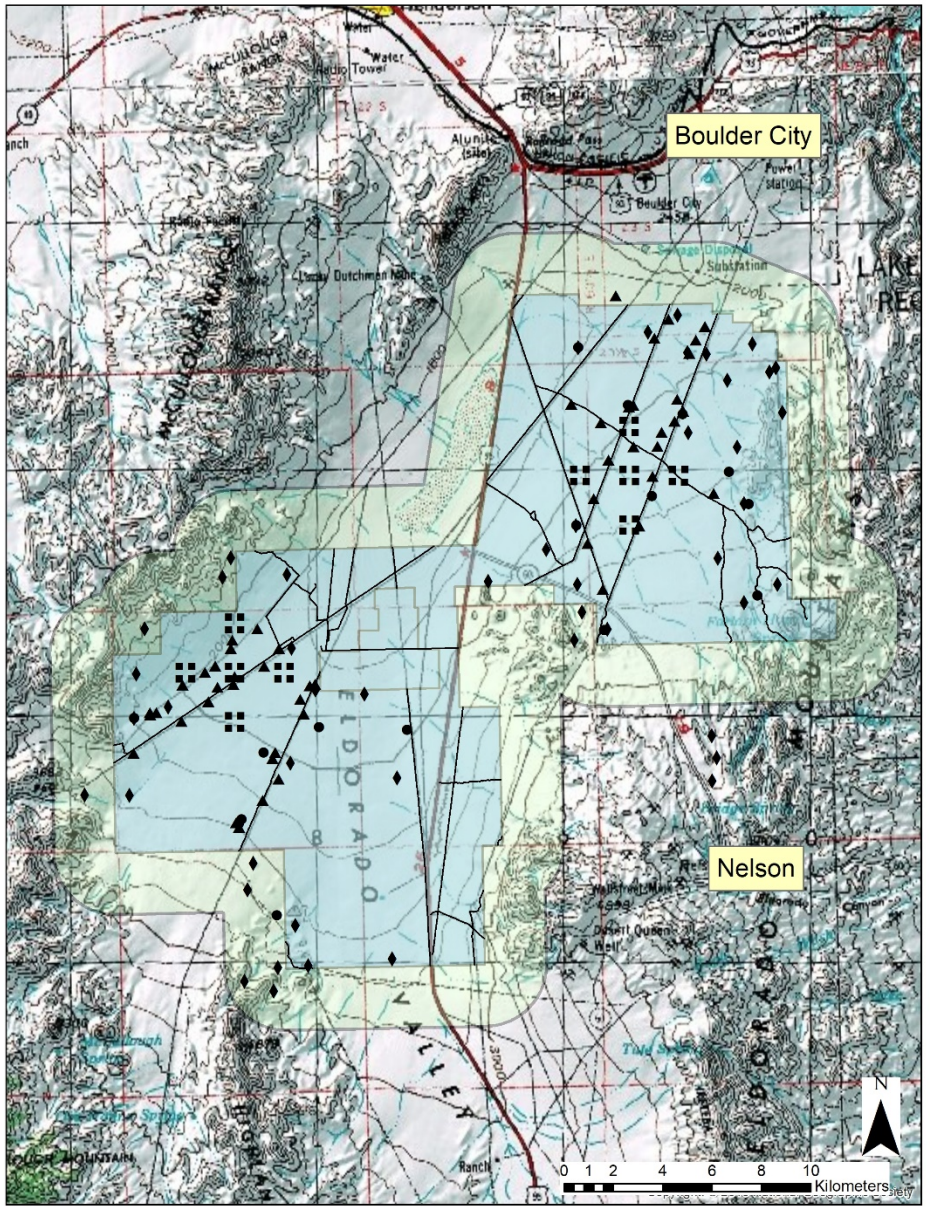
Spotlight transect surveys: preliminary results

- **An index of monthly change in jackrabbit abundance jackrabbits in sighted/km of transect (Black) and density estimates from distance sampling with 95% CI (Blue).**



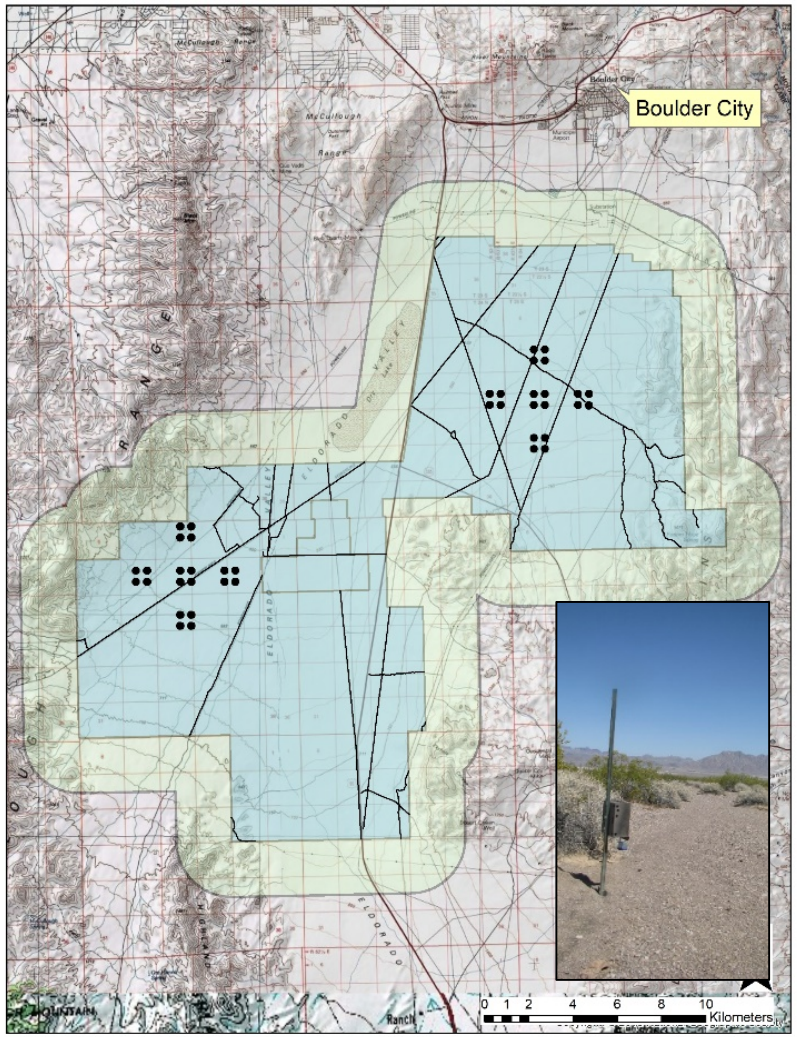
Cameras in grids and washes:

- **Cameras used in a number of settings in BCCE:**
  - Random Grids, Washes, Carcasses, Baited sites for trapping.
- **Density estimation:**
  - REM (random encounter model)
  - MARK
- **Measuring activity patterns for predator and prey.**
  - Daily, annually, and spatially



Random grid observations and REM

- **Grid of 20 cameras in north and 20 in the south BCCE at random points on landscape.**

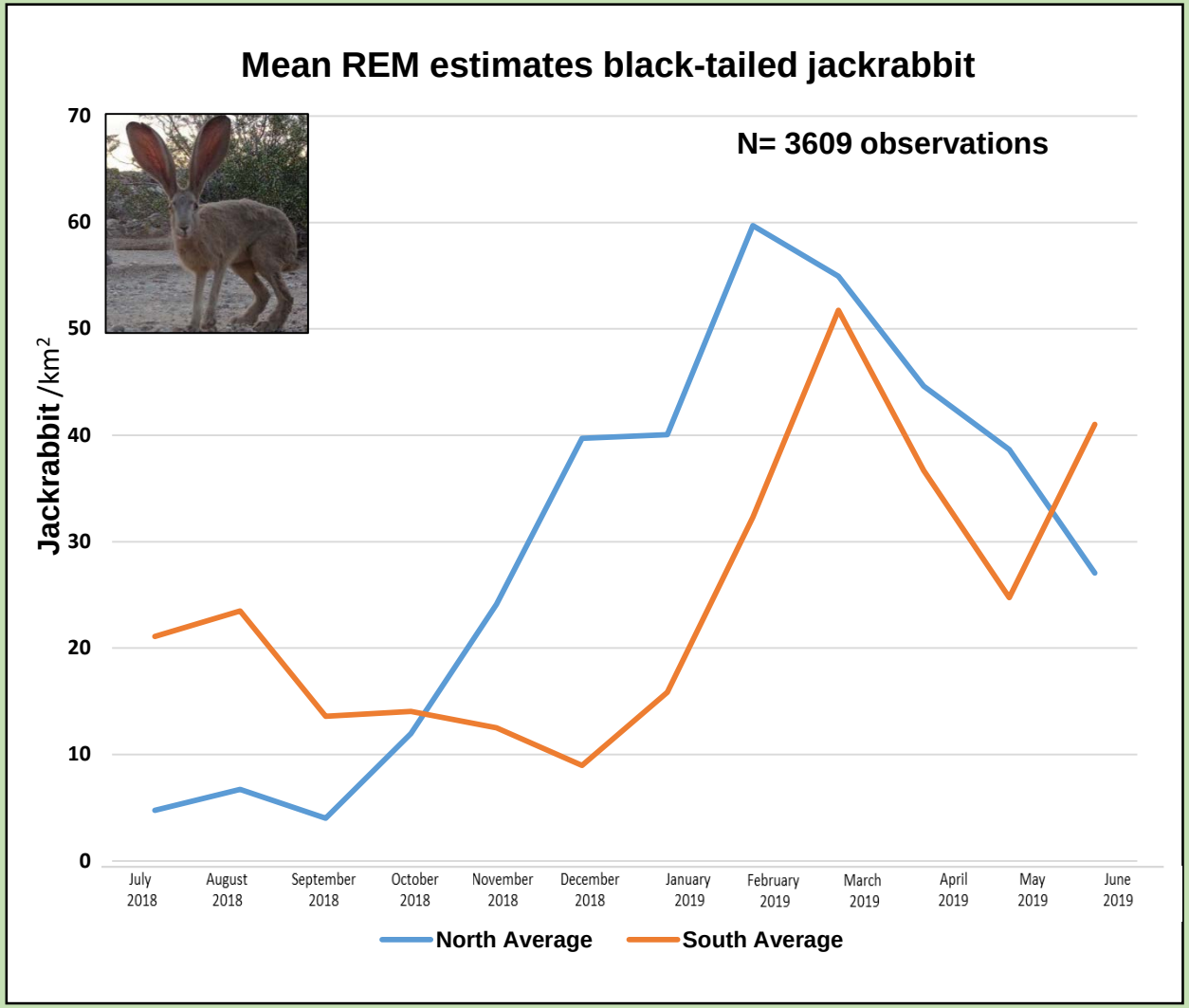


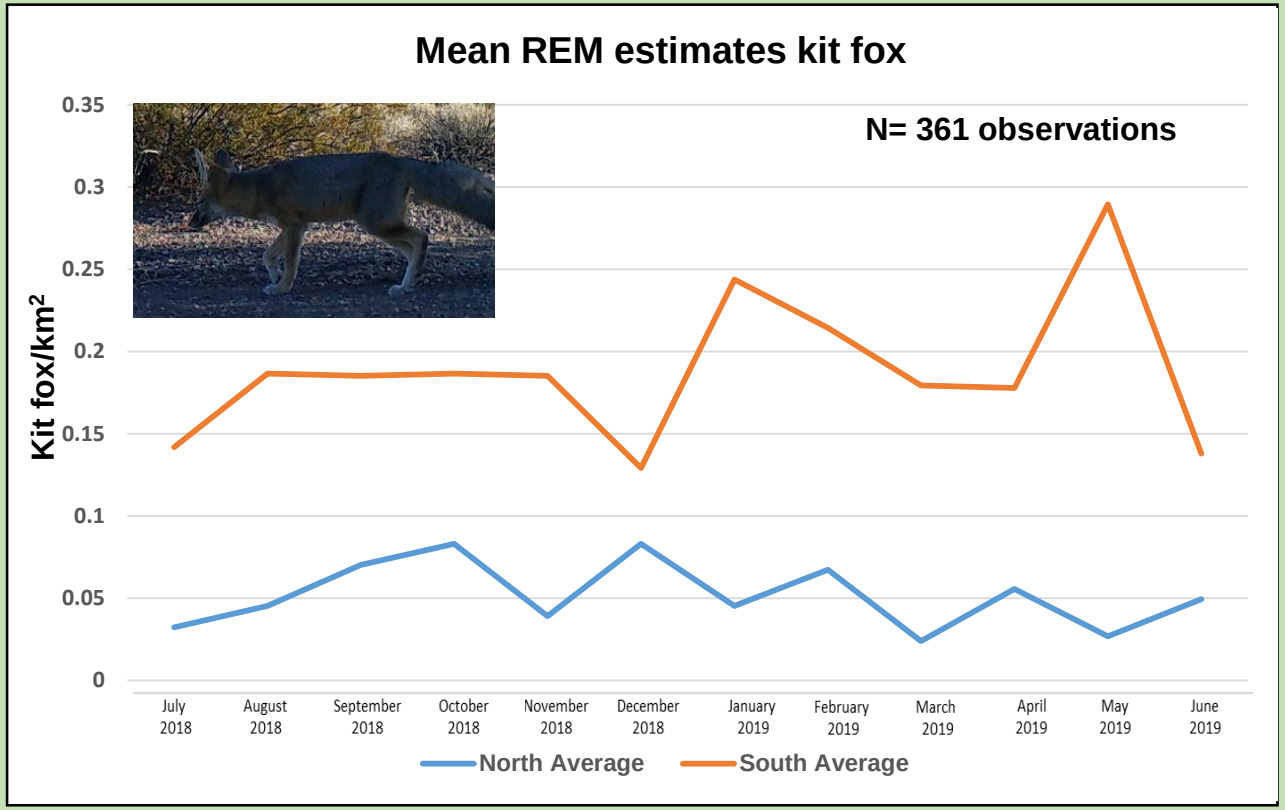
- **D=(y/t)*(π/(vr(2+Θ))**

- **Requirements for REM* density estimations:**
  - Based on photographic rate without need to individually identify animals.
  - Minimum of 20 cameras in an array for density estimates.
  - Minimum of 10 detections in survey period.

*Rowcliffe et al. 2008

REM for jackrabbits and kit foxes in BCCE



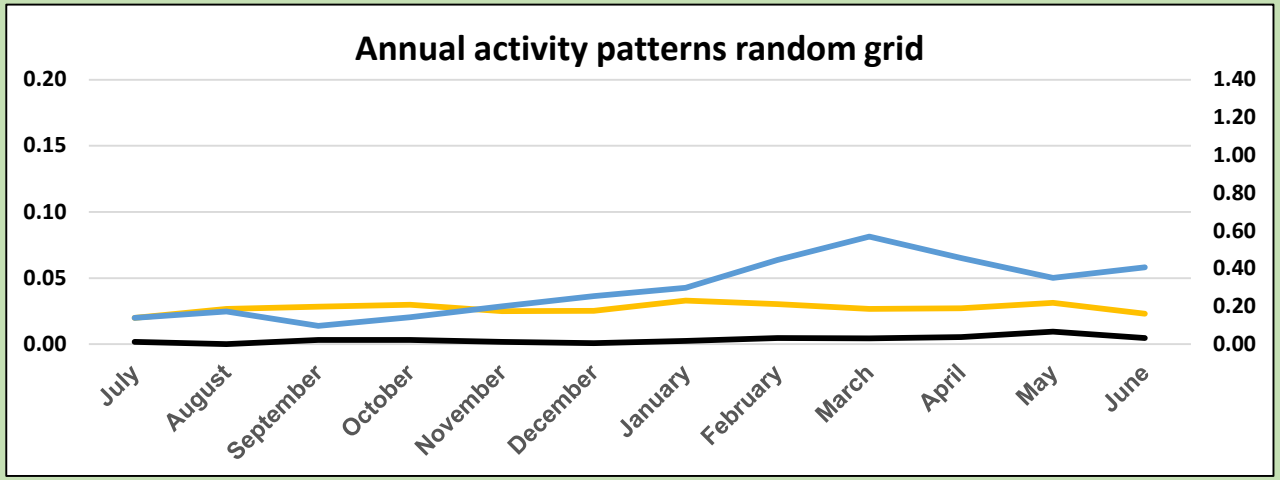


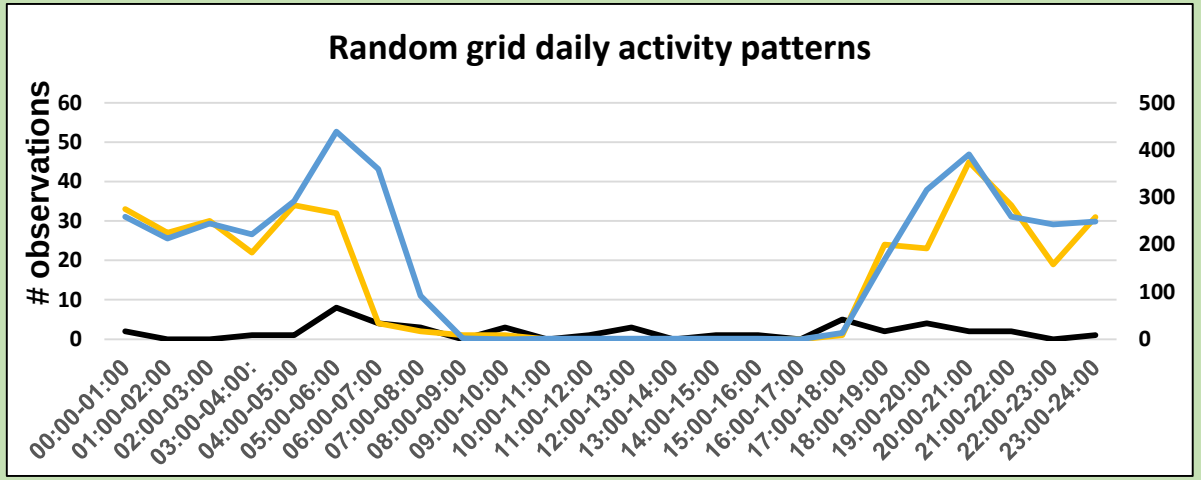
*Frost 2005

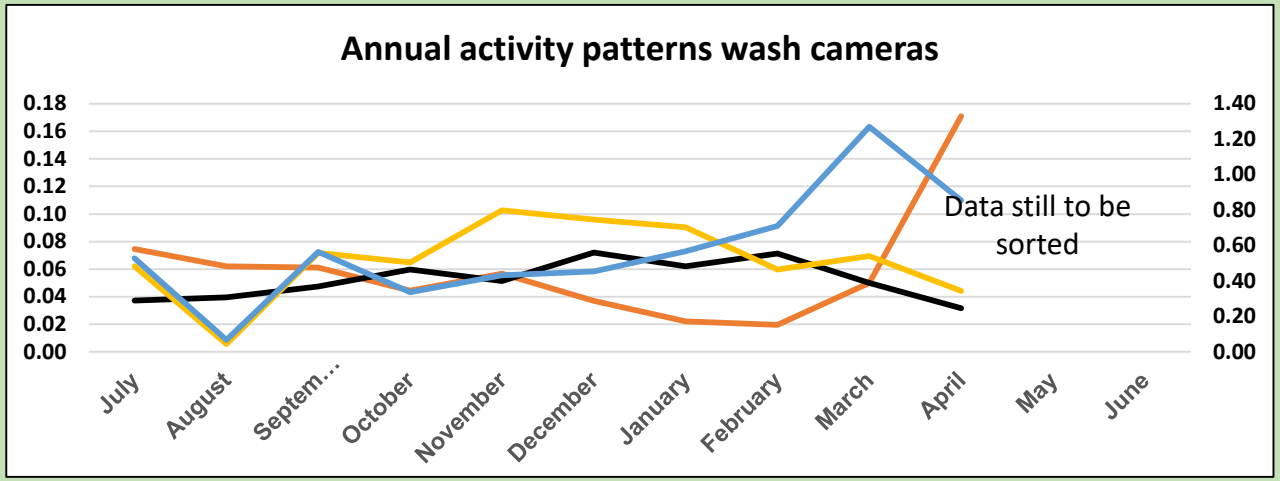
- **Kit Fox REM**
  - **Daily movement data is from California's Central Valley*, may not accurately portray movement in Mojave Desert foxes.**

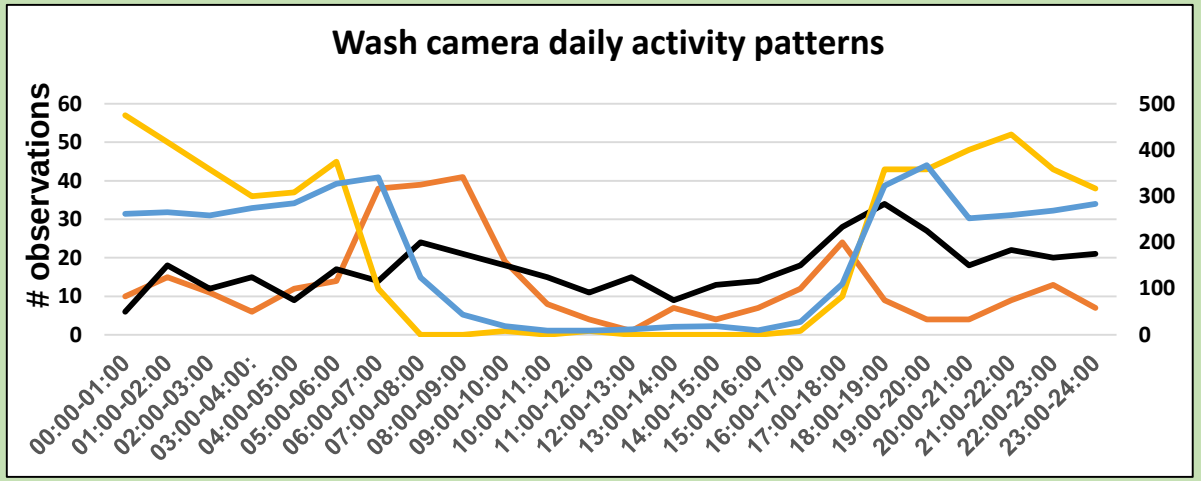
Activity patterns for predators and prey in the BCCE

- Cameras in washes and random grid locations were used to observe predator and prey activity patterns.
- Left and right Y axes are number of observations; jackrabbit observations are on the right axis.
- Annual data are in observations/camera day





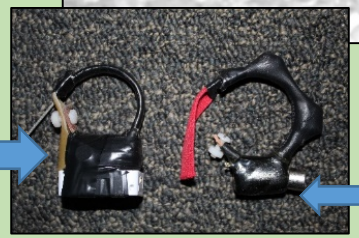




Jackrabbit Telemetry

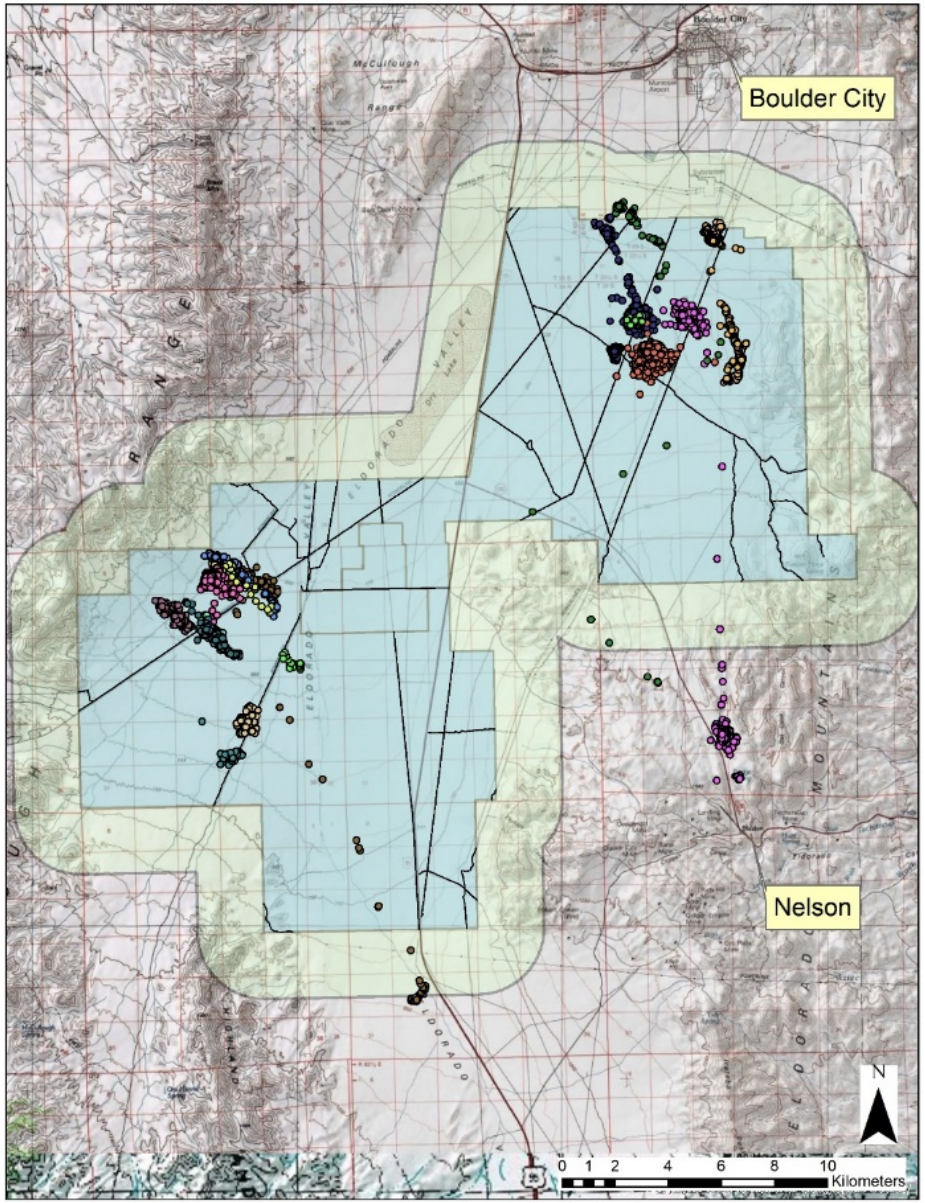
- **Box traps pre-baited with apples**
- **Fitted with GPS collars and vinyl ear tags.**
  - Short term: ~60g, 30 minute GPS fixes.
  - Long term collars: ~35g, 3 hour GPS fixes.

- **Long term collars:** 12 jackrabbits up to 158 days.
- **Short term collars:** 16 jackrabbits up to 46 days.
- **9661 GPS** points from 16 collars to date.



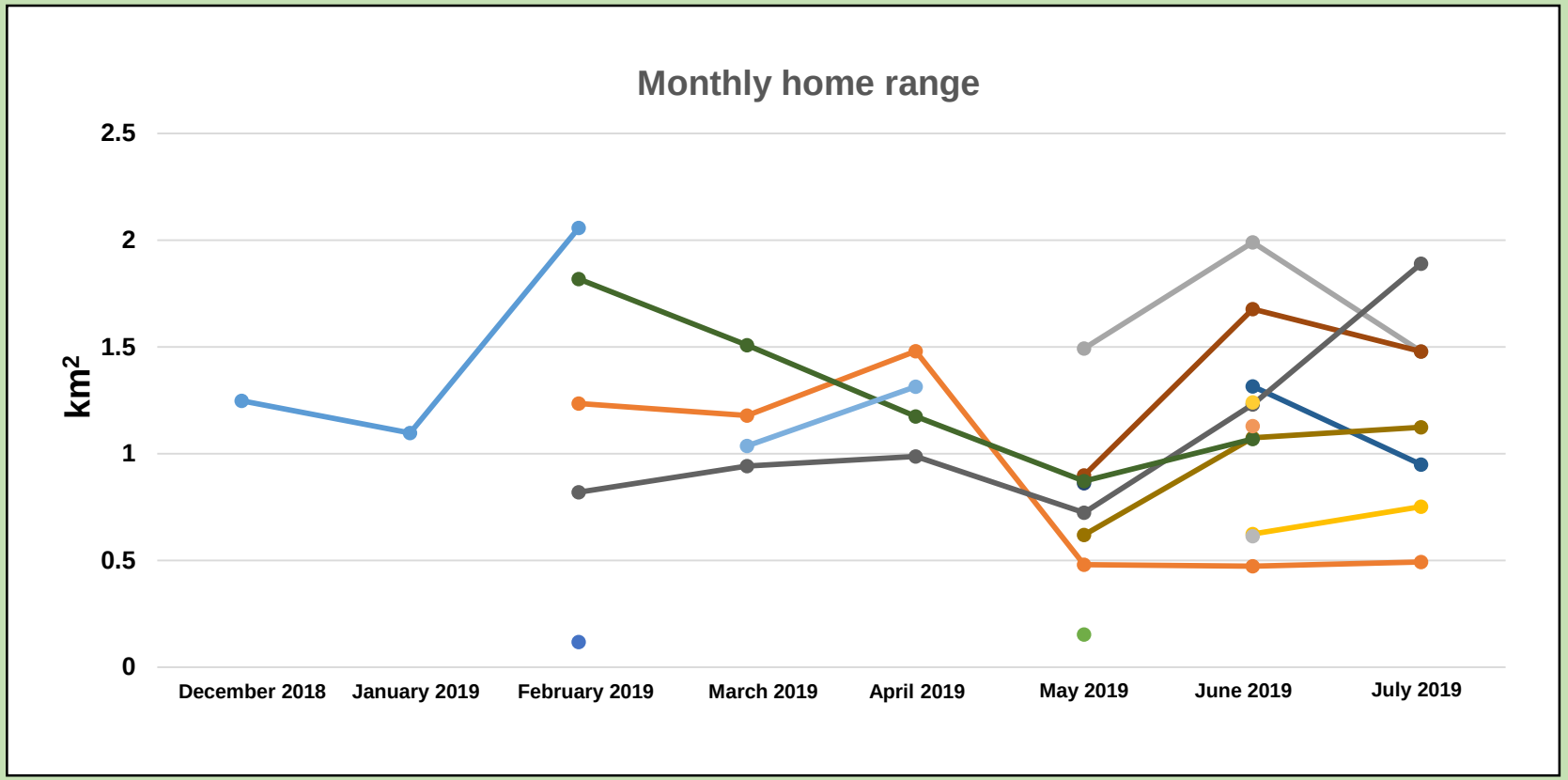
Short term collar

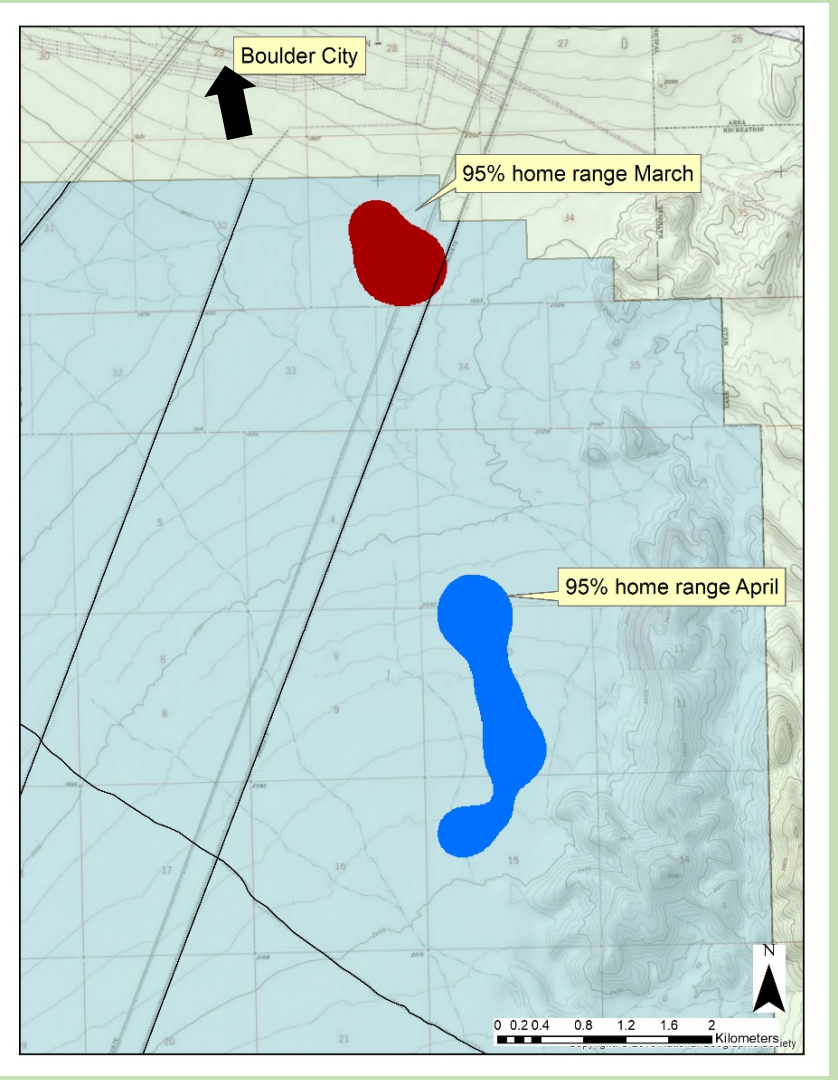
Long term collar



Home Range of Jackrabbits in BCCE

- **Home Ranges were estimated Fixed Kernel Density Estimator (KDE) of 95% utilization area for jackrabbits.**
  - Average 95% home range in BCCE is 1.01 km^2.
  - 95% Home range varied from 0.12-2.19 km^2.

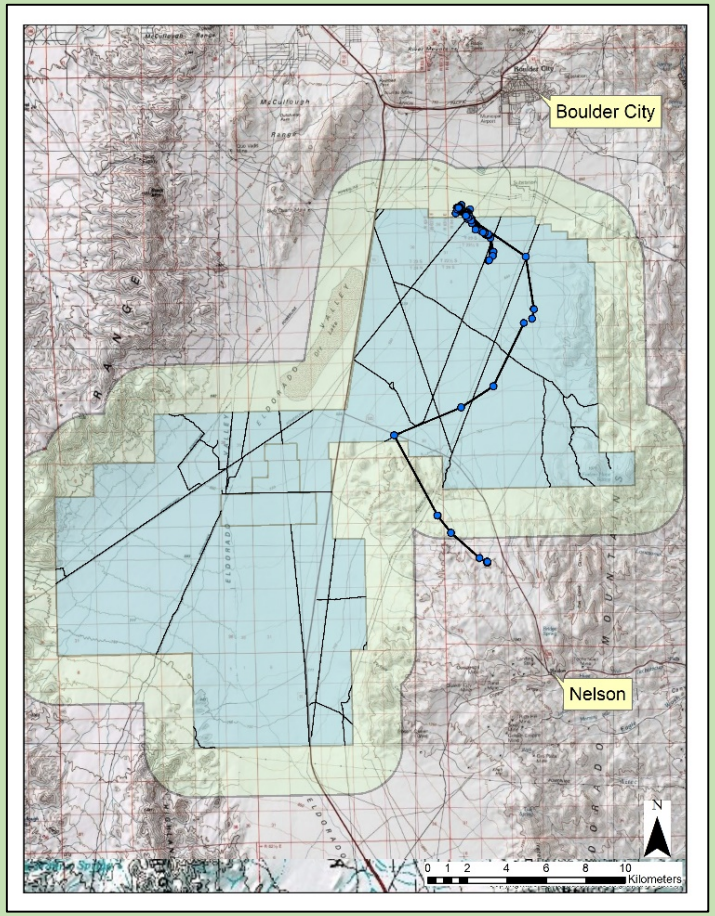


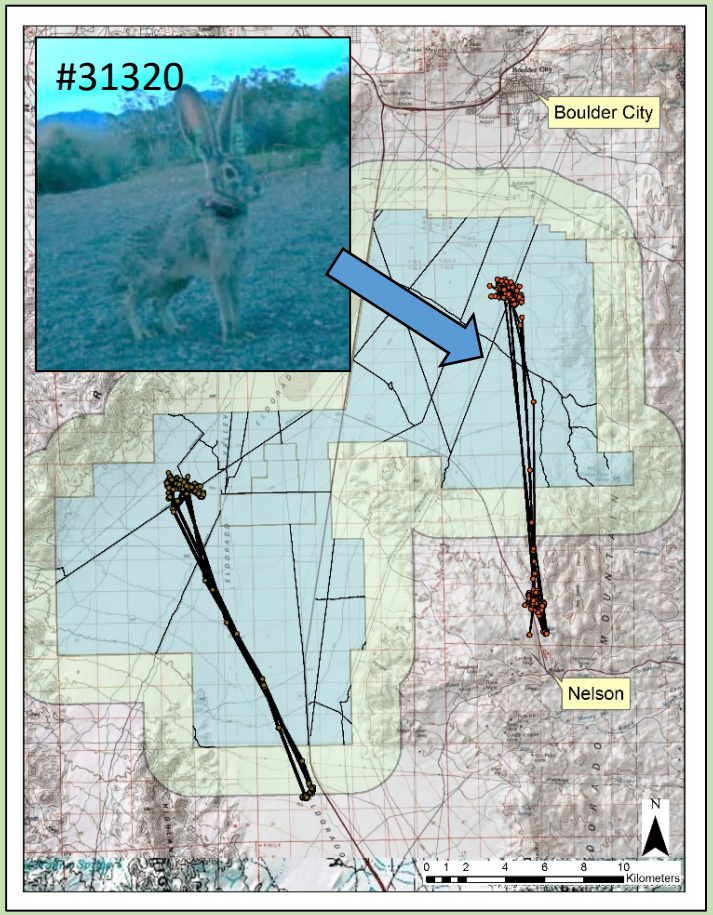


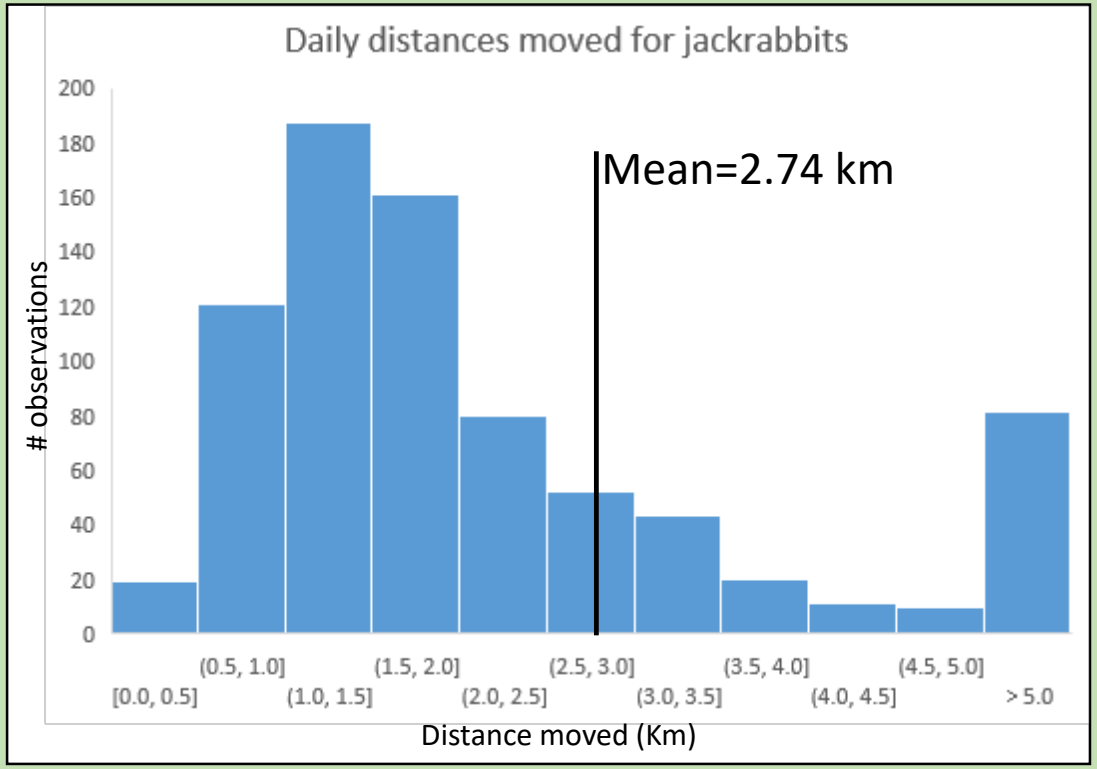
Jackrabbit movements in BCCE

At least 3 Jackrabbits exhibited movements over 10km, ~10% of all daily movements >5km.

- #31319, adult male moved 23 km in 2 days.
- #31320, adult male repeatedly moved >17 km.
- #31321, juvenile made two trips >17 km.







Overview of project in the BCCE

- **<u>Objectives 1,2,3</u>: Ecology of coyotes and jackrabbits in BCCE – (continue data collection over next 21 months)**
  - **34 jackrabbits marked or collared in BCCE**
    - GPS data on movements, survival, mortality causes, and habitat use
  - **14 months of camera data at random locations, 10 in washes/travel corridors**
    - REM estimates of jackrabbit and kit fox density, and abundance estimates marked animals (jackrabbits)
    - Cameras in various habitat types, different communities, spatial/seasonal changes in predator activity in BCCE

Overview of project in the BCCE

- **<u>Objective 4</u>: Methods to measure predator and prey abundance- (continue data collection over next 21 months)**
  - 19 months (February 2018-August 2019) completed.
  - 14 months of camera data random locations
    - REM estimates of jackrabbit and kit fox density
  - 10 Months of cameras data washes/travel corridors
    - Higher detection rates for predators in the BCCE

- **<u>Objective 5:</u> Synthesis of predator/prey habitat use and interactions- Final 12 months**

Plans for the Project this Fall

- Continued monitoring of random grid, and wash camera arrays.
- Continue trapping, marking, and monitoring animals with GPS collars jackrabbits in the BCCE.
- Restart capture efforts for coyotes when cooler temperatures arrive.
- Initiate analysis of coyote food habits in the BCCE.

Interesting natural history found in study

- **Arboreal foraging of cottontails in acacia (*Senegalia greggii)* trees.**
- **Observed 16 times in winter 2018-2019.**
- **Currently in preparation for submission to peer reviewed journal.**

Interesting natural history found in study

- Observations of spotted skunk and gray fox together in the BCCE.
  - Confirmed and supplemented previous observations across southern Nevada.
- Why are these two together?
  - Increased foraging efficiency?
  - Protection?
- Regional Phenomena

Acknowledgments & Questions

- **Thanks to Scott Cambrin, Kimberley Jenkins, and all the people at the Clark County DCP.**

- **Thanks also to the people at the USGS including Felicia Chen, Ben Gottsacker, Amanda McDonald, Jordan Swart, Ross Van Galen, Sara Murray, Brent Cunningham, Riley Miller, Gretchen Gantz.**

Questions?

Literature Cited:

Esque et al. 2010. Effects of subsidized predators, resources variability, and human population density on desert tortoise populations in the Mojave Desert, USA. Endangered Species Research 12: 167-177.

Frost, N. 2005. San Joaquin kit fox home range, habitat use, and movements in urban Bakersfield. MSc thesis, Humboldt State University. 86p.

Rowcliffe et al. 2008. Estimating animal density using camera traps without the need for individual recognition. Journal of Applied Ecology 45:1228-1236.

*__All data and conclusions presented herein are preliminary in nature, and subject to revision.__

__*The use of trade, product, or firm names in this publication is for descriptive purposes only and does not imply endorsement by the U.S. government__.