

Camera Trapping Study at Culp's Hill/Spangler Spring, Gettysburg National Military Park

Fall 2023 and Fall 2024



A report to the National Park Service for research completed under
permit GETT-2022-SCI-0009

March 2024

Correspondence: awilson@gettysburg.edu

Dan Thanh Nguyen, Amber Clark, Meghan Clark, Jamie Dinella, Kate Eulberg, Gabriel Guzman, Tessa McDonald, Jehan Mody, Hannah Sauve, Jess Schaefer, Kaiulani Sund, Finn Warren, Dr. Andy Wilson

Environmental Studies Department
Gettysburg College
300 N Washington Street
Gettysburg
PA 17325

Contents

Introduction.....	3
Methods	4
Results.....	7
Detection Patterns	8
Detection rates in 2021, 2022 and 2023.....	15
Discussion	16
Acknowledgments.....	16
Literature Cited	16

Introduction

This report presents the results of an ongoing camera trapping study in the Culp's Hill area in Gettysburg, PA, as part of a national community science camera-trapping project called "Snapshot USA". The study commenced in 2020, and it is hoped that it will be repeated every fall in perpetuity, with involvement of undergraduate students from Gettysburg College, whenever possible. The aims of Snapshot USA are:

"To facilitate the collaboration of cooperators to contribute to a national database of public wildlife data. Once compiled, our first objective is to examine nationwide trends in mammal community assembly rules associated with natural environmental and anthropogenic filters."

The national project was initiated in 2019, when more than 100 collaborators operated camera-trapping arrays across all 50 US states¹. In 2020, 103 camera-trapping arrays were monitored, increasing to 107 in 2021², and 132 in 2022³.

A secondary aim of the Gettysburg "subproject" is to provide hands-on experience of ecological study design, camera-trapping technologies, data analysis and mammal identification for students in the Environmental Studies major at Gettysburg College. All students enrolled in the course ES302 *Wildlife Ecology* contributed to the study in 2022. The course was not taught in Fall 2023 so the camera trapping was conducted by Andy Wilson, and Senthly (Dan Thanh Nguyen) assisted with identification of species on photos, data analysis and report writing.

Methods

The location for the study was chosen largely because it is within walking distance of Gettysburg College, which means that students can access the site without the need to hire vehicles. The study site is mostly deciduous woodland, surrounded by grassland. Camera deployment locations were selected by placing a 220-meter grid over the wooded parts of Culp's Hill, using the fishnet tool in ArcGIS 10. Snapshot USA protocols stipulate that cameras should be at least 200 m apart, so we added 20 m onto that to allow for some displacement from selected grid locations to find suitable mounting locations. We selected 12 locations from the grid and cameras were placed on trees (9 deployments) or fence posts (3 deployments). One camera went missing in 2022 (#8), and one deployment (#9) was dropped from the study in 2023 due to encroaching vegetation at the prior location used for the camera.

Cameras were set in accordance with Snapshot USA's protocols:

- 1. Each collaborator selects one combination of setting (Urban, Suburban, Rural, Wild, Other) and habitat (Forest, Grassland, Desert, Alpine, Beach, Anthropogenic, Other) to focus on when deploying camera traps.*
- 2. Between 10 and 40 camera traps will be deployed across 10 to 40 locations matching the selected setting-habitat combination. The location, start date, end date, and camera make and model for each deployment must be recorded. *Minimum of 10 cameras with preference for 15+*
- 3. Cameras should be placed so that they are 50 cm off the ground and with regular orientation.*
- 4. The deployed cameras must be at least 200 meters away from other cameras (but no farther than 5 kilometers).*
- 5. No food bait or scent lure will be used.*
- 6. While cameras can be placed on trails or logging roads, this must be indicated by the collaborator.*
- 7. Once field work is complete, the collaborator will upload images and metadata to Wildlife Insights. Our intent is to have all data uploaded by December 1st and a final report to participants shortly after that time. We encourage collaborators to identify their favorite pictures, so that we can highlight these in this collection.*

Due to a high failure rate of cameras in 2020, new Bushnell Trophy Trail Cameras (20 MP) cameras were bought for the 2021 season and they remained in use in 2022 and 2023.

Some cameras had to be positioned slightly away from selected grid locations due to a lack of available trees or posts for mounting; because vegetation that was too dense; or to avoid

pedestrian or vehicular traffic (Figure 1). Seven of the cameras were aimed into woodland, and five away from the woodland edge into grassland (Figure 1).

In 2022, cameras were deployed in the morning on September 9th and collected in the morning on November 3rd and 4th. Ten of the twelve cameras successfully operated throughout the 54-day study, with one (deployment 12) failing on or shortly after 29th September when the battery died due to the overabundance of pictures taken of moving grass, and another camera (deployment 8) went missing.

In 2023, the cameras were deployed on September 13th and retrieved on November 6th. All eleven cameras deployed in 2023 worked throughout the survey period.



Figure 1. Labeled deployment locations for camera traps (in yellow) within study site (in red)

Photos were uploaded and identified using the Wildlife Insights online system during November 2022 through December 2022, and December 2023 through January 2024. The Wildlife Insights system groups photos into sequences based on time-stamps. The majority of sequences are of bursts of three photos, but if animals stayed in front of the camera for a minute or more, sequences of six or more photos were sometimes obtained.

The data analysis included in this report focuses on mammal detection patterns across seasons and within days, and a comparison of capture-rates between 2021, 2022, and 2023. Plots of detection patterns were produced in RStudio¹, with nighttime hours shaded gray, and daytime in white. Sunrise and sunset times for each day were calculated using the R package `suncalc`². The R code for producing these charts can be found at <https://github.com/AndyWilson-GettysburgCollege/SnapshotUSA>. Each symbol on the charts represents one sequence of photos of that species at the respective date and time. These charts were only produced for the six most commonly detected mammals.

Comparisons of capture rates for 2021, 2022, and 2023 were restricted to deployments and dates that were operational in both years. The data was filtered to include eight total deployments: #1, #2, #3, #4, #5, #7, #9, and #10. Since deployment #8 went missing in 2022, deployment #12 failed midway through the study period in 2022, and deployment #6 failed midway through the study period in 2021, these cameras were excluded from the analysis. Comparisons were made from September 14th until November 1st for a total of 49 study days. These comparisons are made only for the five most commonly detected mammals.

Results

We obtained photos of 10 identifiable species of wild mammals in both 2022 (Table 1) and 2023, this excluding feral cats and mice that were not identified to species (Table 2). In all, 1,980 photo sequences of wild mammals were captured in 2022 and 3,287 in 2023.

Deployment #1 captured the most sequences in both years. Eastern Gray Squirrel was by far the most abundant species, accounting for approximately 50% of all mammals in 2022 and 58% in 2023. White-tailed Deer was the second most captured mammal, with 446 sequences, in 2022, and 703 sequences in 2023, accounted for 22% of sequences in both years.

Table 1. Total number of photo sequences of mammals for each camera deployment in 2022

	Camera Deployment											
Common Name	1	2	3	4	5	6	7	8	10	11	12	Total
Coyote									2			2
Eastern Chipmunk	365	3					3				3	374
Eastern Cottontail		4					10					14
Eastern Gray Squirrel	420	165		132			257	1	7		18	1000
Mouse Species	5											5
Northern Raccoon	65	4					3	12	6			90
Red Fox	9	3			3	3		6	4		1	29
Striped Skunk							2					2
Virginia Opossum	3						8					11
White-tailed Deer	31	27	31	27	23	11	23	133	111	29	6	452
Woodchuck	1											1
Total	899	206	31	159	26	14	306	152	130	29	28	1980

Table 2. Total number of photo sequences of mammals for each camera deployment in 2023

	Camera Deployment											
Common Name	1	2	3	4	5	6	7	8	10	11	12	Total
American Mink	3										1	4
Coyote						1		3				4
Eastern Chipmunk	388	3		3			4				9	407
Eastern Cottontail	1					9	3					13
Eastern Gray Squirrel	278	375	123	212	195	377	288	21	13		36	1918
Mouse Species	1											1
Northern Raccoon	17	74	1		7	27	4	7	1			138
Red Fox	8	4			10	27	5	4	6	12	5	81
Striped Skunk						1						1
Virginia Opossum	9	2			2	2	2					17
White-tailed Deer	38	115	9	42	56	53	63	202	31	44	50	703
Total	743	573	133	257	270	497	369	237	51	56	101	3287

Detection Patterns

Charts showing photo sequences across days (x-axis), and within days (y-axis; Figure 2-7), clearly show the strictly diurnal behavior of Eastern Gray Squirrel and Eastern Chipmunk; the nocturnal activity of Virginia Opossum and Northern Raccoon; and the mixed nocturnal and diurnal activity of the Red Fox; and the heightened activity during dusk, night, and dawn of the White-tailed Deer. Sequences of Eastern Gray Squirrel show a peak during late October and Eastern Chipmunks during late September and early October, likely coinciding with the peak tree mast season within the study area.

Overall, the frequency of detections of Eastern Chipmunks, Eastern Gray Squirrels, Red Foxes, and Virginia Opossums increased in 2023 compared to 2022 (Figures 2, 3, 5, and 6). Furthermore, the number of image sequences also indicates a slight increase in White-tailed Deer activities during the night in 2023 compared to 2022 (Figure 7). Conversely, the Northern Raccoon exhibited little change in detections (Figure 4).

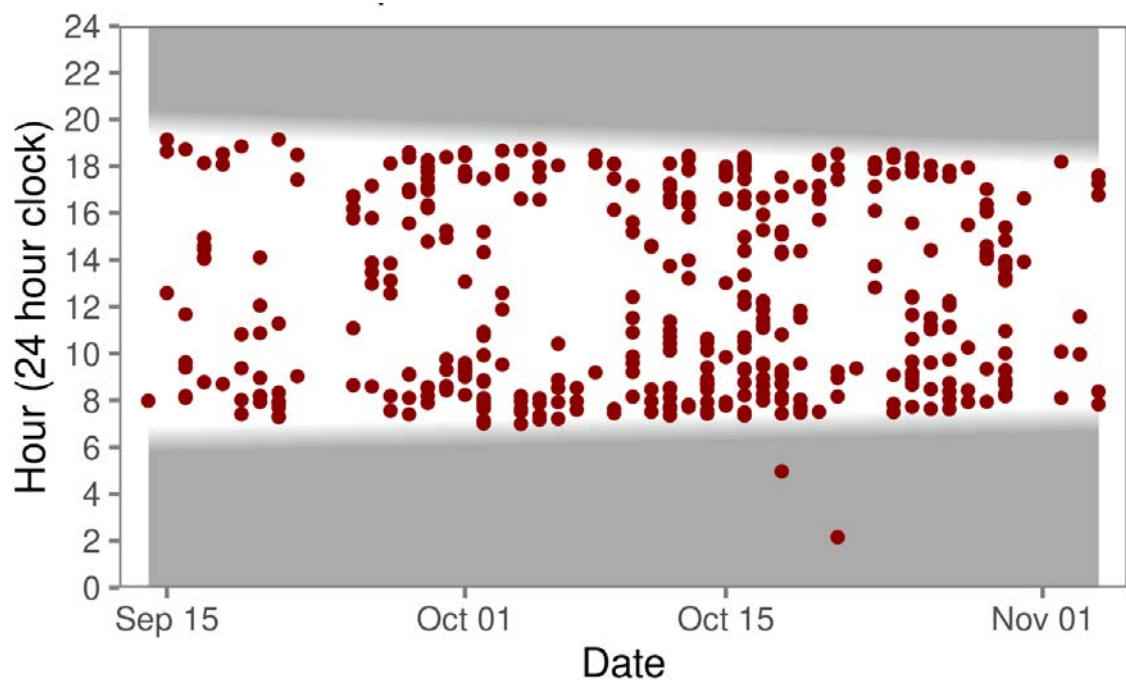
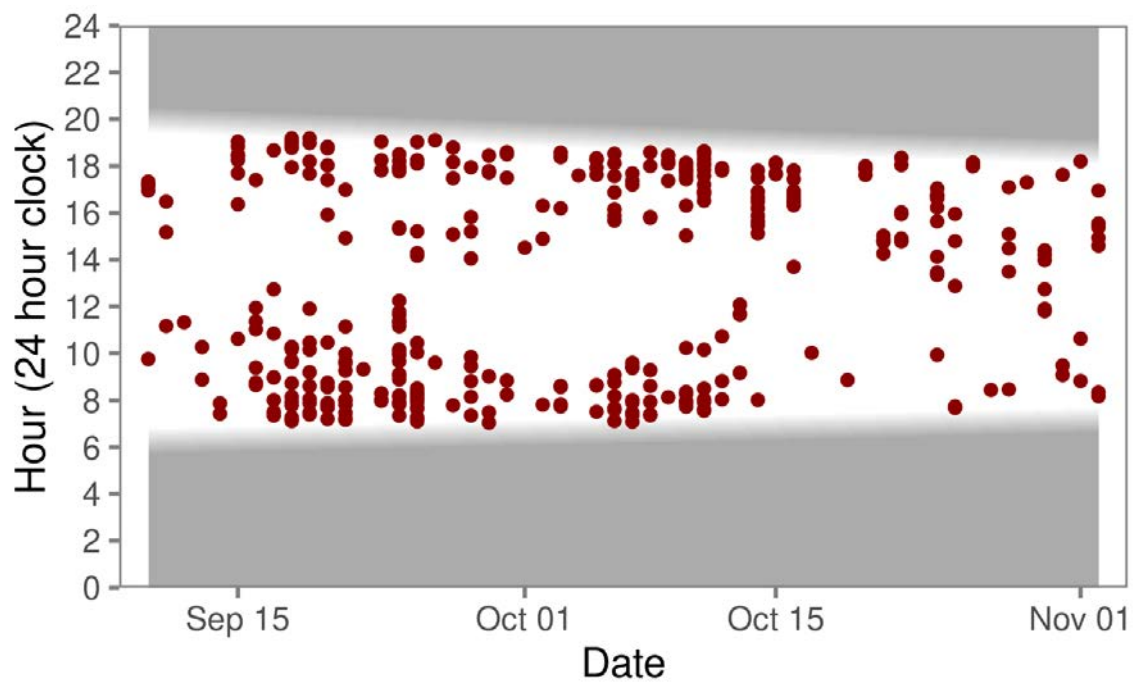


Figure 2. Detection pattern for the Eastern Chipmunk in 2022 (top) and 2023 (bottom)

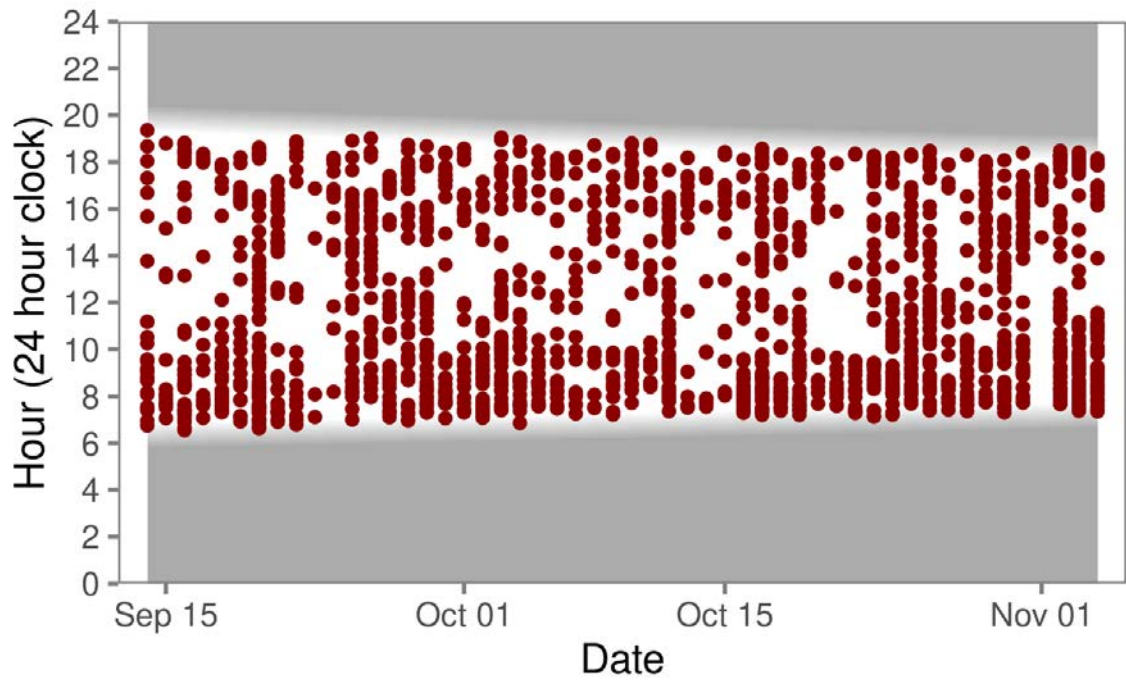
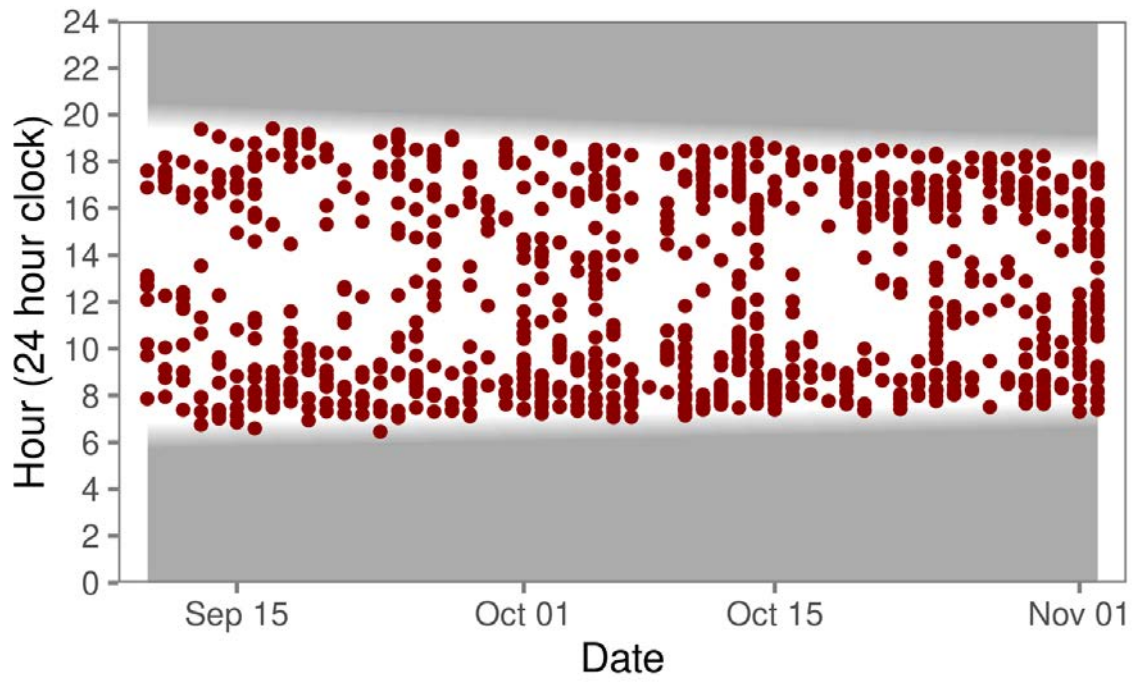


Figure 3. Detection pattern for the Eastern Gray Squirrel in 2022 (top) and 2023 (bottom)

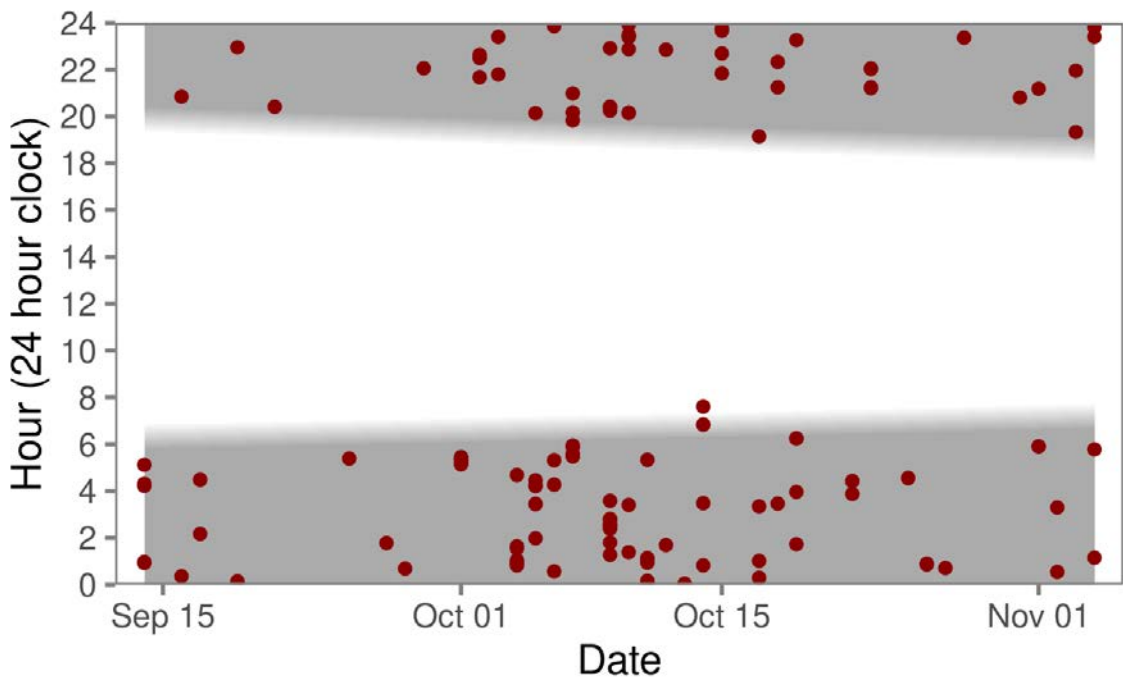
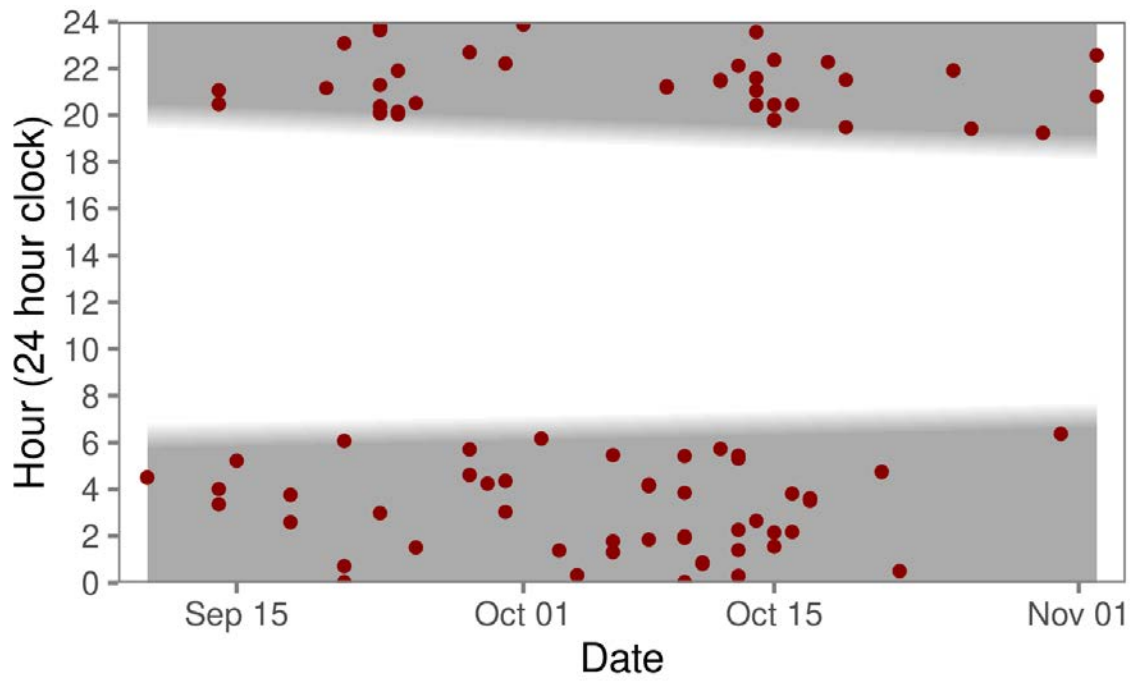


Figure 4. Detection pattern for the Northern Raccoon in 2022 (top) and 2023 (bottom)

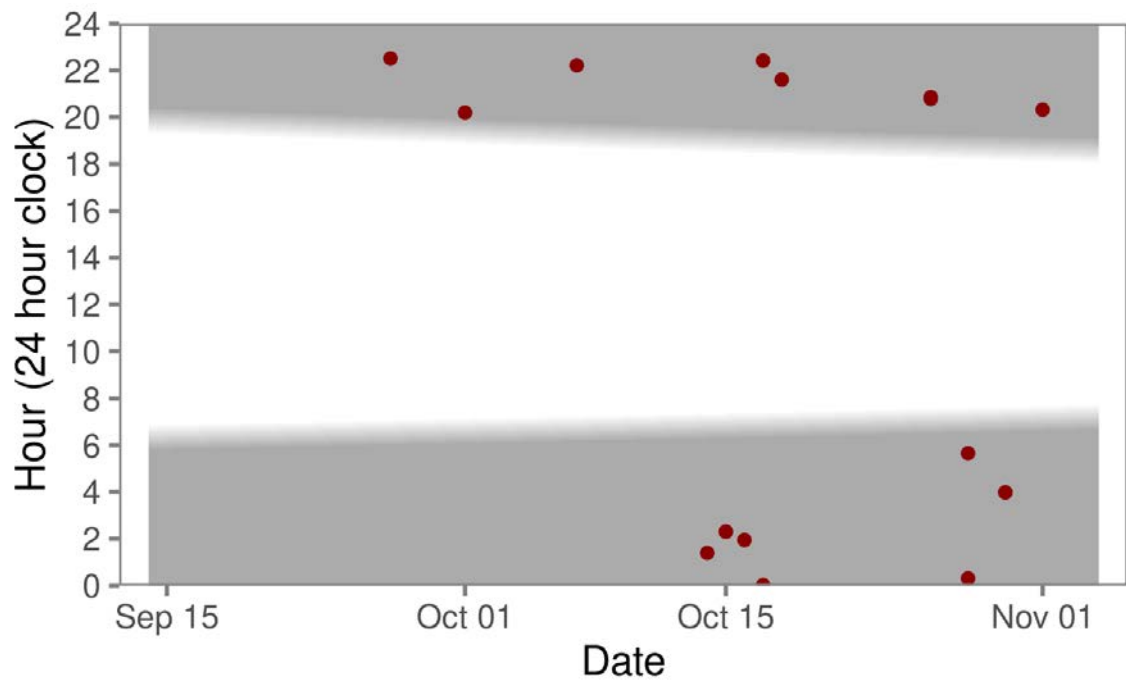
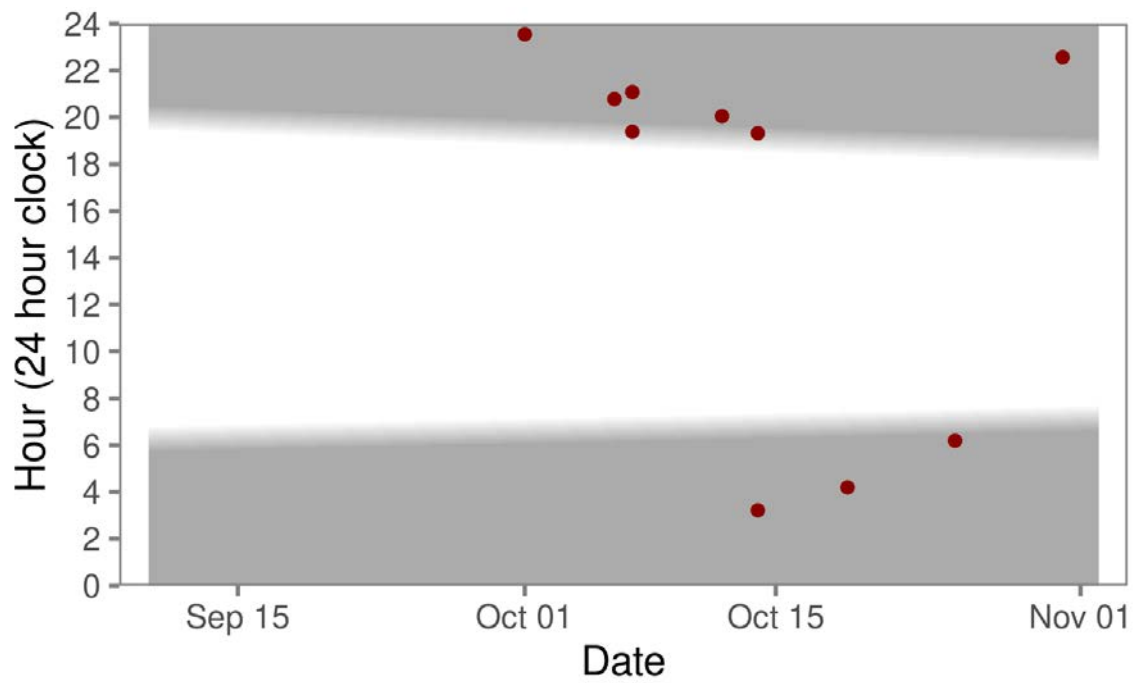


Figure 6. Detection pattern for the Virginia Opossum in 2022 (top) and 2023 (bottom)

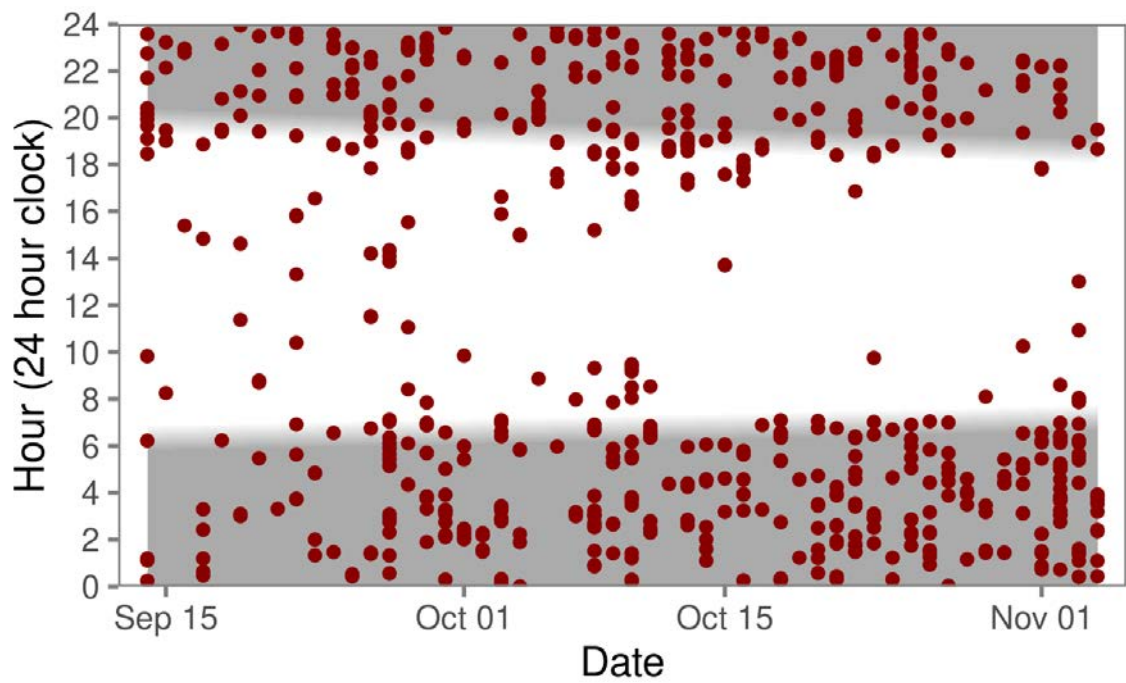
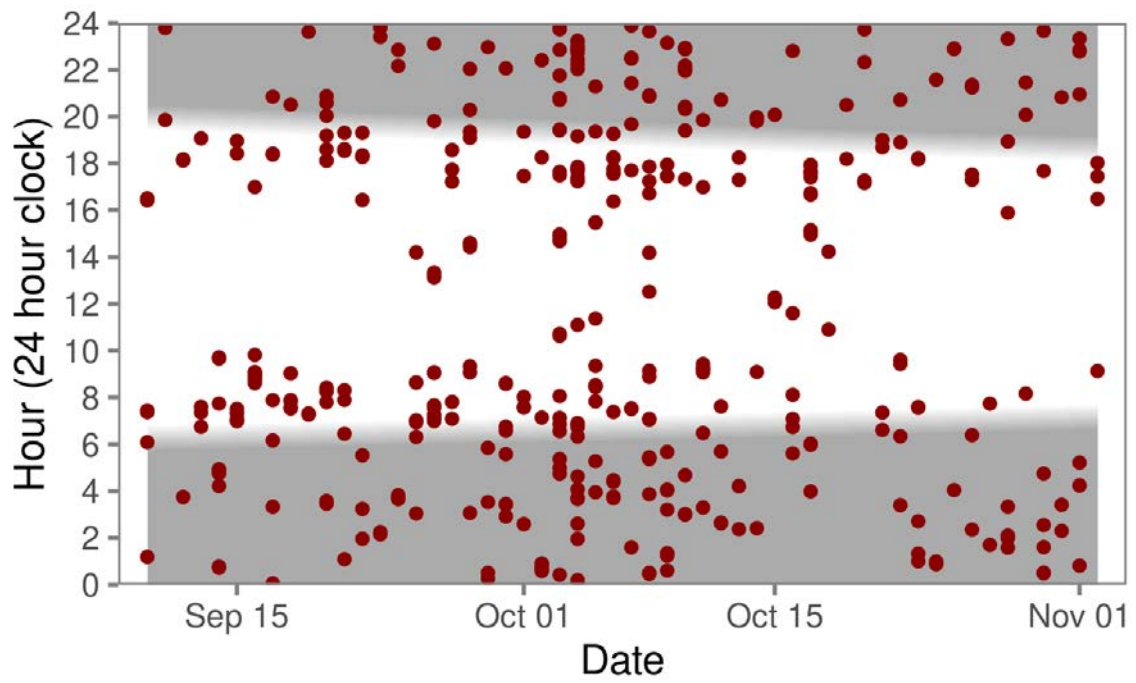


Figure 7. Detection pattern for the White-tailed Deer in 2022 (top) and 2023 (bottom)

Detection rates in 2021, 2022 and 2023

Across the camera-days for deployments that were operational from 2021 to 2023, three of the five most numerous species showed an overall increase in capture rates (Figure 8). The exceptions was the Red Fox, having more detections in 2023 than 2022 but fewer than in 2021.

Specifically, Eastern Chipmunks had a significant increase in 2022 compared to 2021, and a slight increase in 2023 compared to 2022 (Figure 8). Eastern Gray Squirrel witnessed a slight decrease in 2022 compared to 2021, but a dramatic rise in 2023 (Figure 8). Both the Northern Raccoon and Red Fox experienced a slight decrease in detections in 2022, followed by a subsequent rise in 2023 (Figure 8).

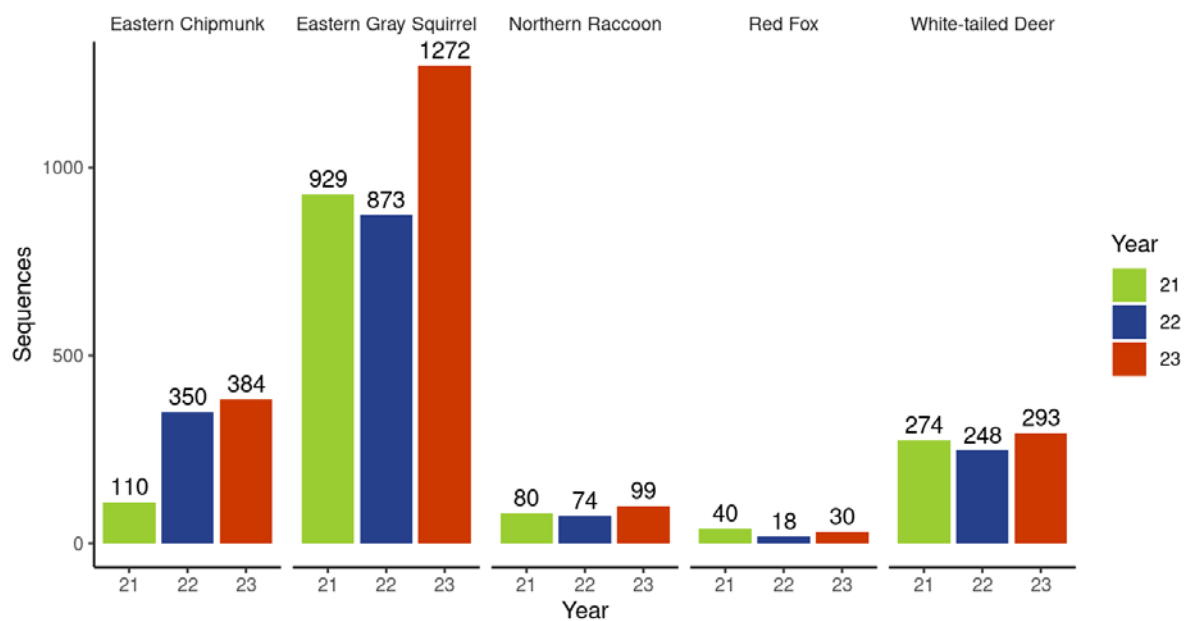


Figure 8. Comparison of total detections/sequences captured between the years 2021-2023 across the same time period.

Discussion

Detections of the most common species of mammal have either increased or remained stable in the Culp's Hill area in 2021 to 2023. Of course, this is a short time-period with which to assess population trends, so we look forward to continuing this project in future years. We believe that a long-term project within Gettysburg National Military Park is imperative to contribute to a holistic understanding of wildlife diversity not only in this ecoregion but also the contiguous United States. Therefore, we will be able to analyze the proportion of changing species abundances over time to help future conservation efforts.

The large increases of both Eastern Chipmunks and Eastern Gray Squirrel throughout the project endurance of three years is probably due to the abundance in northern red oak *Quercus rubra* acorns in the region in 2023⁴.

Acknowledgments

We thank Chris Davis and Dafna Reiner of the National Park Service for assistance in establishing the project and obtaining permits, and the staff of eMammal for providing considerable guidance and training. Funding for the Gettysburg study was entirely by Gettysburg College.

Literature Cited

1. Cove, M. V., et al. 2021. SNAPSHOT USA 2019: a coordinated national camera trap survey of the United States. *Ecology* 102(6):e03353. 10.1002/ecy.3353
2. Kays, R., et al. 2022. "SNAPSHOT USA 2020: A Second Coordinated National Camera Trap Survey of the United States during the COVID-19 Pandemic. *Ecology* 103(10): e3775. <https://doi.org/10.1002/ecy.3775>
3. Rooney, M. et al. SNAPSHOT USA 2021: A third coordinated national camera trap survey of the United States. Submitted to *Ecology*
4. Reed, R. 2023 "Forest Fridays: A Bumper Crop of Red Oak Acorns". <https://paparksandforests.org/forest-fridays-a-bumper-crop-of-red-oak-acorns/>