Raccoon Habitat Selection in Yosemite Valley

Erika L. Anderson[1]*, Sean M. Matthews[1], David, S. Green[1], Rachel Mazur[2], Katie Patrick[2], Esther Kukielka[2], Elizabeth Wold[2]
[1]Institute for Natural Resources, Oregon State University, and [2]Yosemite National Park
*erikalindsay8@gmail.com

INTRODUCTION

Human development and activities influence the space use of wildlife populations by providing resources like anthropogenic food, garbage, and artificial denning structures (Bateman and Fleming 2011, Rogala et al. 2011, Mueller et al. 2018). National Parks, established to preserve natural resources and provide recreational opportunities, are challenged at the forefront of managing human-wildlife interactions (Soukup et al. 1999). In Yosemite Valley, Yosemite National Park (Figure 1), many wildlife-related incidences are linked to raccoons (*Procyon lotor*). **We examined how the availability of anthropogenic resources influenced the space use and habitat selection of raccoons in Yosemite Valley.** We hypothesized that raccoons would select areas where people gathered for cooking and eating, and thus, where anthropogenic food sources were most readily available.

METHODS

- ➔We fitted raccoons (7 M, 4 F) with GPS collars and monitored their movements during the summers of 2017 and 2018.
- ➔We classified developed areas of Yosemite Valley as direct (eg. picnic areas) and indirect (eg. visitor center) sources of anthropogenic food and by management entity (National Park Services or Concessionaire), providing four classes of development (Figure 1).
- ➔We developed a resource selection model using Bayesian analytical tools to determine the areas raccoons were selecting as it related to the availability of anthropogenic food sources within their territory (Linden et al. 2018).
- ➔We fit our model using JAGS in R v. 3.4.3 (Plummer 2003, R Core Team 2017) by running the model for 10,000 iterations, thinned by 10, following 3,000 iterations of adaptation and burn-in. We modeled individual raccoon as a random effect on the intercept.

DISCUSSION

- ➔Raccoons selected for developed areas of Yosemite Valley
  - ◆Anthropogenic resources have an influence on raccoon behavior
- ➔All raccoons select for Direct NPS areas
  - ◆NPS managed campgrounds and picnic areas are more continuous with natural areas than other habitat types but still offers anthropogenic food
  - ◆NPS campgrounds and picnic areas are managed to prevent conflicts with black bears → raccoons require different management strategies
- ➔Overall high degree of individual variation in raccoon habitat selection
  - ◆Behavioral plasticity allows raccoons to exploit and thrive in a variety of habitat types (Lowry et al. 2013)
  - ◆Individual variation has been documented in other carnivores, but never in raccoons
  - ◆Poses a challenge for management
- ➔Females select Indirect Concessions more than males
  - ◆Females exhibit decreased intraspecific tolerance in areas where resources are clumped (Prange et al. 2004)
  - ◆Indirect Concessions areas may act as a refuge for females

STUDY AREA

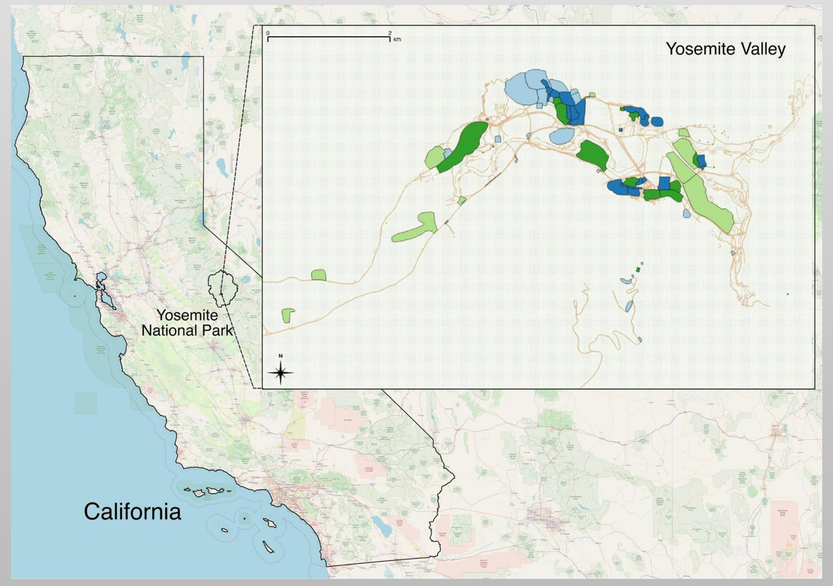

Figure 1. Map of study area with habitat classification. Blue and green indicate indirect and direct sources of food availability, respectively. Lighter shades and darker shades indicate facilities operated by the National Park Service and Concessions, respectively.

RESULTS

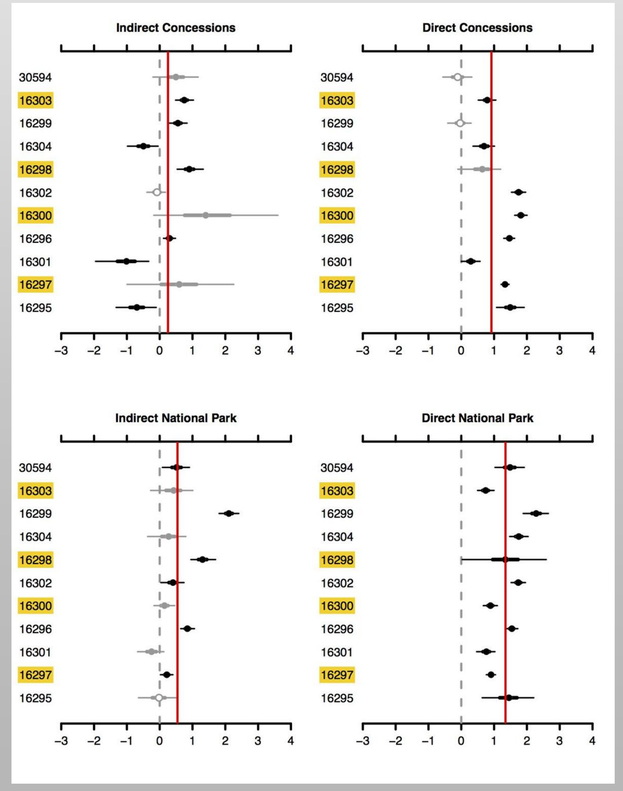

Figure 2. Habitat selection for 11 GPS collared adult raccoons with 95% confidence intervals. Female raccoons are highlighted in yellow on the y-axis, all others are males. Positive numbers on the x-axis represent selection for the habitat type, negative numbers represent avoidance, and zero is no selection. The red line indicates the average for the population.

FUTURE DIRECTIONS

- ➔Larger sample size and more representative sample
  - ◆Targeted trapping in developed areas of the Valley may have inflicted accidental bias in our sample population
- ➔Examine the use and importance of black oaks (*Quercus kelloggii)* in the Valley
- ➔Examine what kinds of resources females are using in Indirect Concessions areas

ACKNOWLEDGEMENTS: Special thanks to the raccoon team in Yosemite National Park for their efforts in the field.

Literature Cited:
-Bateman, P. W., and P. A. Fleming. 2012. Big city life: carnivores in urban environments. *Journal of Zoology* 287: 1-23
-Linden, D.W., Siren, A. P. K., Pekins, P. J. 2018. Integrating telemetry data into spatial- recapture modifies inferences on multi-scale resource selection. Ecosphere 9(4):e02203
-Lowry, H. A. Lill, B. B. M. Wong. 2013. Behavioral responses of wildlife to urban environments.*Biological Reviews* 88: 537-549
-Mueller, M. A., D. Drake. and M. L. Allen. 2018. Coexistence of coyotes (*Canis latrans*) and foxes (*Vulpes vulpes*) in an urban landscape. *PLoS ONE* 13(1): e0190971
-Plummer, Martyn. (2003). JAGS: A Program for Analysis of Bayesian Graphical Models using Gibbs Sampling. 3rd International Workshop on Distributed Statistical Computing (DSC 2003); Vienna, Austria. 124.
-Prange, S., S. D. Gehrt, and E. P. Wiggers. 2004. Influences of Anthropogenic Resources on Raccoon (Procyon lotor) Movements and Spatial Distribution. *Journal of Mammalogy* 85: 483-490
-R Core Team. (2017). R: A language and environment for statistical computing. Vienna, Austria. R Foundation for Statistical Computing.
-Rogala, J. K., M. Hebblewhite, J. Whittington, C. A. White, J. Coleshill, and M. Musiani. 2011. Human Activity Differentially Redistributes Large Mammals in the Canadian Rockies National Parks. *Ecology and Society* 16: 16
-Soukup, M., M. K. Foley, R. Hiebert, and D. E. Huff. 1999. Wildlife Management in the U.S. National Parks: Natural Regulation Revisited. *Ecological Applications* 9: 1-2