Methods for Monitoring the Movement of Wildlife Through Concrete Barrier Gaps

April 2026
Final Report

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16. Abstract

This study evaluated the effectiveness of scupper-modified Jersey barriers in facilitating small wildlife movement across a newly constructed segment of Interstate 49 in southwestern Missouri. Traditional concrete median barriers can reduce wildlife-vehicle collisions through fewer crossing attempts but create impermeable barriers for small-bodied species, fragmenting habitats and limiting connectivity. To address this, the Missouri Department of Transportation installed wildlife median barriers featuring scupper openings designed to allow passage for amphibians, reptiles, and small mammals. The research employed a multi-method approach, including road mortality surveys, camera monitoring within scuppers, roadside and culvert camera studies, coverboard surveys, and environmental DNA (eDNA) sampling.

Results indicate that scuppers are used by a variety of species; rodents were the most frequent users documented by cameras, while eDNA revealed a broader biodiversity signal, detecting amphibians, reptiles, and small mammals not observed visually. Amphibian and reptile roadkill patterns were strongly influenced by precipitation and temperature, with amphibian mortality peaking during rainfall events and reptile mortality concentrated in warmer months. Comparative analysis showed eDNA consistently detected more species than cameras, underscoring its value for identifying cryptic or nocturnal taxa. However, detection of eDNA at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Overall, scuppers in wildlife median barriers represent a cost-effective and promising mitigation strategy to provide small animal permeability between fragmented habitats bisected by roads, especially for small mammals. The use and effectiveness of scuppers for amphibians and reptiles requires further studies that validate their presence at scuppers. Combining structural innovations with controlled studies and integrated monitoring approaches inform future highway design standards and improve ecological connectivity.

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Disclaimer

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Abstract

This study evaluated the effectiveness of scupper-modified Jersey barriers in facilitating small wildlife movement across a newly constructed segment of Interstate 49 in southwestern Missouri. Traditional concrete median barriers reduce wildlife-vehicle collisions but create impermeable barriers for small-bodied species, fragmenting habitats and limiting connectivity. To address this, the Missouri Department of Transportation installed wildlife median barriers featuring scupper openings designed to allow passage for amphibians, reptiles, and small mammals. The research employed a multi-method approach, including road mortality surveys, camera monitoring within scuppers, roadside and culvert camera studies, coverboard surveys, and environmental DNA (eDNA) sampling.

Results indicate that scuppers are used by a variety of species; rodents were the most frequent users documented by cameras, while eDNA revealed a broader biodiversity signal, detecting amphibians, reptiles, and small mammals not observed visually. Amphibian and reptile roadkill patterns were strongly influenced by precipitation and temperature, with amphibian mortality peaking during rainfall events and reptile mortality concentrated in warmer months. Comparative analysis showed eDNA consistently detected more species than cameras, underscoring its value for identifying cryptic or nocturnal taxa.

Overall, wildlife median barriers represent a cost-effective and promising mitigation strategy to reduce habitat fragmentation and mortality risk for small wildlife. Combining structural innovations with integrated monitoring approaches can improve ecological connectivity and inform future highway design standards.

Executive Summary

The Missouri Department of Transportation (MoDOT) implemented an innovative design to address the barrier effect of traditional concrete Jersey barriers on small-bodied wildlife. While these barriers significantly reduce cross-median collisions and improve traffic safety, they create impermeable obstacles that fragment habitats and restrict movement for amphibians, reptiles, and small mammals. To mitigate these impacts, MoDOT installed wildlife median barriers featuring modified scupper openings at the base of the barriers to allow passage. This study evaluated the effectiveness of wildlife median barriers along a 4.66-mile segment of Interstate 49 in McDonald County, Missouri (Study Area) and developed monitoring strategies to assess wildlife use.

The research employed a multi-method approach, including road mortality surveys, camera monitoring within scuppers, roadside and culvert camera studies, coverboard surveys, and environmental DNA (eDNA) sampling. Results indicate that scuppers are used by a variety of species. Cameras documented frequent use by rodents, occasional armadillos, and rare amphibians and reptiles, while eDNA revealed a broader biodiversity signal, detecting amphibians, reptiles, and small mammals not observed visually. Amphibian roadkill peaked during rainfall events, while reptile mortality was concentrated in warmer months, indicating seasonal movement patterns. Comparative analysis showed eDNA consistently detected more species than cameras, underscoring its value for identifying cryptic or nocturnal taxa. Cameras provided behavioral evidence of frequent crossings by high-use species.

Camera studies resulted in millions of image captures. After removing false-positive data and combining individual-specific data, this resulted in the detection of 31 species and more than 3,300 individual animals. The cumulative camera study captured 4 amphibians, 1 reptile, 5 birds, and 21 mammals. At the scuppers, four amphibians (American bullfrog [*Lithobates catesbeianus*], American toad [*Anaxyrus americanus*], general amphibian, and frog/toad), one reptile species (three-toed box turtle [*Terrapene triunguis*]), and seven mammal species (coyote [*Canis latrans*], domestic dog [*Canis familiaris*], nine-banded armadillo [*Dasypus novemcinctus*], northern raccoon [*Procyon lotor*], eastern cottontail [*Sylvilagus floridanus*], plains pocket gopher [*Geomys bursarius*], and generic rodent) were detected.

The eDNA study provided an augmented detailed snapshot of the biodiversity using scuppers and the surrounding areas along the Interstate 49 Study Area. By using multiple sets of primers, a total of 745 distinct taxa were identified from the scupper detritus, soil at the roadside near the scuppers, and water from the culverts, but only a subset were expected to have a high probability of originating from actual use of the scuppers. Species richness statistics generated for samples from the scupper detritus had higher richness than the soil samples collected near the scuppers, indicating that the scuppers are being used more for crossing by various taxa. Combined camera and scupper data indicated with a higher probability that 26 species or species groups (e.g., rodents) were detected from the scuppers.

Overall, scupper-modified barriers are a cost-effective solution to improve connectivity for small wildlife. While direct evidence of complete crossings was limited, multiple data sources confirm scupper use and their potential role in mitigating habitat fragmentation. Future projects should install scuppers at intervals based on species movement patterns, pair structural designs with integrated monitoring methods, and consider additional mitigation measures such as fencing and wildlife crossings in high-risk areas. This study demonstrates that combining innovative barrier design with advanced monitoring techniques can enhance ecological connectivity while maintaining roadway safety.

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List of Abbreviations and Acronyms

Abbreviation	Acronym
AADT	annual average daily traffic
eDNA	environmental DNA
GIS	geographic information systems
I	Interstate
mm	millimeters
MoDOT	Missouri Department of Transportation
PHD	Premium Herpetological Designs
Shannon's H	Shannon’s Diversity Index
USGS	U.S. Geological Survey
WCS	wildlife crossing structure
WMB	wildlife median barrier
WVC	wildlife-vehicle collision

Chapter 1: Introduction

1.1 Background

Traditional concrete Jersey style median barriers date back to their earliest use on the U.S. highway system in the 1930s and 1940s. This barrier prevents vehicles from crossing over into opposite directions of traffic. Nationally, multiple-vehicle opposite direction, cross-median, and head-on crash fatalities have been reduced by 92%, 93%, and 94%, respectively. Construction of concrete barriers preventing cross-median collisions in divided highway settings has no doubt reduced traffic fatalities.

However, their implementation has potentially caused an unintended negative effect on wildlife movement across the transportation system. Although little research exists on the effects of concrete median barriers, it is generally accepted that solid jersey barriers stop small animal passage on divided highways, effectively fragmenting habitat and eliminating connectivity. It has been shown that even paved roadways alone can cause a behavioral change in animal movement, reducing the likelihood small-bodied animals will cross a roadway. This aversion could protect wildlife from mortality due to traffic at moderate to high traffic volumes. However, there can also be consequences such as reduced biological diversity, changes in animal communities, and increased threat of local extirpations (Alexander and Waters 2000; Clevenger and Kociolek 2013). To combat these negative effects, the Missouri Department of Transportation (MoDOT) Environmental Section has implemented the wildlife median barrier (WMB) innovation. WMB is a modified design Jersey barrier with a small 7.5-inch × 15-inch × 24-inch opening (scupper) at the base, providing a way for small-bodied mammals, reptiles, and amphibians to cross a divided highway corridor where one did not exist previously.

Currently there is only one highway with WMBs installed: the newly constructed Interstate (I) 49 corridor (Bella Vista Bypass) in McDonald County. In five miles of new I-49 highway, there are 13 sections of installed WMBs. These are installed in groups of five with 15 feet of spacing between each scupper. By allowing small-bodied mammals, reptiles, and amphibians a passable route across the WMBs on the new I-49 corridor, MoDOT is ensuring that vulnerable wildlife do not become trapped on divided highways.

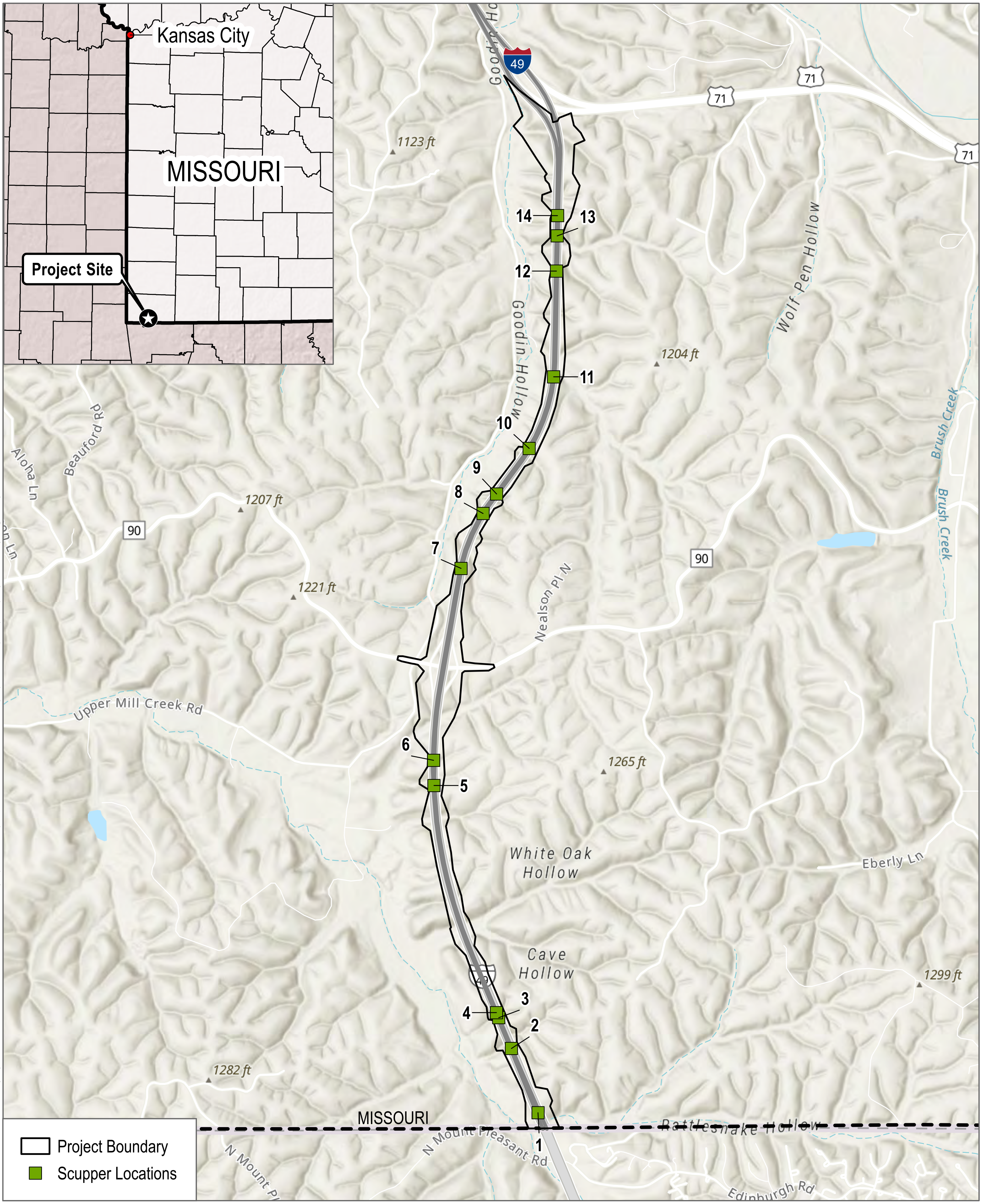
The purpose of this research project is to develop ways to monitor the movement of small animals through the WMBs. This determination will show whether the WMBs are or are not working. If successful, this practice can be implemented on other projects across Missouri. The research team was also directed to develop ways to monitor the sites because video cameras are subject to damage or being stolen if they are located in obvious locations.

1.2 Study Area

The Study Area includes an approximately 4.66-mile segment of the recently constructed I-49 connector that extends the existing I-49 corridor south to the Arkansas state line (Figure 1 and Figure 2A-J). Construction of the segment began in May 2020, and it was opened in September 2021. The Study Area appears on the Noel, Missouri, U.S. Geological Survey (USGS) 7.5-minute topographic map (Sections 10, 15, 21, 22, 27, 28, 33, and 34 in Township 21N, Range 32W) from coordinates 36.568603, −94.385809 to 36.475559, −94.377387, in McDonald County, Missouri. Existing water bodies that are bisected or otherwise occur near or adjacent to the Study Area include Goodin Hollow Creek and tributaries, White Oak Hollow Creek, Mill Creek tributaries, and Rattlesnake Hollow Creek.

I-49 within this segment includes a four-lane interstate within a new alignment. In addition, the project included construction of a standard diamond interchange at Missouri Route (MO) 90 with a bridge at I-49; grading, including cut, fills, and blasting; median barrier construction; reinforced concrete box and pipe culvert construction for hydraulic conveyance of stream flows under I-49; and energy dissipaters at the outlets of the box culverts (MoDOT 2019).

Prior to construction, the alignment was primarily a mix of Ozark-Ouachita woodlands and forests with intermixed pasturelands and herbaceous land covers (Figure 3). These same land covers occur in generally the same configuration, with the exception of the highway extension development footprint. Figure 4 depicts wetland resources as provided by the National Wetland Inventory, National Hydrologic Dataset, and McDonald County Stream Dataset. As shown on Figure 4, there are a number of streams that crossed the alignment and are now channelized within culverts. Additionally, several ponded or water detention areas occur within 0.5 miles of the alignment, with a few that historically occurred within the highway footprint. Some of these were known to support breeding amphibians.



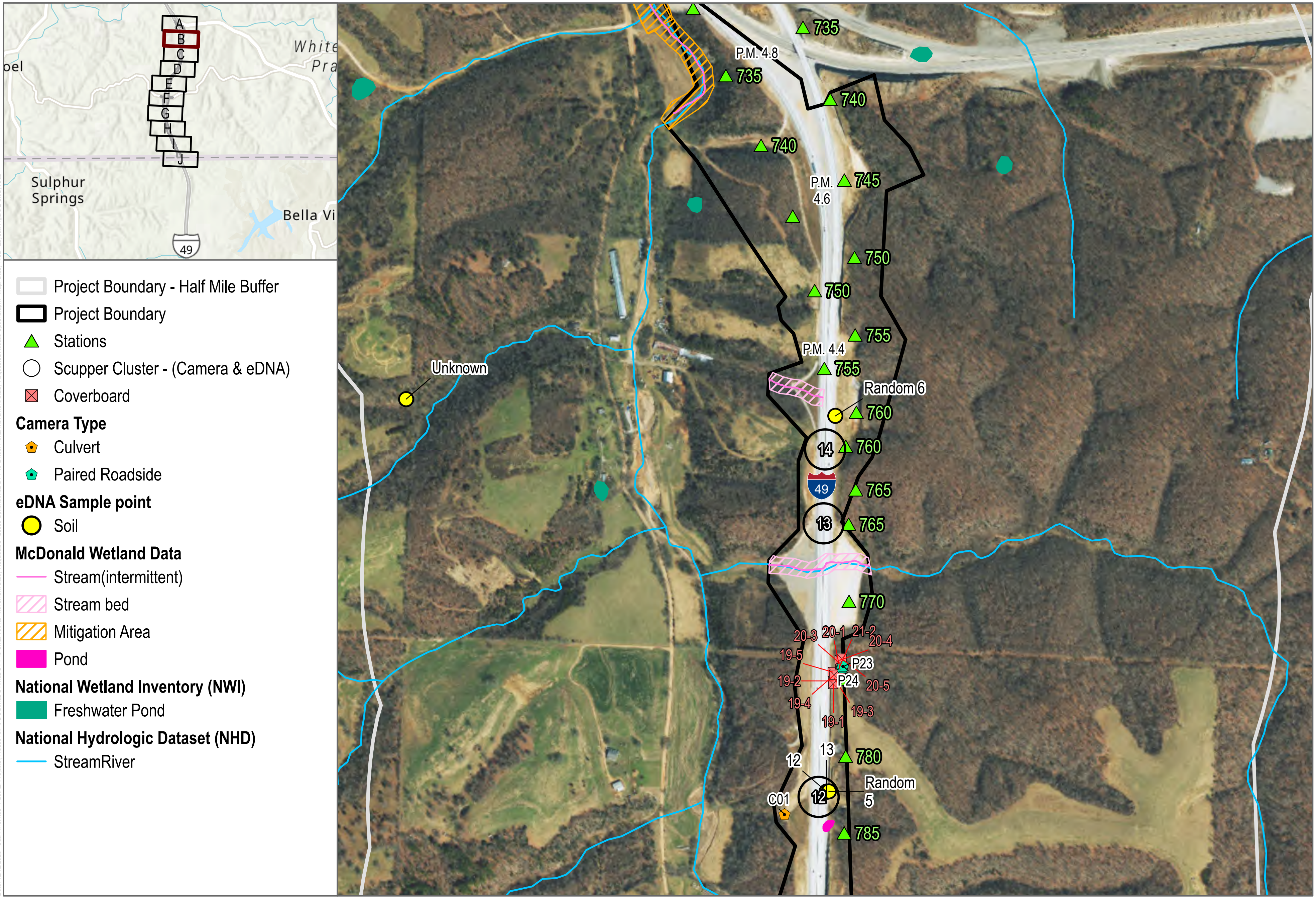
SOURCE: USGS National Map 2025

DUDEK

FIGURE 1

Project Location

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

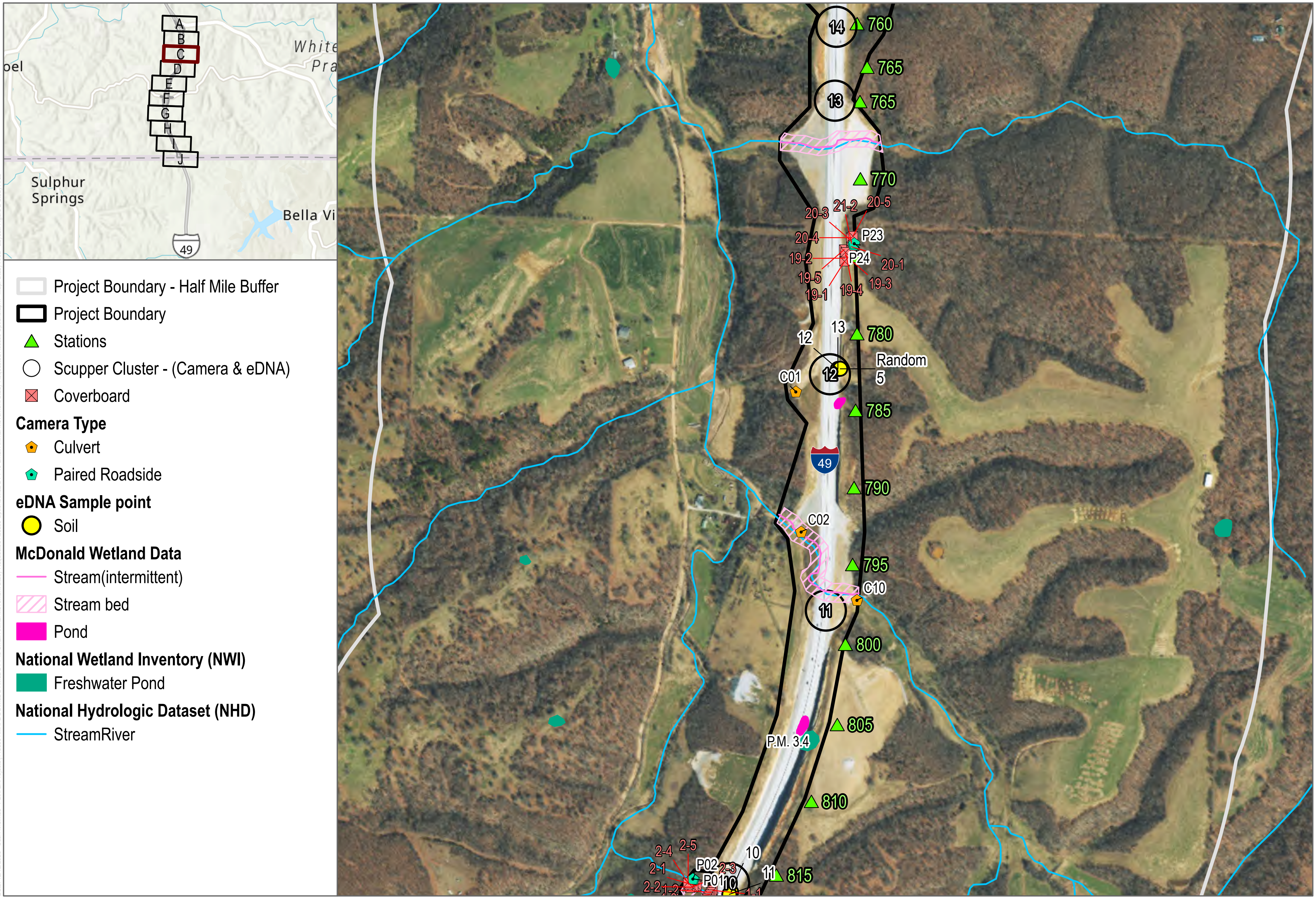
DUDEK

0 412.5 825 Feet

FIGURE 2B

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

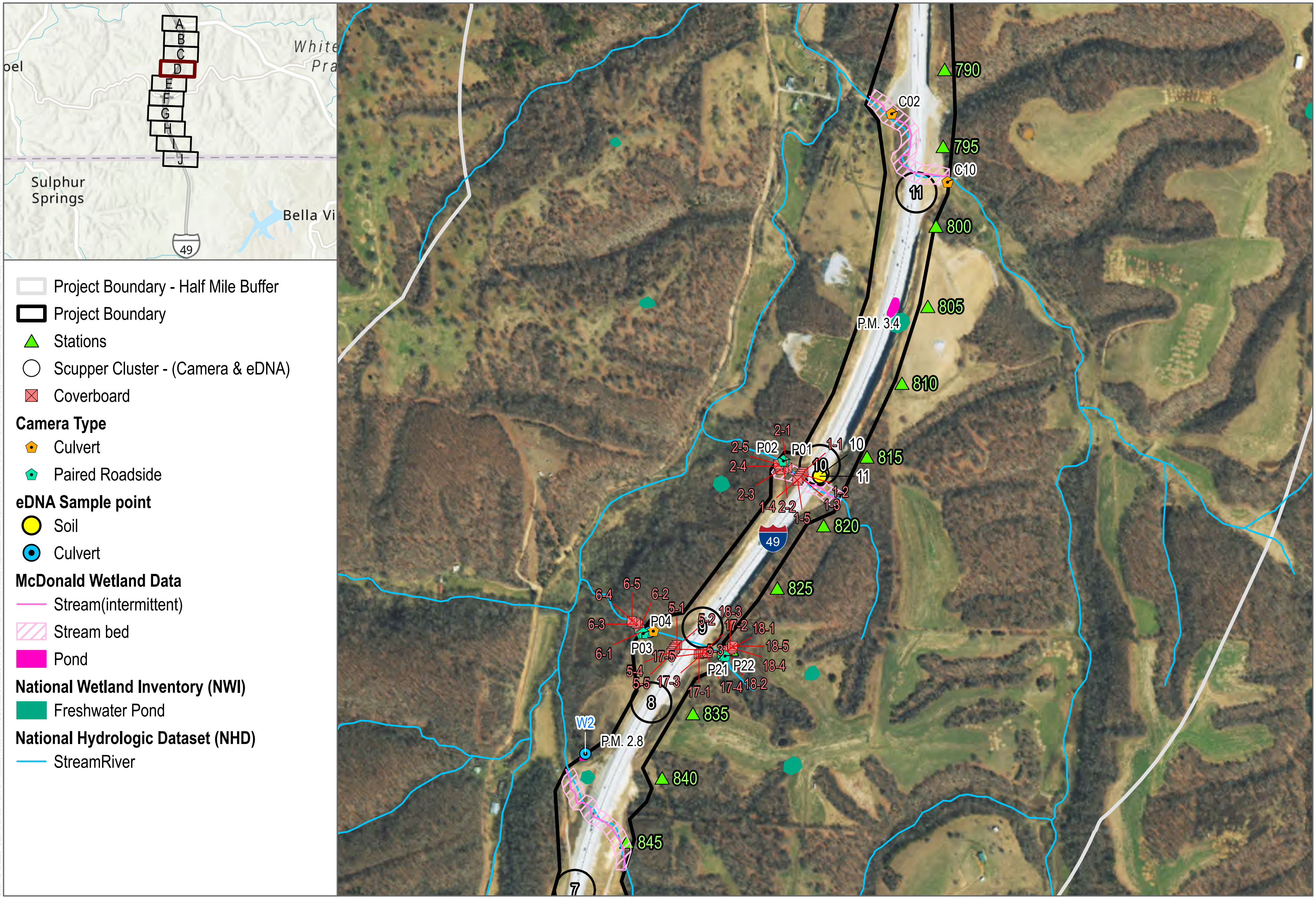
DUDEK

0 412.5 825 Feet

FIGURE 2C

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

DUDEK

0 412.5 825 Feet

FIGURE 2D

Study Area

MoDOT I-49 Small Animal Movement Study

SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

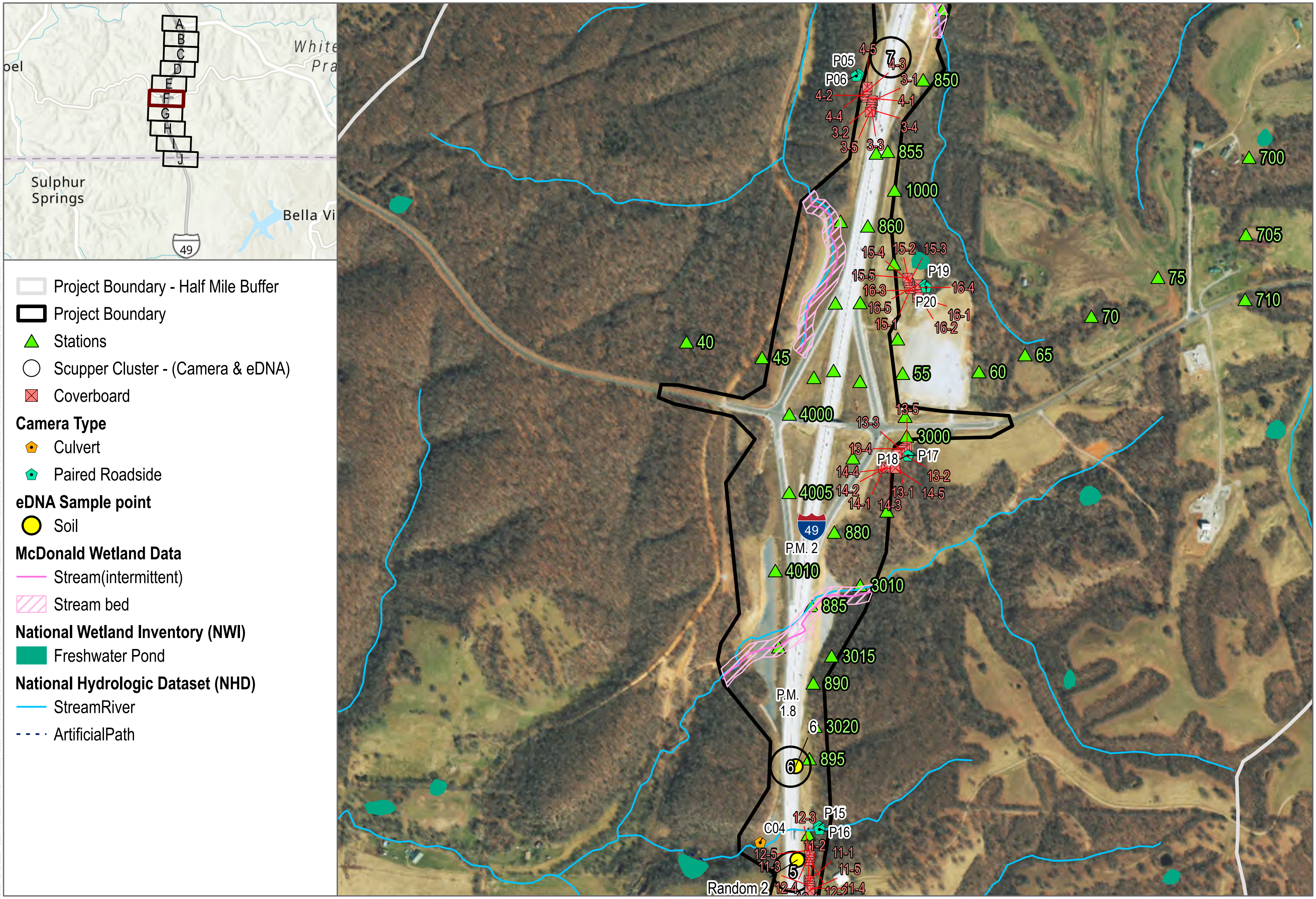
DUDEK

0 412.5 825 Feet

FIGURE 2E

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

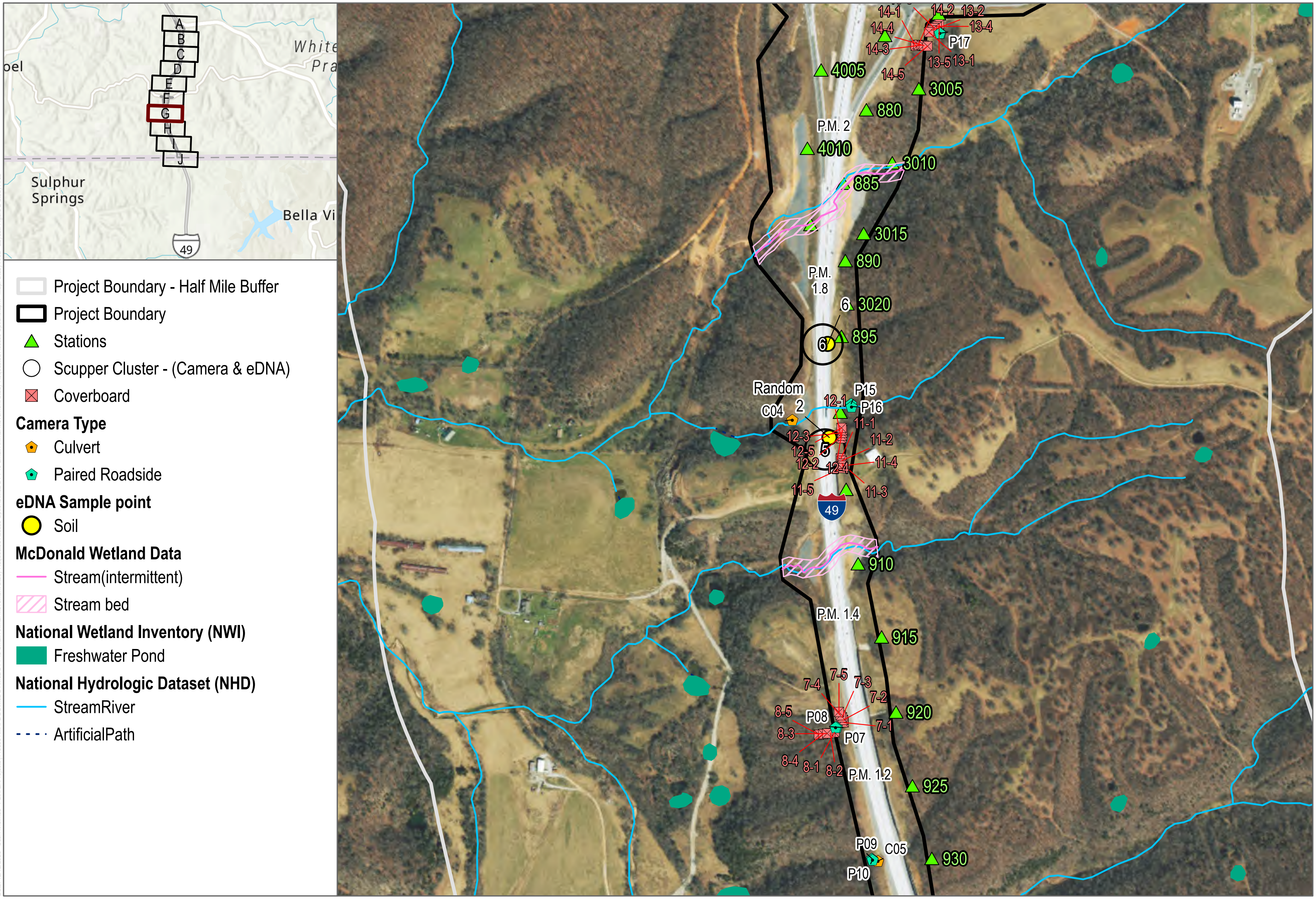
DUDEK

0 412.5 825 Feet

FIGURE 2F

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

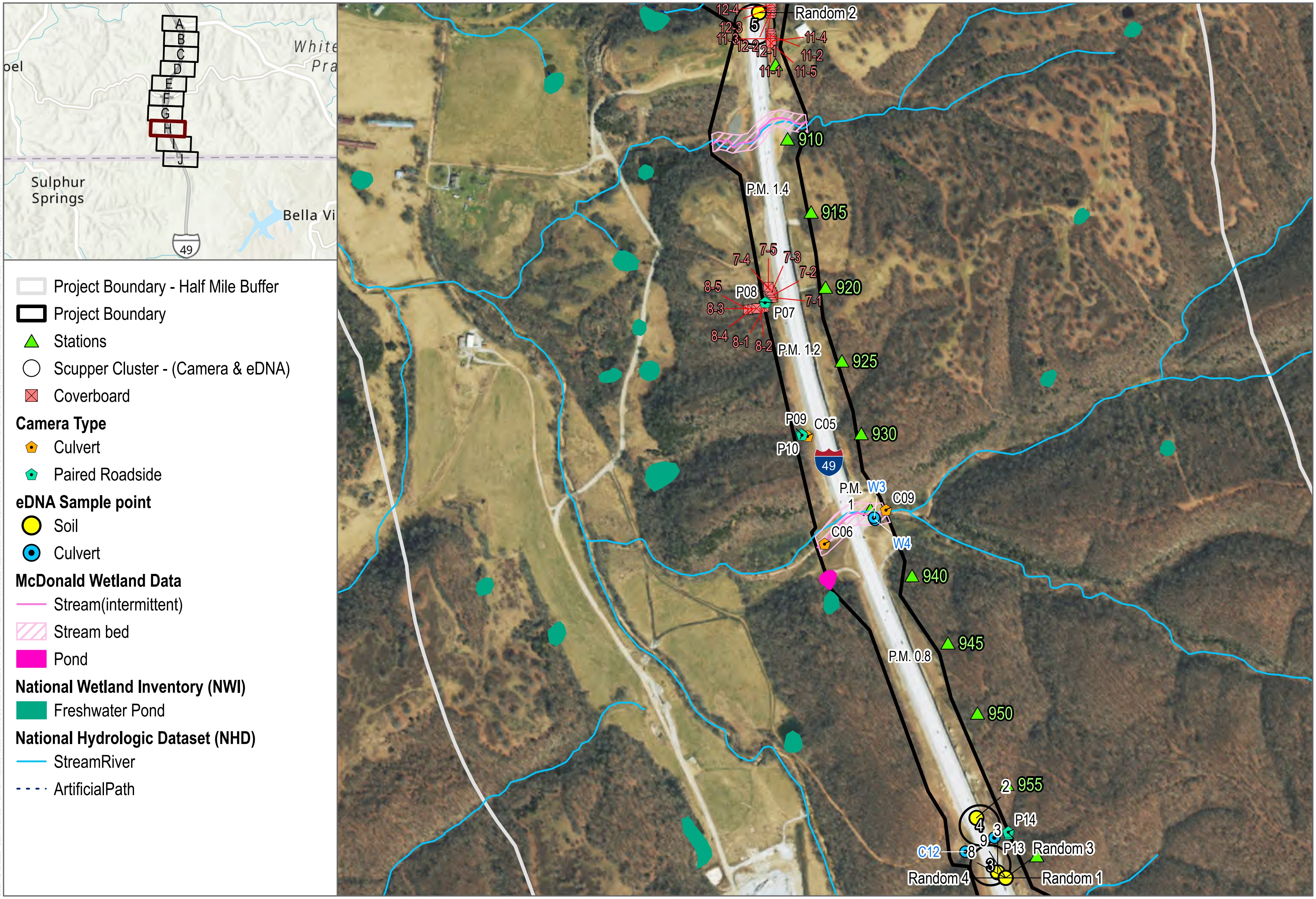
DUDEK

0 412.5 825 Feet

FIGURE 2G

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

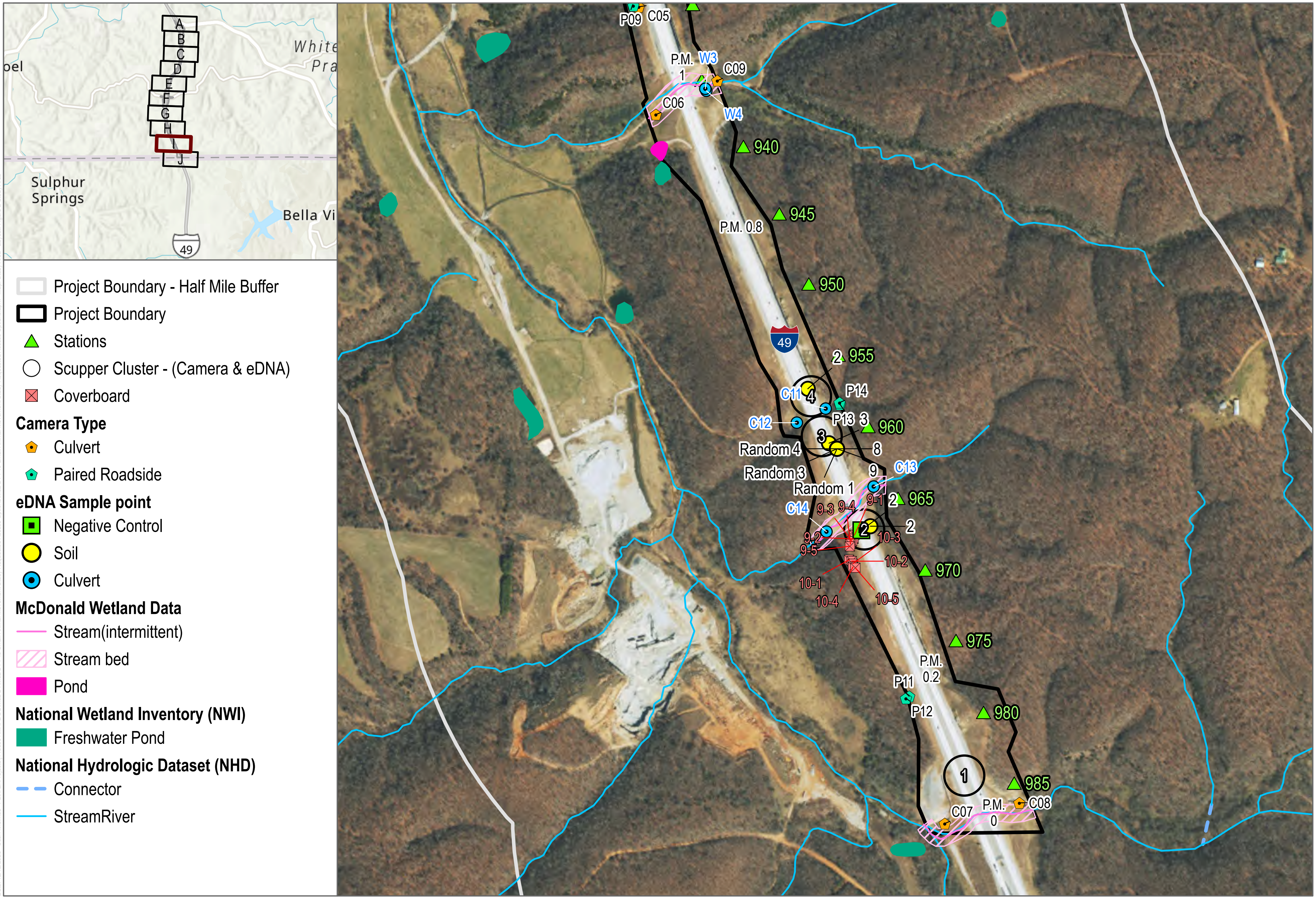
DUDEK

0 412.5 825 Feet

FIGURE 2H

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

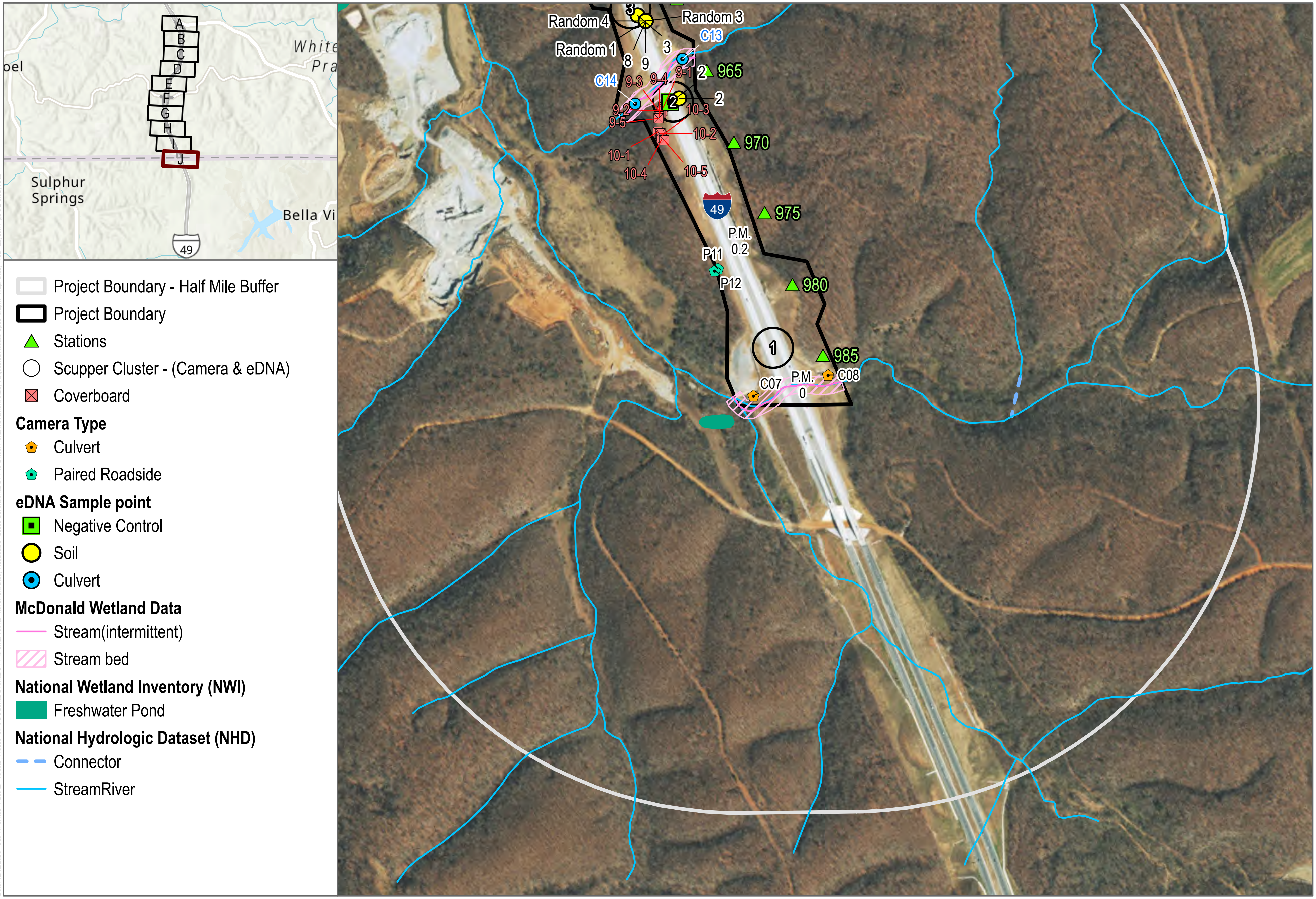
DUDEK

0 412.5 825 Feet

FIGURE 2I

Study Area

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

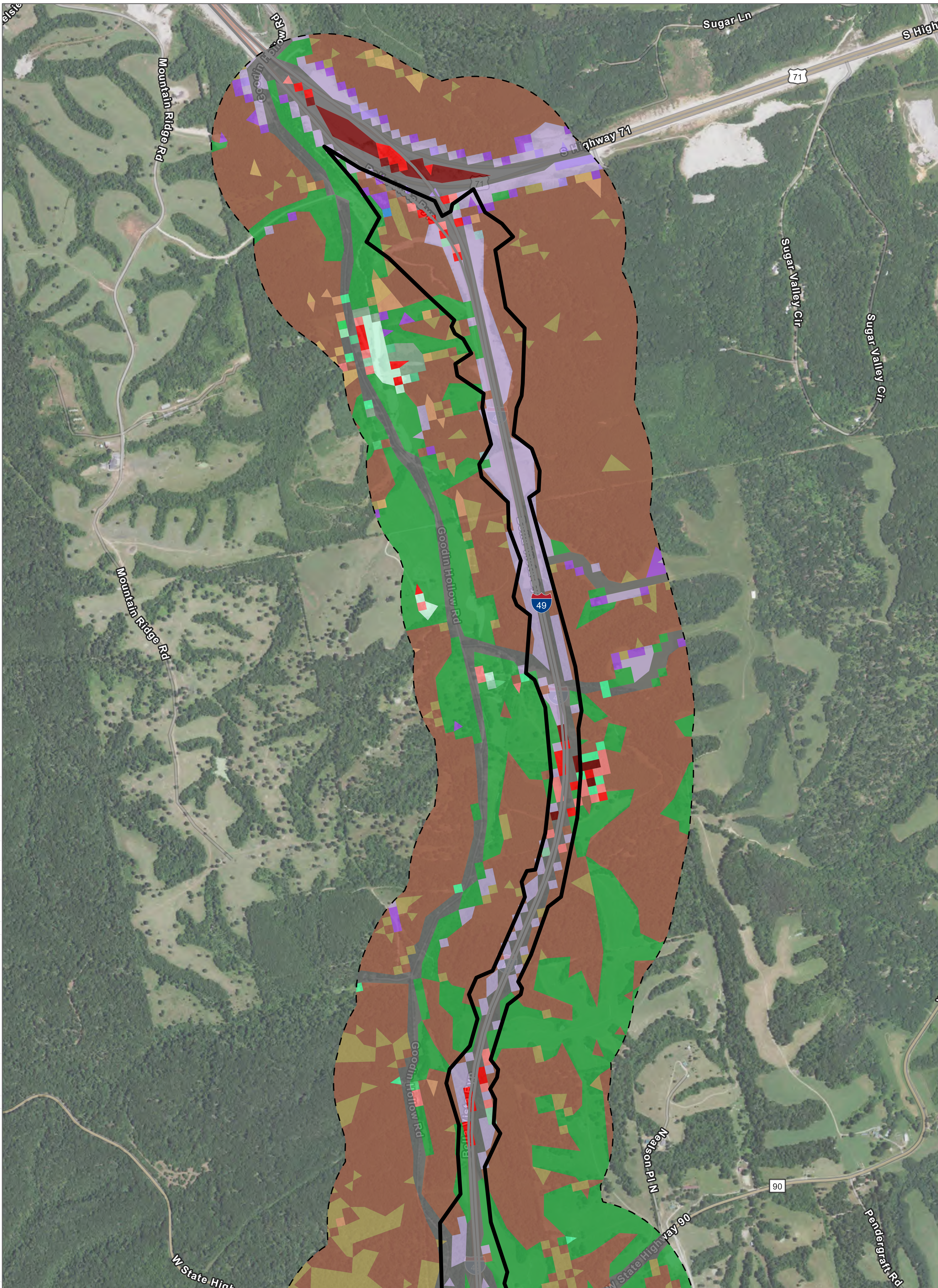
DUDEK

0 412.5 825 Feet

FIGURE 2J

Study Area

MoDOT I-49 Small Animal Movement Study



Project Boundary

Land Cover

- Central Interior Highlands Calcareous Glade and Barrens Herbaceous
- Central Interior Highlands Calcareous Glade and Barrens Woodland
- Developed-High Intensity
- Developed-Low Intensity
- Developed-Medium Intensity
- Developed-Roads
- Eastern Cool Temperate Developed Deciduous Forest
- Eastern Cool Temperate Developed Evergreen Forest
- Eastern Cool Temperate Developed Herbaceous
- Eastern Cool Temperate Developed Mixed Forest
- Eastern Cool Temperate Pasture and Hayland
- Eastern Cool Temperate Urban Deciduous Forest
- Eastern Cool Temperate Urban Evergreen Forest
- Eastern Cool Temperate Urban Herbaceous
- Eastern Cool Temperate Urban Mixed Forest
- Northern & Central Native Ruderal Forest
- Northern & Central Ruderal Meadow
- Northern & Central Ruderal Shrubland
- Ozark-Ouachita Dry Oak Woodland
- Ozark-Ouachita Dry-Mesic Oak Forest
- Ozark-Ouachita Oak Forest and Woodland
- Ozark-Ouachita Shortleaf Pine Forest and Woodland

SOURCE: Landfire, 2024; Missouri DOT, State of Missouri; NAIP

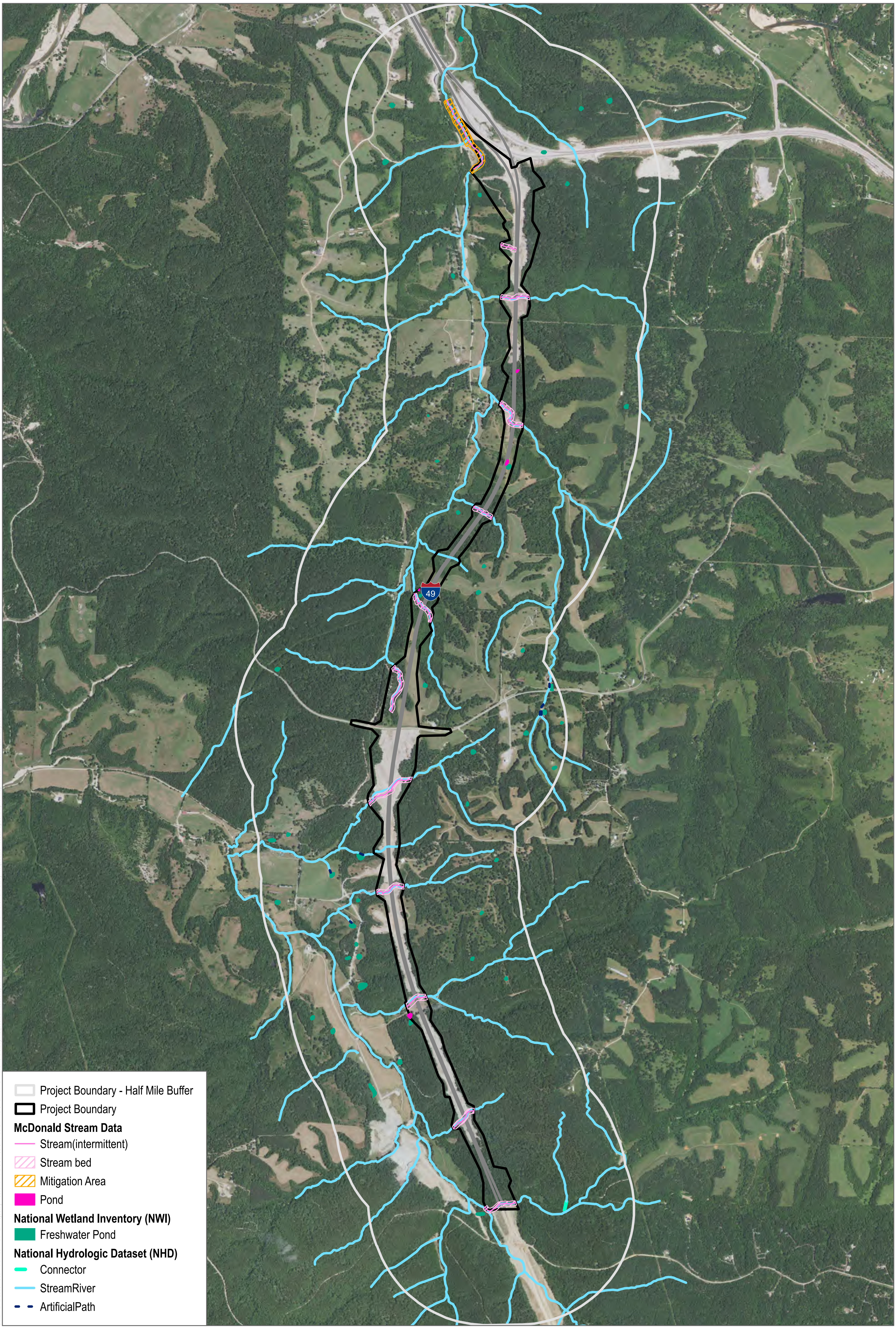
DUDEK

0 500 1,000 Feet

FIGURE 3-1

Land Cover

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; NAIP, 2020; NAIP, 2020; Missouri DOT, State of Missouri

FIGURE 4

Wetland Resources

MoDOT I-49 Small Animal Movement Study

DUDEK

0 950 1,900 Feet

1.3 Issue Description

A median barrier refers to the physical or vegetated space separating opposing lanes of traffic, which varies in width and structure. Common types include solid concrete barriers, cable barriers, metal beam guardrails, vegetated medians, and, in some cases, no barrier at all. Medians are primarily implemented as road safety measures on large highway systems.

Despite the recognized need to understand how median barriers affect wildlife and habitat connectivity (Transportation Research Board 2002), there are still no official guidelines from the American Association of State Highway and Transportation Officials (Clevenger and Kociolek 2013). Furthermore, since Clevenger and Kociolek's review in 2013, no additional meta-analyses have been published to synthesize median barrier effects for transportation practitioners.

Barriers are often categorized by permeability, as more rigid or impermeable structures tend to impede wildlife movement across roadways (Clevenger and Kociolek 2013). Most studies use roadkill rates as a proxy for connectivity, but definitions of median barriers vary widely across the literature. Attempts to generalize habitat and road effects beyond ungulates have proven difficult, likely due to species-specific habitat preferences (Gunson et al. 2011).

Although research on median barrier effects is fragmented, some trends emerge. Concrete barriers generally reduce roadkill rates for many species but exacerbate habitat fragmentation. For example, a national hotspot study in South Korea found concrete barriers decreased roadkill rates (Kim et al. 2021). Similarly, Jersey barriers in British Columbia did not increase American badger mortality (Kinley and Newhouse 2009), and in the Canadian Rockies, longer and closer Jersey barriers reduced roadkill of large mammals (coyote-sized and larger). In Israel, concrete barriers had mixed effects: they reduced mortality for jackals, porcupines, mongooses, whipsnakes, and barn owls but increased it for foxes, martens, and jungle cats (Denneboom et al. 2024).

Roadside fencing and crash barriers appear to have similar effects. Guardrails reduced roe deer, wild boar, and red deer collisions in Castilla-Leon, Spain (Malo et al. 2004), and roadside crash barriers lowered wildlife-vehicle collisions (WVCs) in Freyung-Grafenau, Germany (Pagany and Dorner 2019).

One frequently suggested mitigation strategy is adding scuppers—small openings at the bases of concrete barriers—to allow small animals to cross. However, no studies have tested their effectiveness (Clevenger and Kociolek 2013).

A secondary trend is that vegetated medians often correlate with higher roadkill rates among small and medium-sized mammals. For instance, squirrel and rabbit mortality was higher near large grassy medians along State Route 101 in California (Snyder 2014), and snowshoe hare mortality was 1.4 times higher along vegetated medians in Quebec (Plante et al. 2019). Conversely, densely vegetated medians in Andalusia, Spain, were associated with reduced roadkill rates (Canal et al. 2019).

In summary, while concrete medians generally reduce roadkill and vegetated medians often increase it for small mammals, and species- and site-specific interactions vary widely. Most studies emphasize the urgent need for further research, particularly on the effectiveness of scuppers and other wildlife-friendly design features.

1.4 Culverts

The Study Area includes several culverts that are available for wildlife movement purposes. These are long structures that consist of a combination of box and round concrete structures. The location (Figure 2) and sizing for most structures is provided below in Table 1. Some of the smaller culverts include bends or steep grades and would be assumed to be unsuitable for two-way movement. An attempt was made to collect camera data from a majority of the larger structures (see Section 2.3.2).

Table 1. Culverts Within Study Area

Culvert Name	Approximate Station	Actual Station	Type	Estimated Enclosed Length (feet)	Entrance Dimension (width × height)
X1	740–745	744+08	Concrete box (bent)	620	4 feet × 4 feet
X2	755–760	758+29	2 into 1 concrete box culverts	400	3 feet × 4 feet
X3	765–770	767+74	Double concrete box	526	two - 6 feet × 8 feet
C1	785	783+66	Group A pipe culvert	345	30-inch round
A7052 (C2/C10)	795–800	795+25	Concrete triple box	453	three - 8 feet × 8 feet
X4	815–820	818+19	Group A pipe culvert	332	48-inch round
C3	830	830+22	Group A pipe culvert	440	36-inch round
X5	840–845	843+99	Split concrete box culvert	515 and 325	6 feet × 5 feet and 4 feet × 4 feet
X6	885–890	886+56	Concrete box culvert	622	6 feet × 7 feet
C4	900	899+65	Concrete box culvert, with slope	309 (127 sloped)	4 feet × 4 feet concrete box culvert

Table 1. Culverts Within Study Area

Culvert Name	Approximate Station	Actual Station	Type	Estimated Enclosed Length (feet)	Entrance Dimension (width × height)
X7	910	909+45	Concrete box culvert	409	6 feet × 7 feet
C5	930	nd	nd	197	nd
A7053 (C6/C9)	935	935+75	Concrete triple box	335	three - 6 feet × 7 feet
C12/C11	955–960	nd	Concrete single box	216	4 feet × 4 feet
C14/C13	965	nd	Concrete single box	445	4 feet × 4 feet
A7054 (C7/C8)	985	986+67	Concrete triple box	398	three - 10 feet × 8 feet

Notes: nd = no data; N/A = not applicable.
This table represents most of the culverts—there may be missing smaller culverts.

Chapter 2: Methods

Upon initiation of the project, the team investigated several methods for collecting data on species that might use the scuppers and nearby resources. These included various camera (video and still-image), road mortality, point-count, coverboard, trapping, and tracking techniques. Each technique offered positives and negatives. For instance, cameras, if used, either had to be placed outside the travel lanes or within the scuppers for safety purposes. Cameras placed outside the travel lanes would have to have zoom lenses to capture the small species, and data processing would be difficult as every vehicle would trigger the camera. These cameras would also be subject to increased theft risk. Video cameras would need to be positioned high above the scuppers, and reviewing video feeds would also involve an increased level of labor. Ultimately it was decided to use cameras within the scuppers. The cramped scupper quarters either required expensive close-focus camera systems or acceptance of generally blurry photos of animals. Blurry photos, while not as aesthetic as clear photos, would still allow for identification of animals to the genus or family level. In order to keep the cameras in the scuppers, novel methods needed to be developed—these are discussed below in Section 2.3.2.

One method that was tried and eventually discarded involved the use of tracking media/plates in an effort to bolster the chance of species detection. A promising tracking card sampler from New Zealand (Gotcha Traps 2025) that was suggested by USGS was sourced, but a natural disaster in New Zealand prevented their timely arrival. Hair samplers were considered and then discarded because key species were amphibians and reptiles, space was limited, and there would be too long of an interval between set and collection. Live trapping and establishment of pit-fall trap arrays in roadside areas was considered but was determined to be too labor intensive for the budgetary constraints of this project. Those data would have potentially increased our understanding of the adjacent small fauna diversity, but the data gathered through the other methods would suffice. The use of environmental DNA (eDNA) was still a largely novel technique for collecting data in upland systems and came into play later, as discussed below in Section 2.3.5.

This chapter describes the methodology used to conduct field surveys related to road mortality and usage by wildlife. These activities were carried out over the course of the project from May 9, 2023, to April 13, 2025. The methods include road mortality surveys (Section 2.3.1) and culvert camera surveys (Section 2.3.3). All data collection was standardized using geographic information systems (GIS) and mobile field applications on Dudek tablets.

2.1 Purpose of the Methods

After consideration, the study employed multiple methods to assess wildlife interactions with scupper-modified barriers and adjacent habitats. Camera traps were installed at culverts to monitor wildlife movement through these underpasses, while additional cameras were placed inside scuppers to identify species entering, crossing through, or rejecting these openings. Roadside cameras were deployed to document the pool of species present in nearby habitats that might attempt to cross the roadway or use scuppers. Track plates were incorporated within scuppers to provide an additional means of detecting species presence. eDNA sampling was conducted to identify species using scuppers and those occurring in adjacent habitats, offering a broader biodiversity snapshot. Coverboards were placed along the roadway margins to detect cover-preferring species such as reptiles, amphibians, and small mammals living near the highway. Finally, systematic roadkill surveys were performed to identify species that failed to successfully cross the roadway surface, providing insight into mortality patterns and potential hotspots. Together, these complementary methods provided a comprehensive understanding of wildlife presence, movement, and mortality in relation to the scupper-modified median barriers.

2.2 Literature Review

MoDOT is interested in the role of median barriers in inhibiting wildlife movement across road surfaces and, more generally, the impact of roads on wildlife movement. The technical and scientific (peer-reviewed) literature was searched and relevant articles and reports reviewed. Google Scholar was used to search the scientific and technical literature for articles relevant to medians and median barriers. Search terms used included "median barrier," "median barrier wildlife," "median wildlife," and "median barrier wildlife behavior." Additional literature came from the collections of Dr. Fraser Shilling (Dudek) and Cheryl Brehme (USGS).

2.3 Transportation Agency Feedback

To gather information on the current use and research regarding the effectiveness of scuppers for wildlife connectivity, Dudek developed a brief questionnaire and distributed it via email to 11 departments of transportation across the United States, including those in Washington, Oregon, Idaho, Colorado, Arizona, Georgia, Florida, Vermont, Virginia, California, and Nevada. The following process was used to contact department of transportation representatives from each of the 11 states:

A state representative was contacted and was asked if they were the right person to talk to (proceed accordingly).

- The Google Form survey was shared (questions below) with the contact and a follow-up phone call was conducted.
- Responses were compiled (below).

Email to State DOTs

I hope this message finds you well. With the support of MoDOT, Cheryl Brehme (USGS) and I are working on a review of practice for helping small animals cross transportation rights-of-way. We want to help everyone in the field learn what each other is doing and improve practices, so we will be sharing the results of this surveying effort first with you and then with everyone in the field. We have about a dozen questions to ask you and the survey will take about 10 to 20 minutes, depending on how much depth we go into and which questions can be answered. The questions relate to road infrastructure, such as Jersey barriers, and small animal groups, like reptiles, amphibians, and mammals. Can I give you a call or follow-up email about this?

Thanks

Fraser Shilling

Survey Form

Script: With the support of MoDOT, a group of road ecologists is working on a review of practice for helping small animals cross transportation rights-of-way. We want to help everyone in the field learn what each other is doing and improve practices, so we will be sharing the results of this surveying effort first with you and then with everyone in the field. We have about a dozen questions to ask you and the survey will take about 10 to 20 minutes, depending on how much depth we go into and which questions can be answered. The questions relate to road infrastructure, such as Jersey barriers, and small animal groups, like reptiles, amphibians, and mammals. Can we get started?

Questions

1) Does your state use jersey barriers for safety projects? Are those mitigated for Small Animal (SA) passage?
2) Does your state have mitigations for wildlife movement? Specifically for small animals? What types?
3) Do you have any standards for small animal passage (documents, Standard Operating Procedures [SOPs], Best Management Practices [BMPs])?

If No: what are some barriers to having these?

If No: Are there regulatory, financial, or cultural reasons for not having these?

If No: Do you see a need for BMPs, more comprehensive BMPs for your state?

If Yes:

Do you have separate standards for each of the major groups (herpetofauna, mammals)?

Are there specifications for passages, fencing, approach areas/habitat?

Can you share documents or links providing more information?

4) Have you or anyone at your agency needed the BMP info and if so, where did you get it?
5) Do you see a need for BMPs, more comprehensive BMPs for your state?

If Yes: are there specifics (e.g., spp [species] groups, project types) that you would prioritize?

6) Besides installation, do your BMPs cover monitoring, maintenance (fence, passage), vegetation, and how do they pay for and rationalize these?

7) Do you have any upcoming projects where this would be useful (SOPs and BMPs)?
8) Would you be willing to have a short meeting to discuss further?

Although all states replied, very few substantial responses were received.

2.4 Schedule of Studies

Work components occurred during the periods specified in Table 2.

Table 2. Schedule of Studies

Study	Date Range	Personnel
Road Mortality Studies	June 1, 2023–April 30, 2024; August 20, 2024–April 13, 2025	Brenna Jones, Gabe McClain, Johnathan Evenson, and David Penning (Premium Herpetological Designs)
Median Camera Studies	May 9, 2023–July 11, 2023; July 11, 2023–September 6, 2023; March 19, 2024–September 17, 2024; March 4, 2025–May 19, 2025	Brenna Jones, Gabe McClain, Johnathan Evenson, and David Penning (Premium Herpetological Designs); Cheryl Brehme (USGS); and Clara Woodie, PhD, and Brock Ortega (Dudek)
Tracking Studies	May 9, 2023–July 11 2023; July 11, 2023–September 6, 2023	Brenna Jones, Gabe McClain, Johnathan Evenson, and David Penning (Premium Herpetological Designs) and Brock Ortega (Dudek)
Culvert Camera Studies	November 2023–April 30, 2024; August 20, 2024–April 13, 2025	Gabe McClain and Johnathan Evenson (Premium Herpetological Designs) and Brock Ortega (Dudek)
Paired Roadside Camera Studies	November 2023–April 30, 2024; August 20, 2024–April 13, 2025	Gabe McClain and Johnathan Evenson (Premium Herpetological Designs)
Coverboard Studies	June 1, 2023–April 26, 2024	Brenna Jones, Gabe McClain, Johnathan Evenson, and David Penning (Premium Herpetological Designs)
eDNA Collection	March 6, 2025	Gabe McClain and Johnathan Evenson (Premium Herpetological Designs) and Brock Ortega (Dudek)

Table 2. Schedule of Studies

Study	Date Range	Personnel
Photo Interpretation	August 2023–November 2025	Dave Waetjen, Aleen Vartivarian, Sharon Zarate, and Brock Ortega (Dudek)
eDNA Analysis	April 2025–November 2025	eDNA Explorer team
General Analysis	May 2025–November 2025	Clara Woodie, PhD, and Brock Ortega (Dudek)

2.4.1 Road Mortality Surveys

Premium Herpetological Designs (PHD) scientists performed a road mortality study within the Study Area from June 1, 2023 to April 13, 2025. This included an initial continual round from June 1, 2023 to April 30, 2024 and a repeat effort from August 20, 2024 to April 13, 2025. The survey route included the north- and south-bound lanes from the U.S. 71 interchange to the Arkansas border. Road mortality surveys were conducted on a weekly basis to assess the impact of vehicular traffic on local wildlife. These surveys followed a standardized slow-drive protocol, supplemented by walking surveys to evaluate detection efficacy.

Each road mortality survey was conducted by a three-person field team, with designated roles to ensure safety, efficiency, and accuracy in data collection:

1. Driver: The driver maintained a steady speed of 45–55 mph in the right-hand lane, adjusting based on approaching traffic conditions. Their sole focus was on the road and ensuring safe navigation.
2. Rear Passenger (Safety Observer and Secondary Spotter): The rear passenger monitored oncoming traffic and communicated with the driver regarding any potential hazards (e.g., rapidly approaching vehicles). Additionally, this observer served as a secondary roadkill spotter to confirm detections.
3. Front Passenger (Primary Spotter and Data Recorder): The front passenger actively scanned the road and roadside for wildlife mortality events, recording observations using GIS-integrated field applications (ESRI FieldMaps, Dudek Forms, and Survey123).

When a roadkill specimen was spotted, the vehicle safely pulled over for further verification. The team exited the vehicle and conducted a detailed species-level identification. The field identification of species relied on the Amphibians and Reptiles of Missouri (Briggler and Johnson 2021) and the Wild Mammals of Missouri (Schwartz and Schwartz 2016). Taxonomic updates from Briggler's (2025) Checklist of Missouri Amphibians and Reptiles was incorporated later as appropriate. Each specimen was marked with non-toxic spray paint to prevent duplicate recording in subsequent surveys. Data recorded for each observation included the following:

- Date and time (MM/DD/YYYY; Central Daylight Time)
- GPS coordinates (via GIS application)
- Species identification (as best as possible)
- Body condition (fresh, partially decomposed, skeletonized)
- Road position (lane, shoulder, roadside)
- Traffic conditions
- Weather conditions

During the first field season of the roadkill study, PHD performed a comparative review between walking surveys along the Study Area and slow-drive protocol. The slow-drive method was systematically compared to the walking method to evaluate detection efficiency using a two-pass survey strategy:

1. Pass 1 (Driving Survey): The field team used the slow-drive method to identify road mortality.
2. Pass 2 (Walking Verification Survey): The same section of roadway was walked to assess whether additional roadkill specimens were present.

The results indicated that the walking survey did not detect additional road mortality (i.e., 100% of the specimens were detected during each pass), suggesting that the slow-drive method was sufficient for comprehensive data collection.

All data were recorded in GIS-integrated mobile applications. Roadkill locations were geo-tagged and imported into a centralized GIS database and available for instant review through ESRI's geoportal viewer. Photos were taken of specimens as needed to aid in species identification verification.

2.4.2 Camera Studies

2.4.2.1 Median Camera Studies

PHD, USGS, and Dudek biologists performed a wildlife camera study of the scupper areas associated with I-49 from May 9, 2023, to May 19, 2025. This included the initial deployment from May 9, 2023, to July 11, 2023, continuation through September 2023, and redeployments from March 19, 2024, to September 17, 2024, and March 4, 2025, to May 19, 2025. Table 3 presents the deployments and scupper locations covered during each deployment. Cameras were deployed between two and four scuppers for each scupper group, typically with four cameras deployed per group. As discussed above, cameras were intended to be deployed in conjunction with tracking media (discussed below in Section 2.3.3). In order to do this and keep the cameras in the scuppers and upright, a special mounting plate was constructed. The plate consisted of 0.016- or 0.040-inch aluminum sheet material cut to fit the base and side of the interior scupper (i.e., 15 inches long × 12 inches wide × 7.5 inches tall on one end). The 7.5-inch end was intended to be the exact height of the interior of the scupper so that it would keep the overall plate in the gap. Next to the 7.5-inch side, holes were drilled into the base and bolts were attached so that the cameras could be bolted directly to the plate and angled within the scupper. Once installed, cameras were angled to cover the maximum possible interior area of the scupper while minimizing the capture of external vehicle traffic; once satisfied, the bolts were locked into place. Unfortunately, the as-built plans for the scupper openings were not quite accurate (openings were slightly smaller) and the plates needed to be modified (i.e., bent further) in the field in order to fit into the opening. For the second round of deployment, a fresh set of plates that were properly sized were used.

Deployment involved a rolling closure of I-49's northbound interior lane. MoDOT Southwest District Maintenance Team from the Anderson Shed provided full safety coverage in accordance with MoDOT's (TA-33SD) Short Duration Lane Closure on Multi-Lane Highway. This included a MoDOT lead vehicle, the biological team vehicles, two MoDOT protective vehicles, and an Advanced Warning Vehicle with signage approximately 1 mile behind. MoDOT provided safety protection for the first three deployments and RoadRunner Safety Services Inc. (Springfield, Missouri) provided safety coverage for the last deployment and collection. Initially, the intent was to check cameras twice a month, but recent changes in MoDOT's safety program prevented more frequent access to cameras.

Cameras were deployed during the morning hours. Prior to deployment, either the night before or that morning, cameras were set up, which involved installing batteries and SD cards, setting up data collection, and testing their functionality. Lithium AA batteries were used (Energizer Ultimate Lithium) and 64-gigabyte high performance SD cards were used to maximize data collection duration. When deploying, the biological team would exit the vehicles on the median side when possible, remove debris from the scuppers if necessary, collect data, confirm that the camera was on and triggering appropriately, attach it to the aluminum plate, insert it into the scupper, aim it to balance interior coverage while minimizing passing vehicle photographs, and then lock the nuts and bolts into place (Exhibit 1). In order to be quick, a four-member crew was used for deployment. When collecting the plates and cameras, a smaller crew could be used. Data collection included scupper group, individual scupper number, camera number, SD card number, confirmation of battery life, confirmation of date/time, GPS collection of location, and general environmental conditions.

A combination of the following cameras were used during the course of this study: Browning BTC 6 (7.5-millimeter [mm] focal length), BTC-6HDPX (42.0 mm focal length), BTC-5PXD (42.0 mm focal length), BTC-6PXD (42.0 mm focal length), BTC-8A (7.5 mm focal length) and BTC-8E-H4 (7.5 mm focal length); Bushnell (no focal length identified); and GardPro T5CfF (2.8 mm focal length). Digital cameras were set to capture 8-megapixel photo resolution using an invisible infrared flash with a range of up to 50 feet (15.24 meters). They were set to take photos immediately upon triggering, and three photographs were captured per triggering event. The trigger delay was set at 1 to 10 seconds. Camera aperture settings were set in the mid-range for better image sharpness and to allow for variances across the widest range of site conditions. There was no use of baiting or scent lure.

There were 42 cameras deployed during the first and second passes, 40 deployed during the third pass, and 30 deployed during the fourth pass, for a total of 154 camera stations deployed at a maximum of 10 scupper groups per session (Table 3). Of these, 1 camera was lost or stolen during the first pass, 21 cameras were lost or stolen during the third pass, and 4 were lost or stolen during the last pass. Therefore, a total of 128 camera stations collected data during the study.

Exhibit 1. Scupper camera set-up and installation.

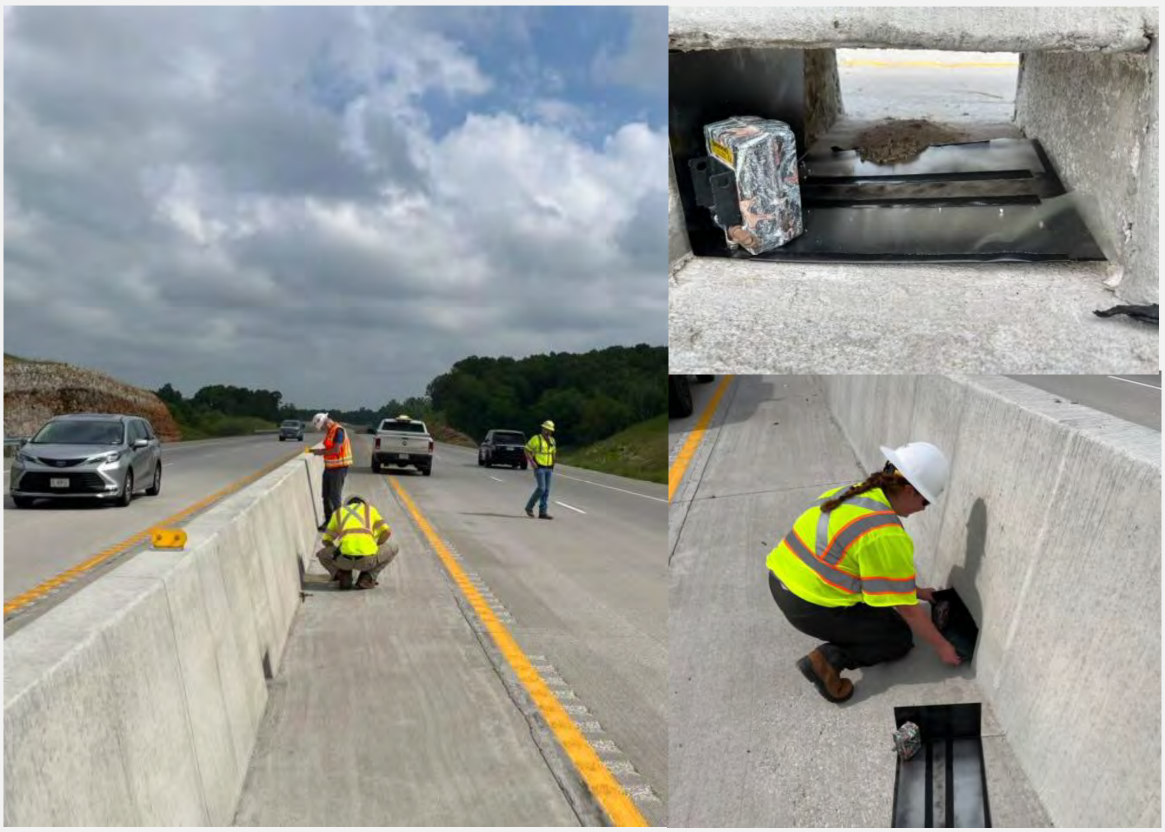


Table 3. Scupper Camera Deployments Including Scupper Locations

Scupper Locations	Approximate Station	5/9/2023–7/11/2023	7/11/2023–9/26/2023	3/19/2024–9/17/2024	3/4/2025–5/19/2025
11	N/A	N/A	N/A	N/A	N/A
2	965	X2	—	—	X
3	960	—	—	—	—

Table 3. Scupper Camera Deployments Including Scupper Locations

Scupper Locations	Approximate Station	5/9/2023–7/11/2023	7/11/2023–9/26/2023	3/19/2024–9/17/2024	3/4/2025–5/19/2025
4	955	—	—	—	—
5	900	X	X	X	X
6	895	X	X	X	X
7	850	X	X	X	X
8	835	X	X	X	X
9	830	X	X	X	X
10	815	X	X	X	X
11	800	X	X	X	—
12	775	X	X	X	X
13	765	X	X	X2	X
14	760	X	X	X2	X

Notes: N/A = not applicable.

1 Scupper location was never constructed.

2 Entire cluster of cameras for scupper group were lost or stolen.

2.4.2.2 Culvert Camera Studies

The culvert camera surveys aimed to document wildlife movement through highway culverts, assessing their use as underpasses for crossing roads. PHD and Dudek biologists performed a wildlife camera study of some culverts associated with I-49 from November 2023 to April 13, 2025, in order to document species use of existing highway culverts. This included the initial deployment from November 2023 to April 30, 2024, and redeployment between August 20, 2024, and April 13, 2025. Table 4 presents the deployments and culvert locations covered during each deployment.

At the beginning of the study, multiple motion-activated cameras were deployed in the following culvert types:

- Small Culverts: 0.5-meter-wide metal pipes
- Large Culverts: Concrete walkable underpasses (more than 2 meters wide)

One camera station was deployed on either side of the culvert where feasible at a position determined by the biologist to be most suitable for capturing wildlife use. Sometimes this required setting the camera on a stake, ground, or tree. Preferred camera sets had a good direct view into the structure entrance or a view of surrounding areas that led to the structure that would likely guide wildlife to the structure. Cameras, settings, and processing are as described in Section 2.3.2.1 for the scupper camera study, except as noted below.

Cameras were unbaited and no scent lure was applied. Station setup varied based on the type of crossing assessed and the surrounding conditions. One method included driving a stake into the ground so that the attached camera would be at the appropriate height, roughly level with the crossing. As a result, some cameras were slightly tilted. Cameras were generally placed approximately 2 to 3 feet (0.6 to 0.9 meters) off the ground. Another method included attaching the camera to an adjacent fence or railing with zip-ties or bungee cords. Neither security cases nor cable locks were used as these locations were generally thought to be inaccessible to humans, but that was not the case as several stations were stolen.

Monthly maintenance checks ensured that battery levels remained adequate, SD cards had sufficient storage capacity, and camera positioning remained stable. Camera data were collected and transferred to a secure server for subsequent analysis. There were 17 cameras deployed during the first pass and 4 during the second (Table 4). Of these, 7 cameras were stolen during the first pass.

Table 4. Culvert Camera Deployments Including Locations

Scupper Locations	Approximate Station	November 2023 – April 30, 2024	August 20, 2024 – April 13, 2025
C1 (west, paired with stolen C1B)	783+66	X	—
C2 (west, paired with C10)	795+25	X	—
C3 (west, Paired with stolen camera C3B)	830+22	X	—
C4 (west, unpaired)	899+65	X	—
C5 (west, unpaired)	930	X	—
C6 (west, paired with C9)	935+75	X	—
C7 (west, paired with C8)	986+67	X	—
C8 (east, paired with C7)	986+67	X	—
C9 (east, paired with C6)	935+75	X	—

Table 4. Culvert Camera Deployments Including Locations

Scupper Locations	Approximate Station	November 2023 – April 30, 2024	August 20, 2024 – April 13, 2025
C10 (east, paired with C2)	795+25	X	—
C11	955–960	—	X
C12	955–960	—	X
C13	965	—	X
C14	965	—	X
Culvert cameras (east and west) unnamed	910	X	—
Stolen cameras east and west	North of 820	X	—
Stolen cameras east and west	Between 765 and 770	X	—
Stolen unpaired camera (west)	Between 755 and 760	X	—

2.4.2.3 Roadside Camera Studies

The roadside camera studies were intended to capture wildlife occurrence data from the road margin areas, both within the open grassland areas and the proximate forested area. PHD biologists installed and maintained paired roadside cameras between November 2023 and April 13, 2025, in order to document species movement through existing highway culverts. This included the initial deployment from November 2023 to April 30, 2024, and a redeployment between August 20, 2024, and April 13, 2025. Table 5 presents the deployments and culvert locations covered during each deployment.

Paired camera stations were set at variable locations along the alignment (see Figure 2 and Table 5). Paired cameras were either set on the northbound or southbound lanes; one camera was directed generally toward the road, while the other one was pointed toward the adjacent wooded area. While one camera was pointed toward the road, traffic motion did not trigger the camera due to topographic buffering. When placing the camera, the biologist attempted to point in the direction of paths, trails, openings, or other possible pinch points to provide a better chance at detecting species. Cameras were generally attached to trees or posts approximately 3 feet above the ground. Cameras, settings, and processing are as described in Sections 2.3.2.1 and 2.3.2.2 for the scupper and culvert camera studies, except as noted below.

Cameras were unbaited and no scent lure was applied. Monthly maintenance checks ensured that battery levels remained adequate, SD cards had sufficient storage capacity, and camera positioning remained stable. Camera data were collected and transferred to a secure server for subsequent analysis.

There were 24 cameras deployed during the first and second passes (Table 5). Of these, several cameras were lost or stolen during the first and second passes.

Table 5. Roadside Camera Deployments Including Locations

Location Name	Approximate Station	Side of I-49	Direction (i.e., Facing Habitat or Roadway)
P12	975–980	Southbound	Road
P11	975–980	Southbound	Trees
P13	955–960	Northbound	Road
P14	955–960	Northbound	Trees
P9	930	Southbound	Road
P10	930	Southbound	Trees
P8	920	Southbound	Trees
P7	920	Southbound	Road
P15	900	Northbound	Road
P16	900	Northbound	Trees
P17	875	Northbound	Road
P18	875	Northbound	Trees
P19	860–865	Northbound	Road
P20	860–865	Northbound	Trees
P5	850	Southbound	Road
P6	850	Southbound	Trees
P3	830	Southbound	Road
P4	830	Southbound	Trees
P21	830	Northbound	Road
P22	830	Northbound	Trees
P1	815–820	Southbound	Road
P2	815–820	Southbound	Trees

Table 5. Roadside Camera Deployments Including Locations

Location Name	Approximate Station	Side of I-49	Direction (i.e., Facing Habitat or Roadway)
P23	775	Northbound	Road
P24	775	Northbound	Trees

2.4.3 Tracking Study

PHD and Dudek biologists attempted to incorporate a track plate survey within the scuppers to provide an additional source of presence data. The track plate study occurred from May 9, 2023, through September 6, 2023. This included the initial deployment from May 9, 2023, to July 11, 2023, and a second deployment from July 11, 2023, through September 6, 2023.

For the first pass, upon the recommendation of the USGS, the team attempted to use track cards from Gotcha Traps LTD (Gotcha Traps 2025) from New Zealand. Unfortunately, due to Cyclone Gabrielle, the company was unable to ship them in a timely manner. Therefore, for the first pass, the team used a sooted plate technique. Each camera aluminum plate was sooted with kerosene smoke and then a strip of white contact paper was installed on either side of the sooted area. Ultimately, because the team was not able to access the scuppers as originally anticipated and had to wait months before collecting the plates and contact paper, it was impossible to decipher track data. Contact paper either had too many dark smudges, was riddled with dirt, or was missing entirely. For the second pass, the track cards from Gotcha Traps were implemented since they had arrived and were available. These were attached in a similar manner to the aluminum camera plates. Ultimately, these too experienced various failures, such as many overlapping tracks or dirt smudges, and did not contribute usable data.

2.4.4 Coverboard

PHD biologists performed coverboard studies targeting reptiles, amphibians, and small mammals along the alignment between June 1, 2023, and April 26, 2024. All data collection followed standardized procedures to ensure consistency, minimize disturbance to local wildlife, maximize detection probability, and maintain animal safety. A total of 100 coverboards were deployed across the Study Area. Coverboards consisted of 0.5-inch-thick plywood (1.27 centimeters) cut into 2-foot by 4-foot pieces (0.61 meters × 1.22 meters). Boards were placed directly on the ground, spaced apart to cover a range of microhabitats (e.g., open grassland edges, forested patches, near water sources). Placement avoided active animal burrows and sensitive vegetation when possible. Each board was georeferenced with handheld GPS units for consistent relocation. If possible, the coverboards were placed outside of the immediate view of the roadway. All boards were deployed on June 1, 2023.

A review of the boards was conducted on a weekly basis, dependent on weather conditions. Surveys were postponed during periods of heavy rainfall, extreme temperatures, or unsafe field conditions. Consistent effort was made to maintain a 7-day survey interval whenever possible. Coverboard checks continued until the end of the contract period (April 30, 2024), at which time all coverboards were removed from the Study Area.

Coverboard inspections were performed by two-person field teams, with clearly defined roles:

- Board Lifter: This individual was responsible for carefully flipping each coverboard. Boards were lifted with deliberate upward motion, facing the underside of the board toward the spotter/handler to maximize detection of animals immediately underneath.
- Spotter/Handler: Positioned adjacent to the board lifter, this individual focused on immediate identification and, when appropriate, the safe capture of any animals revealed. Captures were performed using gloved hands or sanitized equipment to prevent injury to animals.

Both team members remained vigilant and coordinated closely to prevent escapes and reduce disturbance.

Upon detecting an animal under a coverboard, the Missouri Field Guide to Reptiles and Amphibians (2019 edition) and the Missouri Field Guide to Mammals (2016 edition) were used for immediate field identification. Individuals were recorded to the lowest taxonomic level possible. Data recorded for each observation included the following:

- Date and time
- Board ID (assigned at deployment)
- Species identification
- Number of individuals

Captured individuals were briefly examined and immediately released at the point of capture to minimize stress. All field data were recorded using standardized digital datasheets accessed via Dudek Forms or Survey123. Field photographs were taken when necessary to verify unusual or difficult identifications and to document unique species.

2.4.5 eDNA studies

eDNA sample collection was conducted on March 6, 2025, within the Study Area scuppers. In total, 75 soil, scupper detritus, or water samples were taken across 24 sites along the highway. Dudek used eDNA Explorer–provided materials to collect samples. For the scupper detritus sampling, the biologists donned sterile latex gloves; used a sterile bamboo toothbrush to sweep the interior sides, roof, and bottom of the scupper; and then transferred the debris into a sterile 50-milliliter Falcon sampling tube. Samples were collected at the two outer scuppers within any scupper group, and a fifth sample was a control sample of the proximate air. An additional adjacent roadside soil sample was collected and included a similar process except that an approximately 1-square-meter area of roadway was swept and transferred into a sampling tube. Water samples were collected from four adjacent areas, including an isolated pond, a drainage area at the base of the highway leading to a culvert, and two culvert entrances. These were sampled using a Smith-Root vacuum-assisted sampler and self-desiccating filters. In total, 90 samples were collected and sequenced using four eDNA primers (CO1 [reptiles], V16S-U [vertebrates], Vert12S [vertebrates], and amph16S [amphibians]). eDNA was extracted from samples at the CALeDNA lab, and library preparation and sequencing were done in triplicate polymerase chain reactions at the University of New Hampshire lab for the four primers (Table 6). Vert12S and CO1 were amplified following the CALeDNA protocols described in publications (Ballare et al. 2023). The V16S-U and Amph_16S assays were processed following their publications (Table 6), with the exception that SuperFi polymerase replaced the published polymerase. The CALeDNA lab checked that polymerase chain reaction assays worked well and recovered target vertebrates in mock communities and from natural samples with known vertebrate results. The Amph_16S and V16S-U results were not consistently amplifying across samples that had produced good Vert12S results, so they were re-amplified and found to still only produce amplified products in a small set of samples. Therefore, samples were found to be effectively processed but did not contain enough targets to yield extensive results from sequencing for these two markers. Paired-end libraries were sequenced on an Illumina NovaSeq with read length of 250 base pairs with negative controls for quality including the field blanks collected on site. The lab aimed for 75,000 reads per marker per sample.

Resulting sequences were processed on eDNA Explorer for taxa assignment. Taxonomic outputs were assigned using eDNA Explorer Tronko QC (Pipes and Nielsen 2024) for quality control. eDNA Explorer removed adapters and primers using the same methods as Anacapa but with a minimum length of 25 nucleotides to maintain a reading after trimming. They also trim low quality bases under a quality assignment of 30. Further, they do not merge reads. Individual forward and reverse reads are assigned to taxa using Tronko Assign and the LCA setting of -c 10.

Reporting filter settings included the following:

- Level of confidence in taxinomic matches: 5
- Level of taxonomic resolution: Species level

See Scheffer et al. (2025) for more detail on lab methods.

Table 6. Metabarcoding Markers Used in this Project

Marker Short Name	Target	Forward Primer	Reverse Primer	Forward Primer Name	Reverse Primer Name	Reference	Reference DOI	Amplicon Length (bp)
V16S-U	Vertebrates	ACGAGAAGACCCYRYGRARCTT	TCTHRRANAGGATTGCGCTGTTA	V16S-U Forward	V16S-U Reverse	Wang et al. 2023	https://doi.org/10.3389/fevo.2023.1164206	253
Amph_16S	Amphibians	ACGAGAAGACCCYRTGGARCTT	ATCCAACATCGAGGTCGTAA	Amph_16S_1070F	Amph_16S_1340R	Sakata et al. 2022	https://mbmg.pensoft.net/article/76534/	311
Vert12S	Vertebrates	TAGAACAGGCTCCTCTAG	TTAGATACCCCACTATGC	Vert-12SV5–F	Vert-12SV5–R	Riaz et al. 2011	https://doi.org/10.1093/nar/gkr732	270
CO1	Metazoa	GGWACWGGWTGAACWGTWTAYCCYCC	TANACYTCNGGRTGNCCRAARAAYCA	mlCOIintF	Fol-degen-rev	Leray et al. 2013	https://doi.org/10.1186/1742-9994-10-34	333

2.4.6 Photo Processing

Once the cameras were collected, the memory cards were downloaded to the Dudek server and then uploaded to the cloud, which was accessed by Dudek's AIT Tool. This is an automated artificial intelligence photo analyzer that categorizes photos as either including animals or not and also attempts to count the number of animals. It can batch photos containing vehicles and people. Once AIT separated photos into two categories (i.e., those that contained wildlife and those that did not), a Dudek biologist reviewed the "animal" photos to identify the species and number and tag that information to each photo. In addition, an experienced biologist performed random spot-checks of the photos not deemed to include animals, reviewed the species identifications, and reviewed difficult photos (e.g., poor lighting, partial images, bad angles, abnormal specimens [e.g., missing tails]). After this step, the photo dataset was further processed to combine photos of a species and location that had been photographed within a linear fashion in an attempt to realize actual individuals. Photos that had been taken within 10 minutes of each other were considered to be the same individual animal. For instance, one squirrel might have been photographed continuously for 3 hours, then have gone to a tree for 6 minutes, then been photographed again for another 2 hours—this sequence would have been identified as one individual squirrel. These resulting photos were used for final analysis.

2.4.7 Statistical Analysis and Modeling

To analyze wildlife use and potential effects of scuppers along the study roadway, multiple complementary datasets were compiled and integrated, including scupper-associated cameras, paired roadside and culvert cameras, roadkill observations, eDNA samples, and coverboard surveys. Exploratory analyses were performed within datasets, and comparative analyses were conducted between datasets using post-mile intervals as a spatial standard across methods. Analyses focused on describing patterns of wildlife occurrence, diversity, and road mortality in relation to scupper locations. For each data type and focal taxonomic group, total detections were summarized, and Shannon's Diversity Index (Shannon's H) was calculated to capture both species richness and evenness. Shannon's H is a commonly used metric of biodiversity that quantifies diversity by incorporating both species richness (the number of species present) and evenness (how evenly individuals are distributed among those species). The index increases as the number of species increases and as their relative abundances become more even, and it decreases when communities are dominated by one or a few species. Because Shannon's H is sensitive to changes in both rare and common taxa, it is well suited for comparing diversity across datasets that differ in sampling method or detection process. In this analysis, Shannon's H was used to quantify diversity across camera detections, roadkill observations, eDNA samples, and coverboard data. Together, Shannon's H and summarized total detections were used to compare community composition across sampling methods and along the roadway, as well as to assess whether scupper-associated locations exhibited distinct patterns relative to non-scupper areas.

Lower Shannon's H values occur in areas where observations are dominated by one or a few species, meaning most detections come from the same taxa. Higher values are found in locations where detections are spread more evenly across multiple species. Where Shannon's H closely follows total detection counts, higher numbers of detections also include a greater variety of species, rather than repeated detections of the same species. In these cases, increases in total detections reflect broader wildlife presence, causing diversity and total counts to show similar patterns.

As for statistical modeling, ideally one would directly test the effectiveness of scuppers for small animal movement. The effectiveness of median scuppers for facilitating small-animal movement could not be tested directly because wildlife cameras were deployed only at scupper locations, resulting in no comparable movement data from non-scupper sites. Without a matched control representing animal movement in the absence of scuppers, it was not possible to directly compare crossing use or movement rates between scupper and non-scupper locations. Consequently, analyses focused on associations between scupper presence and roadkill patterns across the broader project area rather than direct measures of scupper use or crossing success.

To evaluate whether the presence of median scuppers was associated with small-animal road mortality, we modeled roadkill counts as a function of scupper presence using count-based regression. Roadkill observations were aggregated by road segment (post-mile bin) and survey date, and analyses were conducted separately for amphibians, reptiles, and small mammals. For each taxonomic group, negative binomial generalized linear mixed models (GLMMs) with a log link were fitted, including scupper presence (present/absent) as a fixed effect and random intercepts for road segment and date to account for repeated sampling in space and time. When random-effect variances collapsed to zero or models exhibited singular fits due to limited sample sizes, results were interpreted as equivalent to fixed-effects negative binomial models. Model coefficients were exponentiated to obtain rate ratios, representing proportional differences in roadkill rates between segments with and without scuppers. All analyses were conducted in R (programming language) version 4.4.1, package **lme4**, and the **glmer.nb** function.

2.5 Anecdotal Data

In addition to the data collected above, on September 17, 2024, Dudek biologists Clara Woodie and Brock Ortega found three green frogs (*Lithobates clamitans*) within the triple box culvert located at Station 795+25 (Culvert A7052, Cameras C2/C10, near Scupper Group 11) and one pickerel frog (*Lithobates palustris*) within a triple box culvert located at Station 986+67 (Culvert A7054, Cameras C7/C8, near planned Scupper 1, Exhibit 2).

Exhibit 2. Observed frogs from culverts in the vicinity of scuppers 1 (left) and 11 (right).

Chapter 3: Results

This chapter outlines the results of several studies that were performed for the project. Relevant figures are provided along with summary tables and exhibits. Appendix 1 includes photos from various aspects of the studies and Appendix 2 includes a complete list of species that were detected for the eDNA study.

3.1 Literature Review

3.1.1 Mitigating Habitat Fragmentation and Wildlife Connectivity

Habitat fragmentation and loss due to transportation infrastructure and land use changes are some of the greatest threats to biodiversity (Wilcove et al. 1998; Fahrig 2003; Tscharntke et al. 2012). Landscape connectivity, defined as the degree to which the landscape facilitates or impedes movement among resource patches (Taylor et al. 1993), has emerged as a key component of biological conservation. Constructing methods for wildlife to move over or under highways can mitigate road-mediated habitat fragmentation by facilitating safe wildlife passage and reducing the risk of WVCs. However, structure use can vary with taxonomic group and the characteristics of the structure (Kintsch and Cramer 2011).

Wildlife movement and behavior in response to roads, culverts, bridges, median vegetation and barriers, and traffic can vary widely among taxonomic groups. Small animals (herpetofauna and small mammals) may move in straight lines (Matthews and Pope 1999; Sinsch 2006; Southwood and Avens 2010), including along the road verge (Gunson et al. 2011). Small animal mortality on roads may be distributed evenly along roads adjacent to suitable habitat (Glista et al. 2008; Matos et al. 2012), as opposed to being concentrated in "hotspots." Murid species, such as deer mice, respond to roads differently from each other, potentially because species have different habitat preferences and tolerance for open spaces (McDonald and St. Clair 2004). Similarly, small and medium-sized mammals respond differently to different opening types (e.g., pipe culverts), which could affect their use (Martinig and Bélanger-Smith 2016). Constructed crossing structures for small animals have been demonstrated to be effective using camera traps (e.g., Foresman 2004), camera traps and roadkill surveys (e.g., Snyder 2014), and a combination of camera traps, roadkill surveys, and animal signs (e.g., Ortega et al. 2021).

Traffic is essentially a moving wall preventing live animals from crossing a road. WVCs can affect wildlife populations and can be a barrier to connectivity for small animals with and without traffic (e.g., Brehme et al. 2013). Small mammals and herpetofauna (amphibians and reptiles) can have very high rates of mortality on roads. For example, Smith and Dodd (2003) found 1,821 carcasses of 62 species of small animals on a 3.2-kilometer section of a Florida highway one year prior to wildlife passage/barrier wall construction. The same team (Dodd et al. 2004) investigated the effectiveness of the construction and found a 65% reduction in the number of carcasses in the mitigation area, with most of these located around the ends of barriers and at access road openings onto the highway. Small mammals and herpetofauna accounted for most of the remaining mortality, possibly due to these species climbing the barrier wall and going around the ends of the barriers.

In a recent publication, Cheryl Brehme et al. (2018) summarized the risk that roads pose to amphibians and reptiles:

> Amphibians and reptiles have been identified as being particularly susceptible to the negative effects of roads within their habitat (e.g., Klauber 1931; Forman et al. 2003; Rytwinski and Fahrig 2012; Andrews et al. 2015a, 2015b; D'Amico et al. 2015). Many are slow moving, do not avoid roads, and are simply too small for drivers to see and avoid. During rains many amphibians make long linear terrestrial movements regardless of the presence of intersecting roadways (Glista et al. 2008), and because paved roads typically absorb and retain more heat than the surrounding habitat, snakes and lizards are often attracted to roads for thermoregulation (Case and Fisher 2001; Jochimsen et al. 2004). In fact, road surveys are one of the most common methods for surveying these reptiles (e.g., Sullivan 2012). Many herpetofauna species utilize both aquatic and terrestrial habitat for breeding, development, foraging, and overwintering and therefore require connectivity within and between both aquatic and terrestrial habitats to support basic life history requirements.

3.1.2 Medians and Median Barriers

The term "median" describes the middle of a two-way road alignment, where there is typically undeveloped vegetation, dirt/gravel, pavement, guard rails or barriers, or a combination of these. Each of these will have different consequences for different wildlife species and groups, meaning that there will be many possible combinations of median and species interactions. Median barriers are typically deployed to prevent head-on collisions between vehicles using concrete barriers (e.g., K-rail/Jersey barriers), cable barriers, or metal guard rail. Developed (e.g., paved) or undeveloped (vegetated) median areas are typically wide enough to prevent head-on collisions and may include large areas of habitat for certain species.

Sections 3.1.2.1 and 3.1.2.2 summarize the literature available to describe median conditions and how they can affect wildlife movement.

3.1.2.1 Vegetated Medians

On the surface, vegetated medians seem like places wildlife could use for foraging or travel, reducing the barrier effects of roads. McLaren et al. (2011) found that small mammals were hesitant to cross highways and the presence or width of vegetation in the median did not reduce this effect. In addition, there was not an apparent relationship between hesitancy and traffic volume, but there was dependence on the species' preference (i.e., species dependent). In contrast, McDonald and St. Clair (2004) found that vegetated medians were less of a barrier to small mammal movement than the highway itself, possibly reducing the effect of the highway. When median areas are accessible from wildlife crossing structures, they will access and forage in these areas, which could limit passage through the structures to the other side of the highway (Martinig and Bélanger-Smith 2016). Martinig and McLaren (2019) found that five mammal species or species groups would leave culverts (less than 5 feet in height) within the median and forage. Rates of deer and elk mortality on a highway were reported to be higher in the vicinity of vegetated medians (Singleton and Lehmkuhl 2000). This increase in wildlife mortality in the presence of roadside and median vegetation seems to be a general phenomenon (reviewed in Riley et al. 2014).

In general, vegetated medians may provide foraging opportunities, but this is amidst traffic. If access to the vegetated medians is provided from crossing structures, this may limit effective passage of wildlife from one side of the roadway to the other, defeating the primary purpose of the structure. The only benefit of median vegetation appears to be as a stepping stone across a right-of-way; however, attraction of wildlife to the middle of a divided highway may result in higher rates of roadkill than would otherwise occur.

3.1.2.2 Median Barriers

There are several types of median barriers, with cable barriers providing the most wildlife permeability and concrete Jersey barriers the least. The deployment of median barriers is often based on safety concerns and the type (e.g., cable vs. Jersey) is often based on state requirements for crash mitigation.

Traffic Safety

Median barriers can increase the frequency of crashes and both reduce and increase severity of crashes (reviewed in Hu and Donnell 2010). Concrete and three-beam barriers contribute to greater severity of crashes than cable barriers (Russo and Savolainen 2018). Cable barriers, especially those with greater lateral deflection, can absorb more force without redirecting a vehicle back into traffic lanes (Russo and Savolainen 2018).

Wildlife Impacts

Awareness of the potential impact of median barriers on wildlife movement began at the turn of the century with three key technical and scientific studies. Cooper (1999) described possible barrier effects of median barrier placement on smaller wildlife attempting to move across the Trans-Canada Highway. Singleton and Lehmkuhl (2000) found that rates of deer and elk roadkill were lower in the vicinity of Jersey barriers. Deer, elk, and coyotes (*Canis latrans*) were reported to be hesitant to jump over Jersey or guardrail types of barriers to enter roadways, but would jump them to escape a roadway (Barnum 2003). Malo et al. (2004) found a negative relationship between presence of a median barrier and roadkill incidents. Dodd et al. (2004) found that barriers built on the side of a highway to prevent herpetofauna mortality were more than 70% effective at reducing herpetofauna roadkill. Gunson et al. (2011) found that there was a negative relationship between length of barrier and rate of large mammal collisions. Findings from these and other studies were later summarized in a review by Clevenger and Kociolek (2013). They identified several studies that found mammal roadkill rates were higher in the presence of concrete barriers but concluded that there was no correlation between presence of a median barrier and rates of roadkill. They also suggested that the lack of consistency could be related to poor recognition of confounding factors in statistical analysis. Snyder (2014) found a negative relationship between roadkill rates and both median barrier type and distance to gaps in median barriers. Kim et al. (2021) found a negative relationship between presence of median barriers and concentrations of roadkill. Pagany and Dorner (2019) also found a significant negative relationship between the presence of median barriers and roadkill, in particular for smaller animals. For bobcats (*Lynx rufus*) specifically, Serieys et al. (2021) found that the lowest rate of attempted road-surface crossing and most mortalities occurred in association with high median barriers.

These results strongly suggest that concrete median barriers inhibit wildlife attempting to cross roads, and that where wildlife do attempt to cross, they may become trapped, concentrated at breaks in the barrier, or concentrated at the ends of the barrier. In general, roadkill rates will be lower in the presence of concrete median barriers. Although median barrier height was rarely included as a variable in these studies, if reduced roadkill is due to wildlife perception of a wall, then the relative height of the wildlife and the barrier is important. Results from Snyder (2014) and others suggest that visible breaks in median barriers may provide wildlife with a visual cue to attempt to cross the road surface, whether or not it is safe to do so from a traffic volume point of view.

3.1.3 New and Emerging Trends in Impact Mitigation and Best Management Practices

The most common practice for mitigating wildlife mortality on roadways and wildlife movement across roadways is to construct wildlife-proof fencing along the roadside and safe passages under or above the right-of-way. By various measures, fencing is the most effective way to reduce mortality, and overcrossings are the most effective way to provide connectivity for many species (Rytwinski et al. 2016). Wildlife crossing structures are being built more frequently as mitigation for road and traffic impacts on wildlife. Wildlife crossing structures (WCSs) are often designed to optimize wildlife use, but their design is typically ad hoc and generally coarse-grained, lacking details chosen specifically for the scale of the individual animal species or group of species.

Mitigation for road and traffic impacts on amphibians and other small animals often includes tunnels beneath roadways, accompanied by barriers along the roadside to funnel the animals to the crossings (Schmidt et al. 2008; Andrews et al. 2015a). However, there is little evidence that any animal responds to fencing and barriers by moving toward the crossing. Migrating amphibians may give up after a certain distance when traversing a barrier such as fencing. This means that if they do not encounter a crossing structure, they may fail to cross the roadway. For example, common toads (*Bufo bufo*), Yosemite toads (*Anaxyrus canorus*), and California tiger salamanders (*Ambystoma californiense*) have give-up distances averaging 40–50 meters when they encounter barrier fencing, although they migrate a kilometer or more (Ottburg and van der Grift 2019; Brehme et al. 2021; Brehme et al. 2022). Because amphibians may move in a distributed fashion across a landscape, rather than focused in one area, elevated road segments have been built and evaluated for effectiveness (Brehme et al., unpublished; Vaughan et al., unpublished). These typically consist of a wood platform elevated on pillars, with 0.5 to 1 foot of clearance beneath them for small animal passage.

As is the case for larger animals, wider passages are more likely to be permeable to more small animal species than small tunnels (Martinig and Bélanger-Smith 2016; Schmidt et al. 2020), although small tunnels have been shown to be effective, particularly where spacing between passages was short (e.g., Jarvis et al. 2019). Passages that provide microhabitat conditions (e.g., temperature, substrate, light, and vegetation) similar to the surrounding habitat have been shown to be most effective (see review by Jackson et al. 2015).

Rytwinski et al. (2015) have proposed that wildlife-impact mitigation projects be designed as experiments in order to maximize their cost and ecological effectiveness. Rytwinski et al. (2015) identified the following "seven key questions about mitigation structures (i.e., wildlife crossing structures and fencing) that remain largely or entirely unanswered at the population-level: (1) Does a given crossing structure work? What type and size of crossing structures should we use? (2) How many crossing structures should we build? (3) Is it more effective to install a small number of large-sized crossing structures or a large number of small-sized crossing structures? (4) How much barrier fencing is needed for a given length of road? (5) Do we need funnel fencing to lead animals to crossing structures, and how long does such fencing have to be? (6) How should we manage/manipulate the environment in the area around the crossing structures and fencing? (7) Where should we place crossing structures and barrier fencing?"

Some of these questions have been addressed in recent scientific studies of wildlife crossing mitigation:

a. Ahmed and Ahmed (2022) showed that crash modification factors, common in traffic safety planning, could be used to evaluate effectiveness of WCSs in reducing WVCs. They showed a Crash Modification Factor for WCS of 0.66 using carcass data and 0.56 using crash data. Baker et al. (2022) and Villalobos-Hoffman et al. (2022) used a control-impact approach to demonstrate benefits from crossing structures on reduced roadkill rates. Blackburn et al. (2022) found that ocelots (*Leopardus pardalis*) were not using WCSs built for them and were still suffering high rates of roadkill. They further found that this was related to habitat characteristics around each WCS. They made the point that post-installation assessments were critical to support further decision-making related to WCSs.
b. One of the best recent papers about large versus small crossing structures (Helldin 2022) suggested that in general, having several small structures was preferable to one large structure. As it is often difficult to know exactly where a WCS would be best positioned, spreading out multiple structures increases the chance of a successful crossing.

Many wildlife species are sensitive to human co-use (e.g., as hiking trails), with some species tolerant and others not at all (Warnock-Juteau et al. 2022). Typically, WCSs are not designed or built for human co-use, although it might make sense to take advantage of and re-design human-use structures in urban settings where opportunities are limited.

3.2 Transportation Agency Feedback

All state DOT staff contacted responded to the email, but most did not give any detailed responses, primarily because their states did not have specific best management practices to deal with small animals and roadway infrastructure. The following responses were received from Vermont and California (responses in italics).

VTrans (Glenn Gingras, VTrans)

Questions

1) Does your state use jersey barriers for safety projects? Are those mitigated for small animal (SA) passage?

We have a permanent jersey barrier that is on Interstate 89 in the Waterbury-Bolton area. We did not mitigate for SA passage, I pushed for breaks although the safety component for the breaks trumped the animal movements. We also have temporary jersey barriers on temporary roadway shifts and detours. To my knowledge SA passage is not considered in the installation of the temporary measures.

2) Does your state have mitigations for wildlife movement? Specifically for small animals? What types?

They do not.

3) Do you have any standards for small animal passage (documents, Standard Operating Procedures, Best Management Practices)?

Not really…we do have aquatic organism passage guidelines from VT Fish and Wildlife which would support SA passage.

If No: What are some barriers to having these?

Staff needed to draft and make standards, keep updated. I believe our Agency would be open to adopting other developed standards from other DOT's.

If No: Are there regulatory, financial, or cultural reasons for not having these?

No.

If No: Do you see a need for BMPs, more comprehensive BMPs for your state?

Yes, it would be good to have comprehensive BMPs for the state and local municipalities.

Caltrans (Paul Caron, Francis Appiah, Celina Oliveri)

Questions

1) Does your state use jersey barriers for safety projects? Are those mitigated for SA passage?

Yes, emergency, during construction, SR14 (openings). Places where construction is taking a while. Temporary effects mitigated. Have discussed mitigating effects on SA. Mentioned during trainings for wildlife movement

2) Does your state have mitigations for wildlife movement? Specifically for small animals? What types?

Now in mission and goals of Dept. Also, AB2344 requirements (10/year). Part of 30x30 goals from Governor. Small animals thought to be covered under wildlife in general. SR33 (Ventura County), small drainages under road. Have drop on down-side. Thought about putting in small animals (mouse spp.) ramps to the perched side. Make sure have specs./as-builts so can make available for others. Applied for grant for specs, but did not get. Emphasis has been on large mammals, assumed that they would cover the small mammals and herps. Culvert cleaning/maintenance revealed that small animals are in/using the structures. Fencing – mesh too big for small animals

3) Do you have any standards for small animal passage (documents, Standard Operating Procedures, Best Management Practices)?

SOP for pre-construction movement of mall animals out of zone (e.g., rattlesnakes, coast horned lizards). Required under California Environmental Quality Act, or where ESA permit requirement (Sec. 7).

Clean, (re-)vegetate areas, but there are not necessarily standards for small animals following construction

Resource Agencies don't direct them (Caltrans) to do it. Also, need $$ to carry out.

I-5 example (Wheldon Canyon over-crossing) gravel walkway next to roadway for small animals

I-405 widening, DG for wildlife across Skirball Center Dr over-crossing. May have specs for it.

If No: What are some barriers to having these?

Need baseline data/studies on small animals in an area first. Small animals are more difficult to survey for than large

If No: Are there regulatory, financial, or cultural reasons for not having these?

Only barrier is that they are not thought about. The last ones considered. More education about small animals in general, for public and for Caltrans (non-biologists). Not the same level of concern for small animals compared to large animals within and outside Caltrans. Would help in consideration of small animals in wildlife crossing planning.

If No: Do you see a need for BMPs, more comprehensive BMPs for your state?

Yes, because many small animals are approaching endangered/listing. Will get worse without SOPs and specs.

If Yes: Do you have separate standards for each of the major groups (herpetofauna, mammals)?

Are there specifications for passages, fencing, approach areas/habitat?

Can you share documents or links providing more information?

1) Have you or anyone at your agency needed the BMP info and if so, where did you get it?
2) Do you see a need for BMPs, more comprehensive BMPs for your state?

If Yes: are there specifics (e.g., species groups, project types) that you would prioritize?

Frogs (because a lot are listed). Coast horned lizard (not listed yet, but CDFW said are in decline, plus coast woodrat). Mojave desert tortoise and Mojave ground squirrel.

Where there is grubbing and clearing of native vegetation. A project might be small (like culvert re-align) but might impact nearby species. Widening projects more likely to lead to mitigation (connectivity/crossing). Project location (e.g., wildlife connectivity area). Important connectivity project areas first, then narrow from there. Use CDFW ACE for project/permitting (1600 series agreements). "Corridor analysis/planning" can include small animal consideration

3) Besides installation, do your BMPs cover monitoring, maintenance (fence, passage), vegetation, and how do they pay for and rationalize these?

No response.

4) Do you have any upcoming projects where this would be useful (SOPs and BMPs)?

One project (I-5 HOV lanes), could have used more guidance and specs for small animals. Would have generated more crossings (what to do, including fencing). SR39 re-opening (Wrightwood). SR14 widening (Metro LA), consultants asking for wildlife information. Use these opportunities to get more small animal studies.

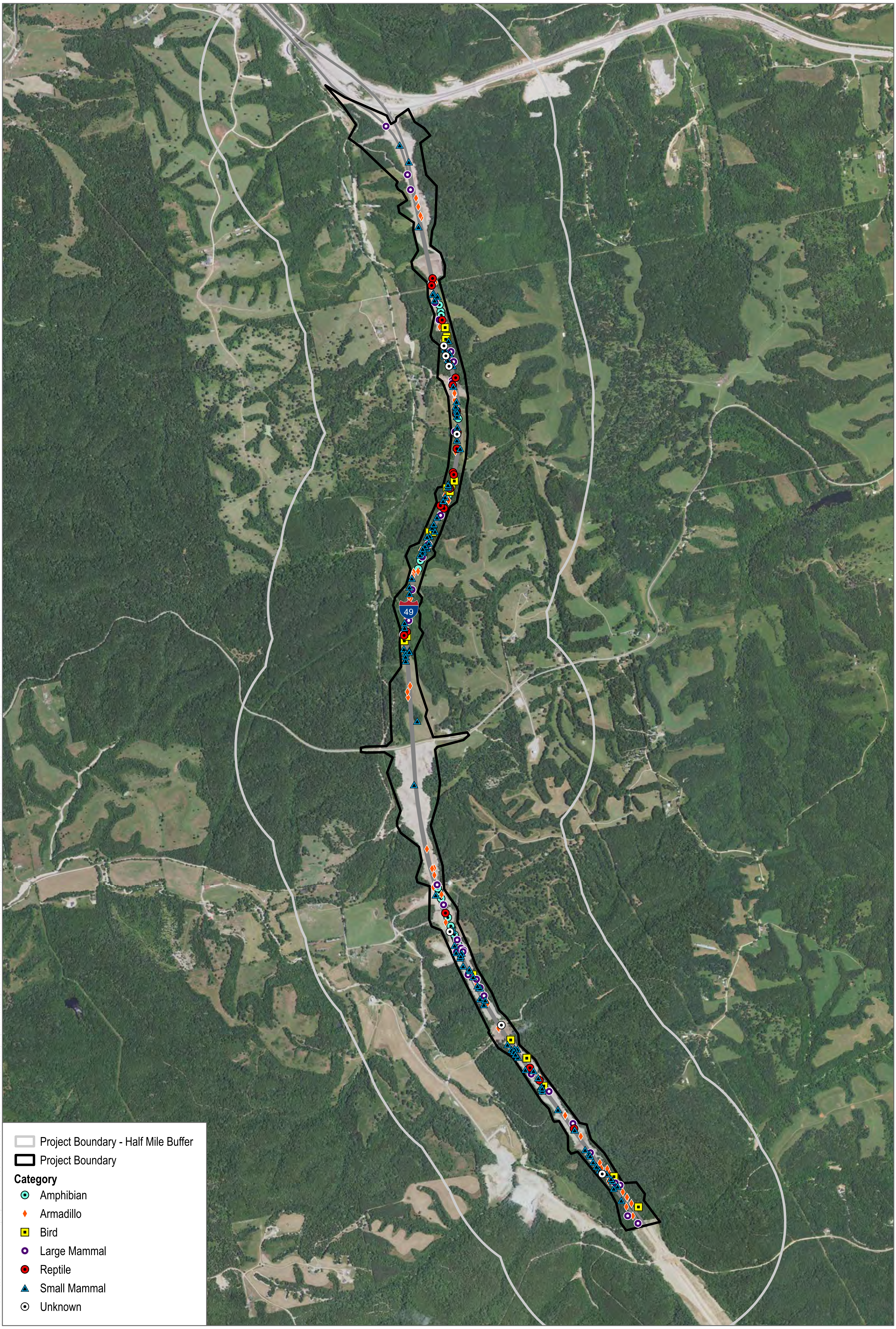
5) Would you be willing to have a short meeting to discuss further?

No response

3.3 Road Mortality

The road mortality study resulted in the detection of 27 species (276 individuals) along the Study Area's I-49 corridor (Table 7). This includes 4 amphibian species (American bullfrog [*Lithobates catesbeianus*], central newt [*Notophthalmus viridescens*], green frog [*Lithobates clamitans*], and southern leopard frog [*Lithobates sphenocephalus*]), 8 reptiles including snakes and turtles, and 15 mammals of all sizes. There was a large newt roadkill event during October 2023. Reptiles included several three-toed box turtles (*Terrapene triunguis*); otherwise, detections were generally low for reptile species. Small mammal roadkill detections were generally low, while larger mammal species detections were higher. A majority of the detections were from nine-banded armadillo (*Dasypus novemcinctus*) (n = 87), followed by northern raccoon (*Procyon lotor*) (n = 50), and white-tailed deer (*Odocoileus virginianus*) (n = 28).

Figure 5 shows cumulative road mortality for all species groups; there was noticeably reduced mortality around White Oak Hollow Canyon, the MO 90 interchange, and the vicinity of scupper group 13—all of which include more pronounced habitat disturbance and steeper modified topography. Figure 6 shows amphibian road mortality by species. There was a spike in central newt mortality in October 2023 between scupper group 5 and White Oak Hollow. There was also a spike in southern leopard frog mortality in August 2023 between scupper groups 8 and 9 and near, but not at, scupper groups 10 and 13. Figure 7 shows road mortality by reptile species. There was more reptile mortality in the northern reach between scupper groups 10 and 13, with turtles of varying species roadkilled throughout. Figure 8 shows road mortality for small mammals. Mortality for small mammals roughly mirrored the cumulative species distribution. Figure 9 and Exhibit 3 show road mortality for nine-banded armadillo. They were pulled out because they saturated the roadkill and they are an invasive species in Missouri. There were clusters of roadkill at various locations along the alignment (e.g., southern end, around scupper groups 5 and 6, and scupper group 11). Figure 10 shows road mortality for large mammals. Large mammal roadkill occurred throughout, with clusters south of scupper group 5 and between scupper groups 11 and 12—these were primarily white-tailed deer. Figure 11 shows road mortality for birds, and Figure 12 shows road mortality for unknown species. Both were distributed throughout and many were unrecognizable.



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

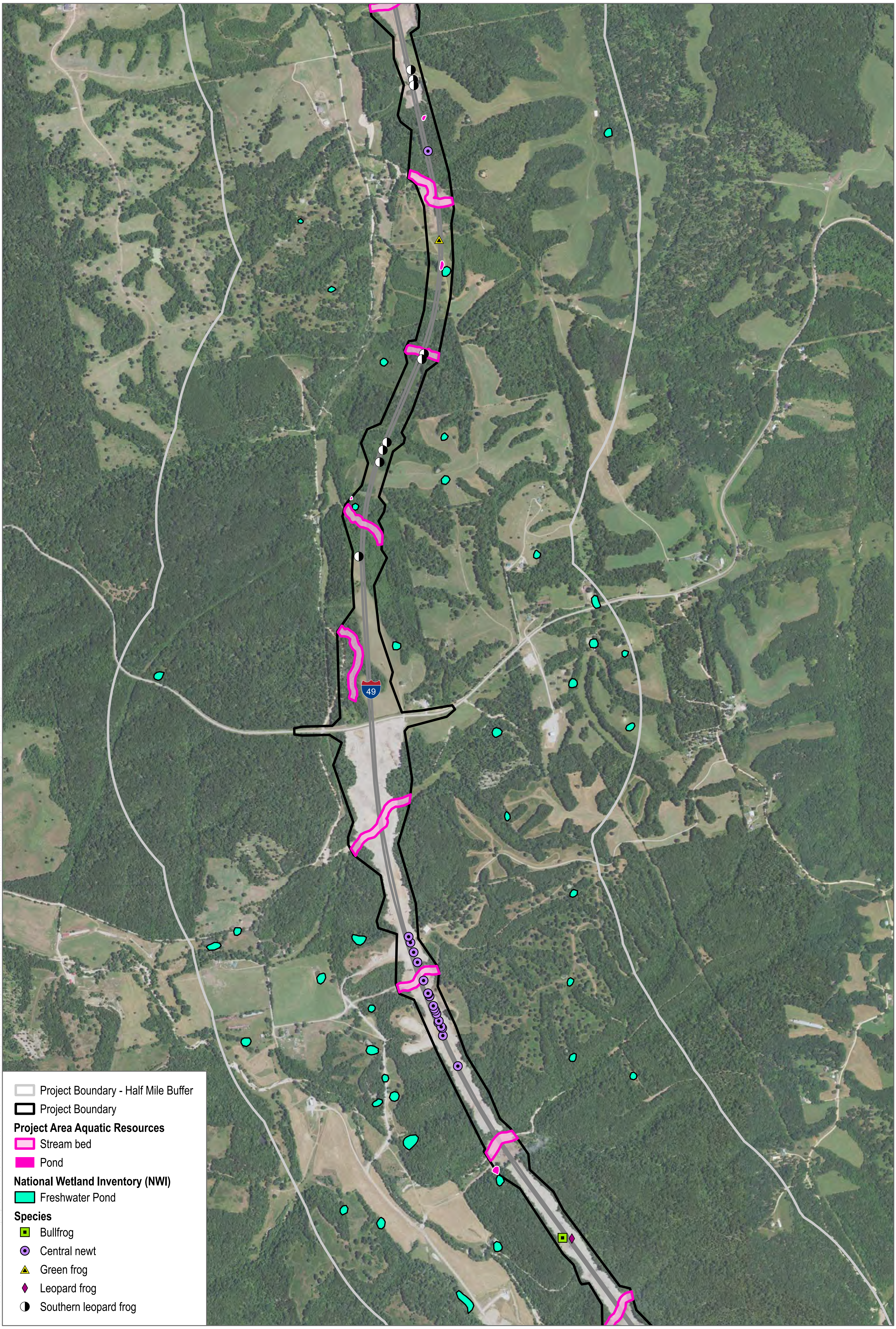
DUDEK

0 875 1,750 Feet

FIGURE 5

Road Mortality - Cumulative

MoDOT I-49 Small Animal Movement Study



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

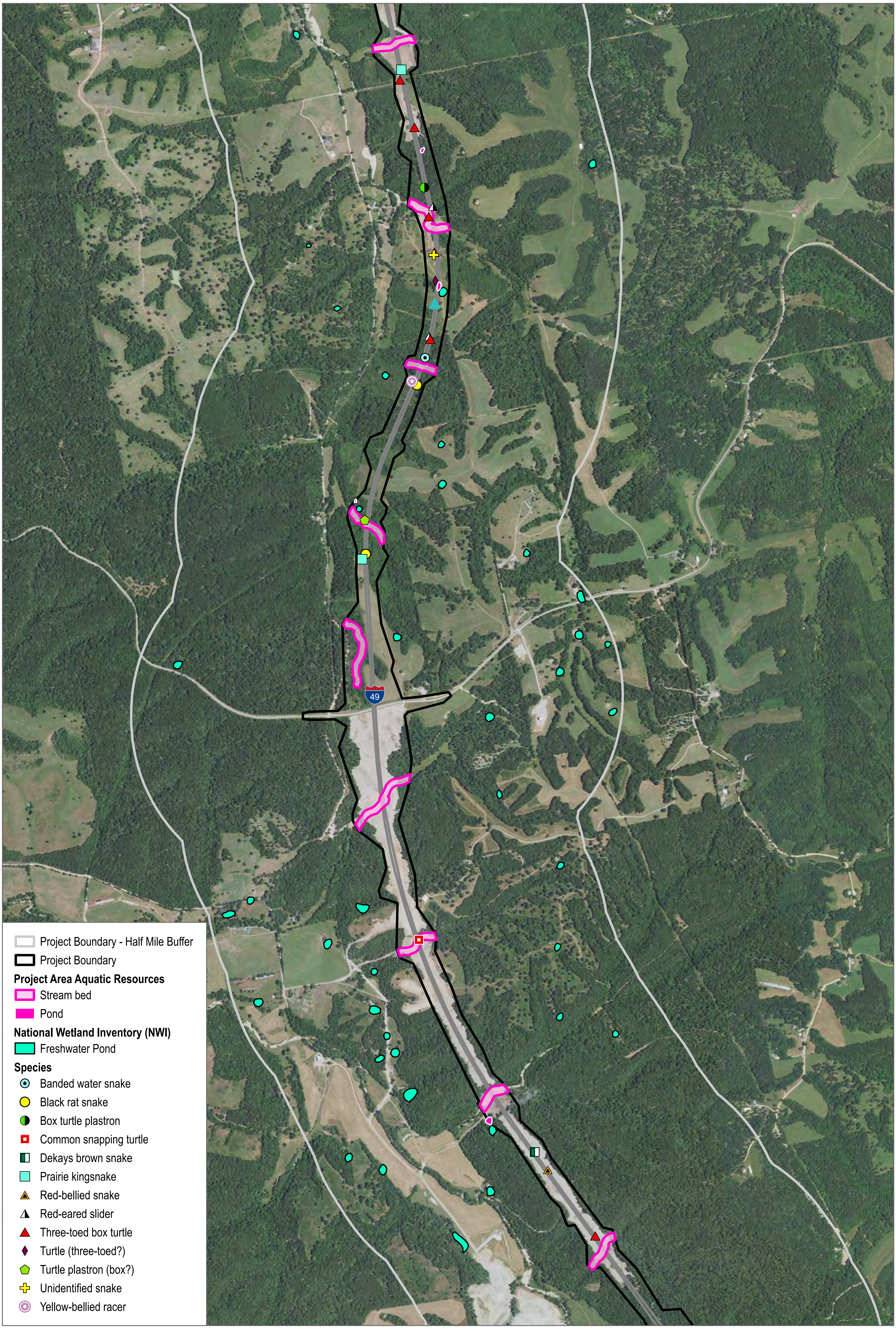
FIGURE 6

Road Mortality - Amphibian

MoDOT I-49 Small Animal Movement Study

DUDEK

0 550 1,100 Feet



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

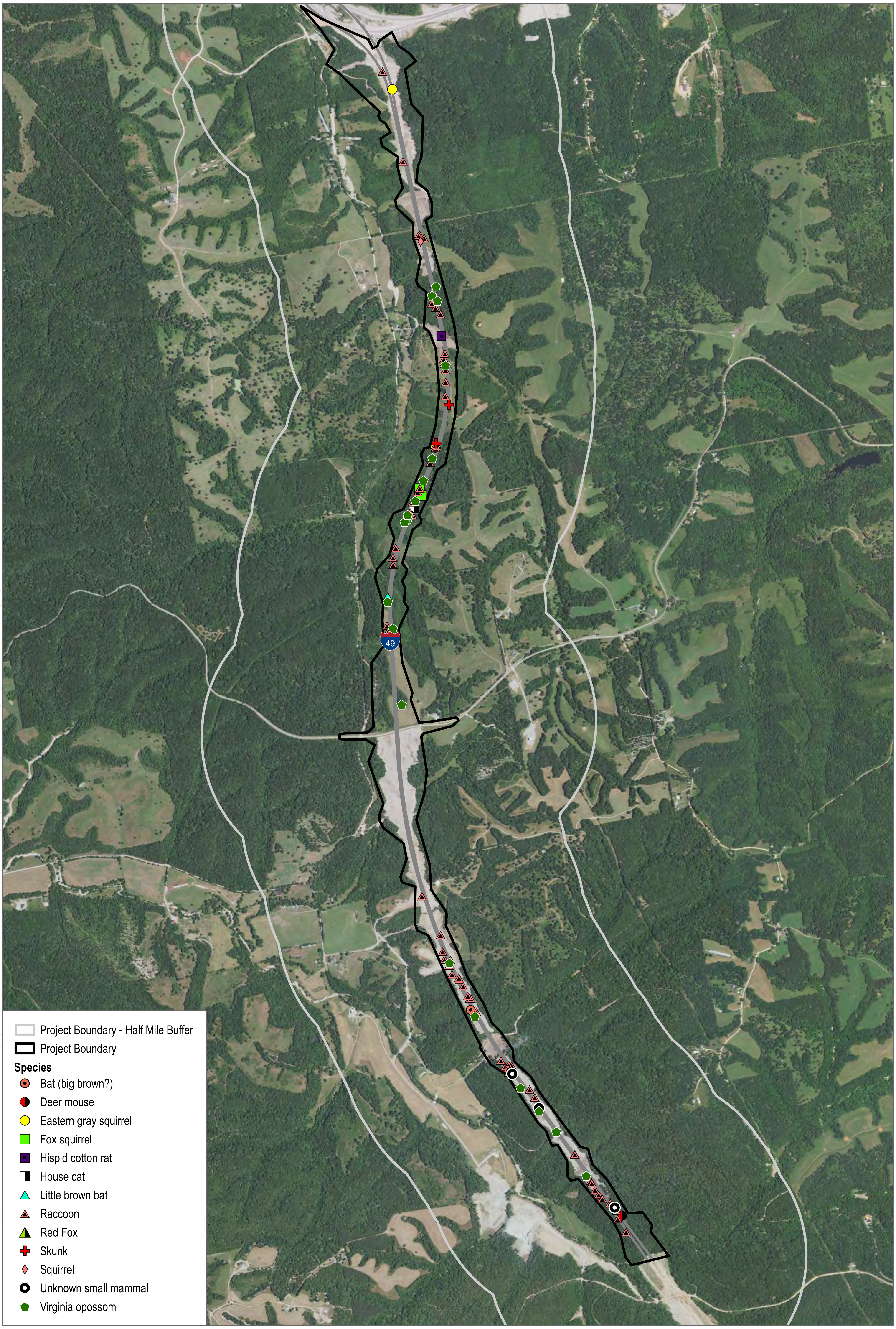
FIGURE 7

Road Mortality - Reptile

MoDOT I-49 Small Animal Movement Study

DUDEK

0 625 1,250 Feet



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

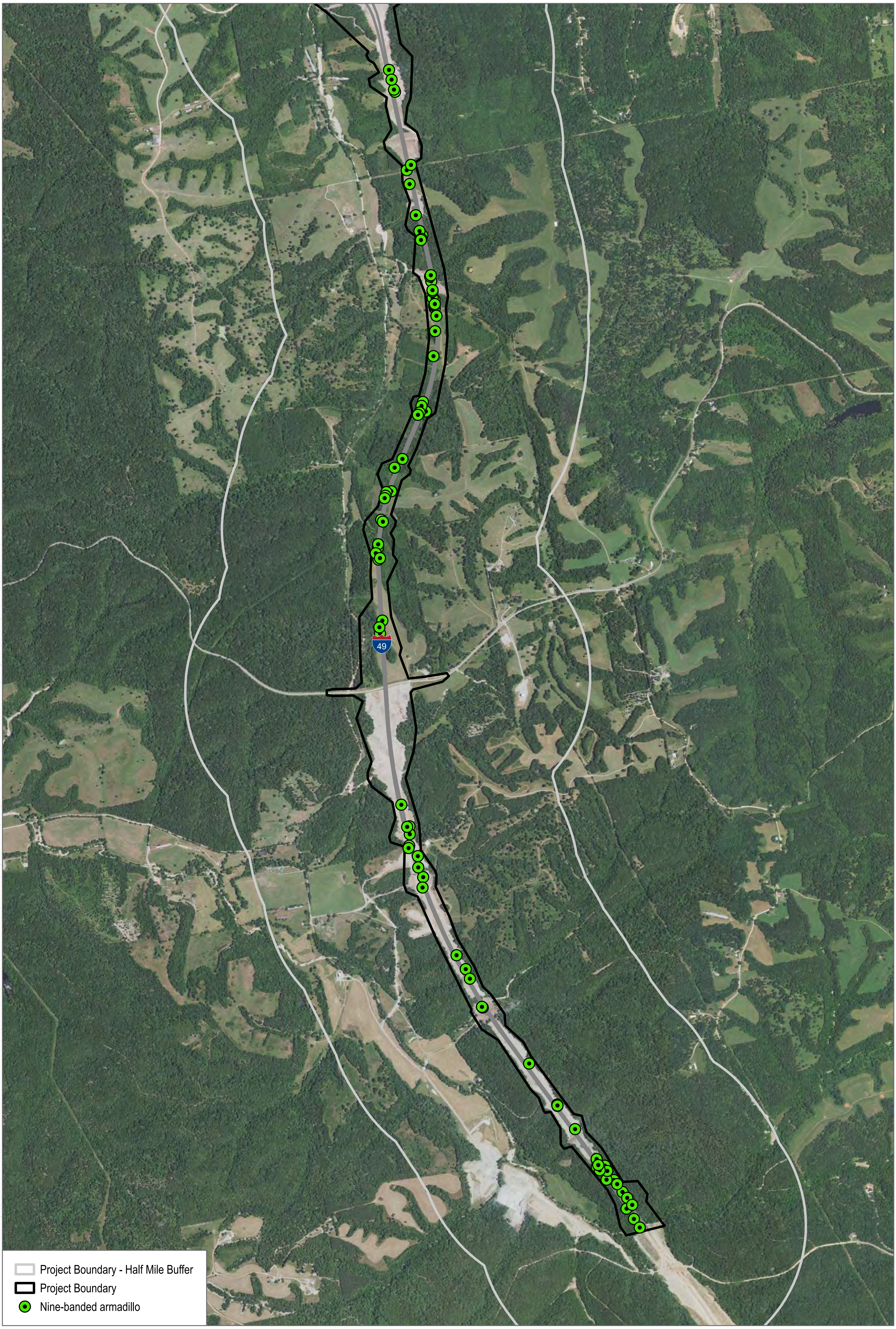
FIGURE 8

Road Mortality - Small Mammal

MoDOT I-49 Small Animal Movement Study

DUDEK

0 800 1,600 Feet



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

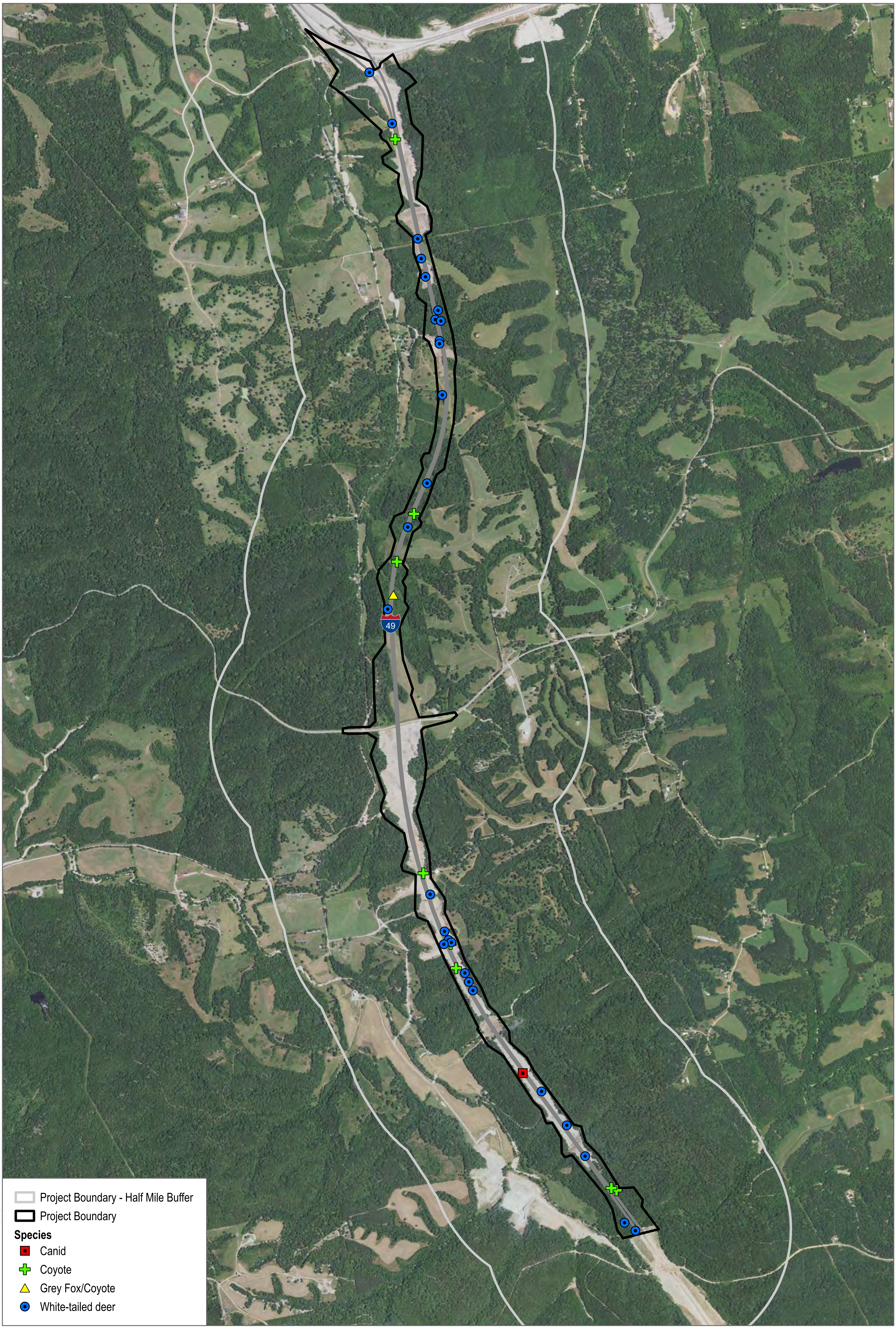
DUDEK

0 750 1,500 Feet

FIGURE 9

Road Mortality - Nine-banded armadillo

MoDOT I-49 Small Animal Movement Study



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

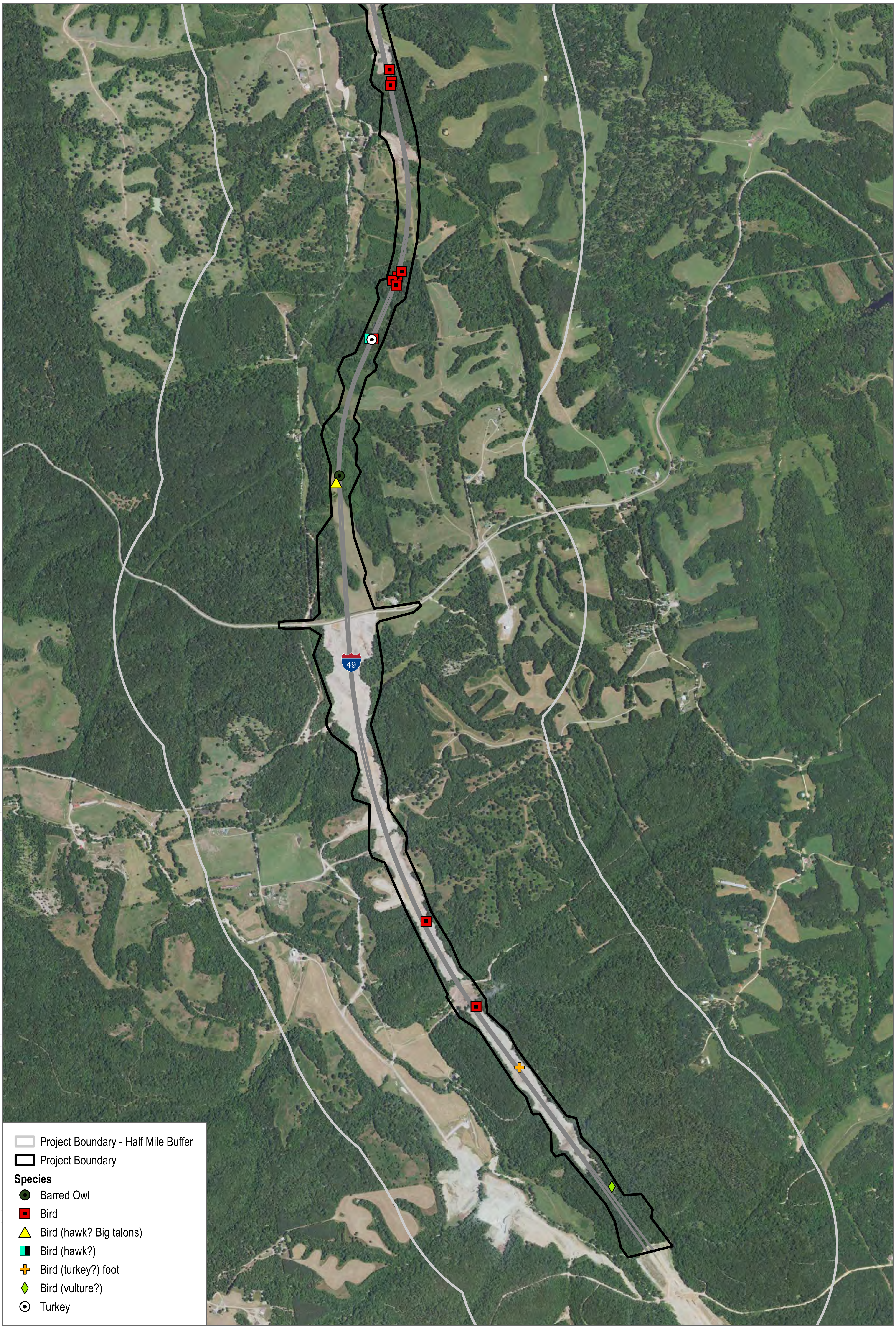
DUDEK

0 830 1,660 Feet

FIGURE 10

Road Mortality - Large Mammal

MoDOT I-49 Small Animal Movement Study



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

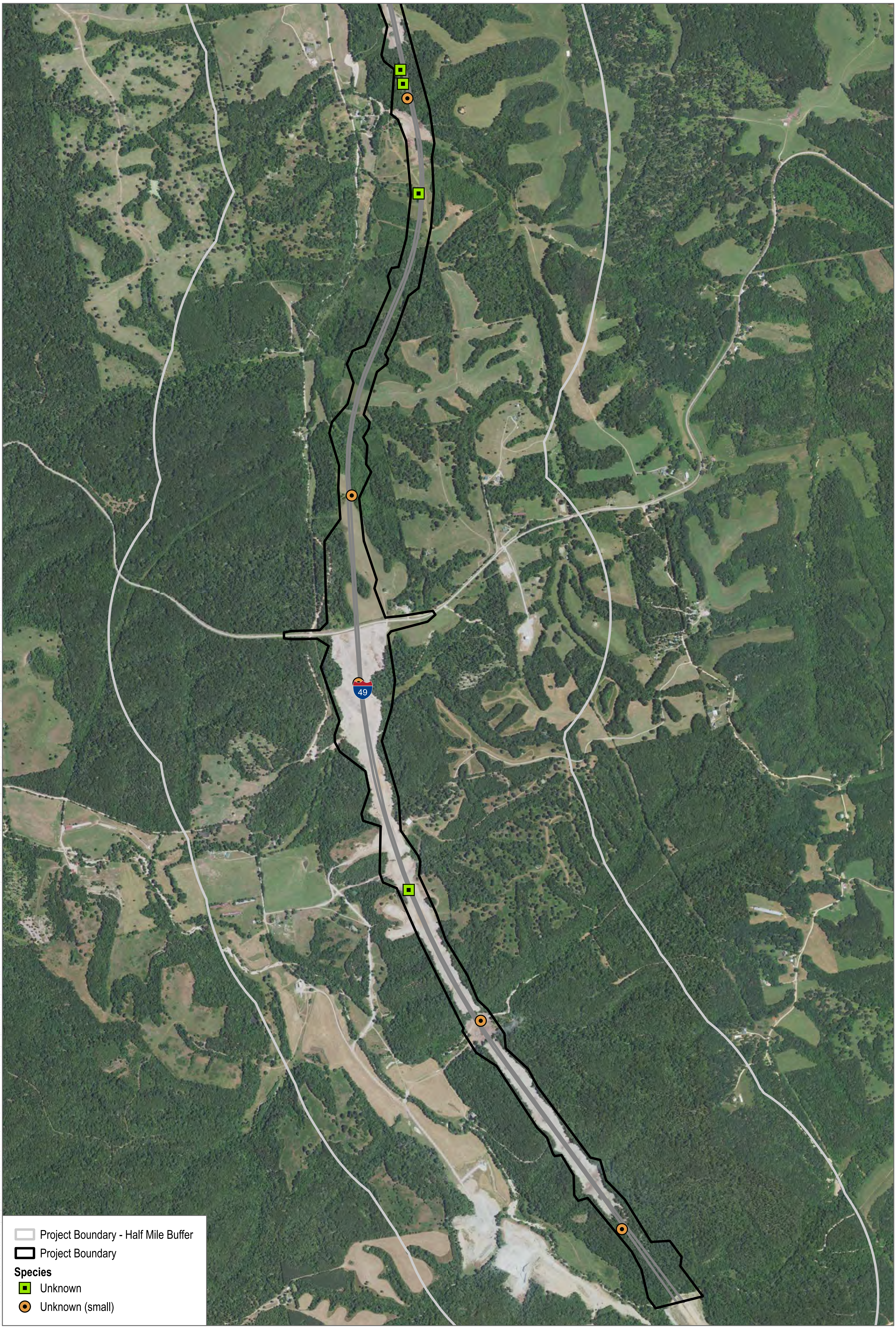
FIGURE 11

Road Mortality - Bird

MoDOT I-49 Small Animal Movement Study

DUDEK

0 650 1,300 Feet



SOURCE: NAIP, 2020; Missouri DOT, State of Missouri

DUDEK

0 625 1,250 Feet

FIGURE 12

Road Mortality - Unknown

MoDOT I-49 Small Animal Movement Study

Exhibit 3. Nine-Banded Armadillo Roadkill Observations Over Time.

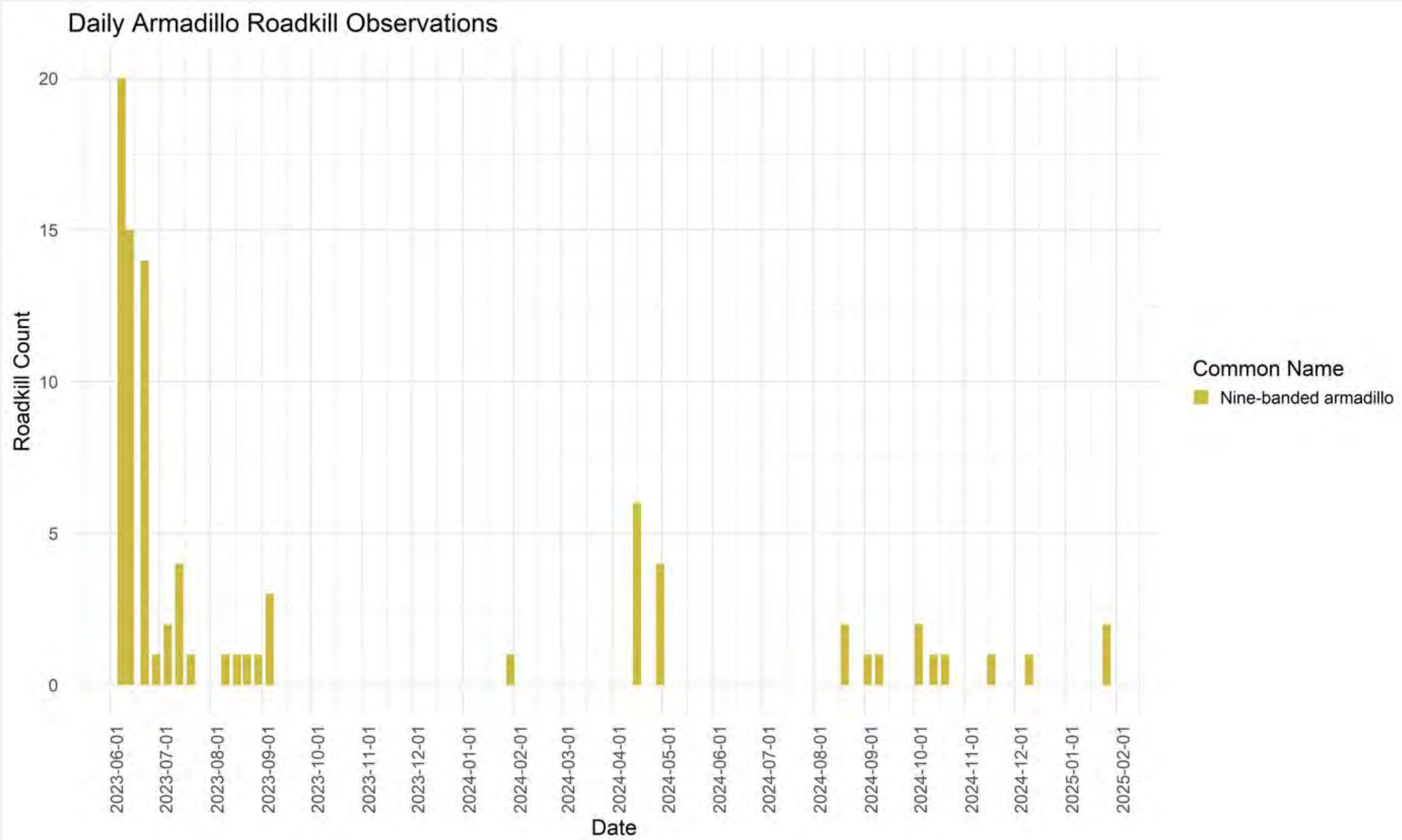


Table 7. Roadkill – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
American bullfrog	*Lithobates catesbeianus*	1
Central newt	*Notophthalmus viridescens*	20
Green frog	*Lithobates clamitans*	1
Southern leopard frog	*Lithobates sphenocephalus*	10
Coyote	*Canis latrans*	7
White-tailed deer	*Odocoileus virginianus*	28
Gray fox	*Urocyon cinereoargenteus*	1
Nine-banded armadillo	*Dasypus novemcinctus*	87
Northern raccoon	*Procyon lotor*	21
Red fox	*Vulpes vulpes*	50
Striped skunk	*Mephitis mephitis*	3
Virginia opossum	*Didelphis virginiana*	21
Dekay's brownsnake	*Storeria dekayi*	1
Eastern snapping turtle	*Chelydra serpentina*	1
Northern rough greensnake	*Opheogrys aestivus*	1
Prairie kingsnake	*Lampropeltis calligaster*	2
Red-bellied snake	*Storeria occipitomaculata*	1
Red-eared slider	*Trachemys scripta*	2
Three-toed box turtle	*Terrapene triunguis*	8
Western black ratsnake	*Pantherophis obsoletus*	1
Big brown bat	*Eptesicus fuscus*	1
Eastern fox squirrel	*Sciurus niger*	2
Eastern gray squirrel	*Sciurus carolinensis*	3
Eastern little brown myotis	*Myotis lucifugus*	1
Hispid cotton rat	*Sigmodon hispidus*	1
	Total	276

Exhibit 4 shows "individuals killed, grouped by species" across the study area, and Exhibit 5 provides more detail over time. Exhibit 6 provides more specific data for large, medium, and small mammals over time. Exhibits 7a and 7b show heat maps of roadkill counts and diversity, respectively, across the study area. There are three general clusters of roadkill with one in the north and two in the south, though those blend into each other. There is a reduced zone of roadkill near the two interchanges (U.S. 71 and MO 90). There is a peak of roadkill detection on the first day as would be expected. That day, the team identified all the species that had been killed prior to the study. Interestingly though, there was no similar peak when surveys restarted on March 20, 2024. In fact, there were minimal detections.

Exhibit 4. Roadkill Individuals by Species Groups by Post Mile.

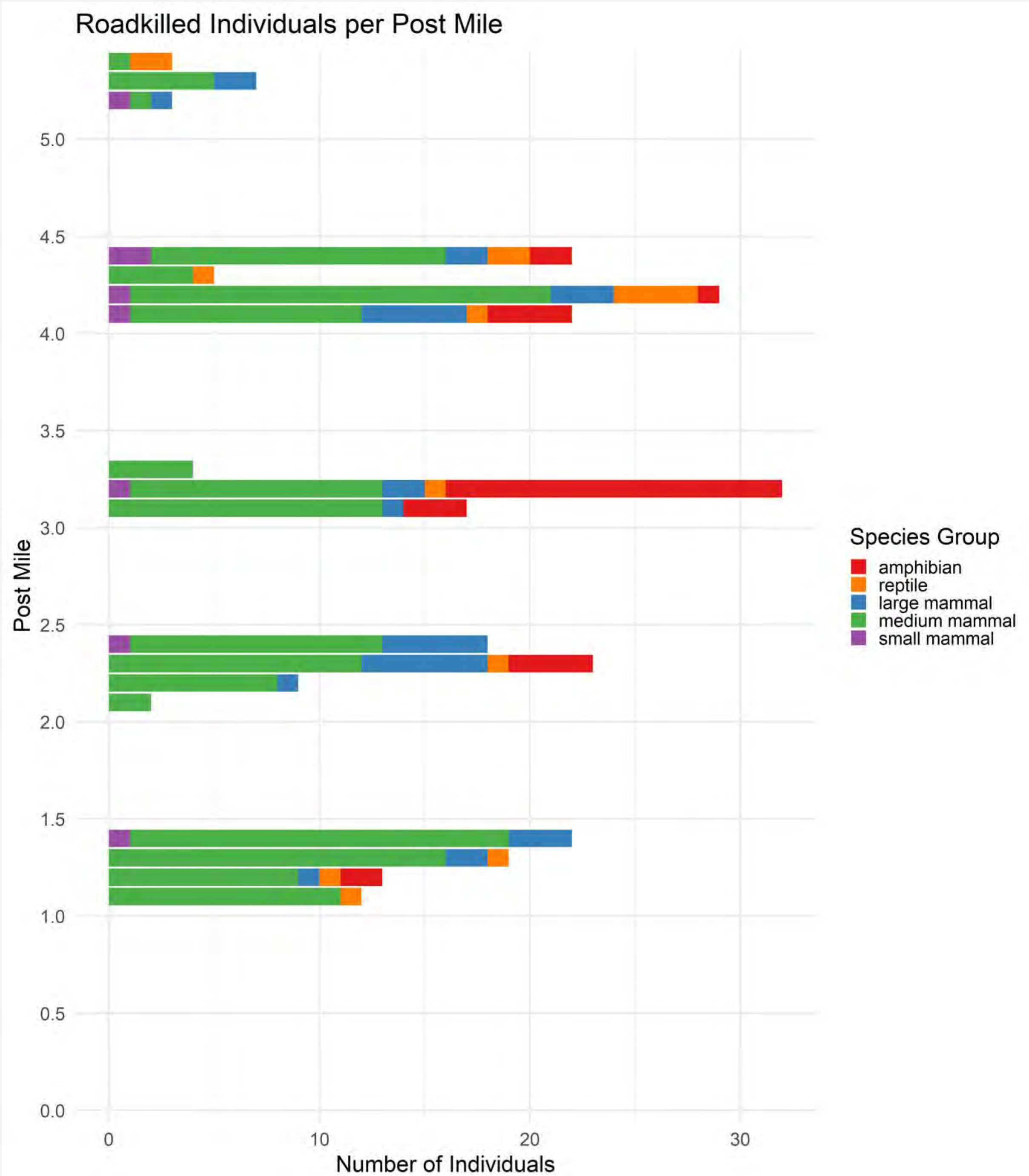
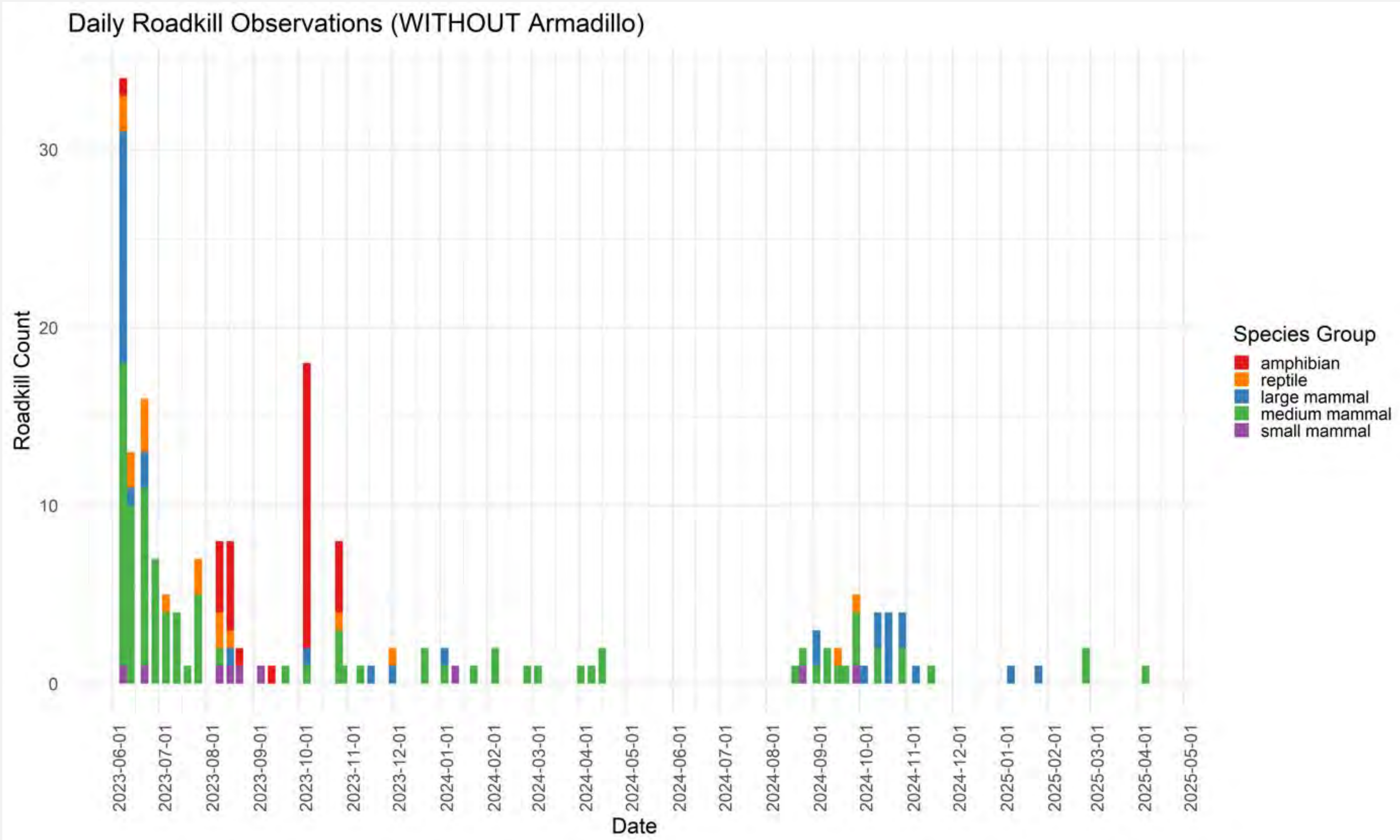


Exhibit 5. Roadkill Species Count by Species Groups Over Time (without Armadillo).



Comment: There was a survey gap between May 1 and August 20, 2024

Exhibit 6. Roadkill Species Counts for Mammals Over Time.

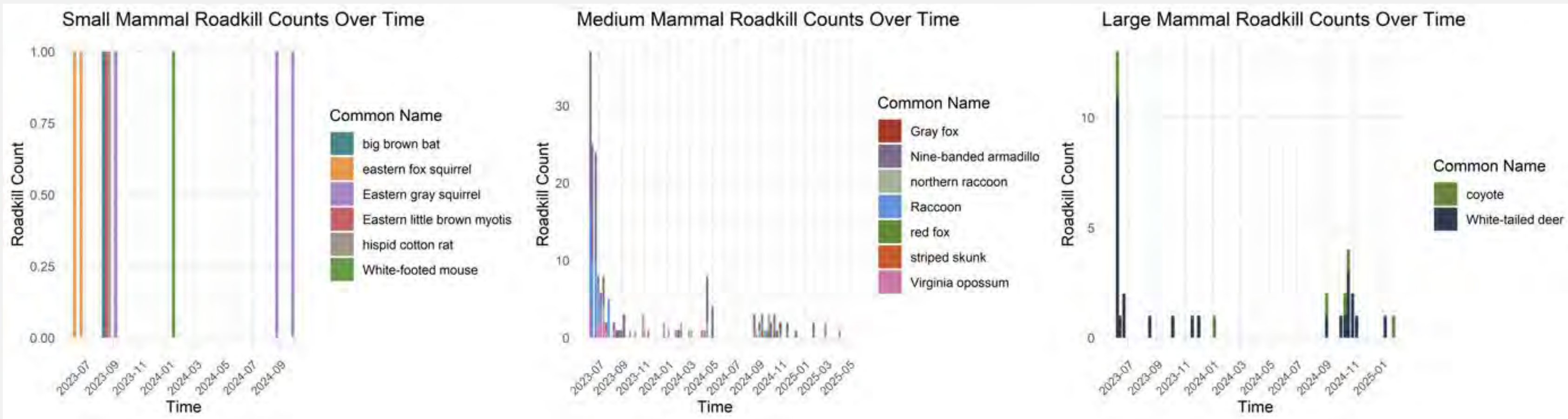


Exhibit 7a. Roadkill Counts Across Study Area.

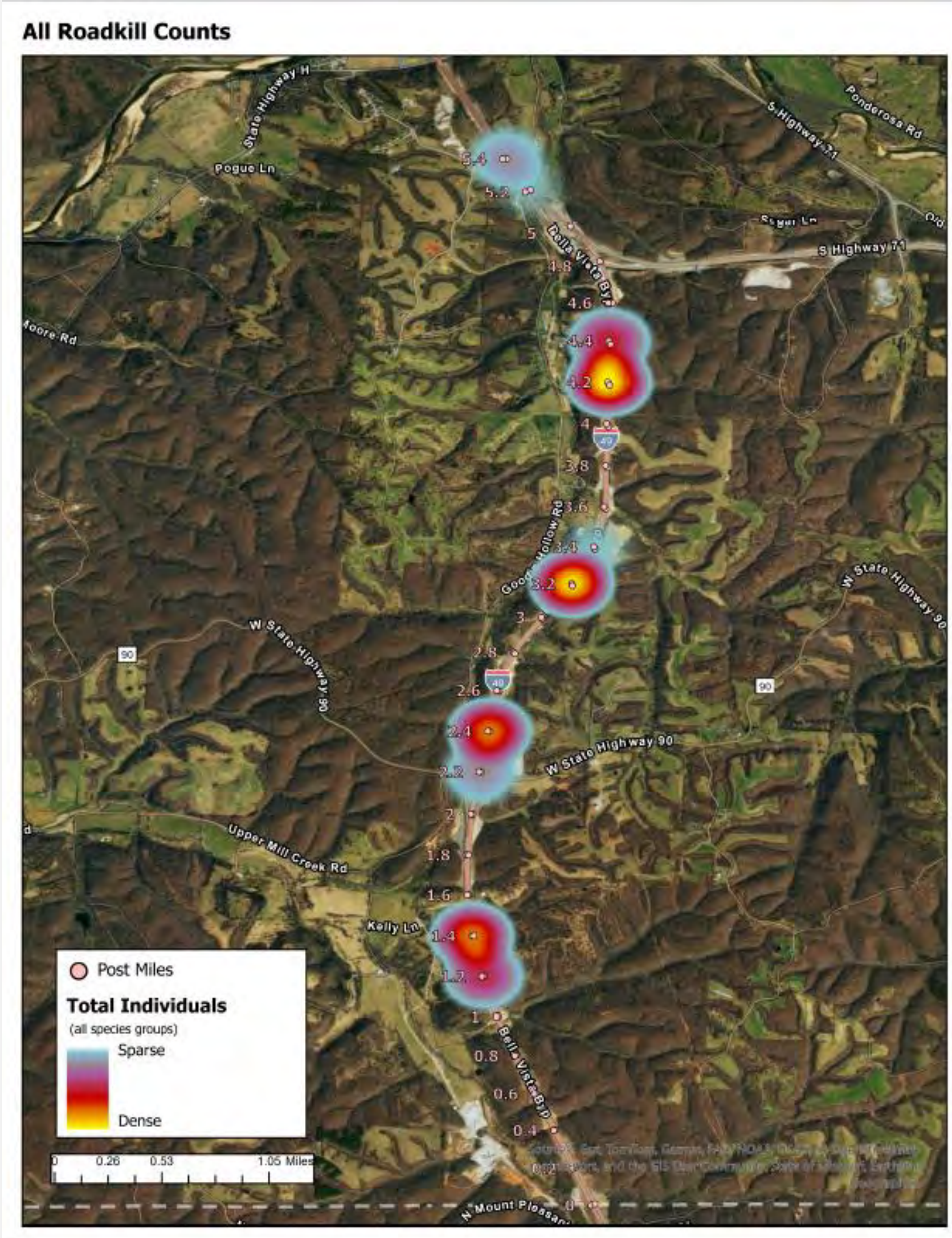
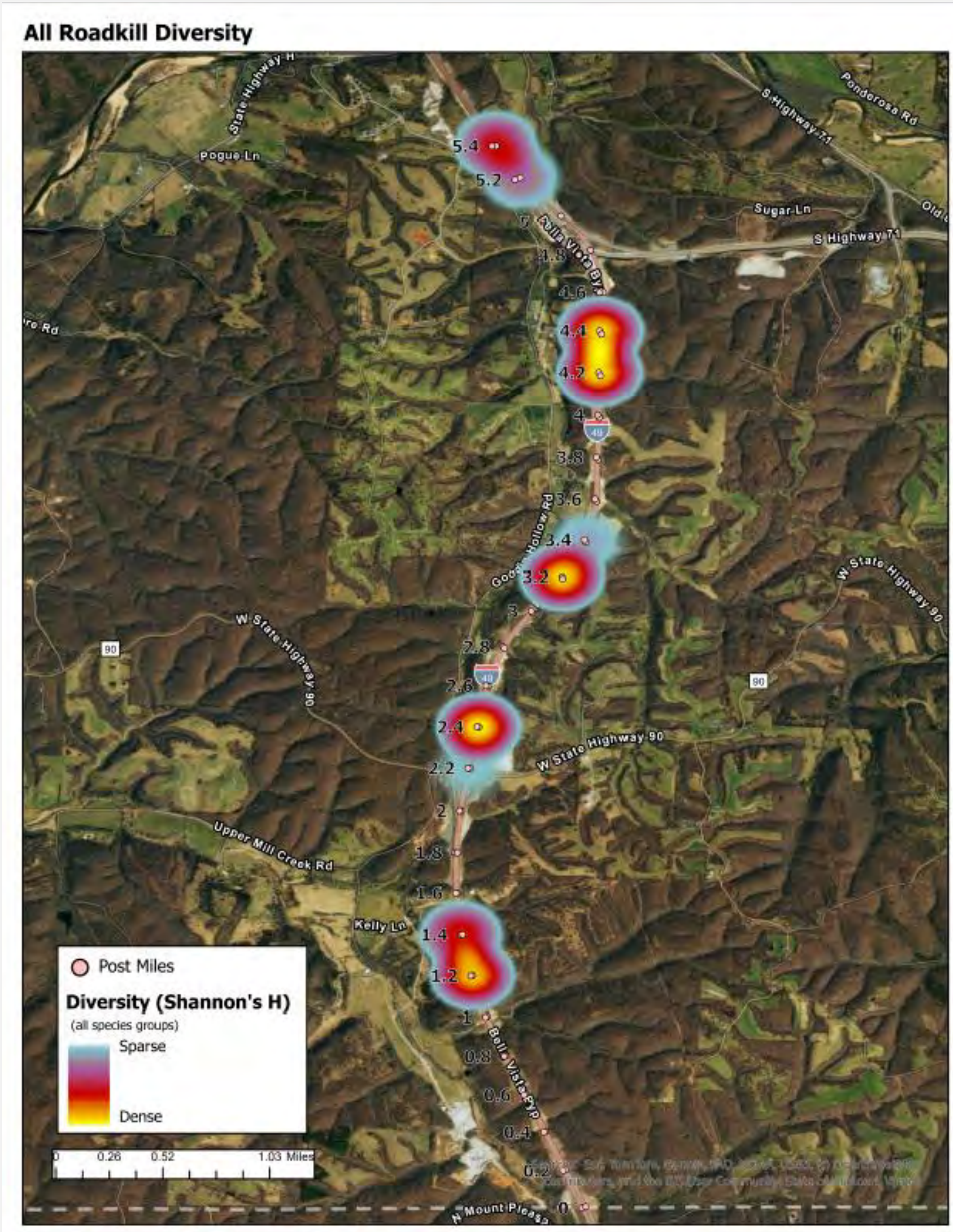


Exhibit 7b. Roadkill Diversity Across Study Area.



3.3.1 Roadkill Statistical Analyses: Association Between Scupper Presence and Roadkill

Roadkill patterns exhibited taxon-specific associations with median scupper presence. Amphibian roadkill rates were significantly higher at road segments (post miles at the 0.1-interval scale) containing scuppers relative to segments without scuppers, corresponding to an estimated ~3.8-fold increase in roadkill rate at scupper-associated locations. This pattern suggests that scuppers coincide with locations where amphibians attempt to cross roadways, rather than indicating that scuppers increase mortality. Reptile roadkill rates were slightly higher at post miles with scuppers than without; however, the detectable effect was zero and came with high uncertainty. Reptile roadkill therefore showed no detectable association with scupper presence, consistent with more variable movement behavior and weaker reliance on drainage-driven pathways. Small mammal roadkill events were too sparse and uniform to support formal statistical inference and were therefore interpreted descriptively. Of the eight small mammal roadkill observations recorded during the study period, two occurred at segments containing scuppers, and six occurred at segments without scuppers. In all models, random-effect variances for road segment and survey data collapsed to zero, indicating limited support for spatial or temporal heterogeneity given the small sample sizes.

Importantly, higher roadkill rates at scupper-associated segments do not indicate that scuppers increase wildlife mortality. Rather, scuppers are placed at landscape features that naturally concentrate animal movement, particularly for taxa that follow drainage networks or moist microhabitats. Additionally, coverboards were placed at the roadside of scupper locations, further drawing animals to road segments where scuppers are, meaning their likelihood of attempting highway crossings here is elevated compared to elsewhere. The analysis therefore identified locations where animals are more likely to attempt road crossings, not the effect of scuppers on crossing success or safety. Without movement data from matched non-scupper locations or before–after comparisons, scupper effectiveness cannot be inferred from roadkill patterns alone. Importantly, there is a need for study designs that include matched non-scupper controls or before–after comparisons to directly assess scupper crossing effectiveness.

3.4 Camera Studies

The broad cumulative camera studies resulted in the capture of more than 4 million images (1.9 terabytes of data), which included over 100,000 wildlife photos. Most of these were false-positive images that needed to be manually reviewed. The resulting roughly 14,000 photos of animals were then combined into discrete individual photo series detections. This reduction resulted in 31 species and more than 3,300 discrete detections of animals. There is no way to determine how many unique individuals were photographed, but an attempt was made to not double-count individuals when images of the same species were captured chronologically close to one another or when a span of 10 minutes had passed since the last detection. The cumulative camera study captured 4 amphibian species, 1 reptile species, 5 bird species, and 21 mammal species. The vast majority of the detections included rodents. Because of the intricacies of identifying rodents (e.g., tail and ear length), these are treated generically as a group. The next highest detected species during the study included white-tailed deer, squirrel, raccoon, and coyote.

Exhibit 8 depicts the total number of camera-trapped individuals by species group for each camera location. The “P” series camera stations represent the roadside cameras, “C” series camera stations are associated with culverts, and “Scupper” stations represent the cumulative cameras for each group of scuppers. Overall, small mammals are more prevalent within the scupper groups, especially scupper groups 6, 9, and 10.

Exhibit 8. Total Camera-trapped Individuals per Location.

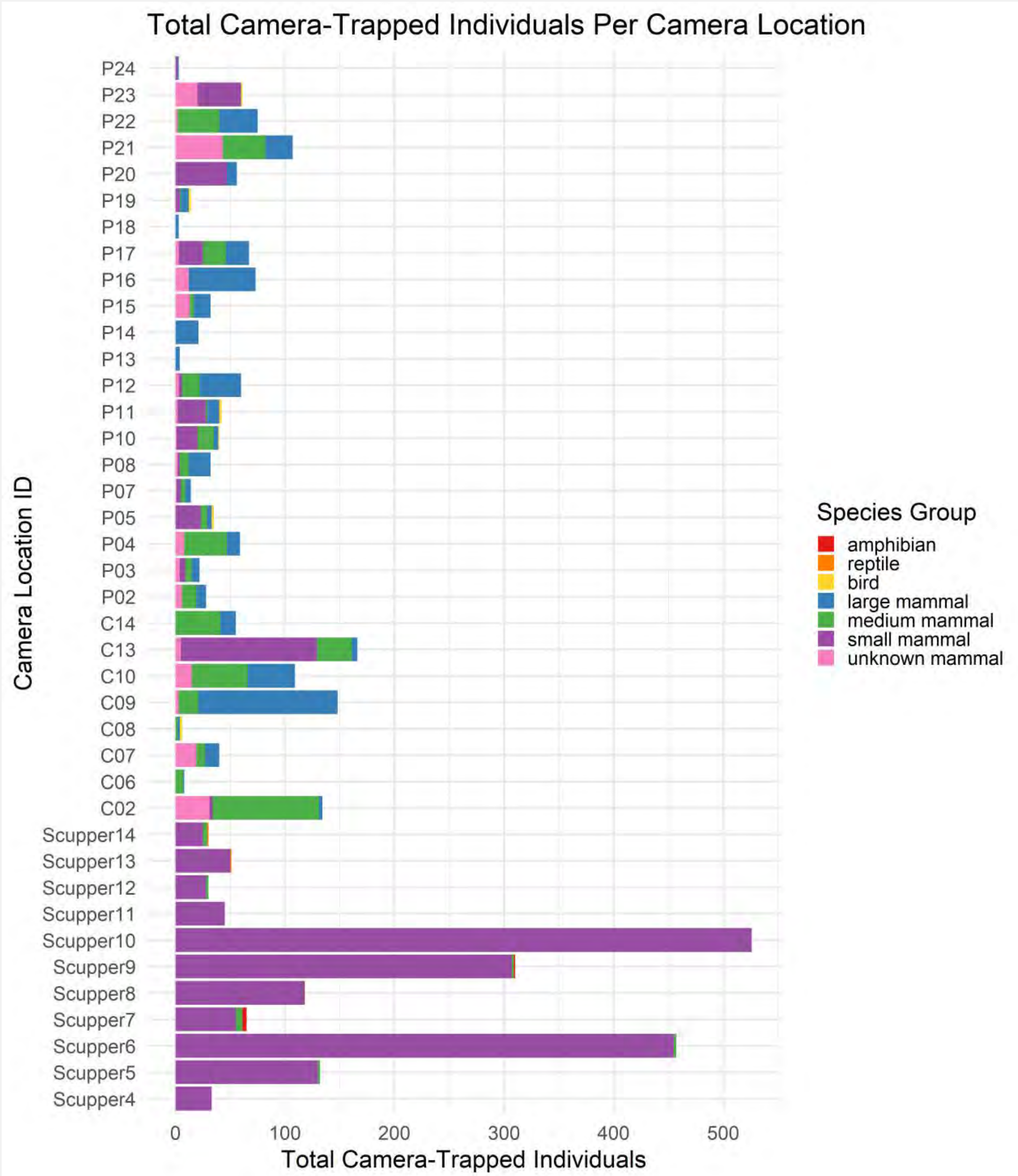
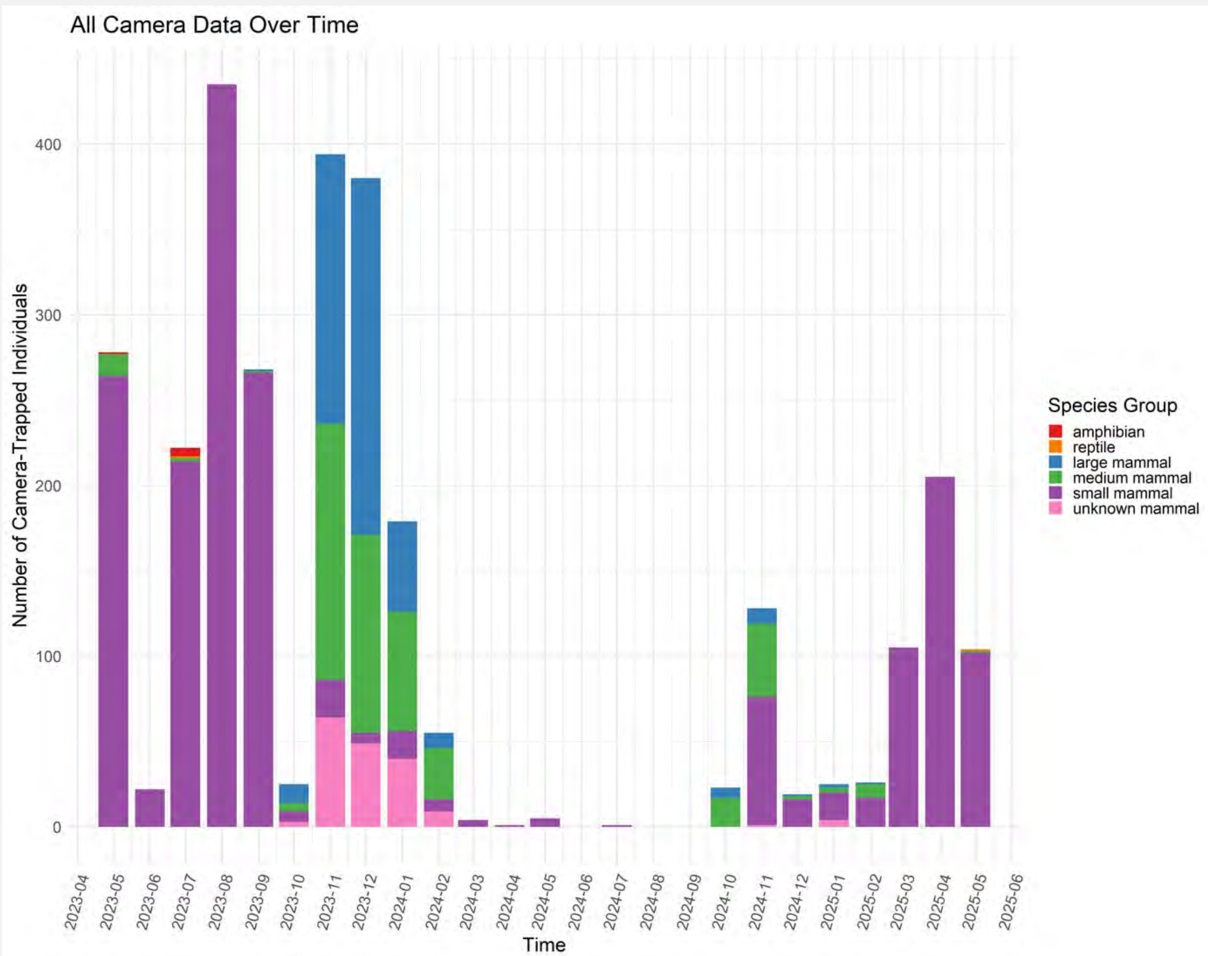


Exhibit 9 depicts the overall camera data over time. While there generally appears to be similar camera data capture from April 2023 through December 2023, the culvert and roadside camera study did not begin until November 2023. Additionally, there was a gap in the culvert and roadside camera efforts from May through most of August 2024 due to study extension discussions. Following September 2024, fewer cameras were placed at culverts, and more cameras were lost broadly.

Exhibit 9. Cumulative Camera Data Over Time.



3.4.1 Median Scupper Camera

The median scupper camera study resulted in the capture of more than 3.3 million images, which included over 739,000 animal photos that were originally identified by AIT to include wildlife but were false positives. It is thought that the occasionally out-of-focus images, combined with moving debris in the images, contributed to the false positives. Ultimately, all the "animal" photos needed to be reviewed by a biologist, resulting in 6,075 animal photos. Once those were further reduced to represent actual individuals (i.e., continuous detections or those that occurred within 10 minutes of each other were condensed), a total of 1,797 individuals were identified overall. This included 12 species or species groupings for the 1,797 discrete scupper detections of animals (Table 8). Due to the close space within the scuppers and difficulties in identifying species by photos (i.e., not in hand), in some cases it was not feasible to identify to the genus level. The study captured four amphibians (American bullfrog, American toad, unidentified amphibian, and frog/toad; six individuals), one reptile species (three-toed box turtle; two individuals), and seven mammal species (coyote, domestic dog [*Canis familiaris*], nine-banded armadillo, northern raccoon, eastern cottontail [*Sylvilagus floridanus*], plains pocket gopher [*Geomys bursarius*], and unidentified rodent; 1,789 individuals). Photographs of wildlife that were walking by (e.g., white-tailed deer) were excluded. The coyote and domestic dog each poked their heads into the scupper. Rodents (n = 1,764 individuals) made the most use of scuppers and were observed to go in and out of the scuppers throughout prolonged periods, even with vehicles passing by. Armadillos were the next most detected species with 13 individuals.

Table 8. Median Scupper Camera – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
American bullfrog	*Lithobates catesbeianus*	1
American toad	*Anaxyrus americanus americanus*	2
Amphibian	*Amphibia*	2
Frog/toad	*Anura*	1
Coyote	*Canis latrans*	1
Domestic dog	*Canis familiaris*	1
Nine-banded armadillo	*Dasypus novemcinctus*	13
Northern raccoon	*Procyon lotor*	4
Box turtle	*Terrapene triunguis*	2
Eastern cottontail	*Sylvilagus floridanus*	4
Plains pocket gopher	*Geomys bursarius*	2
Rodent	*Muridae*	1764
	Total	**1797**

These data are also presented overall (Exhibit 10), by species group (Exhibit 11), and by species over time (Exhibit 12). There were trapping gaps between September 7, 2023 to March 19, 2024 and September 12, 2024 to March 4, 2025.

Exhibit 10. Scupper Camera Data Over Time by Species Group.

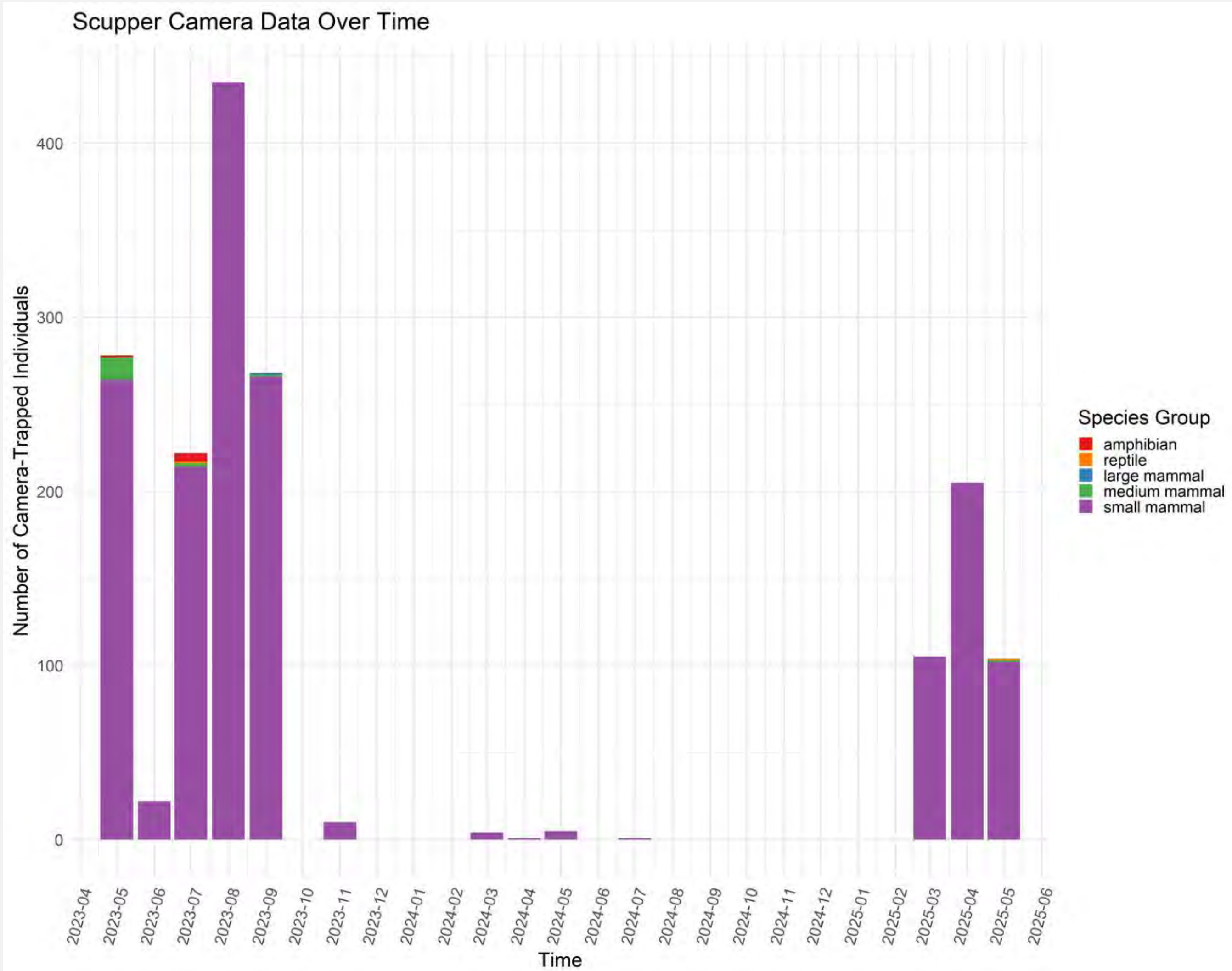


Exhibit 11. Scupper Camera Data by Species Group and Time.

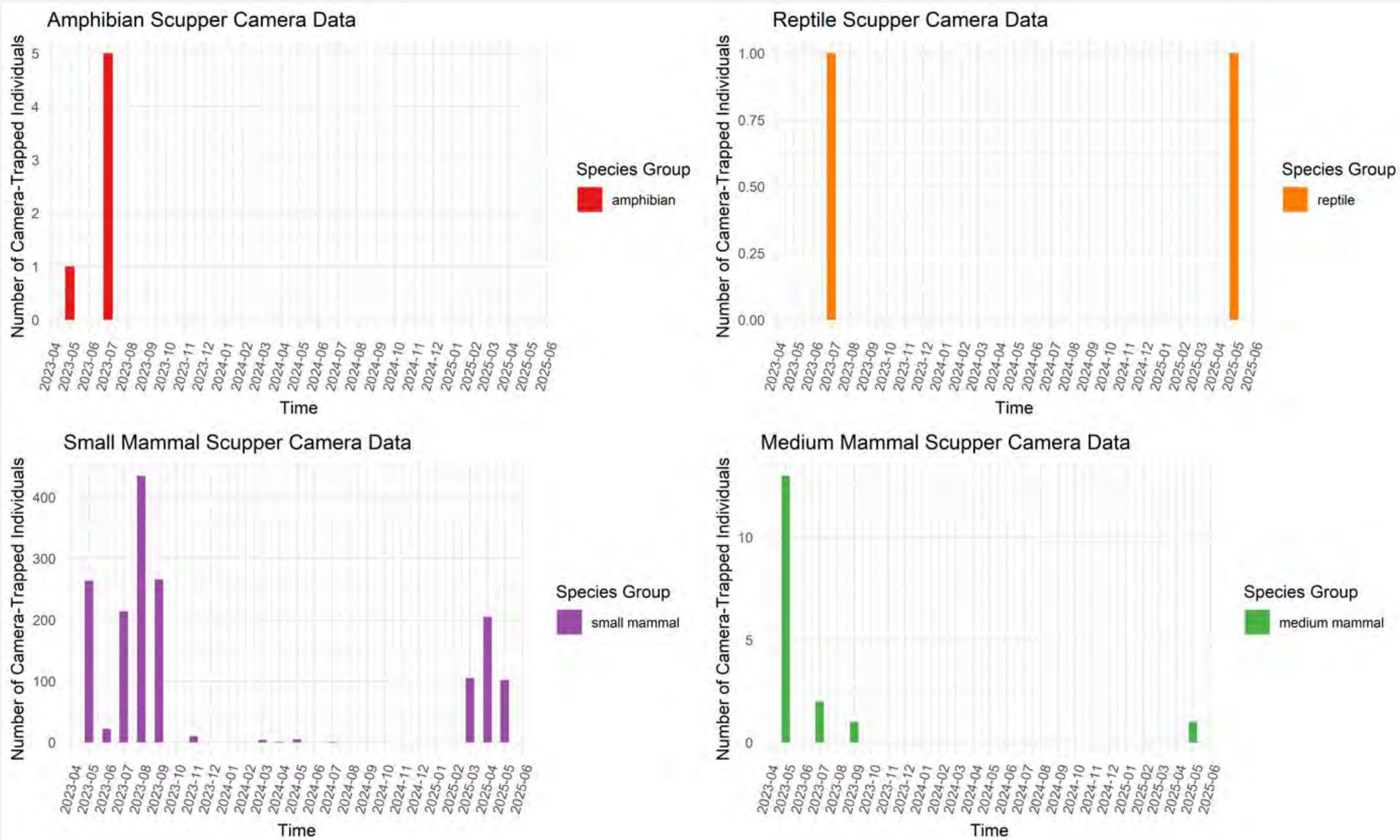
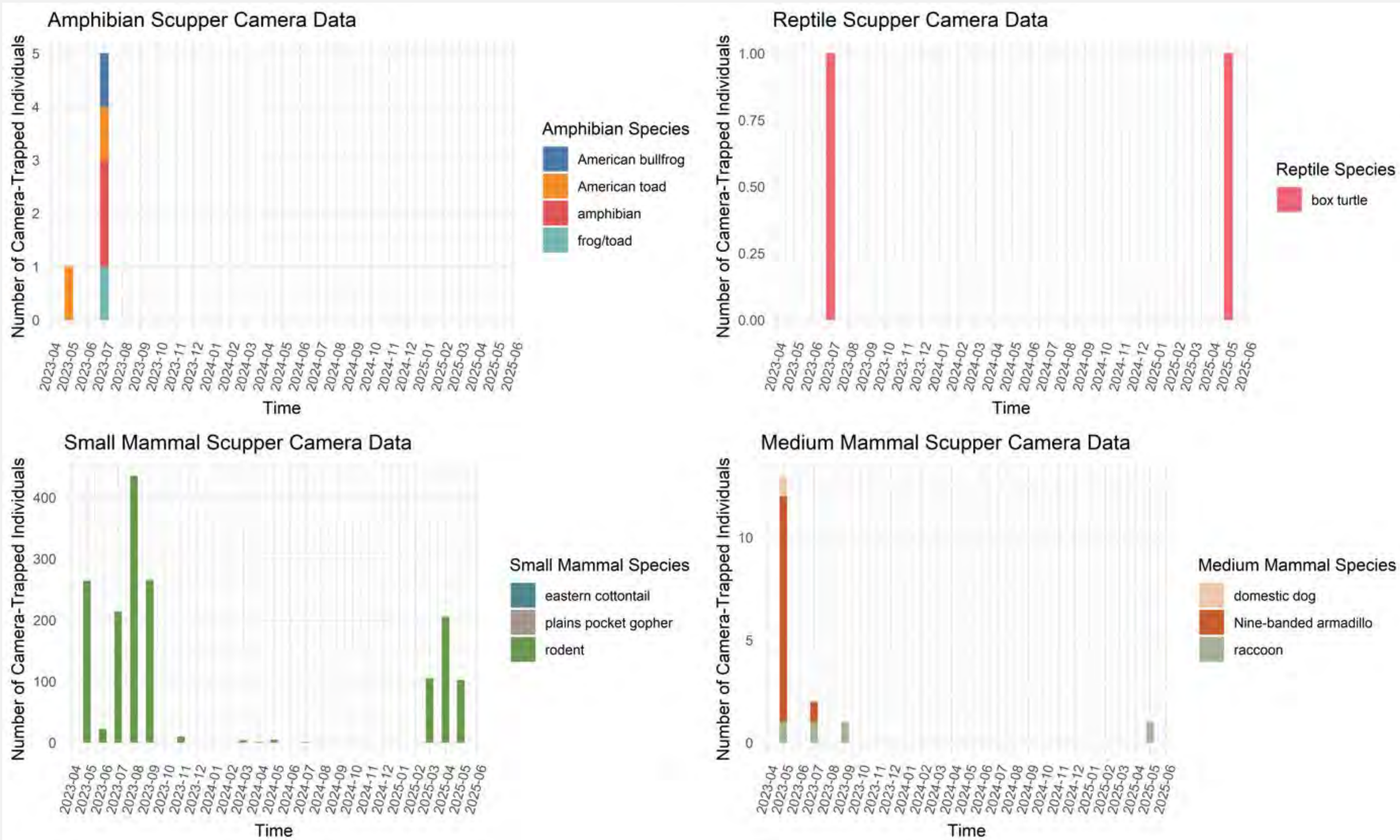


Exhibit 12. Scupper Camera Data by Species over Time.



Exhibits 13a and b presents camera counts and a heat map of the species diversity found at the scupper groups.

Exhibit 13a. Scupper Camera-Trapped Small Species Counts Across Study Area.

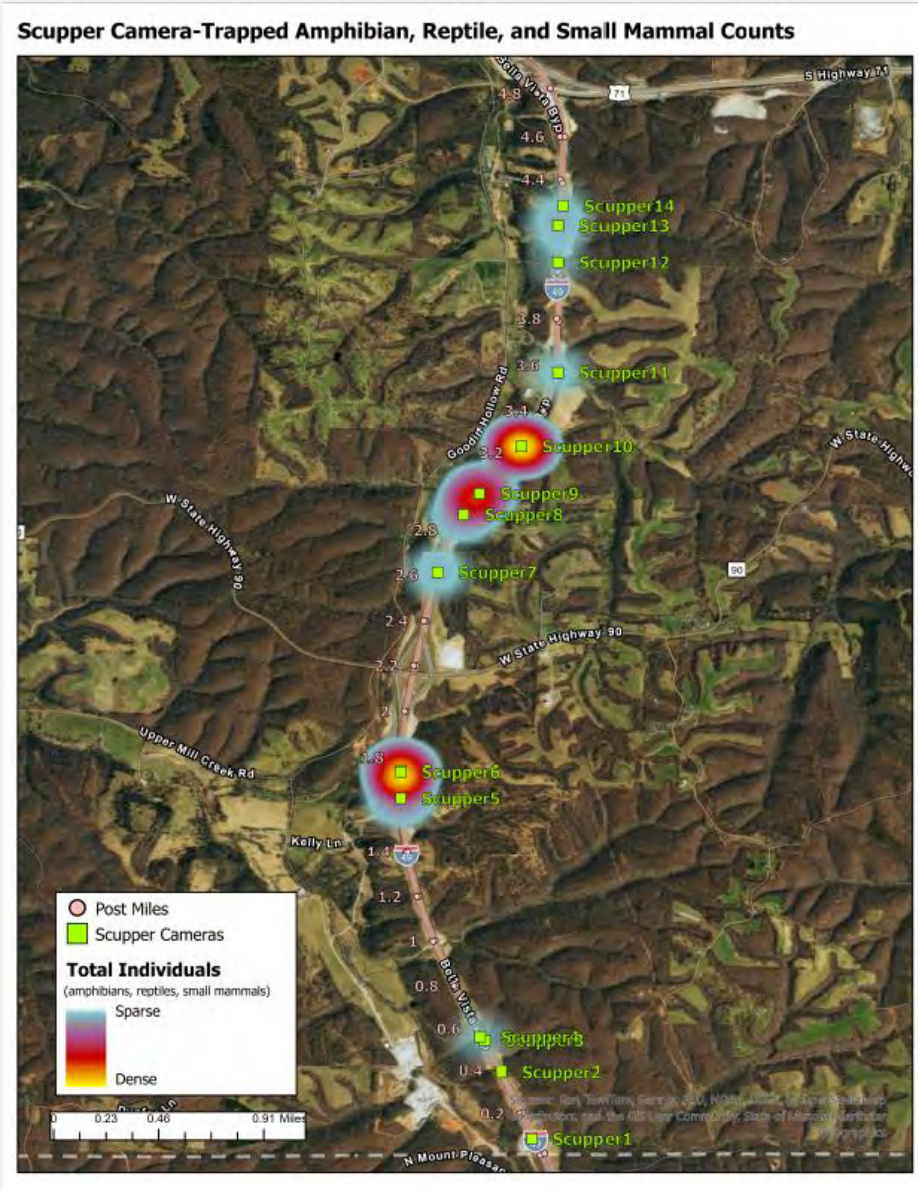
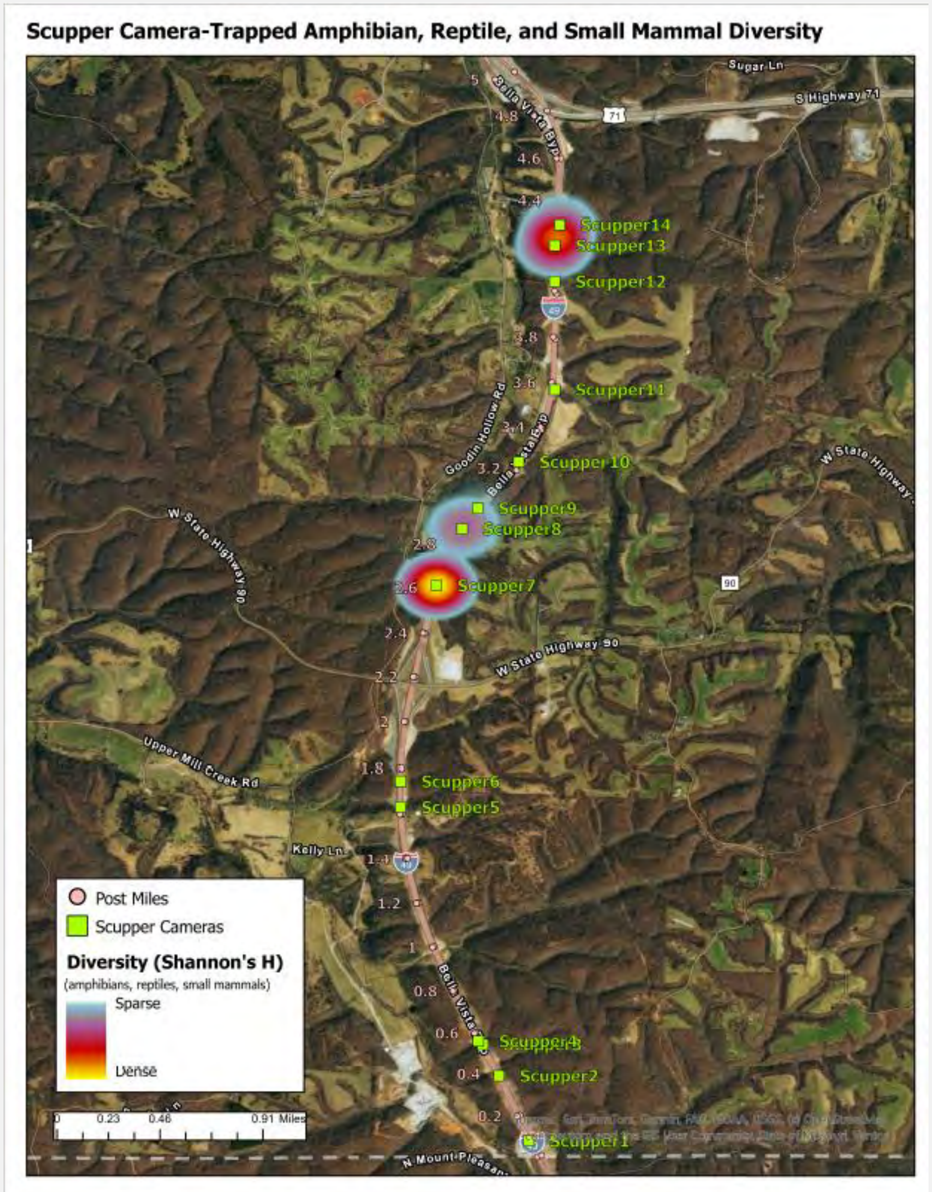


Exhibit 13b. Scupper Camera-Trapped Small Species Diversity Across Study Area..



3.4.2 Culvert Camera

The culvert camera study resulted in the capture of more than over 30,000 animal photos. After weeding out false positive photos, the total was reduced to 5,174 photos of actual animals. This included 15 species or species groupings and 666 discrete detections of animals (Table 9). The study captured one bird species (American crow [*Corvus brachyrhynchos*]; two individuals) and 14 mammal species, including a variety of large and medium-sized species and a few domesticated species. Raccoon was the most detected species (n = 149 individuals), followed by squirrel (n = 123), white-tailed deer (n = 115). Coyote (93 detections) and bobcat (70 detections) were also consistently present. There were an additional 73 mammals that were detected but could not be identified for a variety of reasons (e.g., blurry images, partial features, blocking by vegetation, distance). Also, culvert camera capture was biased against small wildlife like rodents, reptiles, and amphibians due to the field of view and their scale, vegetation, and other factors. Due to intervening vegetation and security reasons, it was not possible to confirm actual movement through culverts, though movement could be inferred for several species due to their consistent presence to and from the facilities.

Table 9. Culvert Camera – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
American crow	*Corvus brachyrhynchos*	2
Coyote	*Canis latrans*	93
White-tailed deer	*Odocoileus virginianus*	115
Bobcat	*Lynx rufus*	70
Canid	Canidae	1
Cat[1]	Felidae	1
Domestic cat	*Felis catus*	15
Nine-banded armadillo	*Dasypus novemcinctus*	4
Raccoon	*Procyon lotor*	149
Red fox	*Vulpes vulpes*	1
Virginia opossum	*Didelphis virginiana*	15
Chipmunk	Tamias	1
Skunk	Mephitidae	3
Squirrel	Sciuridae	123
Mammal	Mammalia	73
	Total	**666**

[1] Could not be differentiated to the species level

3.4.3 Roadside Camera

The paired roadside camera study resulted in the capture of more than 20,000 animal photos. After weeding out false positive photos, the total was reduced to 1,603 photos of actual animals. This included 20 species or species groupings and 848 discrete refined detections of animals (Table 10). The study captured four bird species or groups (generic bird, northern flicker [*Colaptes auratus*], white-crowned sparrow [*Zonotrichia leucophrys*], and wild turkey [*Meleagris* *gallopavo*]; eight individuals) and 16 mammals, including a variety of large and medium-sized species and a handful of domesticated species. White-tailed deer was the most detected species (n = 237 individuals), followed by squirrel (n = 138), coyotes (n = 73), and nine-banded armadillo (n = 70). There were an additional 170 mammals that were detected but could not be identified for a variety of reasons (e.g., blurry images, partial features, blocking by vegetation, distance). Also, roadside camera capture was biased against small wildlife like rodents, reptiles, and amphibians due to the field of view and their scale, vegetation, and other factors.

Table 10. Roadside Camera – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
Bird	*Aves*	5
Northern flicker	*Colaptes auratus*	1
White-crowned sparrow	*Zonotrichia leucophrys*	1
Wild turkey	*Meleagris gallopavo*	1
Coyote	*Canis latrans*	73
White-tailed deer	*Odocoileus virginianus*	237
Wild pig	*Sus scrofa*	2
Bobcat	*Lynx rufus*	32
Domestic cat	*Felis catus*	4
Domestic dog	*Canis familiaris*	1
Gray fox	*Urocyon cinereoargenteus*	1
Nine-banded armadillo	*Dasypus novemcinctus*	70
Raccoon	*Procyon lotor*	44
Red fox	*Vulpes vulpes*	1
Virginia opossum	*Didelphis virginiana*	58
Lagomorph	Lagomorpha	23
Rodent	Muridae	33
Skunk	Mephitidae	3
Squirrel	Sciuridae	138
Mammal	Mammalia	120
	Total	**848**

3.5 Coverboard

The coverboard study resulted in the detection of 21 species under 70 coverboards (out of 110) and 425 individuals (Table 11). This includes two amphibians (southern leopard frog [three individuals] and spotted salamander [*Ambystoma maculatum*] [one individual]); 13 reptiles, including lizards, snakes, and a turtle (71 individuals); and four small mammals (deer mouse [*Peromyscus* spp.] [122 individuals]), hispid cotton rat [*Sigmodon hispidus*] [16 individuals], least shrew [*Cryptotis parva*] [eight individuals], and pine vole [*Microtus pinetorum*] [204 individuals]). It is likely that a number of the same individuals were documented on several occasions. Coverboard 9-1 within the grassy portion of the roadside and near scupper group 2 hosted the second greatest number of individuals—almost all small mammal species—while the 14-1 through 14-5 coverboard group just south of U.S. 71 and also within grassy roadside habitat supported the most individuals overall. Detections occurred throughout the study period and documented the presence of small mammal nests and incidentally located an three-toed box turtle (*Terrapene triunguis*) nest.

Table 11. Coverboard – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
Southern leopard frog	*Lithobates sphenocephalus*	3
Spotted salamander	*Ambystoma maculatum*	1
Possible scorpion	Possible scorpion	1
Broad-headed skink	*Plestiodon laticeps*	6
Brown snake	*Storeria dekayi*	1
Common garter snake	*Thamnophis sirtalis*	1
Copperhead	*Agkistrodon contortrix*	5
Three-toed box turtle	*Terrapene triunguis*	2
Eastern racer	*Coluber constrictor*	1
Five-lined skink	*Plestiodon fasciatus*	7
Little brown skink	*Scincella lateralis*	16
Milk snake	*Lampropeltis triangulum*	1
Prairie fence lizard	*Sceloporus consobrinus*	6
Ring-necked snake	*Diadophis punctatus*	17
Speckled kingsnake	*Lampropeltis holbrooki*	6
Western ratsnake	*Pantherophis obsoletus*	1
Western ribbon snake	*Thamnophis proximus*	1

Table 11. Coverboard – Total Individuals Detected by Species

Common Name	Scientific Name	Total Individuals
Deer mouse (spp.)	*Peromyscus spp.*	122
Hispid cotton rat	*Sigmodon hispidus*	16
Least shrew	*Cryptotis parva*	8
Pine vole	*Microtus pinetorum*	204
	Total	**426**

Exhibit 14 shows total individuals by species group and coverboard; Exhibits 15 and 16 show individuals by species group and coverboard over time. Exhibit 17 shows individuals by species over time and Exhibit 18 provides a heat map of detections across the study area.

Exhibit 14. Individuals by Species Group and Coverboard Location.

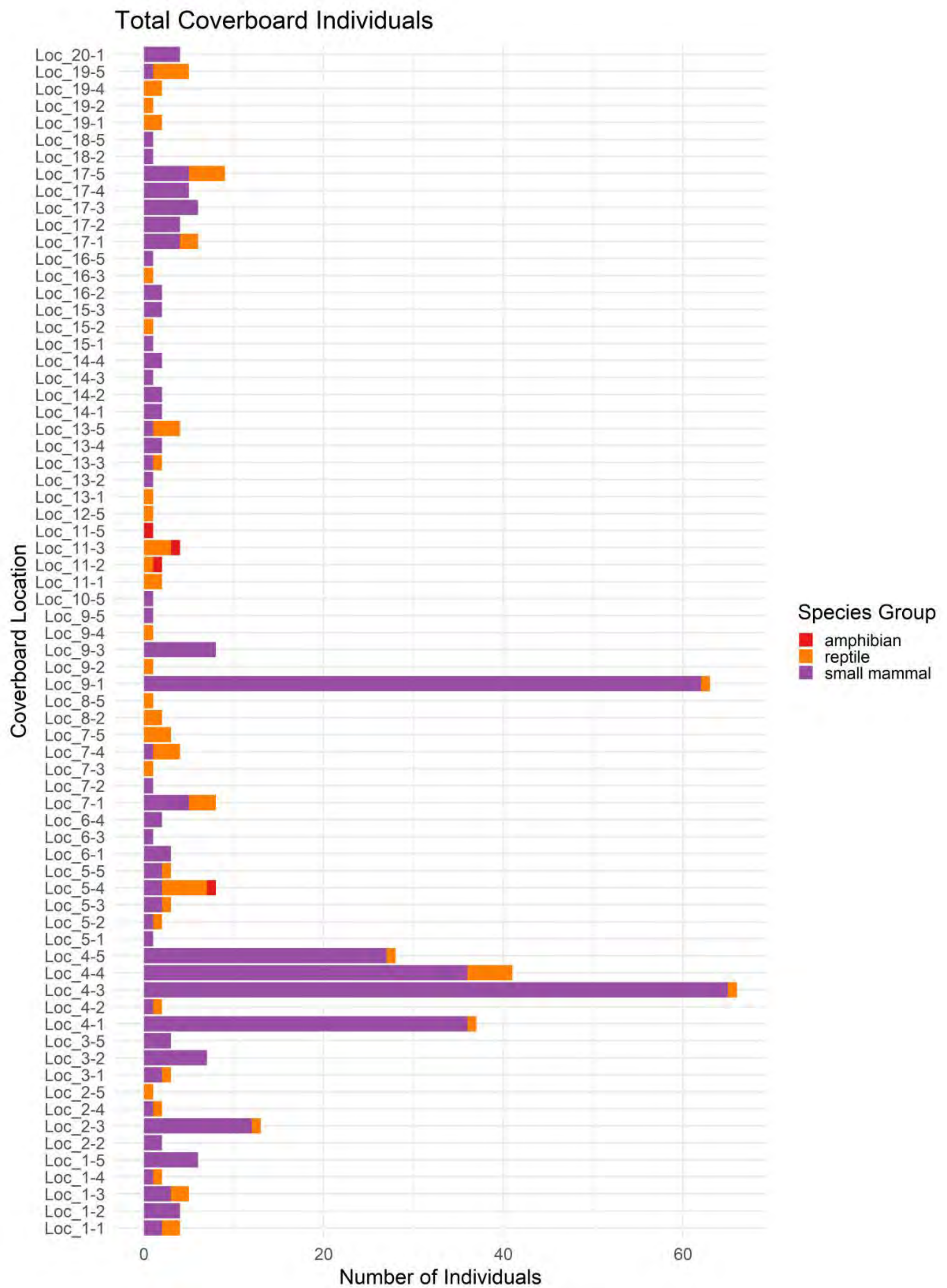


Exhibit 15. Coverboard Data Over Time.

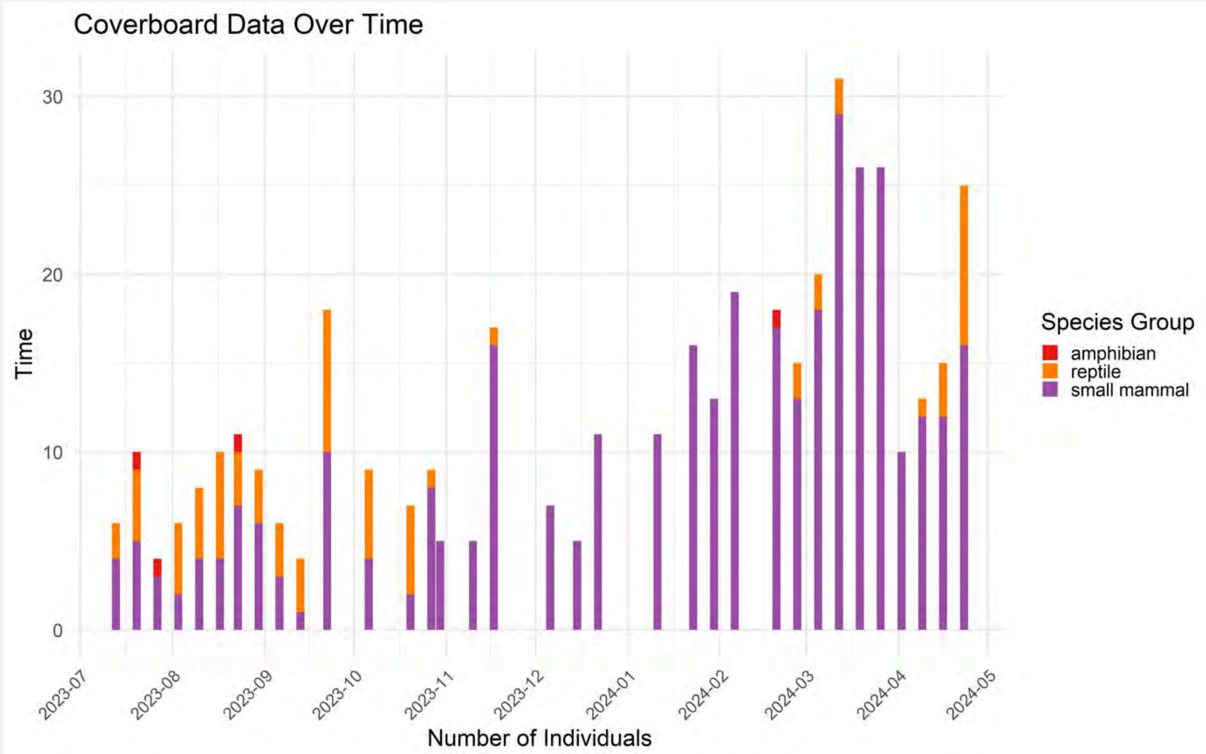


Exhibit 16. Coverboard Species Counts by Species Groups Over Time.

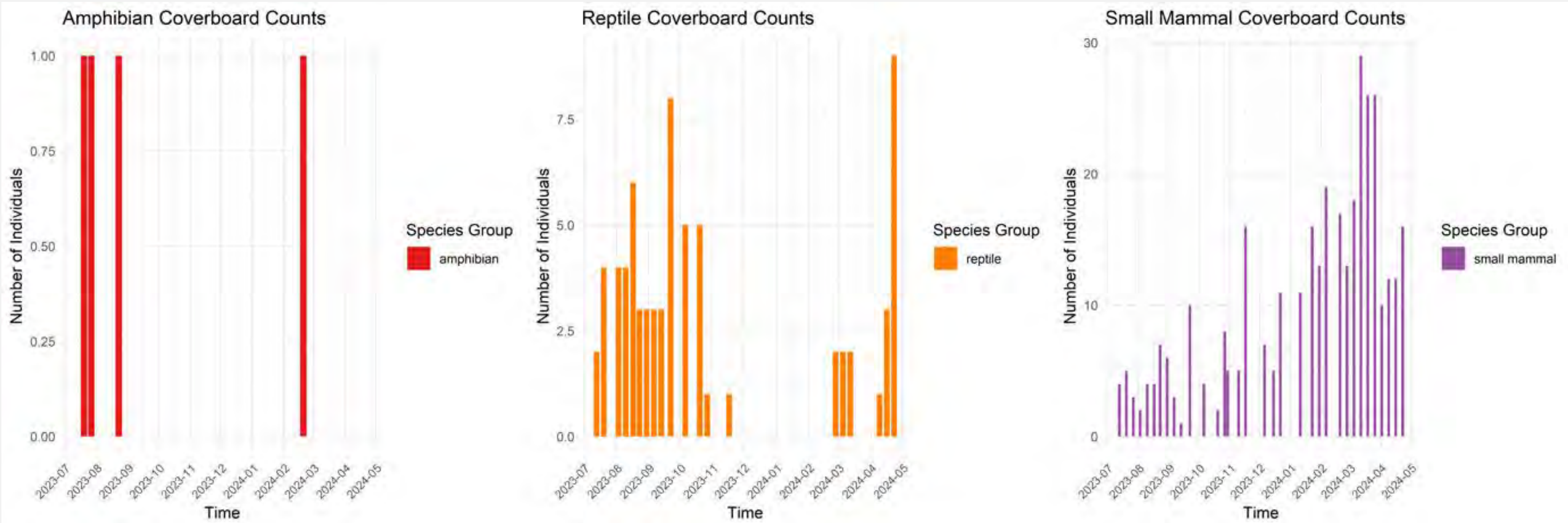


Exhibit 17. Coverboard Species Counts by Species Over Time.

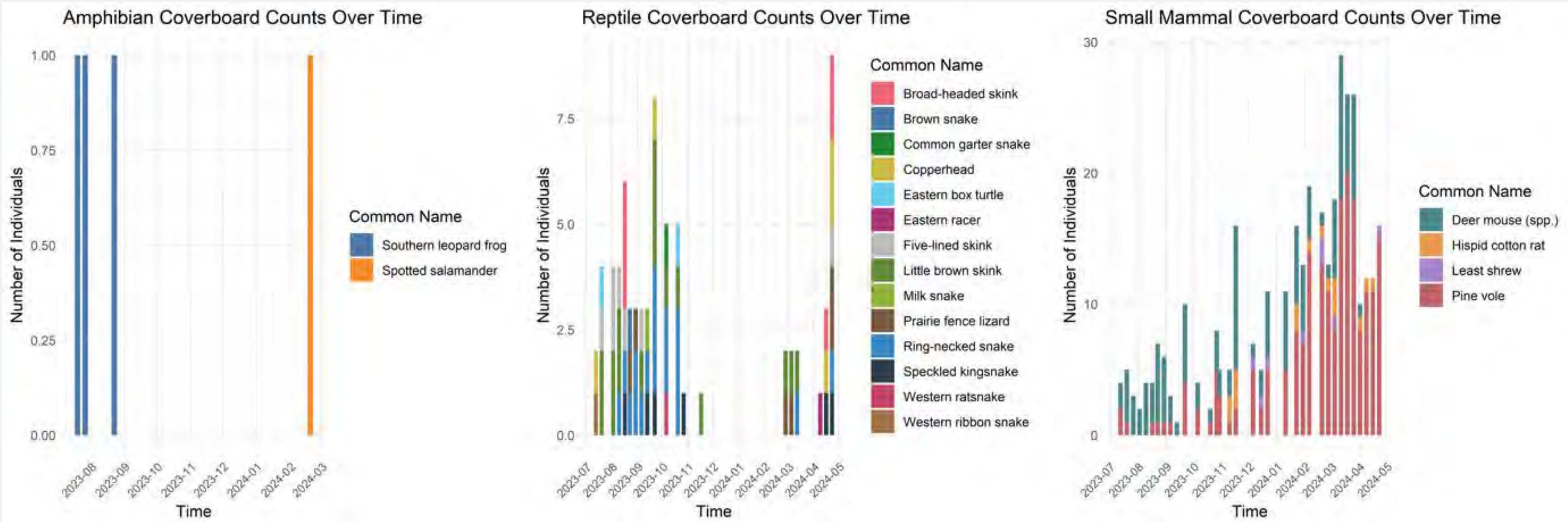


Exhibit 18a. Coverboard Small Animal Counts Across Study Area.

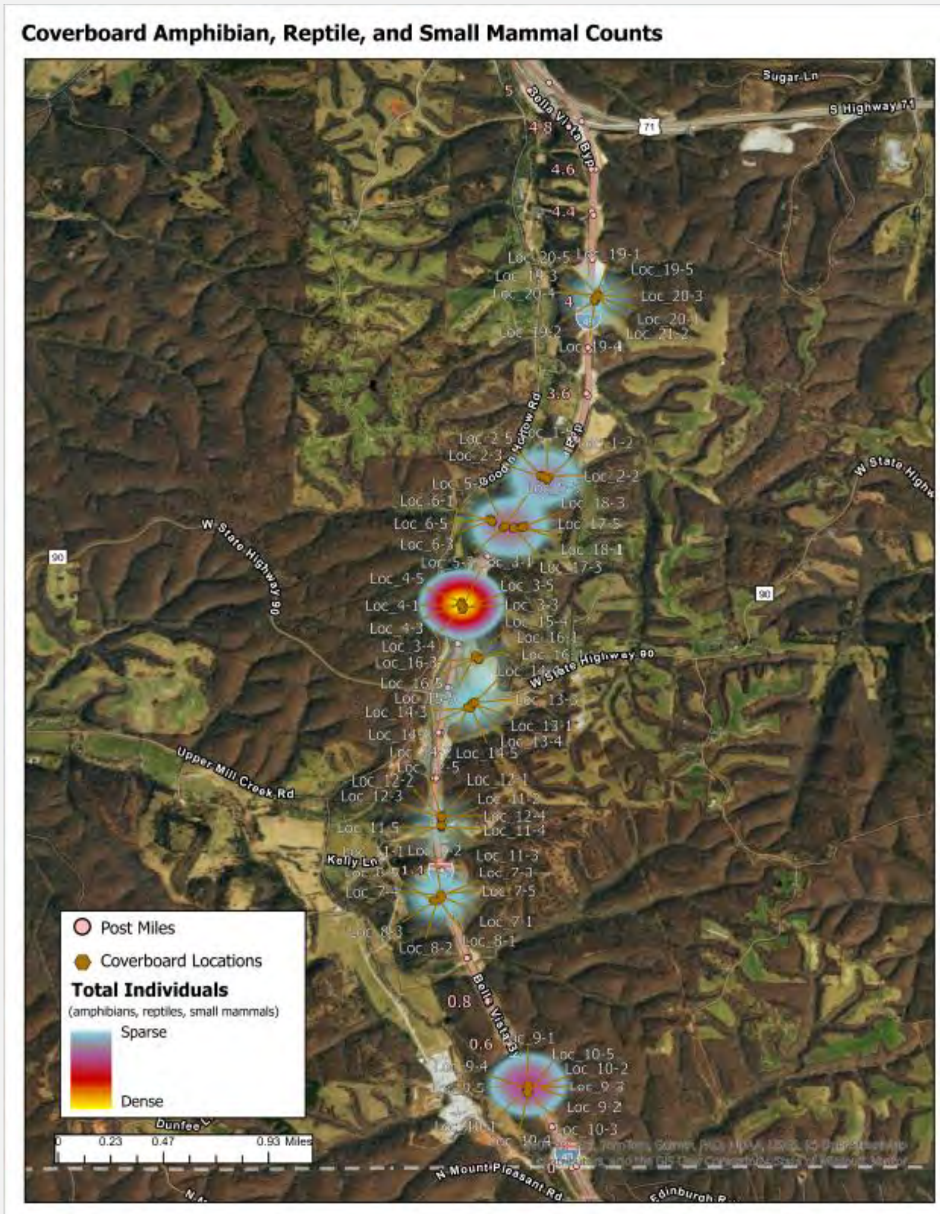
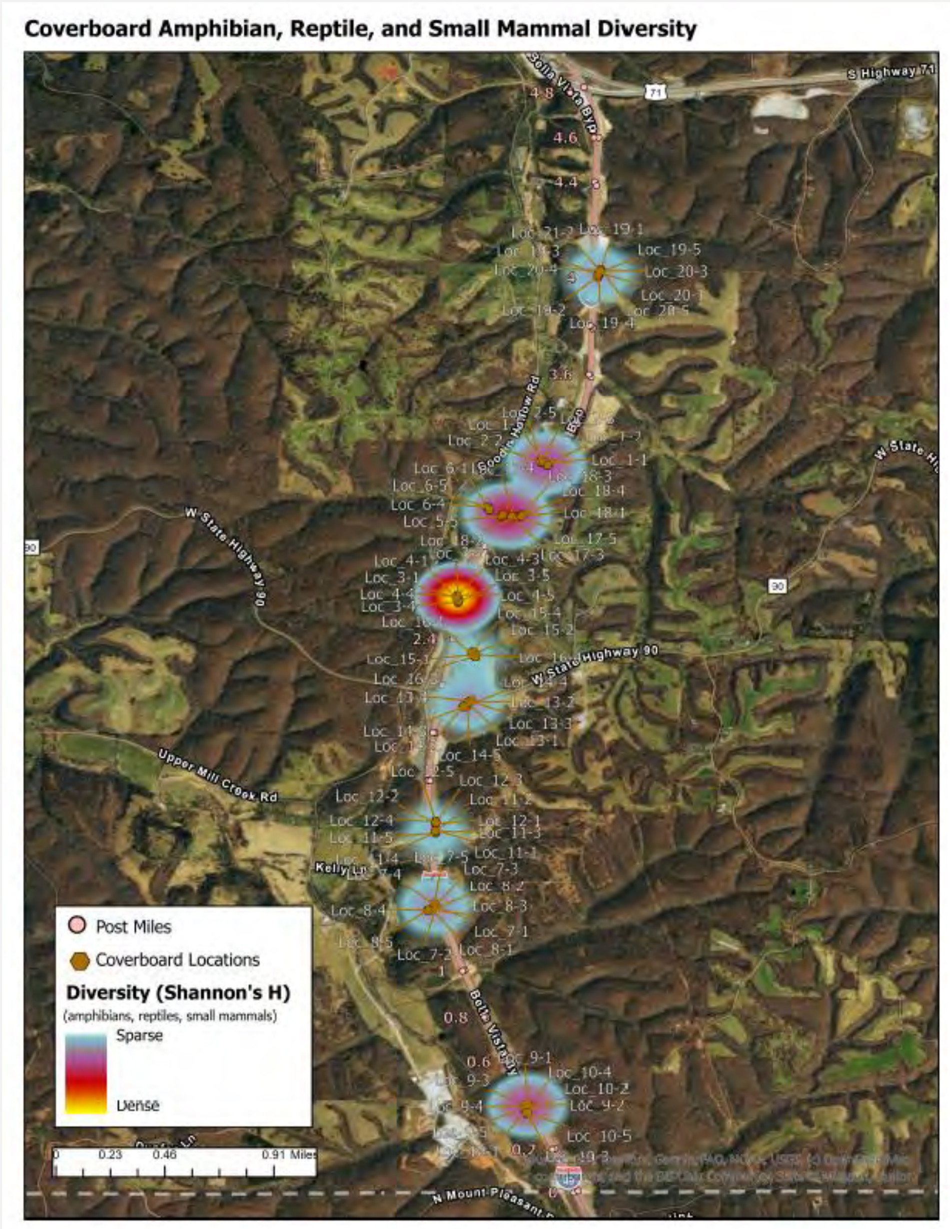


Exhibit 18b. Coverboard Small Animal Diversity Across Study Area.



3.6 eDNA Studies

Environmental DNA (eDNA) detections at roadway features (e.g., scuppers) indicate the presence of genetic material from target taxa but may not provide definitive evidence of live animal use, occupancy, or movement through the feature itself. Detected DNA may originate from taxa that were present upstream, adjacent to the roadway, or at distant locations and subsequently transported to the sampling point via hydrologic flow, rainfall runoff, wind, vehicle traffic (e.g., roadkill transfer), or dust and debris accumulation (Smith & Goldberg 2020; Rishan et al. 2023). Similarly, non-target biological materials, including bird, mammal, or reptile feces, feathers, fur, or carcass fragments, may introduce DNA from species that have not actively used the feature (Darling et al. 2021; USFWSb 2022).

Interpretation can be further constrained by primer and assay limitations, including taxonomic bias, incomplete reference databases, variable detection sensitivity across species, and the potential for both false-positive and false-negative results (Min et al. 2023; García-Machado et al. 2023). Consequently, eDNA detections should be interpreted as probabilistic indicators of recent regional presence, and less a confirmation of culvert use or local population status. eDNA results are best evaluated in combination with complementary lines of evidence, such as camera monitoring, track surveys, roadkill data, or habitat assessments, particularly in highly disturbed roadway environments where DNA transport and contamination risks are elevated (Buxton et al. 2021; Ficetola et al. 2016). The following discussion in this section (Section 3.5) and Chapter 4 provides results as they were identified and seeks to provide interpretation of the results regarding taxa identification and likelihood of actual presence at individual scuppers.

Much of the discussion within this section comes from Scheffer et al. (2025). The eDNA study provided an augmented detailed snapshot of the biodiversity using scuppers and the surrounding areas along the I-49 Study Area. By using multiple sets of primers, including CO1 for invertebrates/reptiles/amphibians and Vert12S, V16S-U, and Amph_16S for vertebrates, a total of 745 distinct taxa (Appendices 2 and 3) were identified from the scupper's detritus, soil at the roadside near the scuppers, and water from the culverts.

The species richness (a measure of alpha diversity) statistics generated for samples from the scupper's detritus had higher richness than the soil samples collected near the scuppers, indicating that the scuppers are being used more for crossing by various organisms, some of which are highlighted in this report (raccoon, opossum, turtle, etc.) or organismal debris was being blown or washed into the scuppers, but from nearby animals.

Two hundred seventy-seven species were identified at the species level across all samples, including the scupper detritus samples. Below are a few key taxa identified in the scupper data.

Box turtle sp., *Terrapene* genus

A terrestrial turtle common in woodlands and grasslands. Because box turtles move slowly and prefer moist ground, scuppers could provide small habitat links across roads.
Found in: Scuppers: 7, 12; Roadside: 12; Water: None

Pond slider (likely red-eared slider), *Trachemys scripta*

Semi-aquatic turtle that basks on logs and pond edges, often inhabiting stormwater ponds, creeks, and wetlands adjacent to roads.

Found in: Scuppers: 6; Roadside: 6; Water: None

American bullfrog, *Lithobates catesbeiana*

Large, aquatic frog common in both rural and urban water bodies. Highly vocal during summer months; often found near culverts and retention basins.

Found in: Scuppers: 14; Roadside: None; Water: None

Chorus frog, *Pseudacris* genus

Small tree frogs are active during rainfall. They are known to cross roads and could enter scuppers or culverts during breeding migrations.

Found in: Scuppers: 5; Roadside: None; Water: None

Woodland salamander, *Plethodon* genus

Terrestrial, lungless salamanders living in moist forest soil, leaf litter, and under logs. Sensitive to desiccation and most active after rain. Little is known about dispersal ability but range between 18 meters (60 feet) (USFWS 2022a) and 230 meters (755 feet), and rarely up to 1 kilometer (0.62 miles) (Chandler 2019).

Found in: Scuppers: 2, 5, 12, 13; Roadside: 2, 12, 13; Water: None

Eastern newts, *Notophthalmus* genus
Eastern newts are common newts of eastern North America. They frequent small lakes, ponds, and streams or nearby wet forests. These newts were exclusively found in scuppers.

Found in: Scuppers: 7; Roadside: None; Water: None.
eDNA identified at the family level Salamandridae was also found in Scuppers 5 and 7.

Other frog families
Ranid frogs (Ranidae), Hylid frogs (Hylidae), and Microhylid Frogs (Microhylidae), which are found in Missouri were found at all scuppers except 4 and 10, all soil sites except for 10, and no water sites.

Found in: Scuppers: 2, 3, 5, 6, 7, 8, 9, 11, 12, 13, 14; Roadside: 2,3, 6, 9, 8, 11, 12, 13; Water: None. Frogs at some level of taxonomy were found in all scuppers, all numbered soil samples, and Water 1.

Other turtle families
Chelidae and Emydidae turtle families were found at various locations.
Chelidae found in: Scuppers: 2, 4, 8, 9, 12, 13, 14; Roadside: 2, 8, 9 , 12, 13; Random: 2; Water: 3.

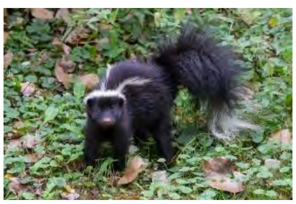
Emydidae found in: Scuppers: 3, 4, 6, 7, 12, 14; Roadside: 3, 6, 12; Random: 1; Water: None.

Testudines Order found in: Scuppers: all; Roadside: all; Water: 2 and 3.

Gray fox, *Urocyon cinereoargenteus*

A flexible carnivore that adapts well to fragmented habitats. Its DNA in scuppers and roadside samples suggests use of these structures for safe crossing.

Found in: Scuppers: 5, 8; Roadside: 8; Water: W2, W3.



Striped skunk, *Mephitis mephitis*

A common roadside scavenger that could enter scuppers for foraging or shelter. Frequent detections indicate regular contact with drainage areas.

Found in: Scuppers: 2, 4, 5, 6, 9, 11, 12; Roadside: 2, 6, 9, 11, 12; Water: W2, W3.

Raccoon, *Procyon lotor*

Regular user of culverts and drains for travel or rest. Strong evidence of interaction with scuppers, which may act as movement corridors or feeding sites.
Found in: Scuppers: 2, 3, 4, 5, 6, 7, 8, 11, 12, 13; Roadside: 2, 3, 6, 8, 11, 12, 13;
Water: W3.

Virginia possum, *Didelphis virginiana*

A nocturnal generalist often active near roads and culverts. Widespread detection suggests scuppers are part of its regular movement and foraging routes.

Found in: Scuppers: all sites; Roadside: 2, 3, 6, 8, 10, 11, 12, 13, R1, U1; Water: W2, W3.

	**Nine-banded armadillo,** *Dasypus novemcinctus* Common along roadways and invading northward. Likely uses scuppers for shelter or foraging while crossing the highway. Found in: Scuppers: 3, 4, 5, 6, 7, 11, 14; Roadside: 3, 6, 11; Water: none;
	**North American Least Shrew**, *Cryptotis parvus* Small insect-eater that prefers moist soils. May enter scuppers for cover or to hunt invertebrates. Found in: Scuppers: 2, 3, 6, 14; Roadside: 2, 3, 4, 6; Water: W3.
	**White-footed deer mouse**, *Peromyscus leucopus* A common small mammal in woodlands and field edges. Its repeated detection suggests scuppers act as sheltered pathways. Found in: Scuppers: 2, 3, 6, 14 ; Roadside: 2, 3, 6, 8, 10, 11, 12, 13, R1, U1; Water: W2, W3.

Diversity and Community Composition

The eDNA analysis from the scupper project reveals a broad spectrum of life, spanning vertebrates, invertebrates, fungi, and oomycetes. Across all samples, over 700 taxa were detected, reflecting the ecological complexity of roadside and drainage environments.

- **Vertebrates**: A diverse assemblage of mammals (foxes, cottontail rabbits, raccoons, muskrats), reptiles (turtles), and amphibians (frogs, salamanders) and birds (turkeys, woodpeckers) were detected, underscoring the biodiversity in the vicinity of the scuppers and their possible role as refugia and movement corridors.
- **Invertebrates**: Invertebrate diversity was particularly rich, encompassing over 90 taxa, including arachnids (*Aleuroglyphus ovatus*), isopods (*Armadillidium nasatum*), and bristle worms (*Dasybranchus* sp.). Aquatic and soil-dwelling taxa such as midges (Chironomidae) and rotifers (*Adineta vaga*) were also detected, reflecting the presence of transient water and organic detritus within the scuppers.

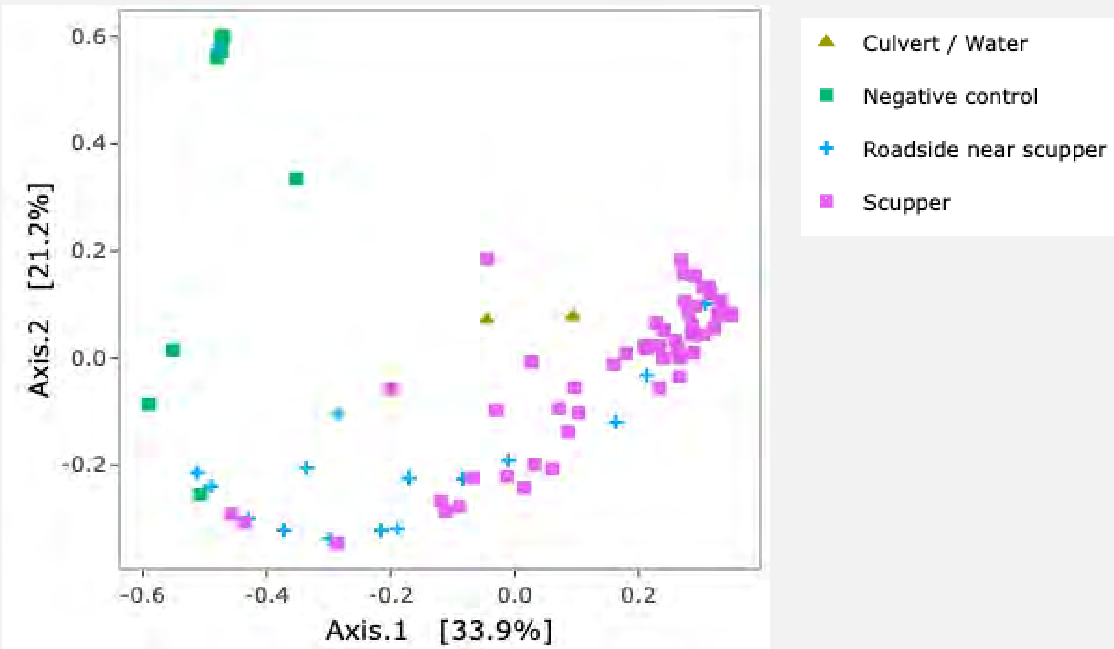
See Appendix 2 for the full list of detected species.

Geospatial Community Comparison

The use of indicators, such as alpha and beta diversity, allows us to understand how biodiversity varies within a sample and between various samples.

Beta Diversity (community similarity): Beta Diversity is a measure of how similar the communities of taxas are between samples. As shown in Exhibit 19, the scupper detritus and soil from the roadside near the scuppers cluster more closely together, suggesting similarity in the biodiversity of these sample types. The culvert water clustered closer to the scupper detritus than the soil near the roadside of the scuppers.

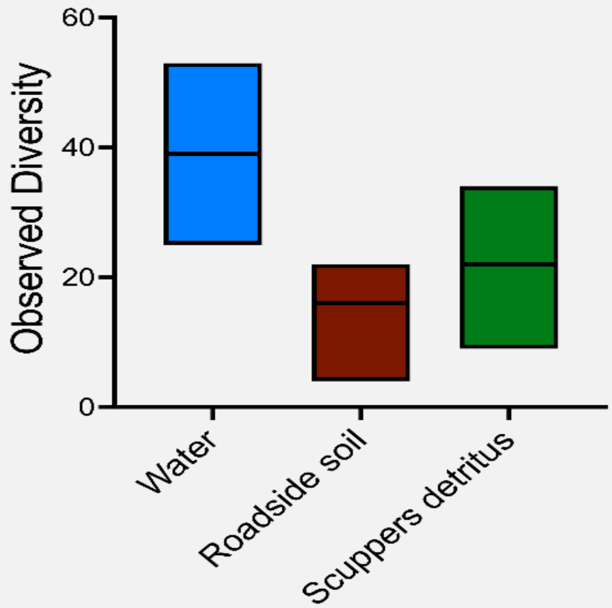
Exhibit 19. PCoA Jaccard beta diversity plot for Vert12S calculated.



Source: Scheffer et al. 2025.
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

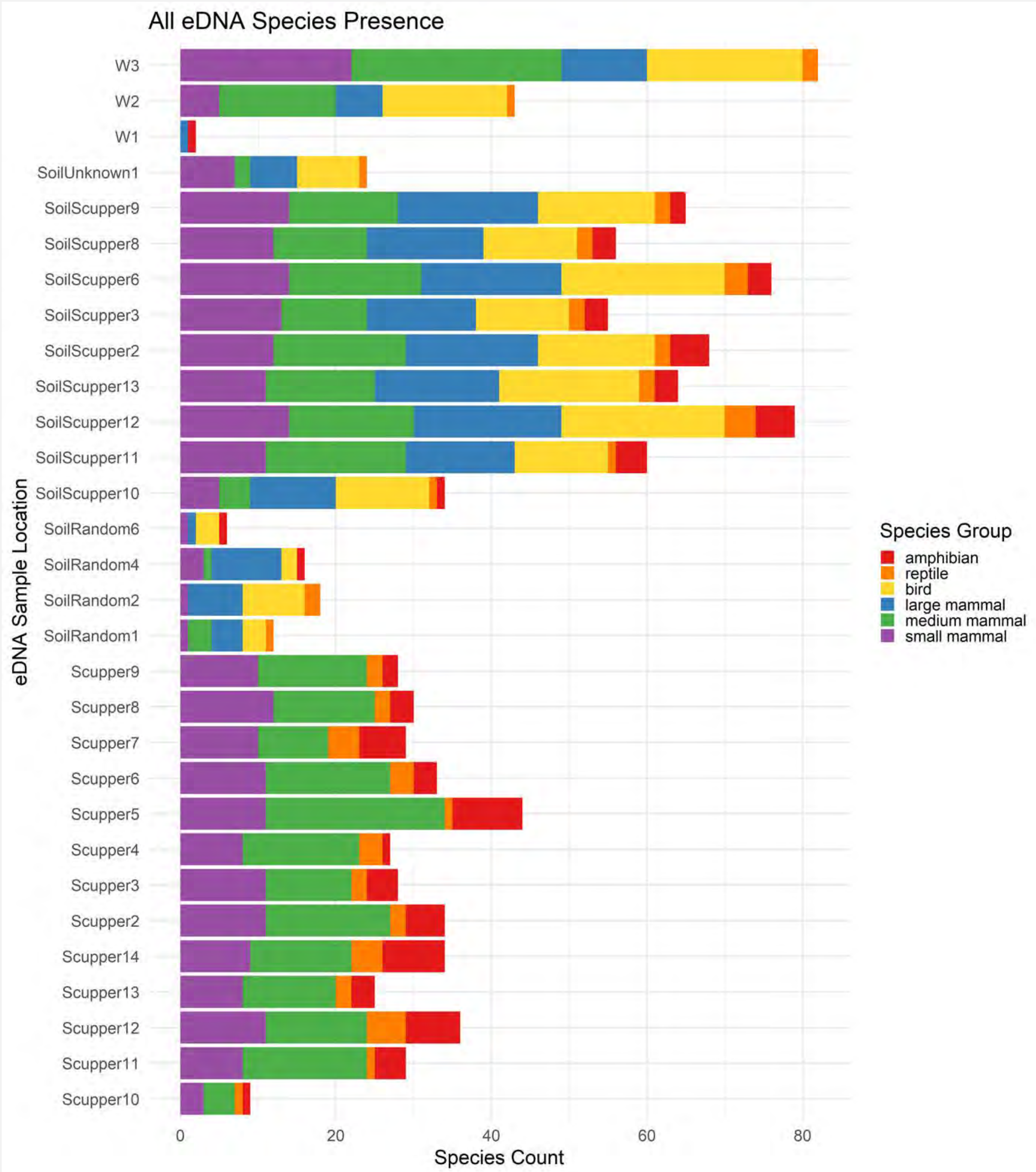
Alpha Diversity (species richness): A higher alpha diversity indicates that multiple species are depositing eDNA at a given location. This could be interpreted as organisms using scuppers as habitat, resting points, or drinking sites with higher frequency as their eDNA accumulates and produces a richer community signal; However, there are many ways that DNA could find its way to the scuppers—through direct presence, wind-blown or water-flow deposition, scat or droppings, and possibly other ways. Regardless, for some species the scuppers appear to function as viable refugia. Exhibit 20 shows that although culvert water had the greatest overall diversity per sample, scupper detritus displayed higher alpha diversity than roadside soil per sample, suggesting that organisms are occurring in the vicinity of the scuppers and some are using the scuppers as crossing points. Exhibit 21 provides a more granular review of this by location. Table 12 includes the vertebrate species that were detected, and a complete list is available in Appendix 2. Exhibit 22a depicts the counts by scupper area and 22b shows the diversity.

Exhibit 20. Observed species richness per sample calculated for each substrate type.



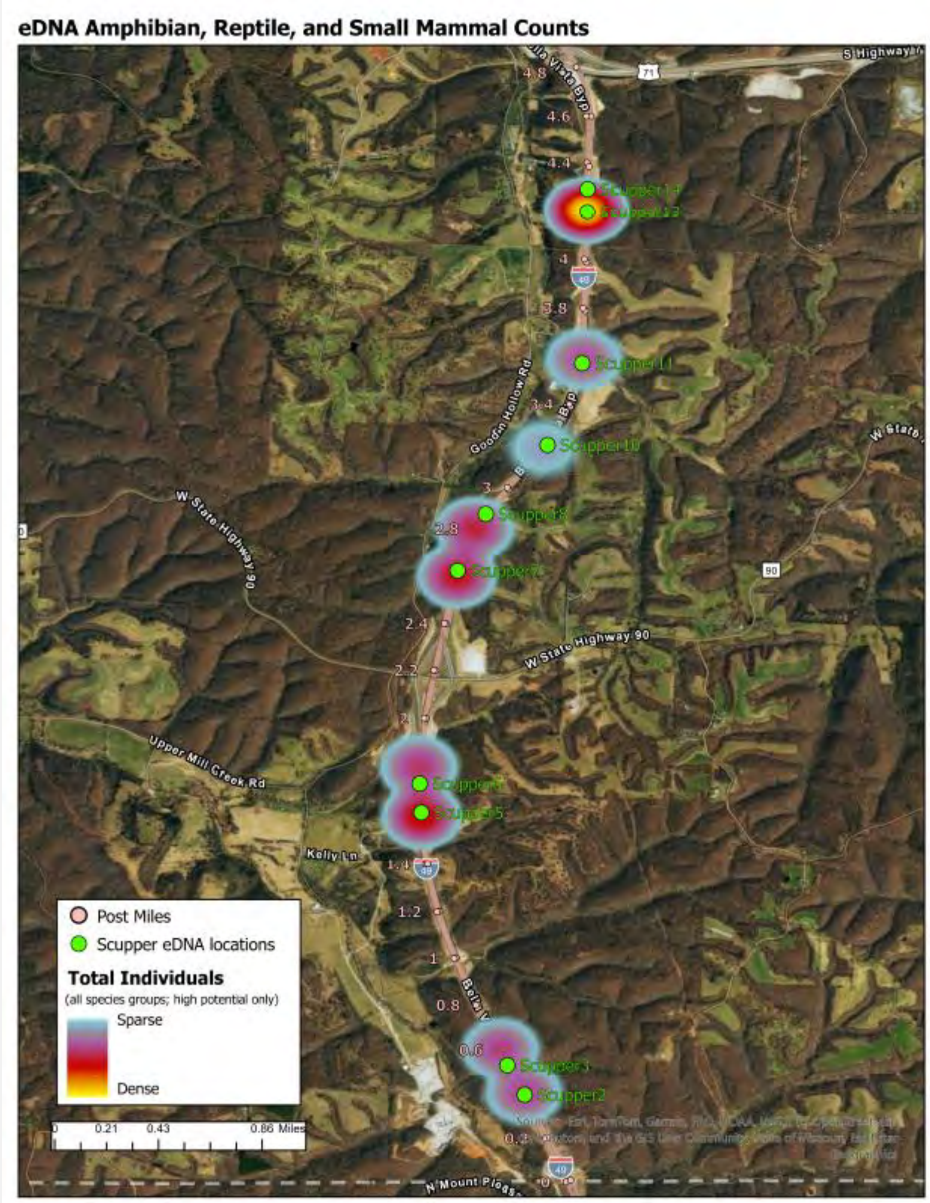
Source: Scheffer et al. 2025.
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 21. eDNA Counts by Species Group by Location.



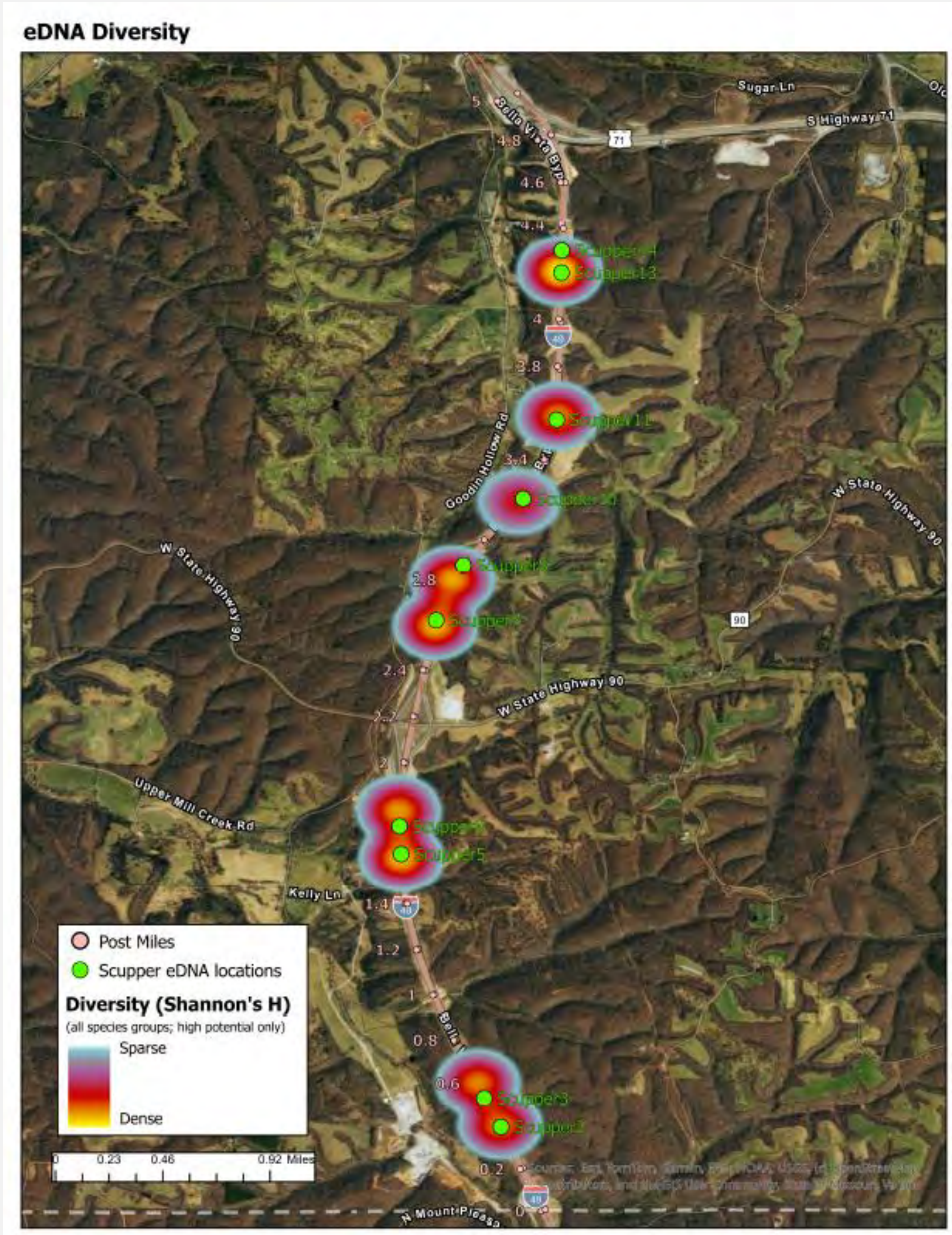
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 22a. eDNA Counts of Small Animals Across Study Area.



Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 22b. eDNA Diversity of Small Animals Across Study Area.



Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Table 12. eDNA – Total Vertebrate Individuals Detected at Sampling Stations by Species

Common Name	Detections at Structure
American bullfrog	3
American toad	18
Frog	33
Newt	3
Ranid frog	20
Treefrog	3
Woodland salamander	8
American robin	1
Bittern	1
Blue jay	3
Chickadee	4
Chicken	28
Common moorhen	2
Common pheasant	1
Corvid	2
Crow	2
Dark-eyed junco	2
Dove	8
Downy woodpecker	1
Duck	10
Eastern phoebe	1
Galliform fowl	11
Great blue heron	2
Gull	3
Hairy woodpecker	1
Heron	2
Northern bobwhite quail	2

Table 12. eDNA – Total Vertebrate Individuals Detected at Sampling Stations by Species

Common Name	Detections at Structure
Northern cardinal	4
Northern flicker	2
Parrot	9
Pine warbler	1
Raptor	10
Ruffed grouse	15
Sandhill crane	1
Seabird	17
Shorebird	8
Songbird	13
Song sparrow	1
Thrush	13
Turkey vulture	2
Wild turkey	12
Woodpecker	2
Anchovies	6
Carp	1
Catfish	4
Cichlid	2
Freshwater sunfishes	1
Herring	2
Salmonid	1
Stingray	2
Sturgeon	2
Tuna	1
Cattle	75
Coyote	12

Table 12. eDNA – Total Vertebrate Individuals Detected at Sampling Stations by Species

Common Name	Detections at Structure
Domestic goat	3
Domestic sheep	7
Goat	4
Horse	3
Mountain lion	1
Pig	13
Sheep	3
Ungulate	13
White-tailed deer	36
Wild pig	17
Bobcat	18
Carnivore	32
Cottontail rabbit	27
Domestic cat	49
Domestic dog	12
Eastern cottontail	13
Gray fox	4
Jackrabbit	17
Nine-banded armadillo	49
Raccoon	27
Red fox	2
Skunk	18
Striped skunk	13
Virginia opossum	60
Weasel	5
Blanding's turtle	4
Box turtle	2
Emydidae (freshwater)turtle	5

Table 12. eDNA – Total Vertebrate Individuals Detected at Sampling Stations by Species

Common Name	Detections at Structure
Red-eared slider	8
Snapping turtle	13
Turtle	26
American beaver	1
Bat	6
Beaver	2
Big brown bat	1
Cricetid rodent	18
Deer mouse	32
Eastern chipmunk	25
Eastern fox squirrel	6
Eastern gray squirrel	13
Eastern woodrat	12
Hispid cotton rat	18
House mouse	24
Leaf-nosed bat	9
Meadow vole	4
Micro bats	5
Mouse-eared bats	13
Muskrat	2
Myotis bat	2
North American deer mouse	2
North American least shrew	8
Old world rodent	25
Prairie vole	3
Rodent	5
Shrew	1
Thomas pine vole	1

Table 12. eDNA – Total Vertebrate Individuals Detected at Sampling Stations by Species

Common Name	Detections at Structure
Vole	5
White-footed deer mouse	24
Woodrat	1

Note: See Appendix 2 for scientific naming and complete list.
Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Chapter 4: Discussion and Recommendations

4.1 I-49 Traffic

The extent to which highways function as barriers to wildlife depends on species traits, road design, and traffic volume. As traffic increases, roads significantly disrupt wildlife by altering habitat use (Rost and Bailey 1979), restricting movement, fragmenting populations (Epps et al. 2005), and raising mortality from vehicle collisions (Groot-Bruinderink and Hazebroek 1996; Gunson and Clevenger 2003). Among contributing factors, traffic volume has the greatest impact, surpassing road design, according to models by Jaeger et al. (2005), with higher traffic intensifying these effects (Jaeger et al. 2005; Mueller and Berthoud 1997).

Highway traffic often creates adjacent wildlife-avoidance zones, functioning like moving fences that diminish permeability and habitat quality (Forman and Alexander 1998; Bellis and Graves 1978). Studies have documented behavioral adjustments near roads in various species. Grizzly bears (*Ursus arctos horribilis*), elk (*Cervus canadensis*), and bobcats (*Lynx rufus*) often use roadside areas during nighttime low-traffic periods (Northrup et al. 2012; Gagnon et al. 2007a, 2013; Lovallo and Anderson 1996). Elk near heavily trafficked interstates maintain permanent avoidance zones (Gagnon et al. 2011).

Traffic noise poses an additional threat, particularly for songbirds: up to 60% of species have reduced densities near roads, and overall species richness is about a third lower adjacent to highways (Reijnen and Foppen 1995; Reijnen et al. 1996). The extent of these noise impact zones varies with vegetation and traffic volume: approximately 0.15 kilometers for 8,000–15,000 vehicles/day, 0.25 kilometers for 15,001–30,000 vehicles/day, and 0.50 kilometers for over 30,000 vehicles/day (Forman and Deblinger 2000).

Even roads with moderate traffic (less than 8,000 AADT [annual average daily traffic]) can act as near-total barriers for species like white-tailed deer, pronghorn antelope (*Antilocapra americana*), and bighorn sheep (*Ovis canadensis*)—with crossing rates under 0.10 per approach (Dodd and Gagnon 2011; Dodd et al. 2009; Gagnon et al. 2012). Elk, which are more tolerant of traffic, only face major passage restrictions at very high vehicle volumes (more than 14,000/day) (Gagnon et al. 2011). Wolves (*Canis lupus*) in Canada cross low-traffic highways at rates averaging 0.93, but that drops to 0.06 along the busy Trans-Canada Highway (Paquet and Callaghan 1996).

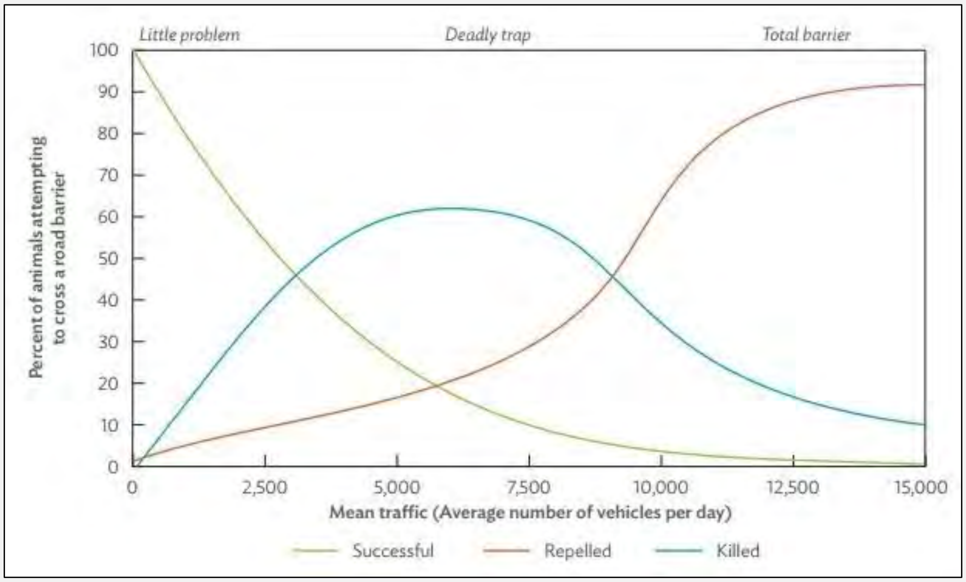
In Sweden, moose (*Alces alces*) crossing rates fell by 89% following highway reconstruction and increased traffic (Olsson 2007).

Impact of Traffic on Wildlife

Understanding how highways affect wildlife and the role of passage structures in reducing these impacts requires examining how traffic influences highway permeability and WVCs. Conceptual models developed by Seiler (2003) and Iuell et al. (2003) suggest that highways carrying between 4,000 and 10,000 AADT act as strong barriers, deterring animals from crossing. Seiler's model (2003) (Exhibit 22) illustrates the concept that as traffic increases, the percentage of successful crossings declines while the proportion of animals killed rises. At moderate traffic levels, mortality peaks because animals may still attempt crossings, perceiving conditions as relatively safe, even though traffic density is too high for safe passage (Seiler 2003).

Empirical studies in Sweden and the United States have validated these theoretical predictions. Highways with fewer than 2,500 vehicles per day generally pose limited obstacles to wildlife movement, while traffic between 2,500 and 4,000 AADT creates intermediate impacts (Seiler 2003; Iuell et al. 2003). Both Seiler (2003) and Iuell et al. (2003) hypothesized that WVC rates correlate with traffic volume, with mortality remaining below 30% at traffic levels under 2,000 vehicles per day where permeability is high. However, even at low traffic volumes, WVCs can be significant because some species congregate near roads for feeding (Dodd et al. 2012). According to Seiler's model (2003), mortality peaks at intermediate traffic levels—around 7,000 AADT—where up to 60% of crossing attempts result in collisions. This occurs below the threshold where highways become nearly impermeable barriers, but higher traffic still increases lethality due to shorter intervals between vehicles and longer exposure times for crossing animals (Waller and Servheen 2005). At volumes exceeding 10,000 AADT, WVC rates decline sharply because few animals attempt crossings, and by 15,000 AADT, only about 10% of crossing attempts result in collisions (Seiler 2003).

Exhibit 22. Conceptual model of the relationship between Traffic and Mortality.



Source: Seiler 2003**.**

Exhibit 22 illustrates the percentage of animals attempting to cross that are killed in WVCs (blue line), successfully cross (green line), and those repelled (red line). At 10,000 AADT and above, Seiler's model (2003) predicts that highways become increasingly impermeable barriers to wildlife. These models have since been empirically validated by research in Sweden and the United States. Conversely, highways with AADT of less than 2,500 vehicles per day are theorized to have only limited impact to successful crossing attempts by animals. Traffic between 2,500 and 4,000 AADT has intermediate impact on wildlife (Exhibit 22).

Another factor that affects the degree to which wildlife species are impacted by traffic is whether they are predominantly diurnal or nocturnal in their activity patterns (Gagnon et al. 2011, 2012). Diurnal species are often impacted to a far greater degree by highways and associated traffic volume, as traffic is typically highest during the daytime hours, as is the case for I-49. Conversely, as traffic typically drops substantially during the nighttime hours, predominantly nocturnal species, such as bobcat, generally exhibit greater flexibility in crossing highways when traffic has a lower influence on highway permeability and road lethality. Yet most WVCs occur at nighttime, with dawn and dusk peaks when animals are most active (Laurance et al. 2009).

As intended, this segment of I-49 has absorbed traffic conveyance from U.S. 71, primarily east of I-49 (Table 13), and to a lesser extent MO 90 with current AADT around 15,000. When compared to the 186,000–165,000 AADT at the California U.S. 101 highway segment where the Wallace Annenberg Wildlife Overcrossing structure is under construction, I-49's 15,000 AADT seems minor, but as discussed above, even that level of traffic can have significant impacts to wildlife's ability to cross or even try to cross.

Table 13. Vehicle AADT For Sections of Highway In and Adjacent to Study Area

Location	2024	2023	2022	2021	2020	2019
I-49 N, north of U.S. 71	7,482	7,482	7,393	7,245	—	—
I-49 S, north of U.S. 71	6,371	6,371	6,295	8,088	—	—
Cumulative I-49 north of U.S. 71	13,853	13,853	13,688	15,333	—	—
U.S. 71 N, east of I-49	2,881	2,864	2,775	2,834	7,523	6,777
U.S. 71 S, east of I-49	2,578	2,917	2,827	2,591	6,806	9,011
Cumulative U.S. 71 east of I-49	5,459	5,781	5,602	5,425	14,329	15,788
I-49 N, north of MO 90	6,486	6,447	6,371	5,637	—	—
I-49 S, north of MO 90	8,538	7,571	7,481	5,671	—	—
Cumulative I-49 north of MO 90	15,024	14,018	13,852	11,308	—	—
I-49 N, south of MO 90	8,698	7,619	8,249	5,761	—	—
I-49 S, south of MO 90	6,413	6,413	6,337	5,813	—	—
Cumulative I-49 south of MO 90	15,111	14,032	14,586	11,574	—	—

4.2 Roadkill Discussion: Carcass Persistence

Carcass persistence is the time a carcass remains detectable before removal or decomposition and is a critical factor in accurately estimating WVC rates. Across systems and taxa, persistence is influenced primarily by body size, taxonomic group, scavenger activity, survey interval, and road context; ignoring these sources of variation can lead to severe underestimation and misdirected mitigation efforts. Guinard et al. (2012) reported high daily persistence probabilities for bird carcasses ($\Phi \approx 0.976 \pm 0.003$), with larger and older carcasses lasting longer and summer showing higher persistence rates. However, scavenging introduced major bias, as corvids and mammals often removed carcasses within hours; this disproportionately affected smaller birds. Henry et al. (2021) estimated mean persistence at approximately 2.7 days across multiple taxa, with heavier carcasses and those located off main traffic lanes persisting longer. Detection probability declined sharply when survey intervals exceeded three days, and body size strongly influenced detectability—larger species were easier to spot, while small-bodied animals were frequently missed, creating size-related detection bias.

Menger et al. (2023) applied open-population capture–recapture models and found species-specific persistence differences: white-eared opossum (*Didelphis albiventris*) carcasses lasted an average of 3.6 days, while black-and-white tegu (*Salvator merianae*) carcasses persisted about 2.9 days, with persistence probabilities ranging from 0.60 to 0.94 depending on survey design and sampling effort. In Brazil, experimental trials along MS-040, BR-267, and BR-262-east monitored 423 carcasses over 1 kilogram and modeled persistence using a Weibull distribution, finding that heavy carcasses remained detectable for an average of 4.3 ± 3.7 days, with less than 60% probability of persisting to 15 days. Season and traffic volume had minimal influence compared to body mass, and paired daily surveys revealed that approximately half of giant anteaters (*Myrmecophaga tridactyla*) struck on paved roads moved off the road—sometimes up to 100 meters—necessitating a correction of the density-weighted proportion from 0.80–0.95 to about 0.50 to account for off-pavement displacement.

Studies on small-bodied vertebrates highlight even shorter persistence times: Santos et al. (2011) found median persistence of about one day for amphibians, small birds, bats, and lizards, requiring daily monitoring to avoid severe underestimation, while larger taxa such as turtles and carnivores persisted longer, allowing 1- to 2-day intervals. Santos et al. (2016) confirmed similar patterns, reporting detectability below 10% for small species and underestimation rates of 2–10 times when uncorrected. Ratton et al. (2014) documented extremely short persistence for small bird and mammal carcasses, with 66% removed within 12 hours and 89% within 24 hours; removal patterns varied by road type and time of day—daytime removal dominated on highways due to traffic and scavenger birds, while nocturnal mammalian scavengers were more active on dirt roads. Barrientos et al. (2018) found that it is best to perform site-specific studies to confirm local persistence rates. However, they concluded that persistence rate seems to be a taxon-related pattern and that habitat and season had little or no influence on carcass persistence, and they postulated that persistence rates subsequently stabilize after four days as carcasses become less attractive to scavengers.

Collectively, these studies demonstrate that carcass persistence is not uniform and increases with body mass, while scavenger dynamics, road context, and survey spacing further modulate detectability. WVC rates can be underestimated by multiples—up to 2–10 times for small taxa—skewing vulnerability assessments and misleading assessments. Regarding the road mortality studies for this project, it is expected that smaller soft-bodied animals (e.g., salamanders and frogs) would most likely be immediately or rapidly disarticulated and removed (or made unrecognizable). Other smaller species (e.g., lizards and small mammals) would not last long due to scavenging, with medium-sized mammals lasting marginally longer. Missouri supports a sizable population of turkey vultures (*Cathartes aura*), and canids and mesocarnivores were readily detectable throughout the study area, so it is reasonable that many medium and small species do not persist long once killed. Therefore, it is likely that actual roadkill rates are at least 7-10 times greater than what was detected.

4.3 eDNA Data Interpretation

A key question when reviewing the eDNA data was whether the eDNA was the result of actual use or dispersion of eDNA from various taxa from one location to another as a result of water runoff or wind distribution. For example, did eDNA end up in the scuppers as a result of actual taxa presence or was it blown there by wind patterns or distributed by wildlife scat, vehicles, or other methods? Table 14 provides information on the eDNA dispersal potential of various organisms.

Table 14. Potential for DNA to Reflect Actual Use of Scuppers

Taxa Group(s)	Probability of Outside Source (Transport/Spread)	DNA Shedding and Persistence	Sources
Terrestrial Mammals (Mesocarnivores, Possums, Armadillos, Small Rodents)	HIGH eDNA is readily shed onto the ground (feces, urine, hair, skin). Rainfall and surface runoff are highly effective mechanisms transporting eDNA from the surrounding environment into drains, scuppers, and water bodies.	MEDIUM TO HIGH Shedding is constant but highly variable based on the animal's biomass, activity, and type of water interaction (e.g., defecating in water causes a large spike). The presence of fur/hair increases shedding and detectability. Due to the amount of mammal shedding, it cannot be known with high certainty if a mammal was in the scupper or nearby.	Leempoel et al. 2020; Sauseng and Schenekar 2025
Turtles (Semi-Aquatic Reptiles)	MEDIUM If the scupper receives water from a natural or human-made pond/wetland where turtles live, the chance is high. Otherwise, they must cross terrestrial ground to reach the area, relying on runoff transport. In this case, scuppers that do not receive much runoff are unlikely to have much spread of turtle eDNA.	LOW Turtles generally shed less eDNA than other vertebrates. This is hypothesized to be because they lack a mucous layer and have hard, keratinized skin/shells to prevent evaporative loss, limiting DNA loss through skin sloughing. Consequently, turtle eDNA shedding tends to be low and limited to the area where the turtle was found.	Adams et al. 2019; Davy et al. 2015

Table 14. Potential for DNA to Reflect Actual Use of Scuppers

Taxa Group(s)	Probability of Outside Source (Transport/Spread)	DNA Shedding and Persistence	Sources
Amphibians (Frogs, Toads, Salamanders)	LOW TO MEDIUM Amphibian eDNA detections in scuppers are less likely to result from long-distance transport. Because their DNA rapidly degrades in dry or sun-exposed conditions, it typically indicates nearby aquatic or semi-aquatic presence. Surface runoff from adjacent ditches, puddles, or moist soils can carry DNA into the scupper, but the signal usually remains localized.	HIGH (Aquatic Phase)/LOW (Terrestrial Phase) Amphibians shed large amounts of DNA when in or near water through skin sloughing, mucous, and gametes. However, eDNA persistence is short due to enzymatic degradation and UV exposure. Detections thus most likely reflect recent activity or occupancy in the scuppers where the eDNA was found.	Goldberg et al. 2008; Svenningsen et al. 2022
Birds	HIGH Bird eDNA is consistently detected in stormwater runoff and in air eDNA. Constant movement and widespread fecal deposition (e.g., near rooftops, ledges, or directly into drains) create a ubiquitous source of eDNA for easy transport by rain and air.	MEDIUM TO HIGH Shedding primarily occurs through feces and other secretions. Due to high mobility, a positive detection could originate from a source far upwind or upstream. Due to the amount of bird shedding, it cannot be known with high certainty if a bird was in the scupper or nearby.	Tetzlaff et al. 2024

Source: Scheffer et al. 2025.
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

4.3.1 Primer Set Coverage Analysis

For this eDNA study investigating which animals are using scuppers in the area, multiple primer sets were applied to target different groups of taxa. The Vert12S primers performed particularly well, successfully amplifying vertebrate DNA as intended and capturing a range of amphibians, reptiles, birds, and small mammals. The CO1 primers provided complementary information to the Vert12S primer set, detecting some additional reptile and amphibian taxa beyond those recovered with Vert12S.

By contrast, the Amph_16S and VERT16S-U primer sets failed due to limited data even after extensive review of the lab process. The targets for these primers are narrower groups and unfortunately did not perform as well as hoped, although they did provide cross confirmation of species found in Vert12S, which was helpful.

Overall, Vert12S provided strong coverage of the vertebrate community as intended, and CO1 added valuable supplementary data about turtles in particular. For future work, both Vert12S and CO1 primers should be retained in the design. Continuing with Amph_16S and VERT16S-U assays in the future is not recommended (Scheffer et al. 2025).

4.3.2 Suspicious Taxa Review

As indicated, all data was provided in this report, including questionable detections that result from the current limitations of eDNA analysis (i.e., primer bias, variable detection sensitivity, and incomplete reference databases), however we also identify issues and attempt to explain or provide rationale for interpretation. This section addressed suspicious taxa identifications.

The current taxonomic assignments were generated using a phylogeny-based approach supported by reference databases that are continuously refined as new verified samples and taxonomic records become available. Over time, these updates will enhance the accuracy and resolution of taxonomic identifications. However, as with all bioinformatics and reference-based methods, some inconsistencies may persist due to limitations in sequence representation and the natural genetic overlap among closely related species. eDNA Explorer reviewed key suspicious taxinomic matches more closely and revised them as discussed below (Scheffer et al. 2025) based on the best available data and references. These have been reflected in the tables provided in Appendix 2.

European Taxa

Mountain gazelle, *Gazella gazella* – Likely Deer

The mountain gazelle (Gazella gazella) is a slender, agile antelope native to the hills and mountains of the Middle East, particularly Israel, Lebanon, and parts of Turkey. Its populations have declined due to habitat loss and hunting, though it remains locally common in protected areas.

Revised interpretation: Upon further investigation, the sequence aligned the most closely to the even-toed ungulates and whales, and more closely to the Odocoilinae family, englobing genera such as *Odocoileus* (deers) and *Rangifer* (caribou).

Bioinformatics context: *Sequences labeled as G. gazella showed three mismatches between reads and the reference database. No exact BLAST match was found to the Mountain gazelle species, but the sequences aligned within the Odocolinae family, which includes ungulates more broadly.*

African Taxa

Lion, Panthera *leo* – Likely Turkey

The lion is a large cat of the genus *Panthera*, currently found only in Sub-Saharan Africa and India. It has a muscular, broad-chested body; a short, rounded head; round ears; and a dark, hairy tuft at the tip of its tail. The lion is an apex and keystone predator.

Revised interpretation: Upon further investigation, the sequence aligned the most closely to the birds group, and more closely to the *Meleagris* genus, englobing turkey species.

Bioinformatics context: *Sequences labeled as P. leo showed four mismatches between reads and the reference database. No exact BLAST match was found to the lion, but the sequences aligned within the Meleagris genus, which includes turkeys more broadly.*

Asian Taxa

Tiger, Panthera *tigris* – Likely Bobcat

The tiger is a large cat and a member of the genus *Panthera* native to Asia. It has a powerful, muscular body with a large head and paws, a long tail and orange fur with black, mostly vertical stripes. It is traditionally classified into nine recent subspecies, though some recognize only two subspecies, mainland Asian tigers and the island tigers of the Sunda Islands.

Revised interpretation: Upon further investigation, the sequence aligned the most closely to the carnivore group, and more closely to the *Lynx rufus* species within the *Felidae* family. Bobcats are local to the site studied.

Bioinformatics context: Sequences labeled as P. tigris showed six mismatches between reads and the reference database. No exact BLAST match was found to the tiger, but the sequences aligned within the bobcat (Lynx rufus).

4.4 Discussion of Scupper Use

To assess biodiversity (Exhibit 23) at scupper locations, species richness was compared using two monitoring methods: visual observations from cameras and molecular detection through eDNA sampling – even when considering the possible challenges in confirming actual use through eDNA techniques. The results, illustrated in Exhibit 23, show that eDNA consistently detects substantially more species than cameras across all sites. Camera-based monitoring recorded between 0 and six species per location, with some sites (e.g., scupper group 10) showing no detections at all. In contrast, eDNA sampling identified six to 17 species that had a probable likelihood of using the scuppers per location (more discussion follows in this section), with the highest richness observed at scupper group 12 (17 species). This discrepancy highlights the limitations of visual monitoring and the possible enhanced sensitivity of eDNA methods. The superior performance of eDNA can be attributed to several factors. As discussed above, eDNA captures genetic material shed by organisms into the environment (e.g., skin cells, mucus, feces), enabling detection of species that are not visually observed due to cryptic behavior, nocturnal activity, not triggering sensors due to ectothermic capabilities or slow movement, or being outside the camera's field of view. DNA can persist at a location for hours to days, providing a cumulative signal of species presence over time. Cameras, by contrast, only record what is visible during their deployment period, offering a limited snapshot unless extended camera trapping occurs. Further, cameras rely on species movement and visibility, while eDNA detects organisms regardless of activity level or size, including rare and elusive species.

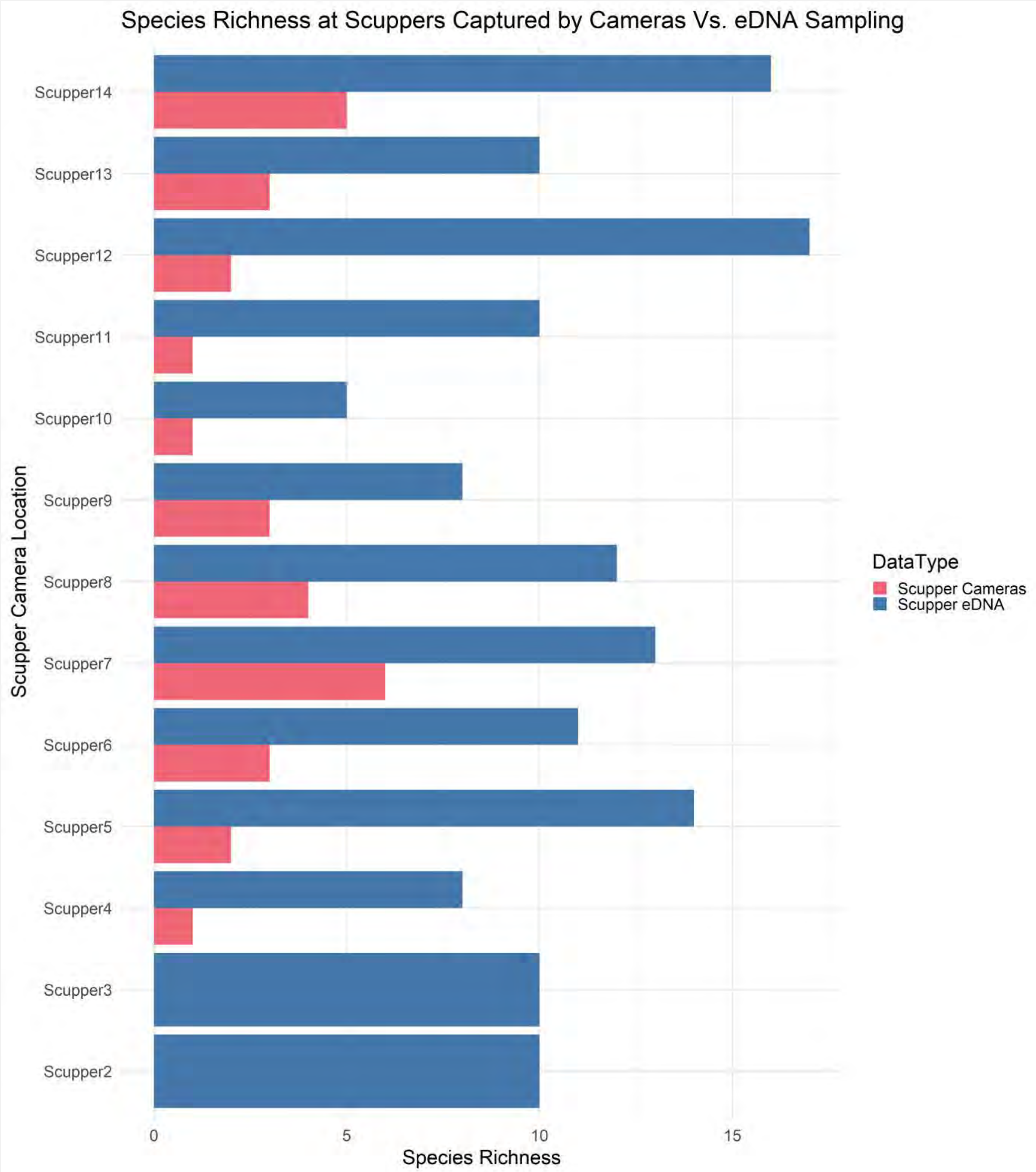
Despite its advantages, eDNA is not without challenges: DNA can persist after an organism has left the area, leading to detections of species that are no longer present; environmental conditions such as temperature, UV exposure, and microbial activity can degrade DNA, potentially reducing detection accuracy; eDNA relies on reference databases for species identification, and incomplete databases can result in ambiguous or incorrect assignments; and currents, wind, scat, vehicle-aided transport and other factors can carry DNA from distant locations, complicating interpretation of local presence. To allow for more detailed interpretation of comparative detection of use by species, Exhibits 24 through 26 provide data on amphibian, reptile, and small mammal presence at scupper groups by detection method. Exhibits 27 through 29 provide a similar comparison by highway post mile, including all subsets of data (i.e., eDNA, cameras, coverboard and roadkill).

Across amphibians, reptiles, and small mammals, eDNA consistently revealed greater species richness than cameras, highlighting its sensitivity for cryptic or nocturnal species. For amphibians, eDNA detected up to seven species per scupper, including American bullfrog, American toad, Ranid frogs, treefrogs, newts, and woodland salamanders, with scupper group 12 and scupper group 5 showing the highest diversity. In contrast, cameras recorded very few amphibians, limited to American toads and bullfrogs at four scuppers, and failed to detect salamanders or treefrogs. This discrepancy underscores the limitations of visual monitoring for species with secretive behaviors or activity patterns. It also points to the possible role of DNA transport to the scuppers, independent of the animal presence.

Reptile detections followed a similar pattern. eDNA identified turtles such as box turtles and pond sliders at multiple scuppers, with occasional snake detections, while cameras recorded only two box turtles at scupper group 13 and scupper group 14. These results suggest reptiles use scuppers or adjacent areas more frequently than cameras indicate, likely due to their slow movement and limited activity periods. For small mammals, both methods confirmed heavy scupper use, particularly by rodents. Cameras documented hundreds of rodent detections at some locations, such as scupper group 11, scupper group 6, and scupper group 9, while eDNA provided species-level detail, identifying deer mice, voles, muskrats, woodrats, and cotton rats, with up to nine species per scupper.

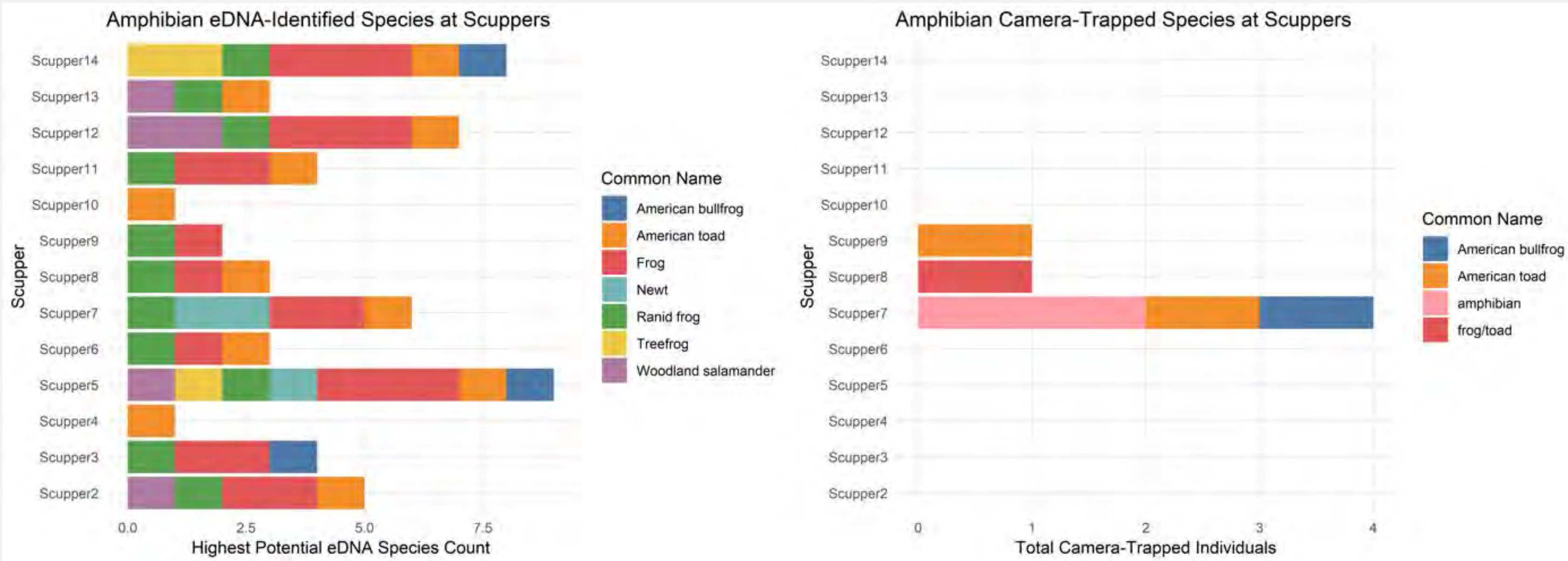
Regardless of whether the eDNA method erroneously detected the amphibians, reptiles, and small mammals in the scupper, it is probable that they did occur close by within the scupper or close vicinity at or near the median concrete barrier due to their visual confirmation, limited detectability (turtles), reduced mobility (salamanders), or susceptibility to rapid disintegration or being scavenged within the roadway.

Exhibit 23. eDNA Versus Camera Species Richness at Scuppers.



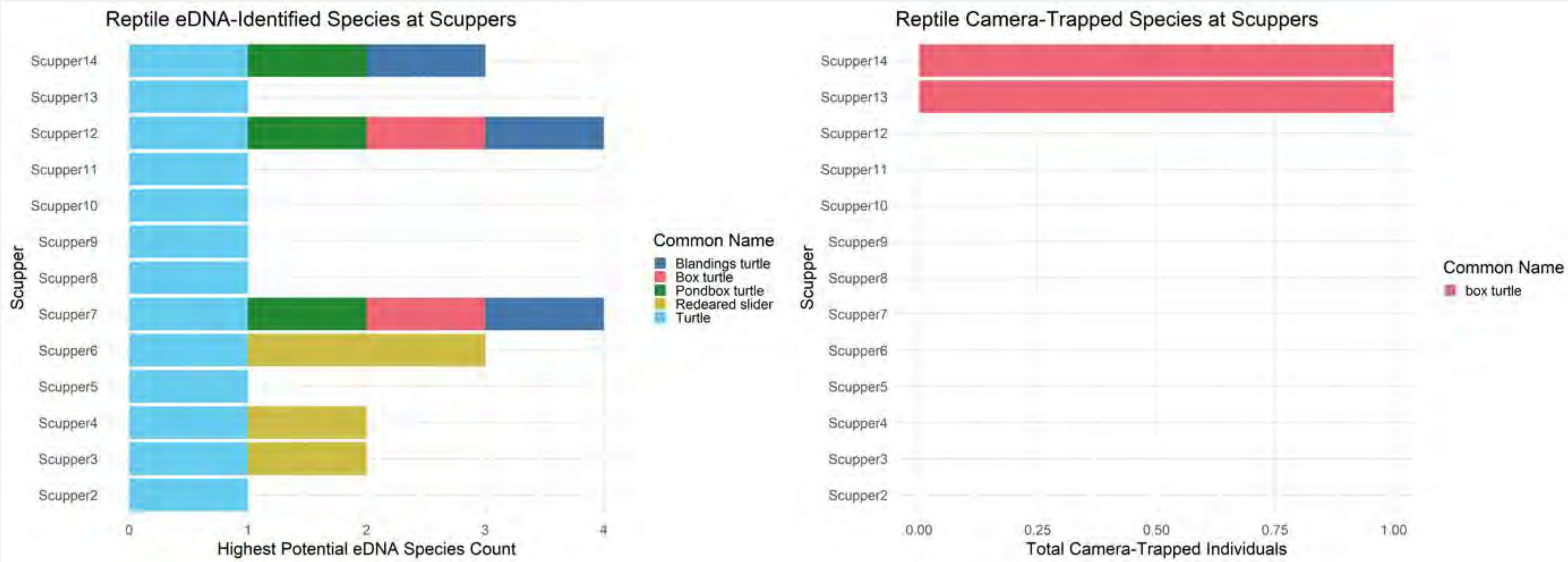
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 24. Amphibians - Camera Versus eDNA Comparison by Scupper.



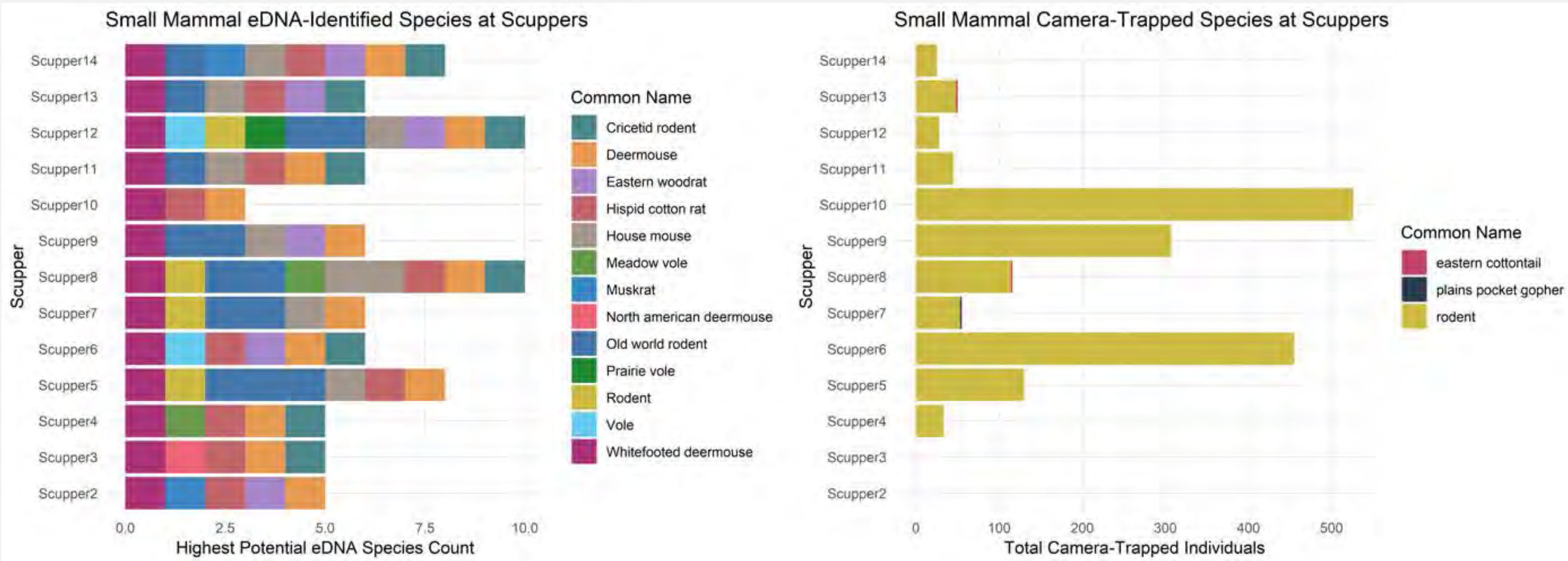
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 25. Reptiles - Camera Versus eDNA Comparison by Scupper.



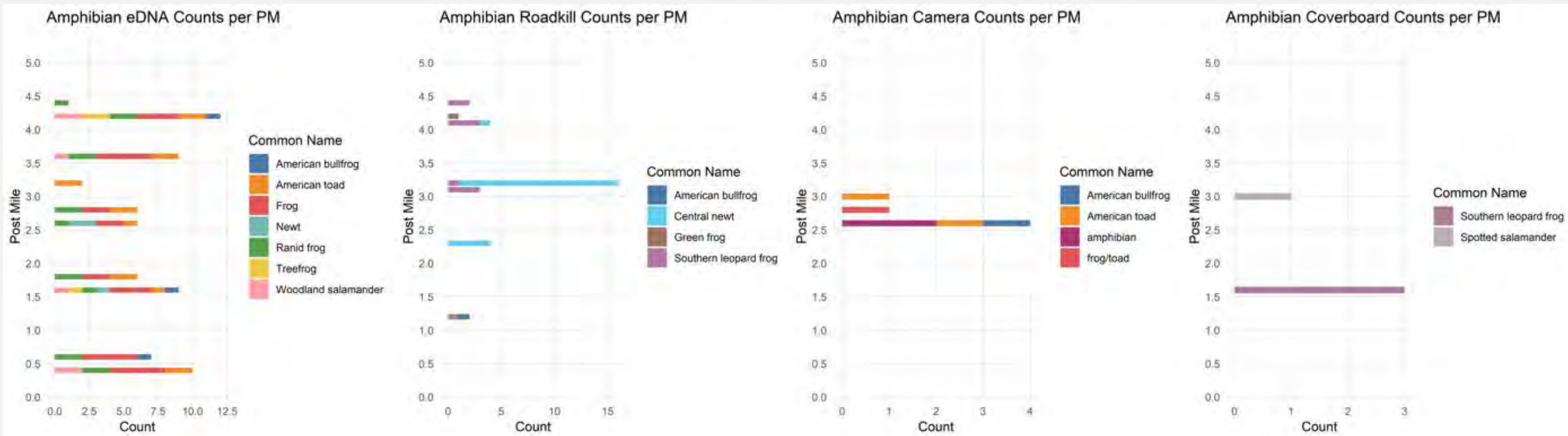
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 26. Mammals - Camera Versus eDNA Comparison by Scupper.



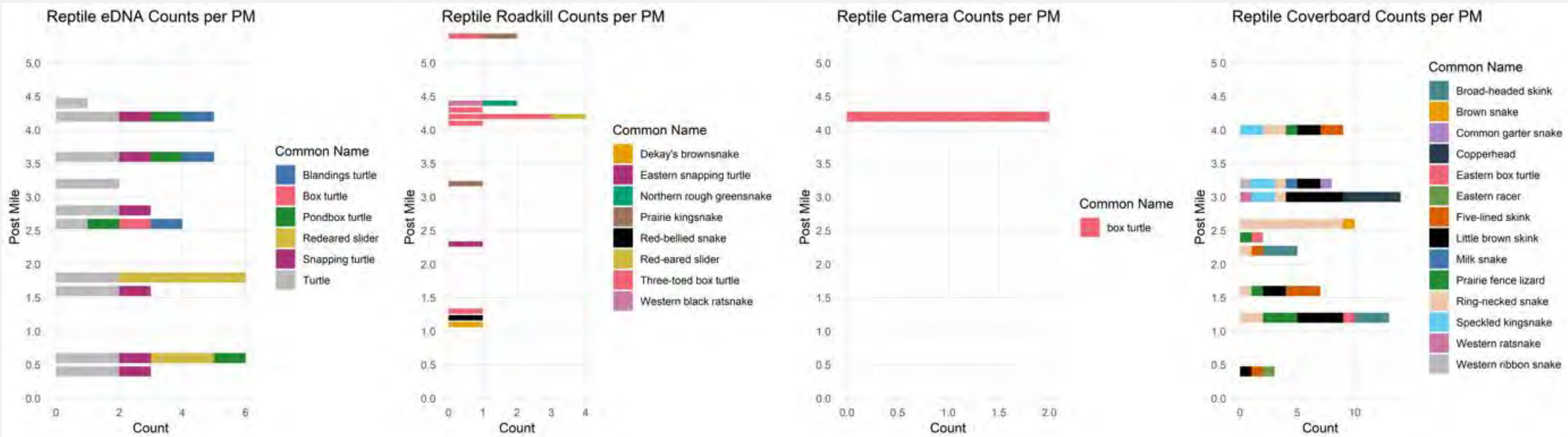
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 27. Amphibians – eDNA, Roadkill, Camera and Coverboard Counts Comparison by Species and Post Mile.



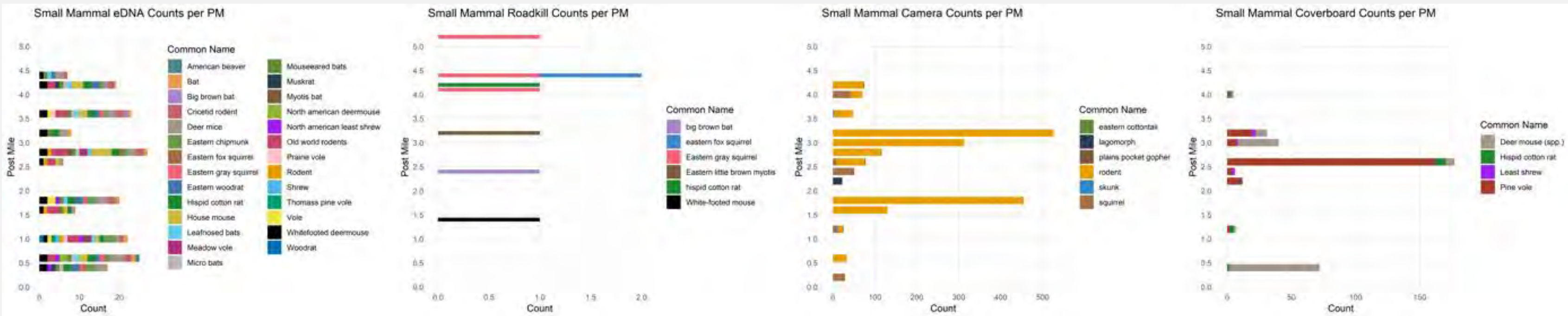
Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 28. Reptiles – eDNA, Roadkill, Camera, and Coverboard Counts Comparison by Post Mile and Species.



Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

Exhibit 29 Small Mammals - eDNA, Roadkill, Camera, and Coverboard Counts Comparison by Post Mile and Species



Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.

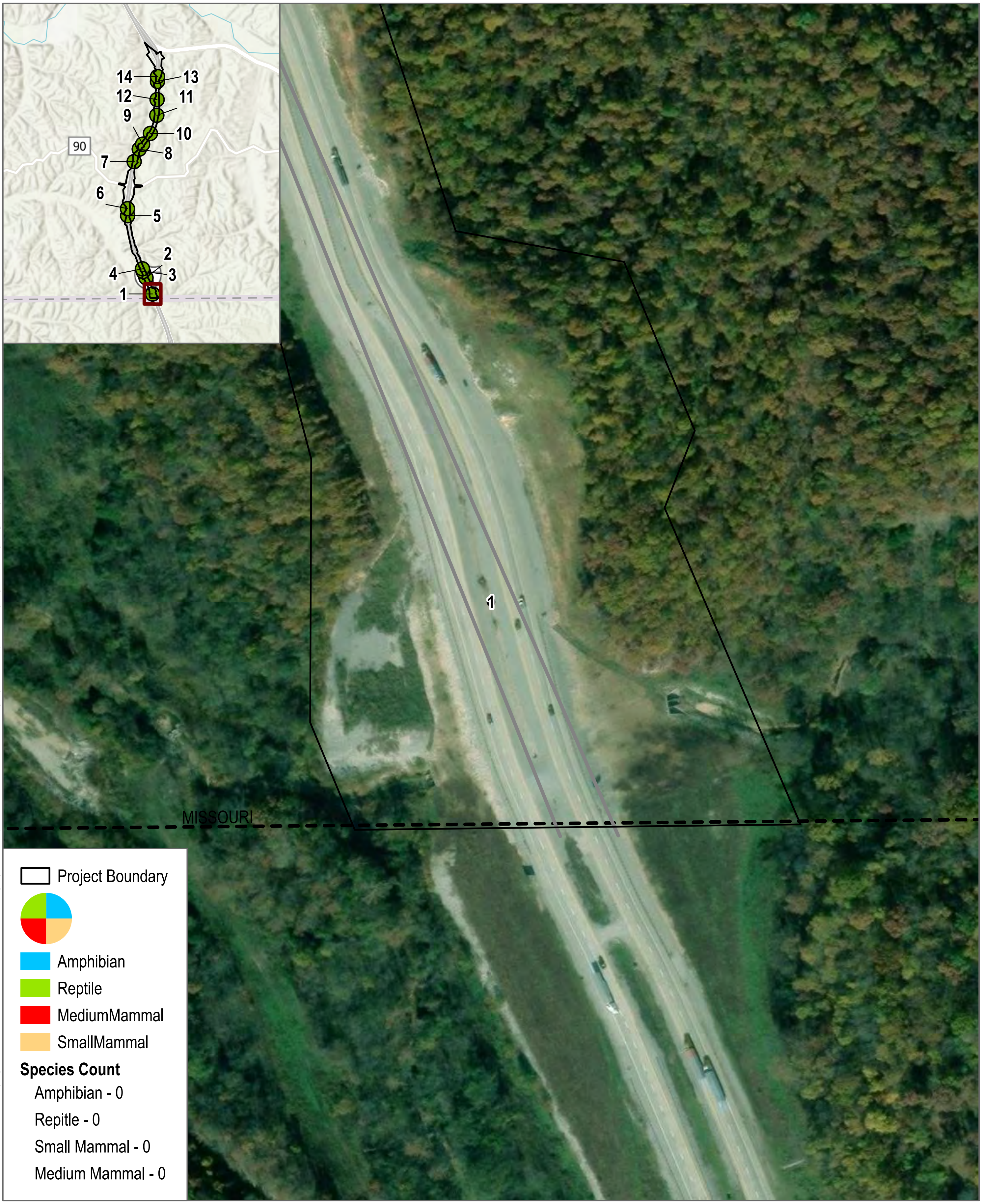
Table 15 shows which species occurred at each scupper group and Figure 13a – 13m shows occurrence by species group. These data include both positive eDNA and camera data that were detected within the scuppers. All amphibians and turtles that were detected are included for the reasons outlined within Section 4.3. Related to eDNA, this list is intended to identify species that have a probable likelihood of actual occurrence in the scuppers—as opposed to being the result of water- or wind-borne transfer. Due to the presence of photographic evidence of similar-sized rodents within these or other scuppers. It seemed likely that they would need to be proximate to the scupper to be detected, and if proximate, then they would be likely to find and use the scupper based on the study photographic evidence. Raccoons and nine-banded armadillos were included due to the camera data, but interestingly, they were not detected by the eDNA analysis within any scuppers. No lizards or snakes were detected as occurring within the scuppers by either study method, and no lizards were found as roadkilled individuals. This may be due to a combination of road avoidance, roadside margin uses for thermoregulation only, disintegration of evidence, rapid removal by scavengers, other factors, or a combination of these.

The resulting list of species included eight amphibians composed of woodland (slender) salamanders, newts, and small and large frogs and toads; four turtles; and 14 mammals composed of two medium-sized species and 12 rodents (or generic rodents). It is expected that any small- or medium-sized mammal, amphibian, or reptile that found the scuppers would use them to continue in the direction they were originally traveling. Some would use the scupper for temporary cover as well —sometimes for extended periods.

Table 15. Species Occurring at Each Scupper

Common Name	Scientific Name	Species Group	Scupper2		Scupper3		Scupper4		Scupper5		Scupper6		Scupper7		Scupper8		Scupper9		Scupper10		Scupper11		Scupper12		Scupper13		Scupper14	
			eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?	eDNA?	Camera?
American bullfrog	*Lithobates catesbeianus*	amphibian	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
American toad	*Anaxyrus americanus*	amphibian	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Newt	*Salamandridae*	amphibian	No	No	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Ranid frog	*Ranidae*	amphibian	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No
Treefrog	*Hylidae*	amphibian	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
Woodland salamander	*Plethodon spp.*	amphibian	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	Yes	No	No	No
Frog/toad	*Anura*	amphibian	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	No	No	Yes	No
Amphibian	*Amphibia*	amphibian	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Blandings turtle	*Emydoidea blandingii*	reptile	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes	No
Three-toed box turtle	*Terrapene carolina triunguis*	reptile	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes
Red-eared slider	*Trachemys scripta elegans*	reptile	No	No	Yes	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Turtle	*Testudines*	reptile	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Raccoon	*Procyon lotor*	medium mammal	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes
Nine-banded armadillo	*Dasypus novemcinctus*	medium mammal	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No	No	No	Yes
Deermouse	*Peromyscus maniculatus*	small mammal	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	Yes	No
Whitefooted deermouse	*Peromyscus leucopus*	small mammal	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Eastern woodrat	*Neotoma floridana*	small mammal	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes	No
Eastern cottontail	*Sylvilagus floridanus*	small mammal	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	Yes	No	No
Plains pocket gopher	*Geomys bursarius*	small mammal	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Hispid cotton rat	*Sigmodon hispidus*	small mammal	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	Yes	No	No	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No
House mouse	*Mus musculus*	small mammal	No	No	No	No	No	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No
Muskrat	*Ondatra zibethicus*	small mammal	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
Vole	*Microtus spp.*	small mammal	No	No	No	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	No
Cricetid rodent	*Cricetidae*	small mammal	No	No	Yes	No	Yes	No	No	No	Yes	No	No	No	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No
Old world rodent	*Muridae*	small mammal	No	No	No	No	No	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	No	No	Yes	No	Yes	No	Yes	No	Yes	No
Rodent	*Rodentia*	small mammal	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes

Note: Detection of environmental DNA (eDNA) at a roadway feature indicates the presence of genetic material but does not confirm live animal presence, residency, or use of the feature. Therefore, eDNA results should be interpreted as probabilistic indicators of recent regional presence and evaluated alongside complementary survey methods.



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

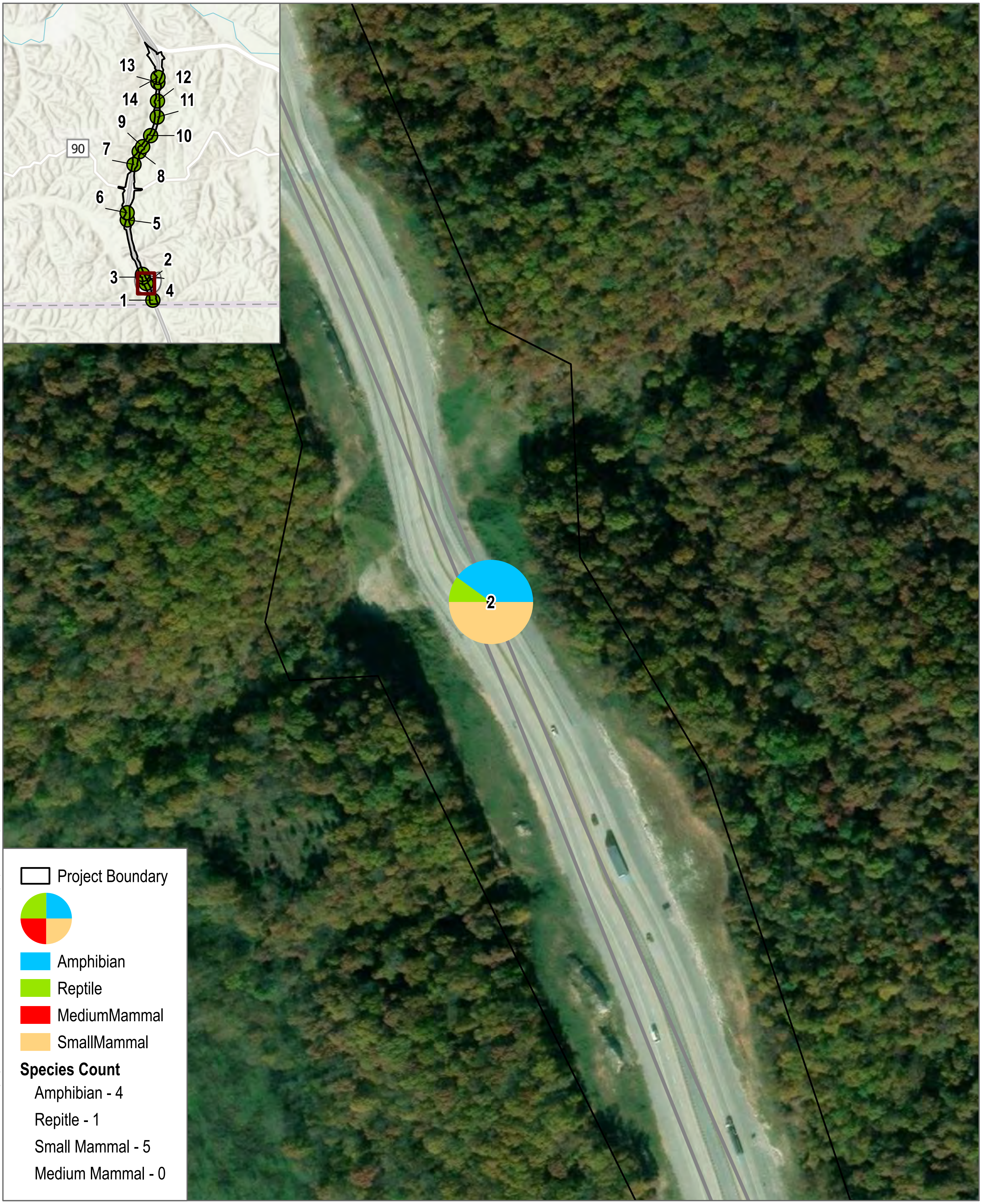
DUDEK

0 105 210 Feet

FIGURE 13

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



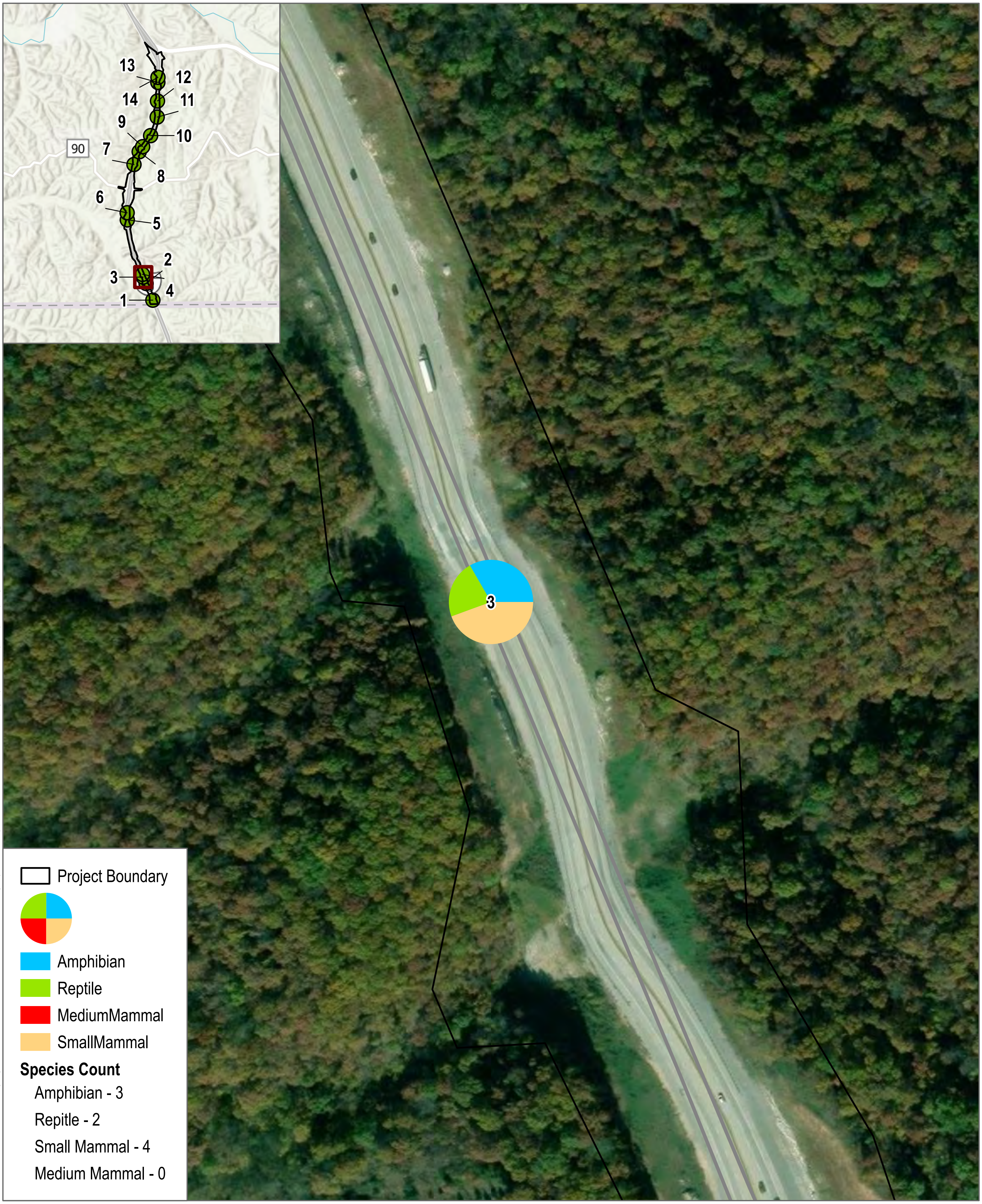
SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

DUDEK

FIGURE 13A

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

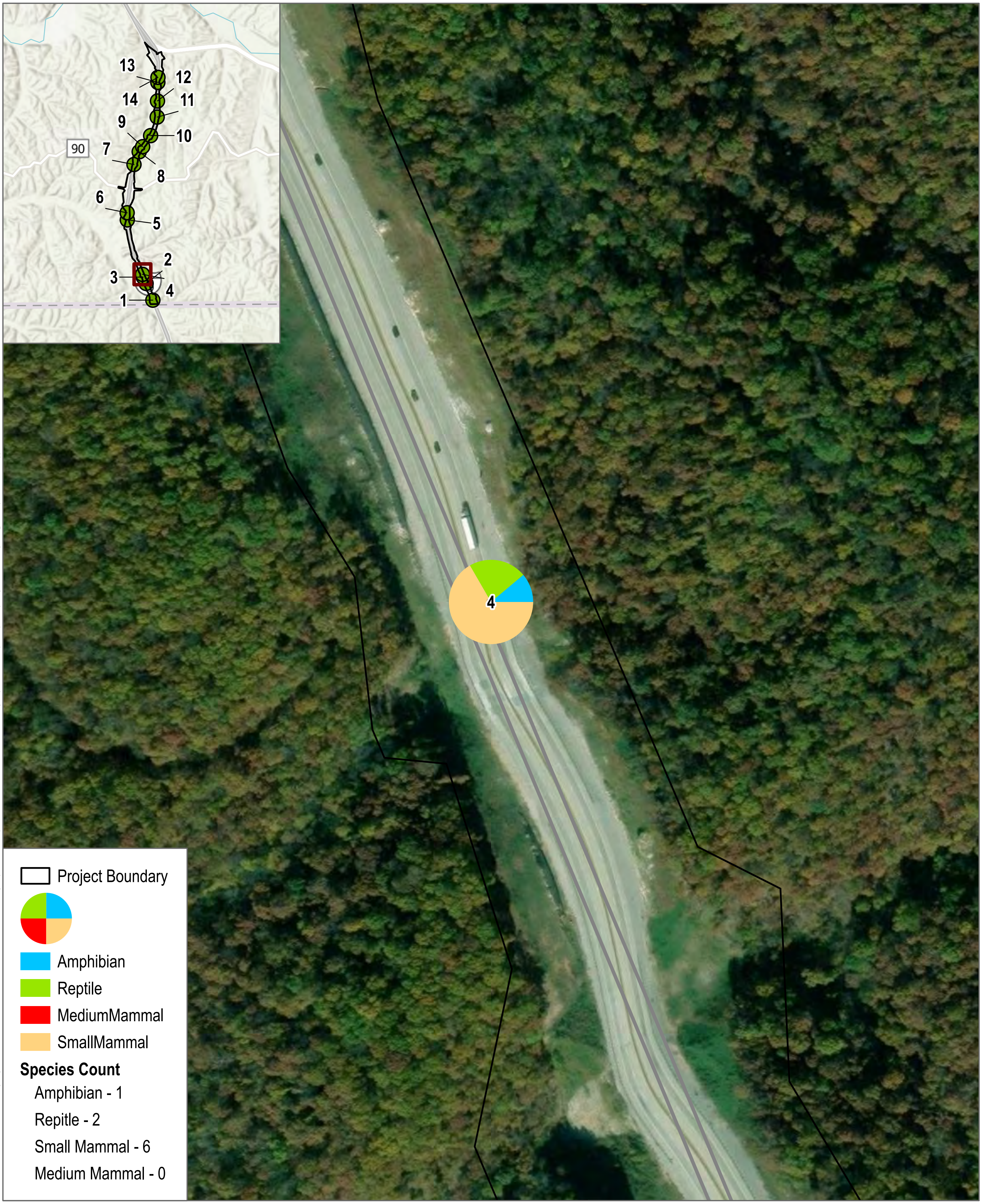
DUDEK

0 105 210 Feet

FIGURE 13B

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



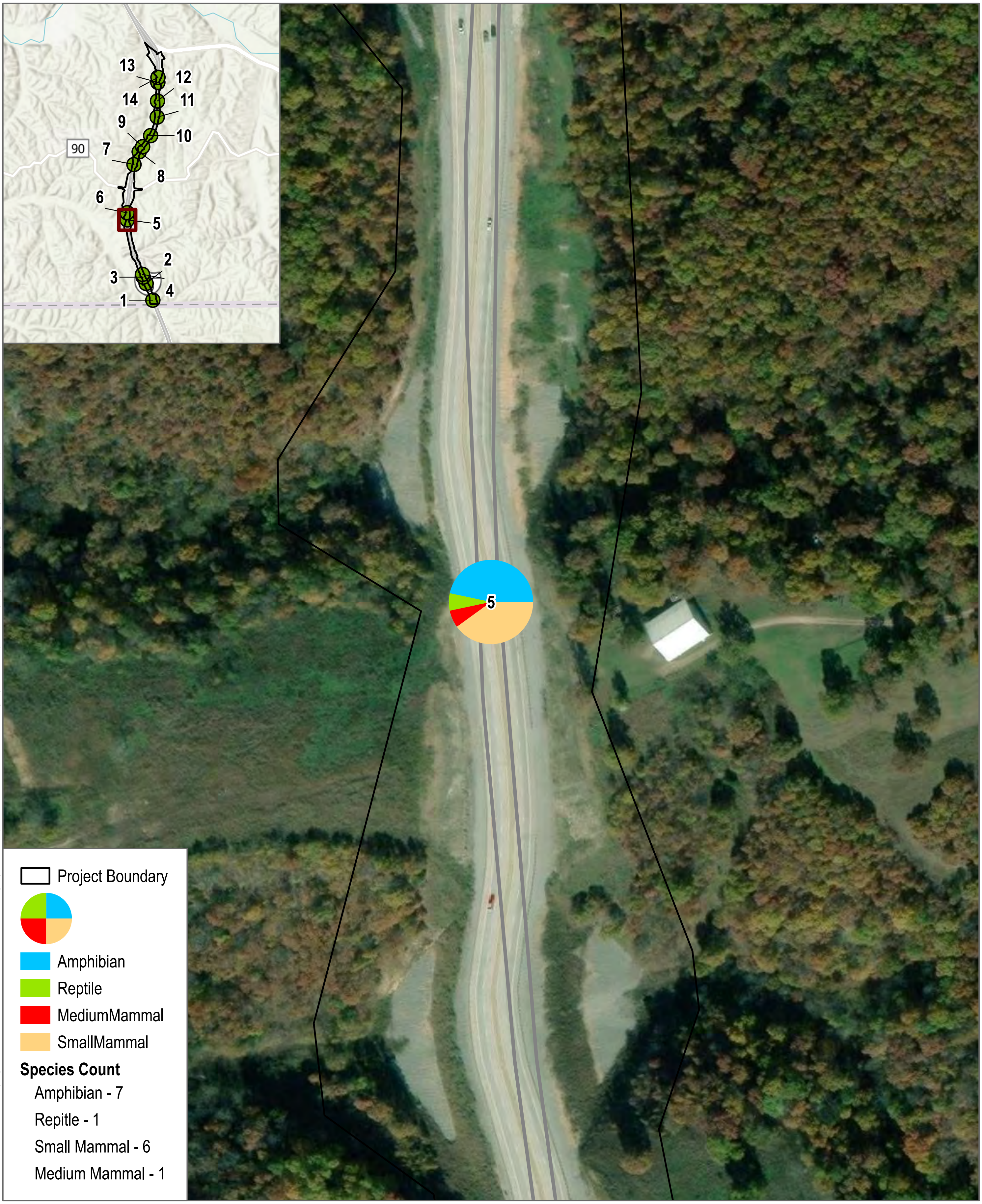
SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

DUDEK

FIGURE 13C

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

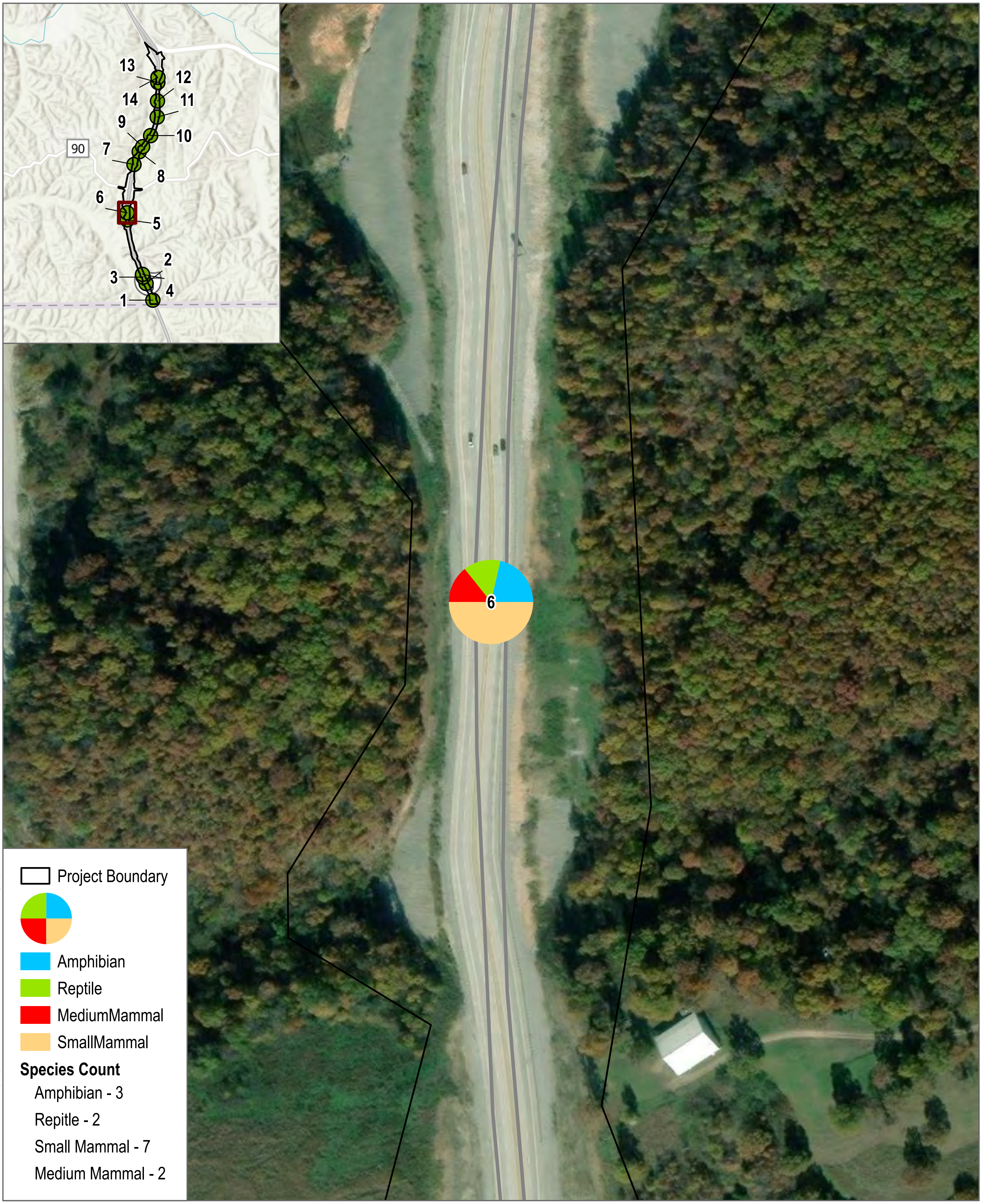
DUDEK

0 105 210 Feet

FIGURE 13D

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

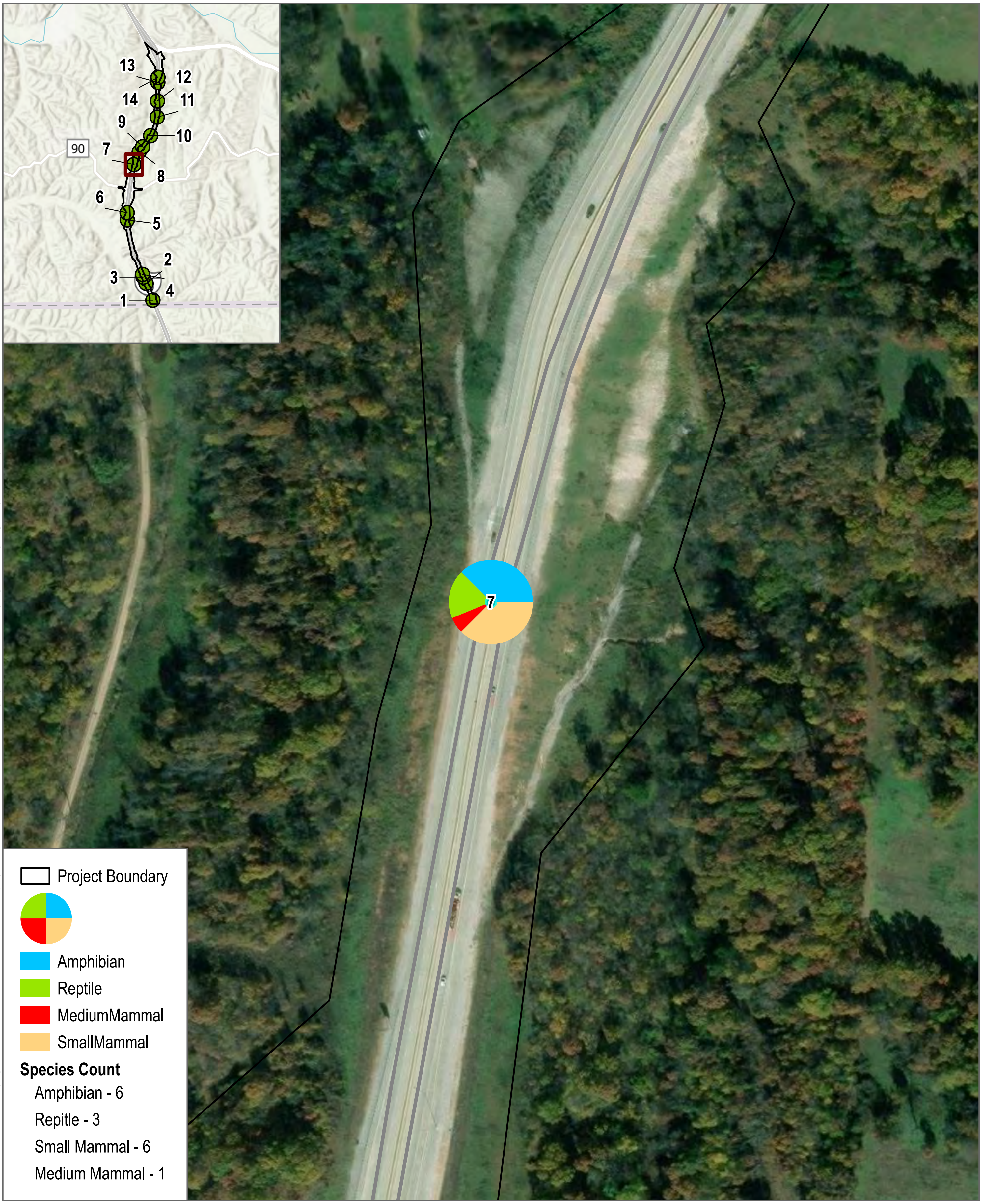
DUDEK

0 105 210 Feet

FIGURE 13E

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

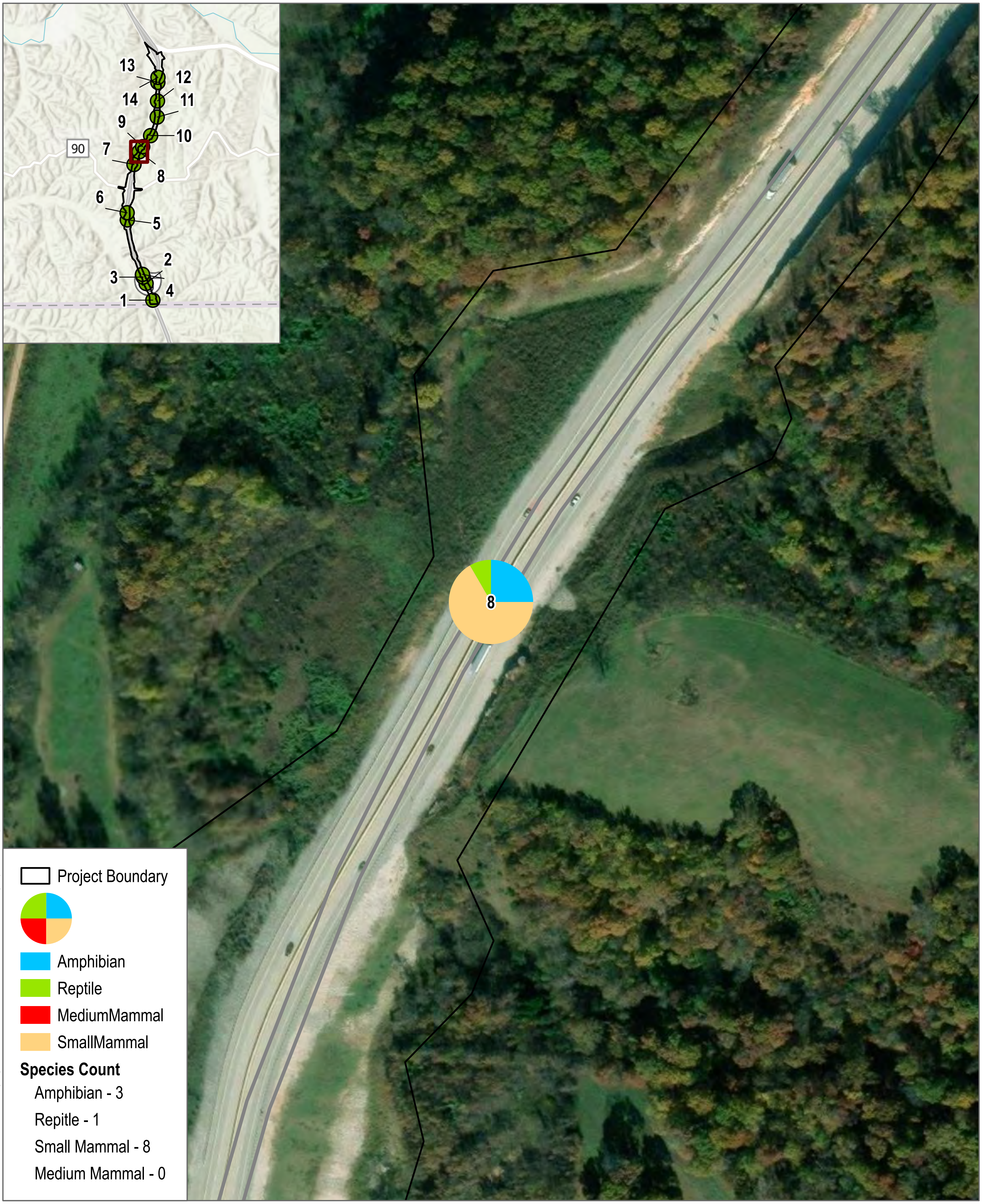
DUDEK

0 105 210 Feet

FIGURE 13F

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

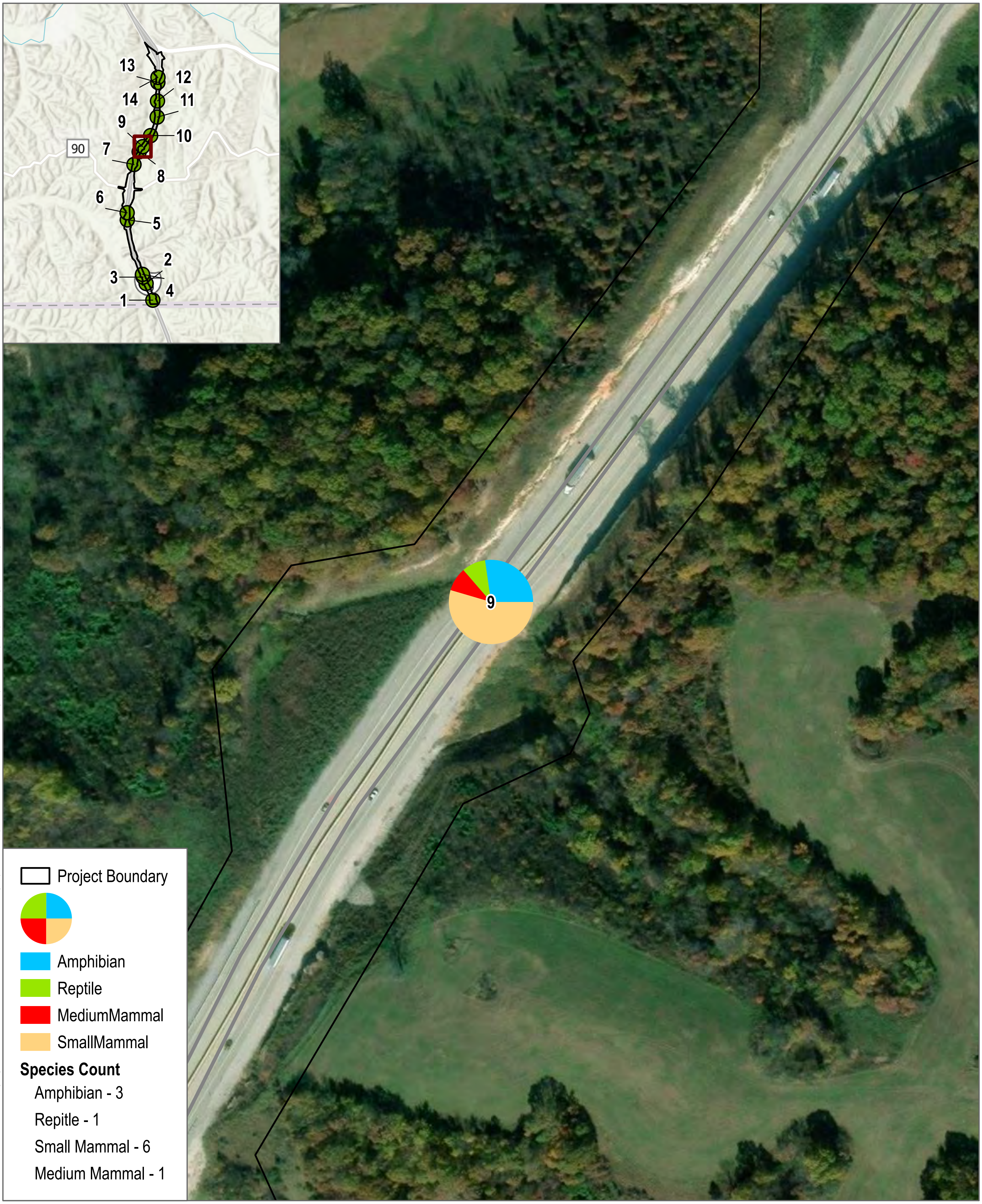
FIGURE 13G

Species use by Scupper

MoDOT I-49 Small Animal Movement Study

DUDEK

0 105 210 Feet



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

FIGURE 13H

Species use by Scupper

MoDOT I-49 Small Animal Movement Study

DUDEK

0 105 210 Feet

SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

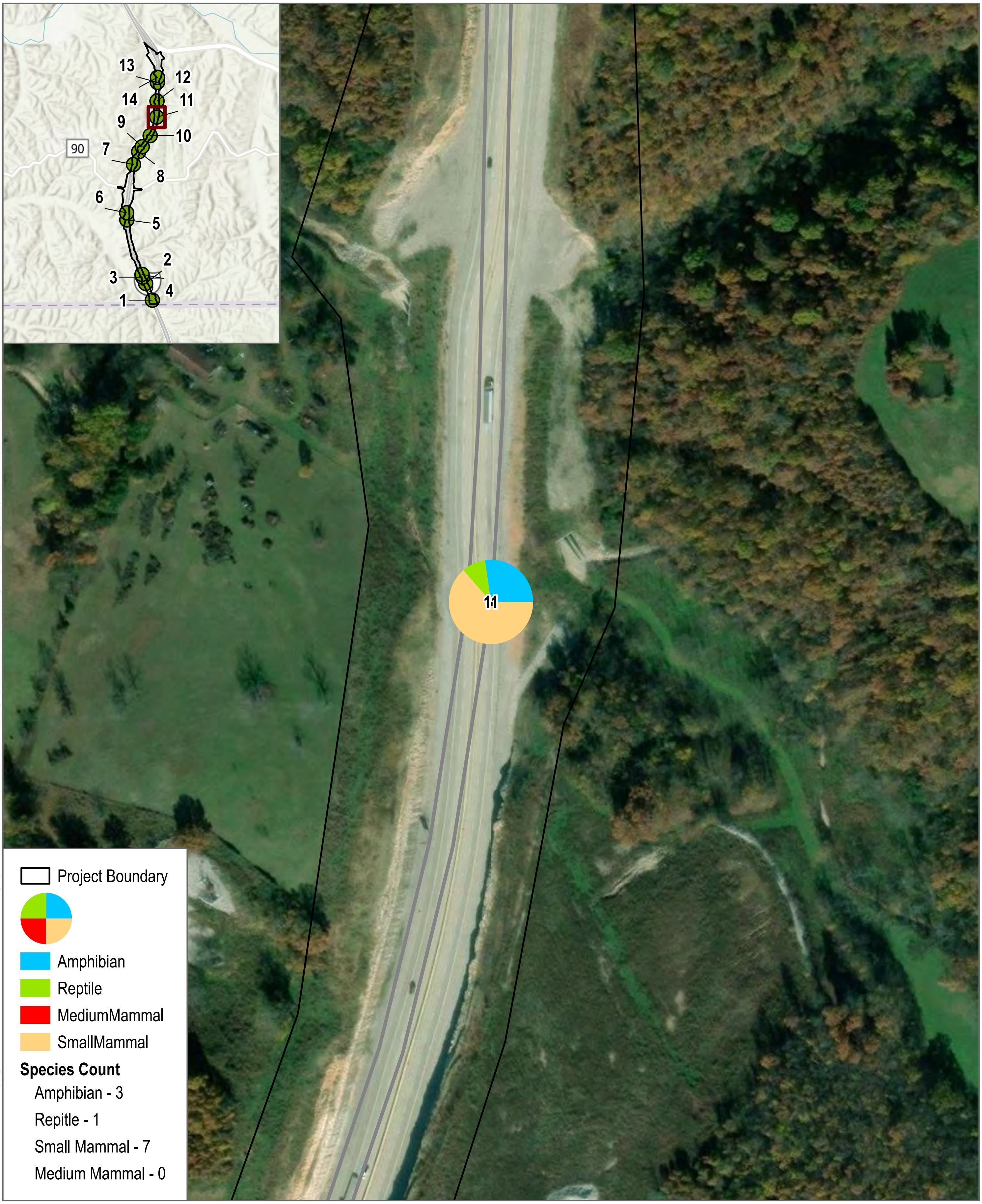
FIGURE 13I

Species use by Scupper

MoDOT I-49 Small Animal Movement Study

DUDEK

0 105 210 Feet



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

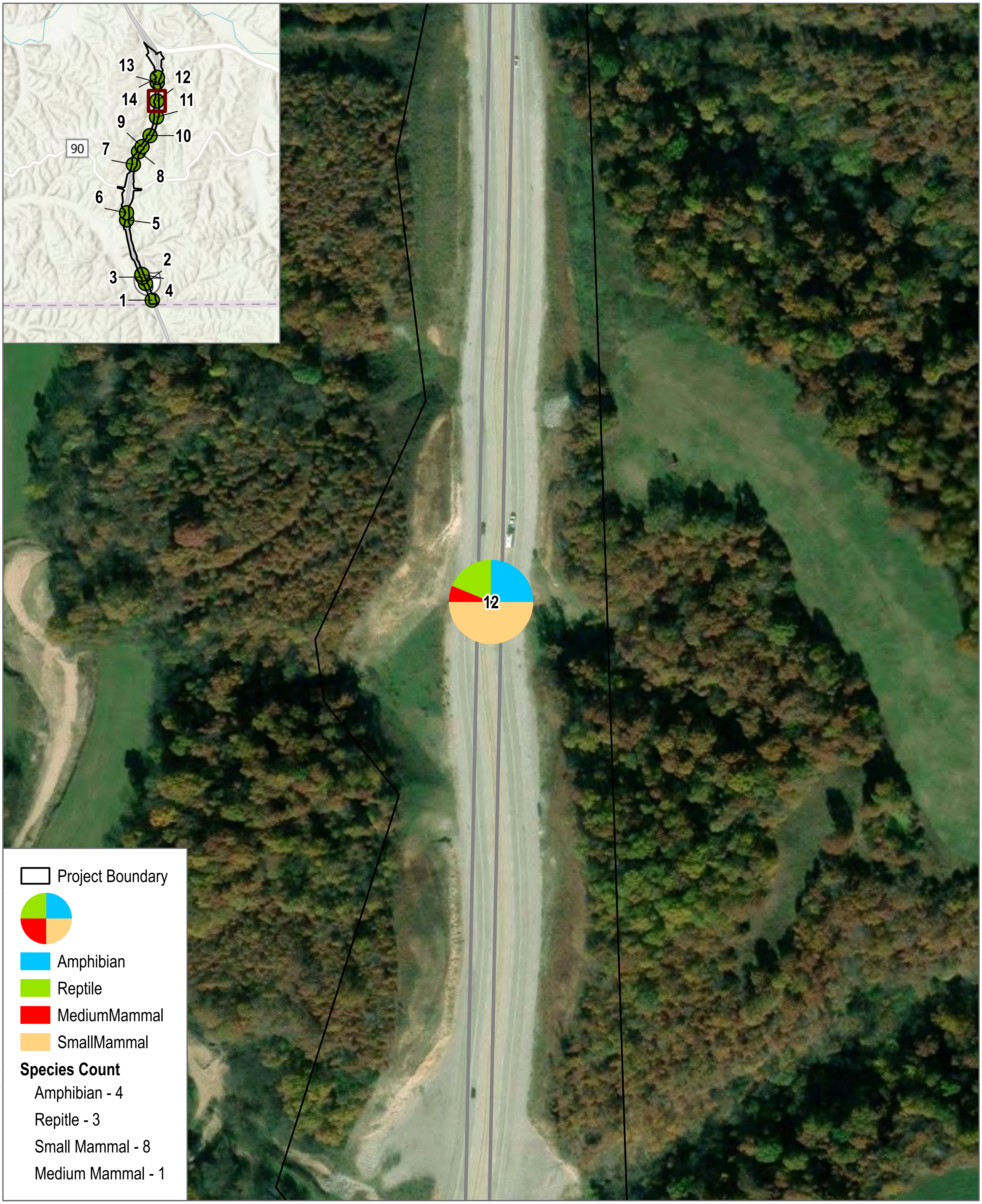
FIGURE 13J

Species use by Scupper

MoDOT I-49 Small Animal Movement Study

DUDEK

0 105 210 Feet



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

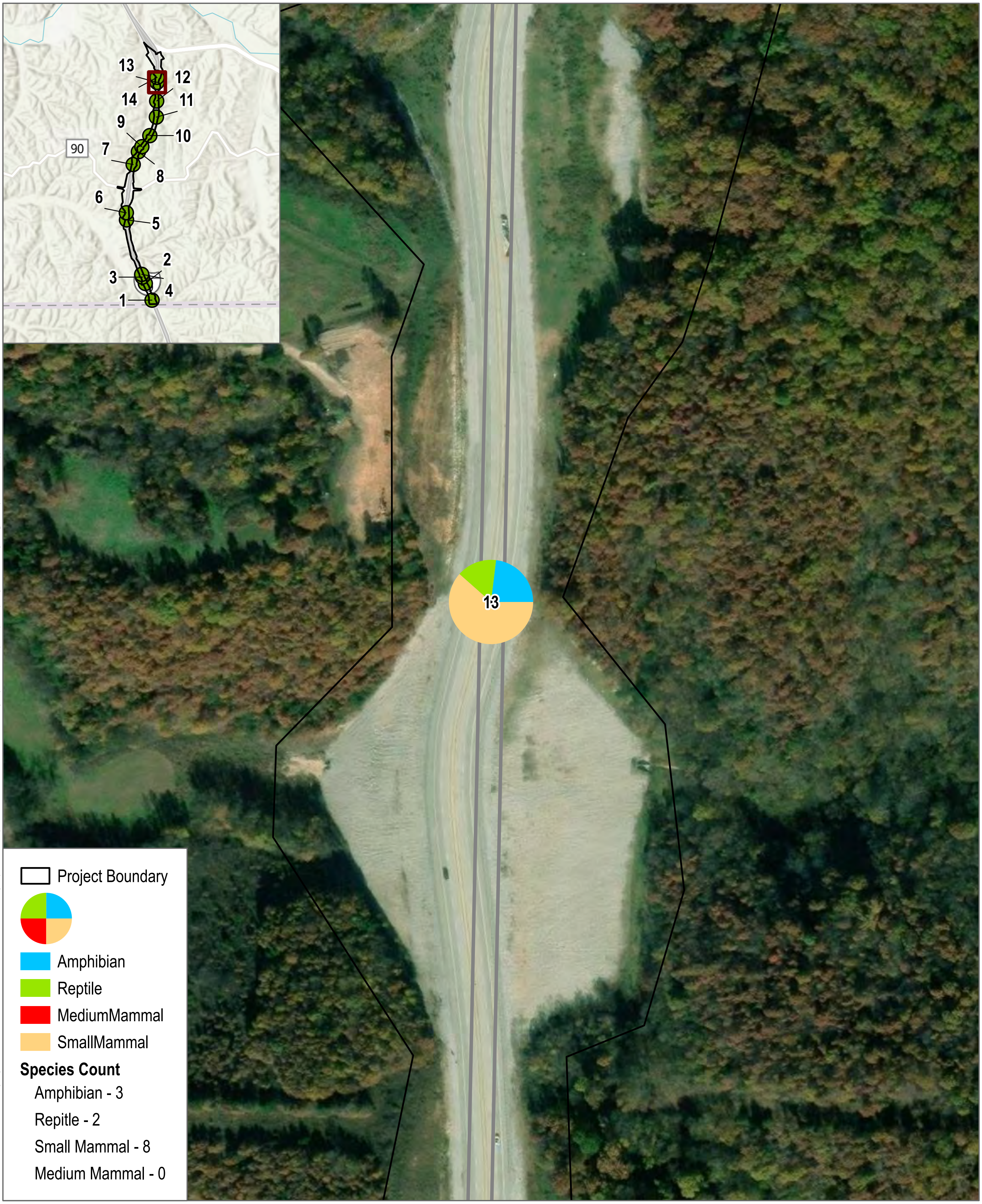
DUDEK

0 105 210 Feet

FIGURE 13K

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

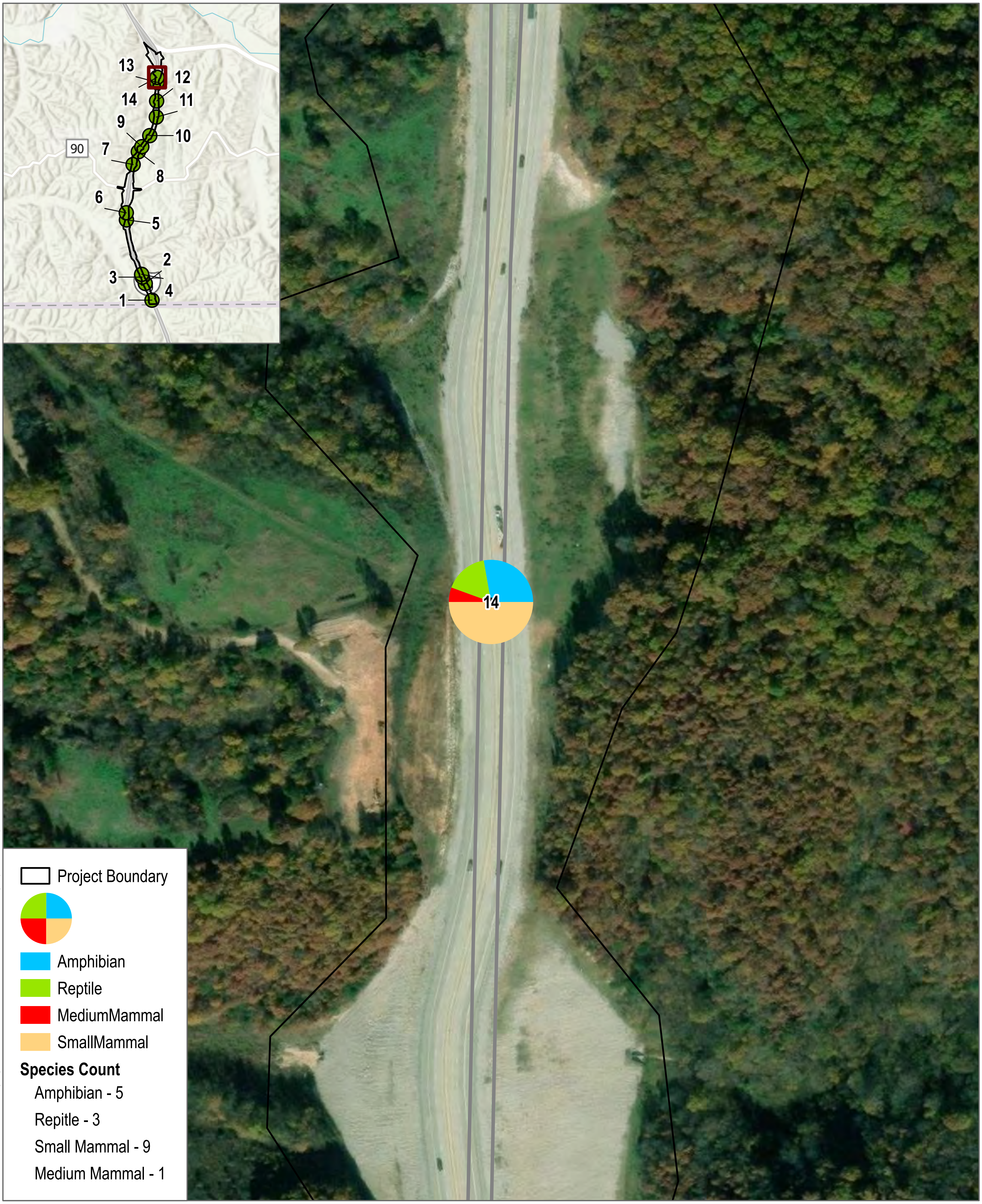
DUDEK

0 105 210 Feet

FIGURE 13L

Species use by Scupper

MoDOT I-49 Small Animal Movement Study



SOURCE: USGS; USFWS; ESRI IMAGERY, 2024; Missouri DOT, State of Missouri

DUDEK

0 105 210 Feet

FIGURE 13M

Species use by Scupper

MoDOT I-49 Small Animal Movement Study

4.5 Additional Discussion

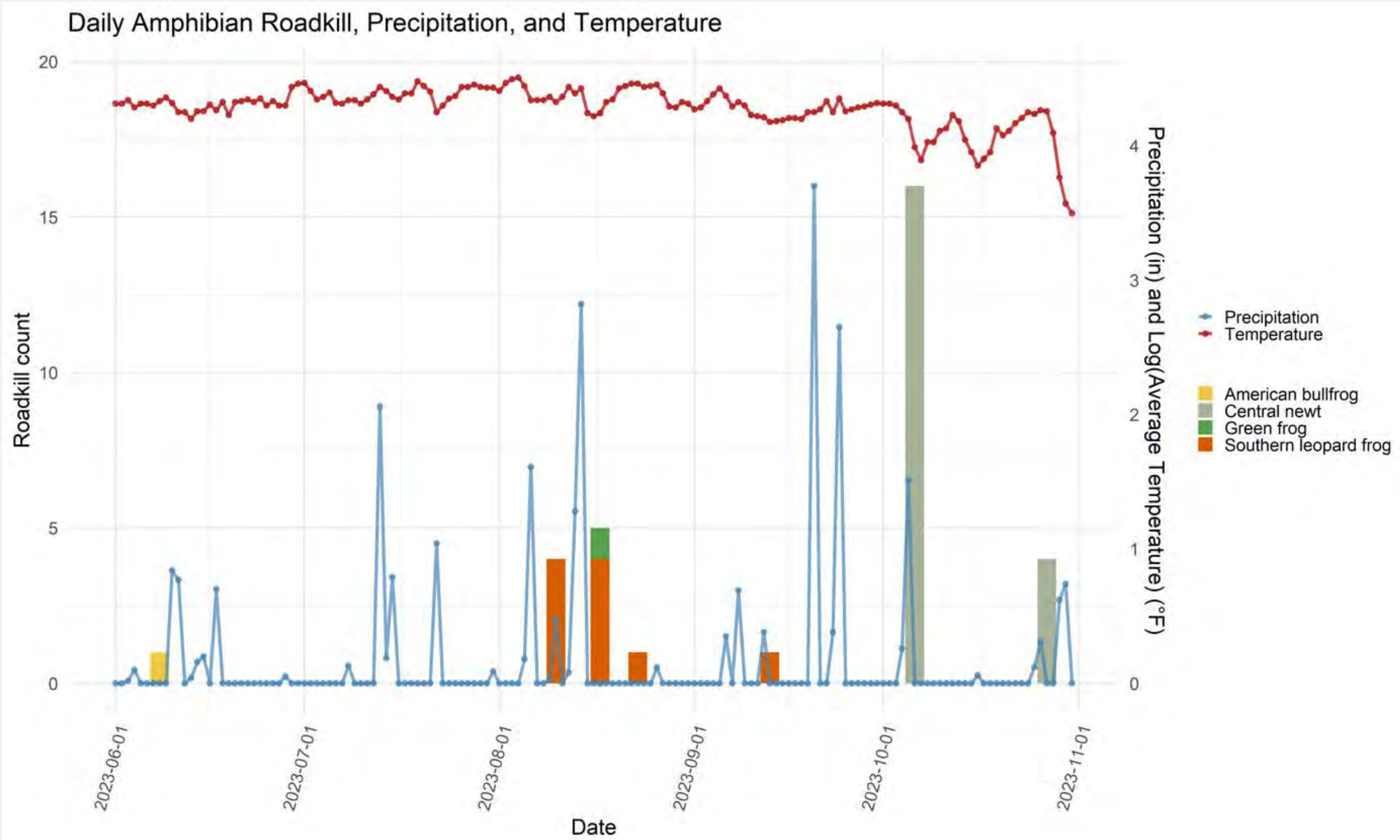
While not the focus of the study, the opportunity exists to look at a couple of factors related to amphibian and reptile movement and road mortality.

Amphibian Movement: Exhibit 30 examines the relationship between daily amphibian roadkill counts, precipitation, and temperature from August to early November 2023 during a period of key amphibian roadkill. Roadkill data are categorized by species, including American bullfrog, central newt, green frog, and southern leopard frog. Precipitation and temperature trends are overlaid to assess environmental drivers of mortality events. Roadkill events were sporadic but exhibited distinct peaks during periods of increased precipitation. The highest mortality occurred in early September, with counts reaching up to 10 individuals per day, primarily of central newts. Additional peaks were observed in mid-September and early October, coinciding with rainfall events. Species composition varied, but central newts dominated most mortality events, while American bullfrogs and southern leopard frogs appeared less frequently. Green frogs were rare, detected only once in mid-September.

Precipitation patterns strongly aligned with roadkill spikes. For example, multiple rainfall events corresponded with the largest roadkill peak in early September, and a major precipitation event (approximately four inches) coincided with a smaller mortality increase in early October. Dry periods, such as late August and mid-October, showed minimal roadkill activity.

Temperature remained relatively stable throughout the study period, gradually declining in late October. No clear correlation between temperature and roadkill frequency was observed, suggesting precipitation is the primary driver of amphibian movement and associated road mortality.

Exhibit 30. Amphibian Species Roadkill, Precipitation, and Temperature.

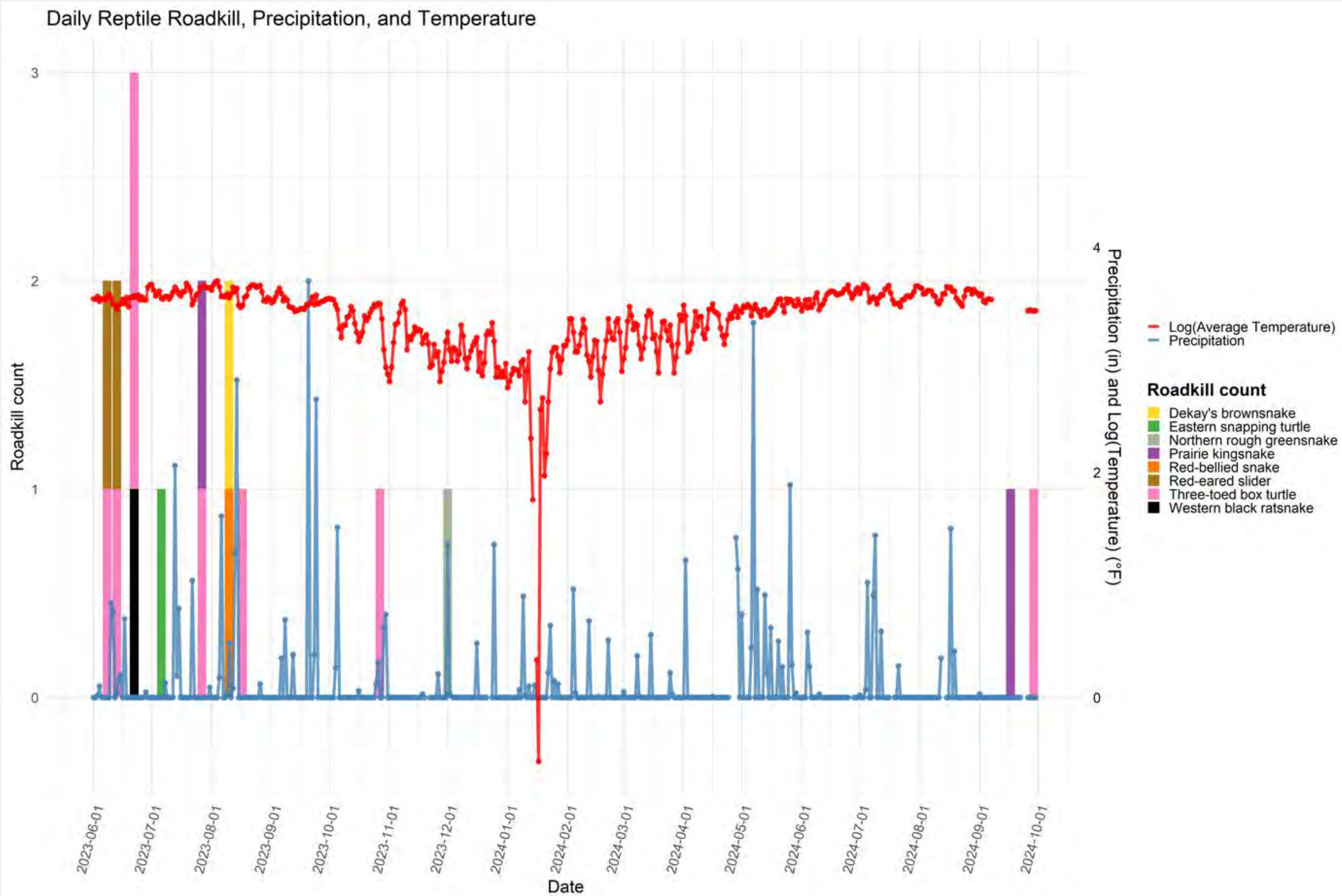


Reptile Movement: Exhibit 31 analyzes daily reptile roadkill counts in relation to precipitation and temperature from August 2023 through early February 2024. Roadkill data include multiple species such as Dekay's brown snake (*Storeria dekayi*), eastern gartersnake (*Thamnophis sirtalis sirtalis),* northern rough greensnake (*Opheodrys aestivus*), plain-bellied watersnake (*Nerodia erythrogaster*), red-bellied snake (*Storeria occipitomaculata*), red-eared slider (*Trachemys scripta elegans*), three-toed box turtle (*Terrapene triunguis*), and western black ratsnake (*Pantherophis obsoletus*). Precipitation and temperature trends are overlaid to identify environmental drivers of mortality events. Reptile roadkill events were generally infrequent, with most days recording 0–two individuals. The highest single-day mortality occurred in early August, reaching three individuals, primarily Dekay's brownsnake. Additional peaks were observed in late August and early September, involving multiple species. Turtles (three-toed box turtle and red-eared slider) appeared later in the season, suggesting seasonal movement patterns distinct from snakes.

Precipitation showed some association with roadkill events, particularly during August and September when rainfall coincided with mortality peaks. However, large precipitation events in October and December did not correspond to significant roadkill, indicating that rainfall alone does not fully explain reptile movement. Temperature remained relatively stable through summer and fall, then declined sharply in late December and January. Roadkill events were concentrated in warmer months (August–October) and nearly absent during colder periods, suggesting temperature strongly influences reptile activity.

The data indicate that reptile roadkill is seasonal, peaking during warm months and declining as temperatures drop. Rainfall may act as a secondary trigger for movement, but its influence appears weaker than for amphibians. Species-specific patterns highlight Dekay's brownsnake as the most vulnerable, while turtles and other snakes exhibit limited but notable mortality during active periods. These findings align with known reptile ecology, where activity and dispersal are temperature-dependent.

Exhibit 31. Reptile Species Roadkill, Precipitation, and Temperature.



4.6 Lessons Learned

Future studies can benefit from the following lessons that were learned during this study:

- Lane closures and contractor safety equipment/staffing can be very expensive, almost doubling the cost of the data collection, but is very important. It is important to stay current with the most recent and pertinent required protection prescriptions and augment as needed for safety.
- Equipment is constantly becoming better and more cost-effective. For example, the recently developed GardPro T5CfF close-focus cameras offer comparable quality to much more expensive or modified cameras. These were tested as they became available late in the study and were found to provide excellent photo clarity of mice within the tight confines of the scuppers. However, due to their recent use, there is no data regarding their longevity.
- HALT "break-the-beam" triggers can enhance data collection but are expensive. The trigger plates are typically positioned below the camera, and the camera is modified to trigger by the broken beam as opposed to the on-board motion/heat triggers. Their lenses are also modified to take closer in-focus photos.
- Future study design could benefit from more uniform casting of scuppers. Camera/track plates were pre-bent for installation efficiency and safety, but the scuppers were slightly smaller than the specifications, so in-field modifications to the plates were necessary.
- Insert plate design was largely effective. There were rare situations where some were either washed out of or blown out of the scupper, but mostly the plates and cameras withstood many months of deployment in the field with minimal loss or damage. Aluminum plates allow for easier site-specific modifications than steel plates would.
- eDNA collection offers many cost-effective opportunities to gather comprehensive data. However, results may provide information on species that occur in the general area or were roadkilled in the vicinity and may not represent actual use of the scupper. Additionally, eDNA studies provide a snapshot of that single sampling event only. eDNA studies should still be paired with camera studies and road mortality studies where feasible.
- For future eDNA work, both Vert12S and CO1 primers should be retained in the design. Amph_16S and VERT16S-U assays are not recommended for use in the future.

4.7 Conclusion

This study demonstrates that scupper-modified Jersey barriers provide measurable benefits for small wildlife movement across divided highways, addressing a critical connectivity issue caused by traditional impermeable barriers. While direct evidence of complete crossings was not feasible under the study design, multiple lines of data—including camera detections, road mortality surveys, coverboard observations, and eDNA analysis—confirm that a variety of species occur in the area and can locate and use scuppers. Rodents were the most frequent users documented by cameras, while eDNA revealed a broader spectrum of biodiversity, including amphibians, reptiles, and small mammals, indicating that scuppers function as microhabitat features and potential movement passages.

Comparative analysis highlights the strengths and limitations of each monitoring method. Cameras provided behavioral insights and confirmed physical presence, but were constrained by field-of-view, possible species detectability, and equipment loss. eDNA offered a more comprehensive biodiversity snapshot, detecting species that cameras missed, though interpretation requires caution due to potential DNA transport and persistence beyond actual occupancy. Road mortality data underscored the vulnerability of amphibians and reptiles, particularly during rainfall and warm periods, reinforcing the need for mitigation measures.

Overall, scupper openings represent a cost-effective and promising enhancement to median barrier design. Their implementation can reduce habitat fragmentation and mortality risk for small-bodied wildlife, especially when paired with complementary strategies such as fencing, optimized spacing, and targeted monitoring. Continued refinement of design standards, integration of multiple survey techniques, and systematic evaluation of scupper placement will be essential to maximize ecological benefits and inform statewide application.

4.8 Recommendations

- In the absence of data, MoDOT used topographic changes to determine where the scuppers should be placed, assuming that those would be the key areas where wildlife would be funneled to the roadway. Either this method should be tested on future projects (i.e., place scuppers uniformly along a highway stretch and tested to determine which receive more use), or they should be installed along all stretches of highway where habitat (broadly defined) occurs.
- Research by Brehme et al. (2021) on amphibian road-crossing systems highlighted the importance of understanding “give-up distance,” the point at which animals abandon attempts to locate a passage along barrier fencing. This is likely important for most species. For instance, they found that for California tiger salamanders, the average give-up distance was approximately 40 meters, with a 90% tolerance interval of about 12.5 meters. Individuals that initially moved in the wrong direction away from a crossing had a very low probability of success without intervention. To mitigate this, the study recommended installing turnarounds at regular intervals—every 25 meters, plus one at 12.5 meters from the crossing—to redirect animals and significantly improve passage success. Taking a cue from these studies, new projects and retrofits where there is native or naturalized habitat adjacent on both sides of the highway should consider installing scuppers at a distance frequency that is equal to or less than the smallest width of lanes. For example, if there are three east-bound lanes that are 52 feet wide (including the lanes, median, and shoulder) and four west-bound lanes that are 64 feet wide, then the distance between scuppers should be a minimum of 52 feet. Preferably, they would be installed at half that distance to increase the likelihood of detection and use. The rationale is that smaller species that are able to make it across the road to the median should then be able to travel along the concrete barrier that distance to locate a scupper and continue their journey. In this case, the presence of crossing opportunity

is a surrogate for the turnaround. Scupper openings are an inexpensive addition to Jersey Barriers with great promise.

- Follow up on eDNA detection of mountain lion in the Study Area with select camera studies. While the species is thought to be extirpated in Missouri and Arkansas, there are occasional confirmed sightings by trail cameras and other methods within Missouri (Knerr, pers. comm. 2025; Missouri Department of Conservation accessed March 2026); these are thought to originate from other states like Texas and Wyoming/South Dakota and primarily are dispersing young males. However, there was a large male road mortality in October 2025 in Hot Spring County, Arkansas (see Zellers 2025), indicating that they can move and may currently be recolonizing formerly occupied habitat in Missouri.
- Begin a systematic evaluation of the existing culvert system within MoDOT facilities, beginning with those within or adjacent to key conservation areas or key species areas. This could be done using eDNA and/or camera studies. eDNA studies can even detect the presence of bats in culverts by guano (including rare species), and new techniques for sampling are being developed continually (e.g., high performing use of spider webs for eDNA sampling [Newton et al. 2026]).

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Appendix 1

Photos from various aspects of the studies

Photo 1. Camera/track plate installed in scupper. Tracking medium in middle with contact paper on sides.

Photo 2. Camera/track plate installed in scupper – note the black-painted side to reduce glare and interest from drivers.

Photo 3. Team installing camera plate into scupper

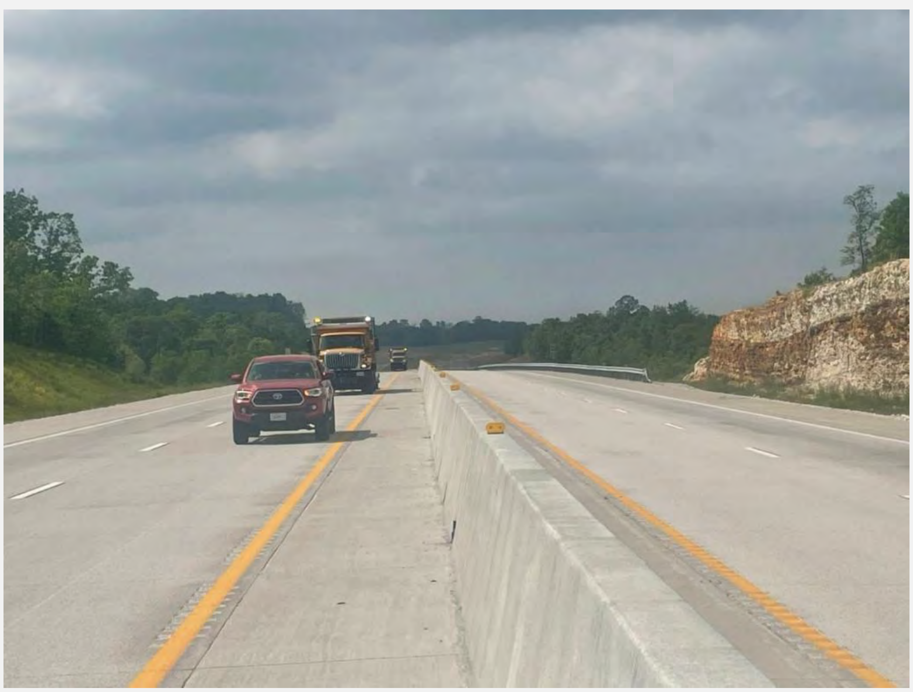

Photo 4. Safety protections for rolling lane closure

Photo 5. Broad head skink

Photo 6. Mating pair of three-toed box turtles

Photo 7. Adult copperhead

Photo 8. Black rat snake

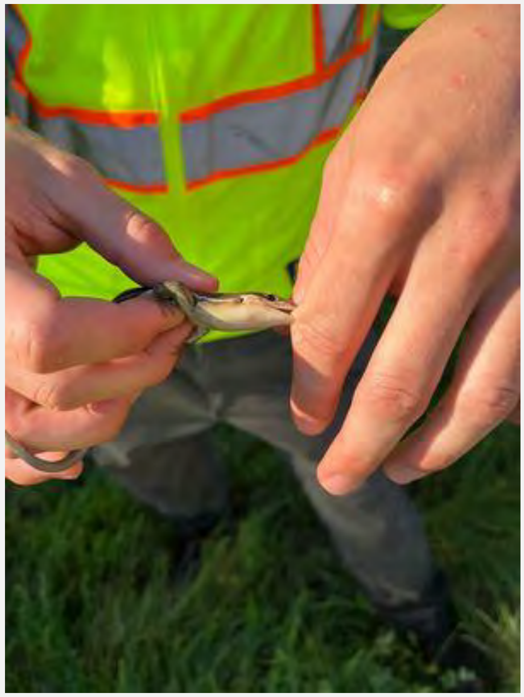

Photo 9. Five-lined skink

Photo 10. Juvenile three-toed box turtle

Photo 11. Juvenile speckled kingsnake

Photo 12. Adult speckled kingsnake

Photo 13. Red milk snake

Photo 14. Prairie ring-necked snake

Photo 15. Two adult copperheads

Photo 16. Eastern cottontail in scupper

Photo 17. Tree frog in scupper

Photo 18: Mouse in scupper

Photo 19. Nine-banded armadillo walking by scupper opening

Photo 20. Injured three-toed box turtle

Photo 21. Coyote looking into scupper

Photo 22. Roadkilled three-toed box turtle

Photo 23. Roadkilled black rat snake from inside scupper

Photo 24. Roadkilled central newt

Photo 25. Roadkilled common snapping turtle

Photo 26. Roadkilled rough green snake

Photo 27. Roadkilled southern leopard lizard

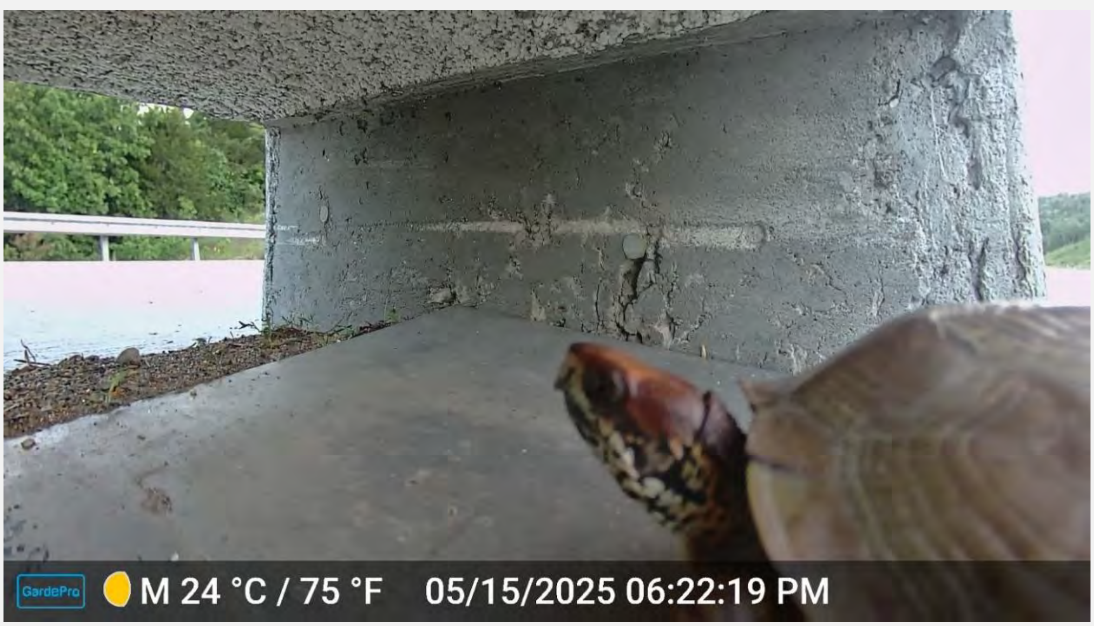

Photo 28. Adult three-toed box turtle using scupper

Photo 29. American bullfrog using scupper

Photo 30. Eastern American toad using scupper

Photo 31. Nine-banded armadillo in scupper – appears to have been injured.

Photo 32. Red fox at roadside camera station.

Photo 33. Two adult bobcats heading toward culvert

Photo 34. Bobcat leaving culvert

Photo 35. Coyote culvert use series – Example of use followed by a flooded situation where it investigates, looks up culvert, decides to leave, then decides to try, tries and immediately regrets it and jumps back out and leaves.

Photo 36: White-tailed deer walking across loose rock

Photo 37. Large white-tailed deer buck walking past culvert

Photo 38. Mouse using scupper example

Appendix 2

Complete list of species that were detected for the eDNA study

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path
No			Eukaryota	Eukaryota	Eukaryota
No			Chordata	Chordates	Eukaryota;Chordata
No			FISH		
No			Actinopteri	Chordates	Eukaryota;Chordata;Actinopteri
No			Micropterus	Freshwater Sunfishes	Eukaryota;Chordata;Actinopteri;Centrarchiformes;Centrarchidae;Micropterus
No			Cichlidae	Cichlid	Eukaryota;Chordata;Actinopteri;Cichliformes;Cichlidae
No			Clupeidae	Anchovies	Eukaryota;Chordata;Actinopteri;Clupeiformes;Clupeidae
No			Clupea	Hering	Eukaryota;Chordata;Actinopteri;Clupeiformes;Clupeidae;Clupea
No			Cypriniformes	Carp-Like Fish	Eukaryota;Chordata;Actinopteri;Cypriniformes
No			Gila orcuttii	Arroyo chub	Eukaryota;Chordata;Actinopteri;Cypriniformes;Leuciscidae;Gila;Gila orcuttii
No			Salmonidae	Salmonids	Eukaryota;Chordata;Actinopteri;Salmoniformes;Salmonidae
No			Salmo salar	Atlantic salmon	Eukaryota;Chordata;Actinopteri;Salmoniformes;Salmonidae;Salmo;Salmo salar
No			Scombriformes	Chordates	Eukaryota;Chordata;Actinopteri;Scombriformes
No			Ictaluridae	Bullhead Catfishes	Eukaryota;Chordata;Actinopteri;Siluriformes;Ictaluridae
			AMPHIBIANS		
Yes	Probable	Frog	Anura	Frogs	Eukaryota;Chordata;Amphibia;Anura
Yes	Probable	Amercian toad	Anaxyrus	North American Toads	Eukaryota;Chordata;Amphibia;Anura;Bufonidae;Anaxyrus
Yes	Probable	Frog	Dicroglossidae	Frogs	Eukaryota;Chordata;Amphibia;Anura;Dicroglossidae
Yes	Probable	American Bullfrog	Hoplobatrachus occipitalis	Crowned Bullfrog	Eukaryota;Chordata;Amphibia;Anura;Dicroglossidae;Hoplobatrachus;Hoplobatrachus occipitalis
Yes	Probable	Frog	Limnonectes macrocephalu	Giant Philippine Frog	Eukaryota;Chordata;Amphibia;Anura;Dicroglossidae;Limnonectes;Limnonectes macrocephalus
Yes	Probable	Treefrog	Pseudacris regilla	Pacific Chorus Frog	Eukaryota;Chordata;Amphibia;Anura;Hylidae;Pseudacris;Pseudacris regilla
Yes	Probable	Ranid frog	Ranidae	Ranid Frogs	Eukaryota;Chordata;Amphibia;Anura;Ranidae
Yes	Probable	treefrog	Philautus acutus	Raspy Bush Frog	Eukaryota;Chordata;Amphibia;Anura;Rhacophoridae;Philautus;Philautus acutus
Yes	Probable	treefrog	Polypedates	Old World Tree Frogs	Eukaryota;Chordata;Amphibia;Anura;Rhacophoridae;Polypedates
Yes	Probable	woodland salamander	Plethodon	Woodland Salamanders	Eukaryota;Chordata;Amphibia;Caudata;Plethodontidae;Plethodon
Yes	Probable	woodland salamander	Plethodon shenandoah	Shenandoah Salamander	Eukaryota;Chordata;Amphibia;Caudata;Plethodontidae;Plethodon;Plethodon shenandoah
Yes	Probable	newt	Salamandridae	Newts	Eukaryota;Chordata;Amphibia;Caudata;Salamandridae
Yes	Probable	newt	Notophthalmus	Eastern Newts	Eukaryota;Chordata;Amphibia;Caudata;Salamandridae;Notophthalmus
			BIRDS		
No			Aves	Birds	Eukaryota;Chordata;Aves
No			Accipitridae	Eagles	Eukaryota;Chordata;Aves;Accipitriformes;Accipitridae
No			Cathartes aura	Turkey Vulture	Eukaryota;Chordata;Aves;Accipitriformes;Cathartidae;Cathartes;Cathartes aura
No			Anatidae	Ducks	Eukaryota;Chordata;Aves;Anseriformes;Anatidae
No			Anas hottentota	Dabbling Ducks	Eukaryota;Chordata;Aves;Anseriformes;Anatidae;Anas;Anas hottentota
No			Raphidura leucopygialis	Swifts	Eukaryota;Chordata;Aves;Apodiformes;Apodidae;Raphidura;Raphidura leucopygialis
No			Charadriiformes	Alcids	Eukaryota;Chordata;Aves;Charadriiformes
No			Laridae	Gulls	Eukaryota;Chordata;Aves;Charadriiformes;Laridae
No			Columbidae	Dove	Eukaryota;Chordata;Aves;Columbiformes;Columbidae
No			Galliformes	Fowls	Eukaryota;Chordata;Aves;Galliformes
No			Phasianidae	Grouse	Eukaryota;Chordata;Aves;Galliformes;Phasianidae
No			Gallus gallus	Chicken	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus;Gallus gallus
No			Meleagris gallopavo	Wild Turkey	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Meleagris;Meleagris gallopavo

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path
No			Phasianus colchicus	Common Pheasant	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Phasianus;Phasianus colchicus
No			Zapornia atra	Waterhens	Eukaryota;Chordata;Aves;Gruiformes;Rallidae;Zapornia;Zapornia atra
No			Passeriformes	Perching Birds	Eukaryota;Chordata;Aves;Passeriformes
No			Cardinalis cardinalis	Northern Cardinal	Eukaryota;Chordata;Aves;Passeriformes;Cardinalidae;Cardinalis;Cardinalis cardinalis
No			Paridae	Chickadees	Eukaryota;Chordata;Aves;Passeriformes;Paridae
No			Junco hyemalis	Dark-eyed Junco	Eukaryota;Chordata;Aves;Passeriformes;Passerellidae;Junco;Junco hyemalis
No			Sturnus	Starlings	Eukaryota;Chordata;Aves;Passeriformes;Sturnidae;Sturnus
No			Sturnus vulgaris	Common Starling	Eukaryota;Chordata;Aves;Passeriformes;Sturnidae;Sturnus;Sturnus vulgaris
No			Illadopsis	Ground Babblers	Eukaryota;Chordata;Aves;Passeriformes;Timaliidae;Illadopsis
No			Ardea purpurea	Purple Heron	Eukaryota;Chordata;Aves;Pelecaniformes;Ardeidae;Ardea;Ardea purpurea
No			Phaethon	Herons	Eukaryota;Chordata;Aves;Pelecaniformes;Phaethontidae;Phaethon
No			Picidae	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae
No			Colaptes	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae;Colaptes
No			Colaptes auratus	Northern Flicker	Eukaryota;Chordata;Aves;Piciformes;Picidae;Colaptes;Colaptes auratus
No			Procellariiformes	Albatrosses, Petrels	Eukaryota;Chordata;Aves;Procellariiformes
No			Cacatuidae	Cockatoos	Eukaryota;Chordata;Aves;Psittaciformes;Cacatuidae
No			Psittacidae	Parrots	Eukaryota;Chordata;Aves;Psittaciformes;Psittacidae
No			Spheniscidae	Penguins	Eukaryota;Chordata;Aves;Sphenisciformes;Spheniscidae
			MAMMALS		
No			Mammalia	Mammals	Eukaryota;Chordata;Mammalia
No			Artiodactyla	Artiodactyls	Eukaryota;Chordata;Mammalia;Artiodactyla
No			Bovidae	Bovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae
No			Bos	Cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos
No			Bos taurus	Domesticated cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos;Bos taurus
No			Gazella gazella	Mountain Gazelle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Gazella;Gazella gazella
No			Ovis	Ovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Ovis
No			Ovis aries	Red Sheep	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Ovis;Ovis aries
No			Philantomba	Bovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Philantomba
No			Saiga tatarica	Saiga	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Saiga;Saiga tatarica
No			Cervidae	deer	Eukaryota;Chordata;Mammalia;Artiodactyla;Cervidae
No			Suidae	Hogs	Eukaryota;Chordata;Mammalia;Artiodactyla;Suidae
No			Sus scrofa	Wild Boar/Pig	Eukaryota;Chordata;Mammalia;Artiodactyla;Suidae;Sus;Sus scrofa
Yes	Medium	Carnivora	Carnivora	carnivores	Eukaryota;Chordata;Mammalia;Carnivora
No			Canidae	Canid	Eukaryota;Chordata;Mammalia;Carnivora;Canidae
No			Canis	Dog	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Canis
Yes	medium	Gray fox	Urocyon cinereoargenteus	Gray Fox	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Urocyon;Urocyon cinereoargenteus
No			Vulpes vulpes	Red Fox	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Vulpes;Vulpes vulpes
Yes	medium	cat	Felidae	cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae
Yes	medium	cat	Felis	Cat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis
Yes	medium	cat	Felis silvestris	Wildcat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis;Felis silvestris
Yes	low	bobcat	Panthera	roaring cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera
Yes	low	bobcat	Panthera leo	Lion	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera;Panthera leo
Yes	medium	skunk	Mephitidae	Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae
Yes	medium	striped skunk	Mephitis mephitis	Striped Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae;Mephitis;Mephitis mephitis
Yes	medium	weasel	Martes foina	Beech Marten	Eukaryota;Chordata;Mammalia;Carnivora;Mustelidae;Martes;Martes foina

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path
Yes	medium	raccoon	Procyonidae	Procyonid Carnivore	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae
Yes	medium	carnivore	Viverridae	CIVETS, GENETS AND OYANS	Eukaryota;Chordata;Mammalia;Carnivora;Viverridae
Yes	medium	carnivore	Genetta	CIVETS, GENETS AND OYANS	Eukaryota;Chordata;Mammalia;Carnivora;Viverridae;Genetta
No			Phyllostomidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Phyllostomidae
No			Pteropodidae	Old World fruit bats	Eukaryota;Chordata;Mammalia;Chiroptera;Pteropodidae
No			Vespertilionidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae
No			Eptesicus fuscus	Big Brown Bat	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae;Eptesicus;Eptesicus fuscus
No			Myotis	Mouse-Eared Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae;Myotis
Yes	medium	nine-banded armadillo	Cingulata	Mammals	Eukaryota;Chordata;Mammalia;Cingulata
Yes	medium	nine-banded armadillo	Dasypus	Long-nosed Armadillos	Eukaryota;Chordata;Mammalia;Cingulata;Dasypodidae;Dasypus
Yes	medium	Virginia opossum	Didelphidae	American opossums	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae
Yes	medium	Virginia opossum	Didelphis virginiana	Virginia Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelphis;Didelphis virginiana
Yes	medium	North American Least Shrew	Cryptotis parvus	North American Least Shrew	Eukaryota;Chordata;Mammalia;Eulipotyphla;Soricidae;Cryptotis;Cryptotis parvus
Yes	low	Jackrabbit	Leporidae	Hares	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae
Yes	low	Jackrabbit	Lepus	Hares	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Lepus
Yes	medium	Cottontail rabbit	Oryctolagus cuniculus	European Rabbit	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Oryctolagus;Oryctolagus cuniculus
Yes	medium	Cottontail rabbit	Sylvilagus	Cottontails	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus
Yes	medium	Eastern Cottontail	Sylvilagus floridanus	Eastern Cottontail	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus;Sylvilagus floridanus
No			Equus	Horses	Eukaryota;Chordata;Mammalia;Perissodactyla;Equidae;Equus
Yes	probable	Rodent	Rodentia	rodents	Eukaryota;Chordata;Mammalia;Rodentia
Yes	medium	Beaver	Castor canadensis	American Beaver	Eukaryota;Chordata;Mammalia;Rodentia;Castoridae;Castor;Castor canadensis
Yes	probable	Cricetid rodent	Cricetidae	Hamsters, Voles, Lemmings, And Allies	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae
Yes	probable	vole	Microtus	Meadow Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus
Yes	probable	Prairie Vole	Microtus ochrogaster	Prairie Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus ochrogaster
Yes	probable	Meadow Vole	Microtus pennsylvanicus	Meadow Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus pennsylvanicus
Yes	probable	eastern woodrat	Neotoma	Packrats	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Neotoma
Yes	probable	muskrat	Ondatra zibethicus	Muskrat	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Ondatra;Ondatra zibethicus
Yes	probable	deermouse	Peromyscus	Deer Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus
Yes	probable	White-footed Deermouse	Peromyscus leucopus	White-footed Deermouse	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus;Peromyscus leucopus
Yes	probable	Hispid Cotton Rat	Sigmodon hispidus	Hispid Cotton Rat	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Sigmodon;Sigmodon hispidus
Yes	probable	Old world rodent	Muridae	Small Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae
Yes	probable	Old world rodent	Acomys percivali	Percival's Spiny Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Acomys;Acomys percivali
Yes	probable	Old world rodent	Arvicanthis	African Grass Rats	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Arvicanthis
Yes	probable	House mouse	Mus	House Mice	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus
Yes	probable	House mouse	Mus musculus	House Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus;Mus musculus
Yes	low	Eastern chipmunk	Sciuridae	Chipmunks	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae
Yes	low	Eastern chipmunk	Tamias striatus	Eastern Chipmunk	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Tamias;Tamias striatus
			REPTILES		
Yes	probable	Turtle	Testudines	Chordates	Eukaryota;Chordata;NA;Testudines
Yes	low	snapping turtle	Chelidae	Turtle	Eukaryota;Chordata;NA;Testudines;Chelidae
Yes	probable	Pond/box turtle	Emydidae	Emydid Turtles	Eukaryota;Chordata;NA;Testudines;Emydidae
Yes	probable	Blanding's turtle	Emys	pond turtle	Eukaryota;Chordata;NA;Testudines;Emydidae;Emys
Yes	probable	red-eared slider	Trachemys scripta	Common Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys;Trachemys scripta

Include?	2	3	4	5	6	7	8	9	10	11	12	13	14
No	0%	40%	0%	0%	20%	20%	0%	20%	0%	0%	0%	0%	40%
No	83%	100%	100%	100%	80%	100%	100%	100%	100%	100%	100%	100%	100%
No													
No	17%	0%	0%	20%	0%	0%	0%	20%	0%	0%	0%	0%	20%
No	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	20%	0%	0%
No	50%	40%	75%	20%	20%	20%	20%	40%	0%	0%	0%	40%	40%
No	0%	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	17%	20%	0%	20%	0%	20%	20%	40%	0%	0%	0%	0%	0%
Yes	33%	20%	0%	40%	0%	40%	20%	20%	0%	20%	40%	0%	40%
Yes	17%	0%	25%	20%	20%	20%	20%	0%	25%	40%	40%	20%	20%
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Yes	17%	80%	0%	20%	20%	40%	20%	40%	0%	20%	80%	20%	40%
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Yes	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	20%	0%	0%
Yes	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	20%	0%
Yes	0%	0%	0%	20%	0%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
No	67%	80%	75%	80%	80%	60%	100%	80%	50%	100%	100%	80%	80%
No	50%	0%	25%	40%	20%	40%	20%	40%	0%	40%	40%	20%	60%
No	0%	0%	25%	20%	0%	0%	0%	0%	0%	0%	0%	40%	20%
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No	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	17%	0%	25%	0%	20%	0%	0%	20%	25%	0%	20%	0%	20%
No	0%	0%	0%	0%	20%	0%	0%	20%	0%	0%	0%	0%	0%
No	17%	0%	25%	0%	20%	20%	0%	0%	0%	0%	20%	20%	20%
No	67%	20%	50%	20%	40%	20%	20%	60%	0%	40%	40%	40%	80%
No	67%	100%	100%	100%	100%	100%	100%	80%	100%	100%	100%	100%	100%
No	67%	100%	100%	100%	100%	100%	100%	80%	75%	100%	100%	100%	100%
No	67%	100%	100%	100%	60%	40%	80%	60%	75%	60%	100%	100%	80%

Include?	2	3	4	5	6	7	8	9	10	11	12	13	14
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	0%	0%	0%
No	0%	0%	25%	0%	20%	0%	0%	0%	0%	0%	0%	20%	20%
No	50%	40%	25%	20%	40%	40%	20%	60%	50%	80%	60%	40%	60%
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No	0%	0%	0%	0%	20%	0%	20%	0%	0%	20%	20%	0%	0%
No	17%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%
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No	67%	60%	75%	80%	40%	20%	60%	60%	50%	100%	80%	100%	100%
No	67%	80%	100%	100%	60%	80%	60%	60%	25%	100%	80%	80%	80%
No	50%	40%	25%	60%	60%	20%	40%	60%	25%	40%	80%	60%	80%
No	67%	100%	100%	100%	100%	100%	100%	80%	100%	100%	100%	100%	100%
No	100%	100%	100%	100%	100%	100%	100%	80%	100%	100%	100%	100%	100%
No	83%	100%	100%	100%	80%	100%	100%	80%	75%	100%	100%	100%	100%
No	0%	20%	0%	40%	0%	0%	0%	20%	0%	0%	20%	40%	0%
No	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	20%	20%	0%
No	17%	0%	0%	0%	20%	0%	0%	0%	25%	0%	20%	0%	0%
No	0%	0%	0%	20%	0%	40%	0%	0%	0%	0%	0%	0%	0%
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No	50%	100%	100%	100%	40%	40%	60%	60%	75%	80%	100%	80%	60%
No	0%	0%	0%	0%	20%	20%	40%	20%	0%	20%	20%	40%	40%
No	50%	80%	100%	60%	60%	80%	100%	60%	75%	60%	100%	100%	80%
Yes	67%	80%	75%	80%	60%	60%	60%	80%	50%	60%	60%	100%	60%
No	17%	0%	0%	20%	0%	0%	0%	40%	0%	20%	40%	40%	20%
No	67%	100%	75%	40%	40%	0%	40%	60%	50%	40%	60%	80%	80%
Yes	0%	0%	0%	20%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	20%	0%	0%
Yes	0%	0%	50%	20%	20%	0%	20%	20%	0%	40%	0%	40%	20%
Yes	33%	0%	0%	20%	20%	0%	20%	20%	0%	40%	0%	20%	0%
Yes	0%	0%	25%	0%	20%	0%	20%	0%	0%	0%	20%	20%	0%
Yes	0%	0%	25%	20%	20%	0%	20%	20%	0%	20%	0%	0%	20%
Yes	0%	0%	0%	40%	0%	40%	0%	20%	0%	0%	0%	0%	0%
Yes	33%	20%	25%	20%	40%	0%	20%	20%	0%	60%	40%	0%	0%
Yes	17%	0%	25%	20%	20%	0%	0%	20%	0%	60%	20%	0%	0%
Yes	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Include?	2	3	4	5	6	7	8	9	10	11	12	13	14
Yes	17%	0%	25%	20%	0%	0%	0%	0%	0%	0%	40%	0%	20%
Yes	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	40%
Yes	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
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No	0%	0%	0%	20%	20%	0%	0%	20%	25%	0%	20%	0%	0%
No	33%	0%	25%	20%	0%	0%	0%	20%	0%	0%	20%	40%	60%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%
No	67%	100%	100%	80%	40%	80%	100%	80%	50%	100%	60%	100%	80%
Yes	17%	20%	75%	60%	0%	40%	0%	20%	0%	80%	40%	0%	80%
Yes	17%	60%	100%	100%	40%	60%	20%	20%	0%	80%	40%	60%	80%
Yes	33%	40%	50%	60%	20%	20%	0%	20%	0%	60%	40%	20%	40%
Yes	67%	60%	50%	80%	40%	20%	40%	0%	25%	80%	80%	60%	40%
Yes	17%	20%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	20%
Yes	67%	20%	0%	20%	20%	0%	0%	40%	25%	20%	0%	0%	20%
Yes	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	20%	0%	20%	0%	20%	0%	0%	0%	0%	0%
Yes	67%	60%	50%	20%	40%	0%	20%	60%	25%	40%	20%	60%	40%
Yes	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
No	17%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	40%	20%
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Yes	0%	0%	25%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
Yes	17%	0%	0%	0%	20%	0%	0%	20%	0%	0%	20%	20%	20%
Yes	17%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
Yes	33%	60%	50%	40%	20%	0%	40%	20%	25%	40%	60%	0%	40%
Yes	67%	80%	75%	60%	20%	40%	40%	20%	25%	60%	40%	20%	20%
Yes	33%	20%	50%	20%	20%	0%	20%	0%	25%	20%	0%	60%	20%
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Yes	67%	20%	75%	40%	40%	40%	0%	40%	0%	60%	40%	60%	0%
Yes	17%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	67%	60%	50%	60%	20%	80%	20%	80%	25%	100%	40%	100%	80%
Yes	17%	0%	25%	0%	0%	0%	20%	40%	0%	0%	40%	20%	20%
Yes	0%	0%	0%	0%	0%	40%	0%	0%	0%	0%	20%	0%	40%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	20%	0%	20%
Yes	0%	20%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	2	3
No			Eukaryota	Eukaryota	Eukaryota	0%	40%
No			Chordata	Chordates	Eukaryota;Chordata	83%	100%
			FISH				
Yes	Vicinity	Sturgeon	Actinopteri	Chordates	Eukaryota;Chordata;Actinopteri	17%	0%
Yes	Vicinity	Freshwater Sunfishes	Micropterus	Freshwater Sunfishes	Eukaryota;Chordata;Actinopteri;Centrarchiformes;Centrarchidae;Micropterus	17%	0%
Yes	Vicinity	cichlid	Cichlidae	cichlid	Eukaryota;Chordata;Actinopteri;Cichliformes;Cichlidae	0%	0%
Yes	Vicinity	Anchovies	Clupeidae	Anchovies	Eukaryota;Chordata;Actinopteri;Clupeiformes;Clupeidae	50%	40%
Yes	Vicinity	carp	Cypriniformes	Carp-Like Fish	Eukaryota;Chordata;Actinopteri;Cypriniformes	0%	0%
Yes	Vicinity	salmonid	Salmonidae	Salmonids	Eukaryota;Chordata;Actinopteri;Salmoniformes;Salmonidae	0%	0%
Yes	Vicinity	tuna	Scombriformes	Chordates	Eukaryota;Chordata;Actinopteri;Scombriformes	0%	0%
Yes	Vicinity	catfish	Ictaluridae	Bullhead Catfishes	Eukaryota;Chordata;Actinopteri;Siluriformes;Ictaluridae	17%	20%
			AMPHIBIANS				
Yes	Location	frog	Anura	Frogs	Eukaryota;Chordata;Amphibia;Anura	33%	20%
Yes	Location	American toad	Anaxyrus	North American Toads	Eukaryota;Chordata;Amphibia;Anura;Bufonidae;Anaxyrus	17%	0%
Yes	Location	frog	Dicroglossidae	Frogs	Eukaryota;Chordata;Amphibia;Anura;Dicroglossidae	17%	20%
Yes	Location	ranid frog	Ranidae	Ranid Frogs	Eukaryota;Chordata;Amphibia;Anura;Ranidae	17%	80%
Yes	Location	woodland salamander	Plethodon shenand	Shenandoah Salamander	Eukaryota;Chordata;Amphibia;Caudata;Plethodontidae;Plethodon;Plethodon shenanc	17%	0%
			BIRDS				
no			Aves	Birds	Eukaryota;Chordata;Aves	67%	80%
Yes	Vicinity	raptor	Accipitridae	Eagles	Eukaryota;Chordata;Aves;Accipitriformes;Accipitridae	50%	0%
Yes	Vicinity	turkey vulture	Cathartes aura	Turkey Vulture	Eukaryota;Chordata;Aves;Accipitriformes;Cathartidae;Cathartes;Cathartes aura	0%	0%
Yes	Vicinity	duck	Anatidae	Ducks	Eukaryota;Chordata;Aves;Anseriformes;Anatidae	33%	20%
Yes	Vicinity	duck	Anas hottentota	Dabbling Ducks	Eukaryota;Chordata;Aves;Anseriformes;Anatidae;Anas;Anas hottentota	0%	0%
Yes	Vicinity	shorebird	Charadriiformes	Alcids	Eukaryota;Chordata;Aves;Charadriiformes	17%	0%
Yes	Vicinity	gull	Laridae	Gulls	Eukaryota;Chordata;Aves;Charadriiformes;Laridae	0%	0%
Yes	Vicinity	dove	Columbidae	Dove	Eukaryota;Chordata;Aves;Columbiformes;Columbidae	17%	0%
Yes	Vicinity	galliform fowl	Galliformes	Fowls	Eukaryota;Chordata;Aves;Galliformes	67%	20%
Yes	Vicinity	nirthern bobwhite quail	Odontophoridae	New World Quail	Eukaryota;Chordata;Aves;Galliformes;Odontophoridae	0%	0%
Yes	Vicinity	ruffed grouse	Phasianidae	Grouse	Eukaryota;Chordata;Aves;Galliformes;Phasianidae	67%	100%
Yes	Vicinity	domestic chicken	Gallus gallus	Chicken	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus;Gallus gallus	67%	100%
Yes	Vicinity	wild turkey	Meleagris gallopavc	Wild Turkey	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Meleagris;Meleagris gallopavo	67%	100%
Yes	Vicinity	common pheasant	Phasianus colchicus	Common Pheasant	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Phasianus;Phasianus colchicus	0%	0%
Yes	Vicinity	common moorhen	Zapornia atra	Waterhens	Eukaryota;Chordata;Aves;Gruiformes;Rallidae;Zapornia;Zapornia atra	0%	0%
Yes	Vicinity	songbird	Passeriformes	Perching Birds	Eukaryota;Chordata;Aves;Passeriformes	50%	40%
Yes	Vicinity	Northern Cardinal	Cardinalis cardinalis	Northern Cardinal	Eukaryota;Chordata;Aves;Passeriformes;Cardinalidae;Cardinalis;Cardinalis cardinalis	0%	20%
Yes	Vicinity	chickadee	Paridae	Chickadees	Eukaryota;Chordata;Aves;Passeriformes;Paridae	0%	0%
Yes	Vicinity	Dark-eyed Junco	Junco hyemalis	Dark-eyed Junco	Eukaryota;Chordata;Aves;Passeriformes;Passerellidae;Junco;Junco hyemalis	17%	0%
Yes	Vicinity	thrush	Illadopsis	Ground Babblers	Eukaryota;Chordata;Aves;Passeriformes;Timaliidae;Illadopsis	33%	40%
Yes	Vicinity	great blue heron	Ardea purpurea	Purple Heron	Eukaryota;Chordata;Aves;Pelecaniformes;Ardeidae;Ardea;Ardea purpurea	0%	0%
Yes	Vicinity	heron	Phaethon	Herons	Eukaryota;Chordata;Aves;Pelecaniformes;Phaethontidae;Phaethon	0%	0%
Yes	Vicinity	woodpecker	Picidae	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae	0%	0%
Yes	Vicinity		Colaptes	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae;Colaptes	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	2	3
Yes	Vicinity	Northern Flicker	Colaptes auratus	Northern Flicker	Eukaryota;Chordata;Aves;Piciformes;Picidae;Colaptes;Colaptes auratus	0%	0%
Yes	Vicinity	Seabirds	Procellariiformes	Albatrosses, Petrels	Eukaryota;Chordata;Aves;Procellariiformes	0%	20%
Yes	Vicinity	Parrots	Psittacidae	Parrots	Eukaryota;Chordata;Aves;Psittaciformes;Psittacidae	33%	60%
Yes	Vicinity	Seabirds	Spheniscidae	Penguins	Eukaryota;Chordata;Aves;Sphenisciformes;Spheniscidae	67%	60%
			MAMMALS				
No			Mammalia	Mammals	Eukaryota;Chordata;Mammalia	67%	80%
Yes	Vicinity	ungulate	Artiodactyla	Artiodactyls	Eukaryota;Chordata;Mammalia;Artiodactyla	50%	40%
Yes	Vicinity	Cattle	Bovidae	Bovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae	67%	100%
Yes	Vicinity	Cattle	Bos	Cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos	100%	100%
Yes	Vicinity	Cattle	Bos taurus	Domesticated cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos;Bos taurus	83%	100%
Yes	Vicinity	white-tailed deer	Gazella gazella	Mountain Gazelle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Gazella;Gazella gazella	0%	20%
Yes	Vicinity	domestic sheep	Ovis	Ovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Ovis	0%	0%
Yes	Vicinity	domestic sheep	Ovis aries	Red Sheep	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Ovis;Ovis aries	17%	0%
Yes	Vicinity	domestic goat	Saiga tatarica	Saiga	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Saiga;Saiga tatarica	0%	0%
Yes	Vicinity	white-tailed deer	Cervidae	deer	Eukaryota;Chordata;Mammalia;Artiodactyla;Cervidae	50%	100%
Yes	Vicinity	pig	Suidae	Hogs	Eukaryota;Chordata;Mammalia;Artiodactyla;Suidae	0%	0%
Yes	Vicinity	wild pig	Sus scrofa	Wild Boar/Pig	Eukaryota;Chordata;Mammalia;Artiodactyla;Suidae;Sus;Sus scrofa	50%	80%
Yes	Location	carnivore	Carnivora	carnivores	Eukaryota;Chordata;Mammalia;Carnivora	67%	80%
Yes	Location	domestic dog	Canidae	Canid	Eukaryota;Chordata;Mammalia;Carnivora;Canidae	17%	0%
Yes	Location	coyote	Canis	Dog	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Canis	67%	100%
Yes	Location	red fox	Vulpes vulpes	Red Fox	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Vulpes;Vulpes vulpes	0%	0%
Yes	Location	domestic cat	Felidae	cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae	0%	0%
Yes	Location	domestic cat	Felis	Cat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis	33%	0%
Yes	Location	domestic cat	Felis silvestris	Wildcat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis;Felis silvestris	0%	0%
Yes	Location	bobcat	Panthera	roaring cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera	0%	0%
Yes	Location	skunk	Mephitidae	Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae	33%	20%
Yes	Location	striped skunk	Mephitis mephitis	Striped Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae;Mephitis;Mephitis mephitis	17%	0%
Yes	Location	raccoon	Procyonidae	Procyonid Carnivore	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae	17%	0%
Yes	Vicinity	leaf-nosed bats	Phyllostomidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Phyllostomidae	0%	20%
Yes	Vicinity	bat	Pteropodidae	Old World fruit bats	Eukaryota;Chordata;Mammalia;Chiroptera;Pteropodidae	0%	0%
Yes	Vicinity	Micro bats	Vespertilionidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae	33%	0%
Yes	Vicinity	Big Brown Bat	Eptesicus fuscus	Big Brown Bat	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae;Eptesicus;Eptesicus fuscu	0%	0%
Yes	Vicinity	Mouse-Eared Bats	Myotis	Mouse-Eared Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae;Myotis	67%	100%
Yes	Location	nine-banded armadillo	Cingulata	Mammals	Eukaryota;Chordata;Mammalia;Cingulata	17%	20%
Yes	Location	nine-banded armadillo	Dasypus	Long-nosed Armadillos	Eukaryota;Chordata;Mammalia;Cingulata;Dasypodidae;Dasypus	17%	60%
Yes	Location	virginia opossum	Didelphidae	American opossums	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae	33%	40%
Yes	Location	virginia opossum	Didelphis virginiana	Virginia Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelphis;Didelphis virgi	67%	60%
Yes	Location	North American Least Shrew	Cryptotis parvus	North American Least Shrew	Eukaryota;Chordata;Mammalia;Eulipotyphla;Soricidae;Cryptotis;Cryptotis parvus	17%	20%
Yes	Location	jackrabbit	Leporidae	Hares	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae	67%	20%
Yes	Location	jackrabbit	Lepus	Hares	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Lepus	0%	0%
Yes	Location	cottontail rabbit	Sylvilagus	Cottontails	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus	67%	60%
Yes	Location	Eastern Cottontail	Sylvilagus floridanu:	Eastern Cottontail	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus;Sylvilagus floridanu	17%	0%
Yes	Vicinity	horse	Equus	Horses	Eukaryota;Chordata;Mammalia;Perissodactyla;Equidae;Equus	17%	20%
Yes	Vicinity	American Beaver	Castor canadensis	American Beaver	Eukaryota;Chordata;Mammalia;Rodentia;Castoridae;Castor;Castor canadensis	0%	20%
Yes	Location	Cricetid rodent	Cricetidae	Hamsters, Voles, Lemmings, A	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae	0%	20%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	2	3
Yes	Location	vole	Microtus	Meadow Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus	0%	0%
Yes	Location	Prairie Vole	Microtus ochrogaste	Prairie Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus ochrogaster	0%	0%
Yes	Location	Meadow Vole	Microtus pennsylvai	Meadow Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus pennsylvanicu	0%	0%
Yes	Location	eastern woodrat	Neotoma	Packrats	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Neotoma	17%	0%
Yes	Location	Deermouse	Peromyscus	Deer Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus	33%	60%
Yes	Location	White-footed Deermouse	Peromyscus leucop	White-footed Deermouse	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus;Peromyscus leucopu	67%	80%
Yes	Location	Hispid Cotton Rat	Sigmodon hispidus	Hispid Cotton Rat	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Sigmodon;Sigmodon hispidus	33%	20%
Yes	Location	Old world rodent	Muridae	Small Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae	0%	0%
Yes	Location	Old world rodent	Arvicanthis	African Grass Rats	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Arvicanthis	0%	0%
Yes	Location	house mouse	Mus	House Mice	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus	0%	0%
Yes	Location	house mouse	Mus musculus	House Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus;Mus musculus	0%	0%
Yes	Location	Eastern Chipmunk	Sciuridae	Chipmunks	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae	67%	20%
Yes	Location	Eastern Chipmunk	Tamias striatus	Eastern Chipmunk	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Tamias;Tamias striatus	17%	0%
			REPTILES				
Yes	Location	turtle	Testudines	Chordates	Eukaryota;Chordata;NA;Testudines	67%	60%
Yes	Location	snapping turtle	Chelidae	Turtle	Eukaryota;Chordata;NA;Testudines;Chelidae	17%	0%
Yes	Location	Pond/box turtle	Emydidae	Emydid Turtles	Eukaryota;Chordata;NA;Testudines;Emydidae	0%	0%
Yes	Location	Blanding's turtle	Emys	pond turtle	Eukaryota;Chordata;NA;Testudines;Emydidae;Emys	0%	0%
Yes	Location	red-eared slider	Trachemys scripta	Common Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys;Trachemys scripta	0%	20%

Include?	6	8	9	10	11	12	13	Random 1	Random 2	Random 3	Random 4	Random 5	Random 6	Unknown 1
No	20%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	80%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Yes	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	40%	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
Yes	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	20%	40%	0%	0%	0%	0%	100%	0%	0%	0%
Yes	20%	20%	0%	25%	40%	40%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	20%	40%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	40%	0%	20%	80%	20%	0%	0%	0%	0%	0%	100%	0%
Yes	0%	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%
no	80%	100%	80%	50%	100%	100%	80%	0%	100%	0%	0%	0%	0%	100%
Yes	20%	20%	40%	0%	40%	40%	20%	0%	100%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	40%	0%	0%	20%	40%	0%	100%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	20%	25%	0%	20%	0%	0%	0%	0%	0%	0%	0%	100%
Yes	20%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Yes	20%	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%	0%	100%	0%
Yes	40%	20%	60%	0%	40%	40%	40%	0%	100%	0%	0%	0%	0%	0%
Yes	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%
Yes	100%	100%	80%	100%	100%	100%	100%	100%	100%	0%	100%	0%	0%	100%
Yes	100%	100%	80%	75%	100%	100%	100%	100%	100%	0%	100%	0%	0%	100%
Yes	60%	80%	60%	75%	60%	100%	100%	100%	0%	0%	0%	0%	0%	100%
Yes	0%	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	20%	60%	50%	80%	60%	40%	0%	0%	0%	0%	0%	0%	100%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	40%	25%	40%	60%	60%	0%	100%	0%	0%	0%	0%	100%
Yes	20%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Include?	6	8	9	10	11	12	13	Random 1	Random 2	Random 3	Random 4	Random 5	Random 6	Unknown 1
Yes	0%	0%	0%	25%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	25%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%
Yes	20%	20%	20%	0%	40%	20%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	60%	60%	50%	100%	80%	100%	0%	100%	0%	0%	0%	100%	100%
No	60%	60%	60%	25%	100%	80%	80%	0%	0%	0%	0%	100%	0%	100%
Yes	60%	40%	60%	25%	40%	80%	60%	0%	100%	0%	0%	0%	0%	100%
Yes	100%	100%	80%	100%	100%	100%	100%	100%	100%	0%	100%	0%	0%	100%
Yes	100%	100%	80%	100%	100%	100%	100%	100%	100%	0%	100%	0%	100%	100%
Yes	80%	100%	80%	75%	100%	100%	100%	100%	100%	0%	100%	0%	0%	100%
Yes	0%	0%	20%	0%	0%	20%	40%	0%	0%	0%	100%	0%	0%	0%
Yes	0%	0%	0%	25%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	25%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	60%	60%	75%	80%	100%	80%	100%	0%	0%	100%	0%	0%	0%
Yes	20%	40%	20%	0%	20%	20%	40%	0%	0%	0%	0%	0%	0%	100%
Yes	60%	100%	60%	75%	60%	100%	100%	0%	0%	0%	0%	0%	0%	100%
Yes	60%	60%	80%	50%	60%	60%	100%	100%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	40%	0%	20%	40%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	40%	60%	50%	40%	60%	80%	0%	0%	0%	100%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	20%	0%	40%	0%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	20%	0%	40%	0%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	0%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	20%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	20%	20%	0%	60%	40%	0%	0%	0%	0%	100%	0%	0%	0%
Yes	20%	0%	20%	0%	60%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	20%	0%	40%	60%	40%	0%	0%	0%	0%	0%	0%	100%
Yes	20%	0%	20%	25%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	20%	0%	0%	20%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	100%	80%	50%	100%	60%	100%	100%	100%	0%	100%	0%	0%	100%
Yes	0%	0%	20%	0%	80%	40%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	20%	20%	0%	80%	40%	60%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	20%	0%	60%	40%	20%	0%	0%	0%	0%	0%	0%	100%
Yes	40%	40%	0%	25%	80%	80%	60%	100%	0%	0%	0%	0%	0%	100%
Yes	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	40%	25%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	20%	60%	25%	40%	20%	60%	100%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	20%	0%	0%	20%	40%	20%	0%	0%	0%	100%	0%	100%	100%

Include?	6	8	9	10	11	12	13	Random 1	Random 2	Random 3	Random 4	Random 5	Random 6	Unknown 1
Yes	20%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	20%	0%	0%	20%	20%	0%	0%	0%	0%	0%	0%	100%
Yes	20%	40%	20%	25%	40%	60%	0%	0%	0%	0%	100%	0%	0%	100%
Yes	20%	40%	20%	25%	60%	40%	20%	0%	0%	0%	0%	0%	0%	100%
Yes	20%	20%	0%	25%	20%	0%	60%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	0%	20%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	40%	20%	40%	0%	0%	0%	0%	0%	0%	0%
Yes	40%	0%	40%	0%	60%	40%	60%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	20%	80%	25%	100%	40%	100%	0%	100%	0%	0%	0%	0%	100%
Yes	0%	20%	40%	0%	0%	40%	20%	0%	100%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	100%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Include?	occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	W1	W2	W3
No			Chordata	Chordates	Eukaryota;Chordata	0%	100%	100%
			AMPHIBIANS					
Yes	Occupy	frog	Anura	Frogs	Eukaryota;Chordata;Amphibia;Anura	100%	0%	0%
			BIRDS					
No			Aves	Birds	Eukaryota;Chordata;Aves	0%	100%	100%
Yes	vicinity	Raptor	Accipitridae	Eagles	Eukaryota;Chordata;Aves;Accipitriformes;Accipitridae	0%	100%	100%
Yes	Occupy	ducks	Anatidae	Ducks	Eukaryota;Chordata;Aves;Anseriformes;Anatidae	0%	100%	100%
Yes	Occupy	shorebird	Charadriiformes	Alcids	Eukaryota;Chordata;Aves;Charadriiformes	0%	100%	100%
Yes	vicinity	dove	Columbidae	Dove	Eukaryota;Chordata;Aves;Columbiformes;Columbidae	0%	100%	100%
Yes	vicinity	galliform fowl	Galliformes	Fowls	Eukaryota;Chordata;Aves;Galliformes	0%	100%	100%
Yes	vicinity	ruffed grouse	Phasianidae	Grouse	Eukaryota;Chordata;Aves;Galliformes;Phasianidae	0%	100%	100%
Yes	vicinity	chicken	Gallus gallus	Chicken	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus;Gallus gallus	0%	100%	100%
Yes	vicinity	wild turkey	Meleagris gallopavo	Wild Turkey	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Meleagris;Meleagris ga	0%	0%	100%
Yes	Occupy	sandhill crane	Gruidae	Cranes	Eukaryota;Chordata;Aves;Gruiformes;Gruidae	0%	0%	100%
Yes	vicinity	song bird	Passeriformes	Perching Birds	Eukaryota;Chordata;Aves;Passeriformes	0%	100%	100%
Yes	vicinity	Northern Cardinal	Cardinalis cardinalis	Northern Cardinal	Eukaryota;Chordata;Aves;Passeriformes;Cardinalidae;Cardinalis;Cardinali:	0%	100%	0%
Yes	vicinity	crow	Corvidae	Crows	Eukaryota;Chordata;Aves;Passeriformes;Corvidae	0%	100%	100%
Yes	vicinity	corvid	Corvus	Corvid Species	Eukaryota;Chordata;Aves;Passeriformes;Corvidae;Corvus	0%	100%	100%
Yes	vicinity	song bird	Plocepasser mahali	White-browed Sparrow-Weaver	Eukaryota;Chordata;Aves;Passeriformes;Passeridae;Plocepasser;Plocepa:	0%	100%	0%
Yes	vicinity	thrush	Illadopsis	Ground Babblers	Eukaryota;Chordata;Aves;Passeriformes;Timaliidae;Illadopsis	0%	100%	100%
Yes	vicinity	americna robin	Turdus	Robins	Eukaryota;Chordata;Aves;Passeriformes;Turdidae;Turdus	0%	100%	0%
Yes	vicinity	thrush	Turdus olivaceofuscus	Sao Tome Thrush	Eukaryota;Chordata;Aves;Passeriformes;Turdidae;Turdus;Turdus olivaceo	0%	100%	0%
Yes	vicinity	Eastern Phoebe	Sayornis phoebe	Eastern Phoebe	Eukaryota;Chordata;Aves;Passeriformes;Tyrannidae;Sayornis;Sayornis pho	0%	0%	100%
Yes	Occupy	bittern	Ardeidae	Bitterns	Eukaryota;Chordata;Aves;Pelecaniformes;Ardeidae	0%	0%	100%
Yes	vicinity	woodpecker	Picidae	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae	0%	0%	100%
Yes	vicinity	downy woodpecker	Dryobates pubescens	Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae;Dryobates;Dryobates pubesc	0%	0%	100%
Yes	vicinity	hairy woodpecker	Picoides villosus	Pied Woodpeckers	Eukaryota;Chordata;Aves;Piciformes;Picidae;Picoides;Picoides villosus	0%	0%	100%
Yes	vicinity	parrot	Psittacidae	Parrots	Eukaryota;Chordata;Aves;Psittaciformes;Psittacidae	0%	0%	100%
Yes	vicinity	seabird	Spheniscidae	Penguins	Eukaryota;Chordata;Aves;Sphenisciformes;Spheniscidae	0%	0%	100%
Yes	vicinity	stingray	Myliobatiformes	Stingray	Eukaryota;Chordata;Chondrichthyes;Myliobatiformes	0%	100%	100%
			MAMMALS					
No			Mammalia	Mammals	Eukaryota;Chordata;Mammalia	0%	100%	100%
Yes	vicinity	ungulate	Artiodactyla	Artiodactyls	Eukaryota;Chordata;Mammalia;Artiodactyla	0%	100%	100%
Yes		cattle	Bovidae	Bovine	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae	0%	100%	100%
Yes		cattle	Bos	Cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos	0%	100%	100%
Yes		cattle	Bos grunniens	yak	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos;Bos grunniens	0%	100%	100%
Yes		cattle	Bos taurus	Domesticated cattle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Bos;Bos taurus	0%	100%	100%
Yes	vicinity	white-tailed deer	Gazella gazella	Mountain Gazelle	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Gazella;Gazella gazel	0%	0%	100%
Yes	vicinity	domestic goat	Pantholops hodgsonii	Chiru	Eukaryota;Chordata;Mammalia;Artiodactyla;Bovidae;Pantholops;Pantholo	0%	0%	100%
Yes	vicinity	white-tailed deer	Cervidae	deer	Eukaryota;Chordata;Mammalia;Artiodactyla;Cervidae	100%	0%	100%
Yes	vicinity	wild pig	Sus scrofa	Wild Boar/Pig	Eukaryota;Chordata;Mammalia;Artiodactyla;Suidae;Sus;Sus scrofa	0%	0%	100%
Yes	vicinity	carnivores carnivores	Carnivora	carnivores	Eukaryota;Chordata;Mammalia;Carnivora	0%	100%	100%
Yes	vicinity	coyote	Canidae	Canid	Eukaryota;Chordata;Mammalia;Carnivora;Canidae	0%	100%	100%

Include?	occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	W1	W2	W3
Yes	vicinity	domestic dog	Canis	Dog	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Canis	0%	100%	100%
Yes	vicinity	Gray Fox	Urocyon cinereoargen	Gray Fox	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Urocyon;Urocyon cinere	0%	100%	100%
Yes	vicinity	Red Fox	Vulpes vulpes	Red Fox	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Vulpes;Vulpes vulpes	0%	0%	100%
Yes	vicinity	Cat	Felidae	cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae	0%	100%	100%
Yes	vicinity	Cat	Felis	Cat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis	0%	0%	100%
Yes	vicinity	Cat	Felis silvestris	Wildcat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Felis;Felis silvestris	0%	0%	100%
Yes	vicinity	Cat	Otocolobus manul	Pallas' cat	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Otocolobus;Otocolobus	0%	0%	100%
Yes	vicinity	bobcat	Panthera	roaring cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera	0%	100%	100%
Yes	vicinity	bobcat	Panthera leo	Lion	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera;Panthera leo	0%	0%	100%
Yes	vicinity	bobcat	Panthera tigris	Tiger	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Panthera;Panthera tigris	0%	0%	100%
Yes	vicinity	mountain lion	Puma	pumas	Eukaryota;Chordata;Mammalia;Carnivora;Felidae;Puma	0%	0%	100%
Yes	vicinity	skunk	Mephitidae	Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae	0%	0%	100%
Yes	vicinity	Striped Skunk	Mephitis mephitis	Striped Skunk	Eukaryota;Chordata;Mammalia;Carnivora;Mephitidae;Mephitis;Mephitis m	0%	0%	100%
Yes	vicinity	weasel	Mustelidae	Mustelid Carnivore	Eukaryota;Chordata;Mammalia;Carnivora;Mustelidae	0%	100%	100%
Yes	vicinity	weasel	Martes foina	Beech Marten	Eukaryota;Chordata;Mammalia;Carnivora;Mustelidae;Martes;Martes foina	0%	100%	100%
Yes	Occupy	raccoon	Procyonidae	Procyonid Carnivore	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae	0%	100%	100%
Yes	vicinity	carnivores	Viverridae	CIVETS, GENETS AND OYANS	Eukaryota;Chordata;Mammalia;Carnivora;Viverridae	0%	100%	100%
Yes	vicinity	carnivores	Genetta	CIVETS, GENETS AND OYANS	Eukaryota;Chordata;Mammalia;Carnivora;Viverridae;Genetta	0%	0%	100%
Yes	vicinity	carnivores	Paguma larvata	Masked Palm Civet	Eukaryota;Chordata;Mammalia;Carnivora;Viverridae;Paguma;Paguma larv	0%	0%	100%
Yes	vicinity	leaf-nosed bat	Phyllostomidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Phyllostomidae	0%	100%	100%
Yes	vicinity	bat	Pteropodidae	Old World fruit bats	Eukaryota;Chordata;Mammalia;Chiroptera;Pteropodidae	0%	100%	100%
Yes	vicinity	micro bats	Vespertilionidae	Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae	0%	100%	0%
Yes	vicinity	myotis bat	Myotis	Mouse-Eared Bats	Eukaryota;Chordata;Mammalia;Chiroptera;Vespertilionidae;Myotis	0%	100%	100%
Yes	vicinity	nine-banded armadillo	Cingulata	Mammals	Eukaryota;Chordata;Mammalia;Cingulata	0%	100%	100%
Yes	vicinity	nine-banded armadillo	Chlamyphoridae	Mammals	Eukaryota;Chordata;Mammalia;Cingulata;Chlamyphoridae	0%	100%	0%
Yes	vicinity	nine-banded armadillo	Dasypus	Long-nosed Armadillos	Eukaryota;Chordata;Mammalia;Cingulata;Dasypodidae;Dasypus	0%	100%	100%
Yes	vicinity	virginia opossum	Didelphidae	American opossums	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae	0%	100%	100%
Yes	vicinity	virginia opossum	Didelphis marsupialis	Common Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelphis;Di	0%	0%	100%
Yes	vicinity	virginia opossum	Didelphis virginiana	Virginia Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelphis;Di	0%	100%	100%
Yes	vicinity	shrew	Soricidae	Shrew	Eukaryota;Chordata;Mammalia;Eulipotyphla;Soricidae	0%	0%	100%
Yes	vicinity	North American Least Shrew	Cryptotis parvus	North American Least Shrew	Eukaryota;Chordata;Mammalia;Eulipotyphla;Soricidae;Cryptotis;Cryptotis p	0%	0%	100%
Yes	vicinity	jackrabbit	Lepus	Hares	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Lepus	0%	0%	100%
Yes	vicinity	cottontail rabbit	Sylvilagus	Cottontails	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus	0%	100%	100%
Yes	vicinity	rodent	Rodentia	rodents	Eukaryota;Chordata;Mammalia;Rodentia	0%	0%	100%
Yes	vicinity	cricetid rodent	Cricetidae	Hamsters, Voles, Lemmings, And	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae	0%	0%	100%
Yes	vicinity	vole	Microtus	Meadow Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus	0%	0%	100%
Yes	vicinity	Prairie Vole	Microtus ochrogaster	Prairie Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus och	0%	0%	100%
Yes	vicinity	Meadow Vole	Microtus pennsylvanic	Meadow Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus per	0%	0%	100%
Yes	vicinity	Thomas's Pine Vole	Microtus thomasi	Thomas's Pine Vole	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Microtus;Microtus tho	0%	0%	100%
Yes	vicinity	woodrat	Neotoma	Packrats	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Neotoma	0%	0%	100%
Yes	vicinity	deermouse	Peromyscus	Deer Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus	0%	0%	100%
Yes	vicinity	White-footed Deermouse	Peromyscus leucopus	White-footed Deermouse	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus;Peromysc	0%	0%	100%
Yes	vicinity	Hispid Cotton Rat	Sigmodon hispidus	Hispid Cotton Rat	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Sigmodon;Sigmodon l	0%	0%	100%
Yes	vicinity	old world rodents	Muridae	Small Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae	0%	0%	100%
Yes	vicinity	old world rodents	Arvicanthis	African Grass Rats	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Arvicanthis	0%	0%	100%
Yes	vicinity	old world rodents	Diplothrix legata	Ryukyu Islands Tree Rat	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Diplothrix;Diplothrix leg	0%	0%	100%
Yes	vicinity	house mouse	Mus musculus	House Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus;Mus musculus	0%	0%	100%
Yes	vicinity	Eastern Chipmunk	Sciuridae	Chipmunks	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae	0%	100%	100%
Yes	vicinity	Eastern Chipmunk	Tamias	Chipmunks	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Tamias	0%	0%	100%
Yes	vicinity	Eastern Chipmunk	Tamias striatus	Eastern Chipmunk	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Tamias;Tamias striatu	0%	0%	100%
			REPTILES					
Yes	Occupy	turtle	Testudines	Chordates	Eukaryota;Chordata;NA;Testudines	0%	100%	100%
Yes	Occupy	red-eared slider	Trachemys scripta	Common Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys;Trachemys scrip	0%	0%	100%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
			FISH					
No			Brevoortia tyrannus	Bugfish	Eukaryota;Chordata;Actinopteri;Clupeiformes;Clupeidae;Brevoortia;Brevoortia tyrannus	20%	0%	0%
			AMPHIBIANS					
No	probable	American toad	Anaxyrus	North American Toads	Eukaryota;Chordata;Amphibia;Anura;Bufonidae;Anaxyrus	0%	0%	0%
No	probable	ranid frog	Rana catesbeiana	Ranid Frogs	Eukaryota;Chordata;Amphibia;Anura;Ranidae;Rana;Rana catesbeiana	0%	0%	0%
			BIRDS					
			Aves	Birds	Eukaryota;Chordata;Aves	80%	60%	75%
No			Cathartes aura	Storks	Eukaryota;Chordata;Aves;Ciconiiformes;Cathartidae;Cathartes;Cathartes aura	0%	0%	0%
No			Columbidae	Dove	Eukaryota;Chordata;Aves;Columbiformes;Columbidae	0%	0%	0%
No			Gallus	Junglefowl	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus	20%	0%	0%
No			Gallus gallus	Chicken	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus;Gallus gallus	40%	60%	75%
No			Cyanocitta cristata	Blue Jay	Eukaryota;Chordata;Aves;Passeriformes;Corvidae;Cyanocitta;Cyanocitta cristata	0%	0%	0%
No			Cardinalis cardinalis	Finches	Eukaryota;Chordata;Aves;Passeriformes;Fringillidae;Cardinalis;Cardinalis cardinalis	0%	0%	0%
No			Setophaga pinus	Pine Warbler	Eukaryota;Chordata;Aves;Passeriformes;Parulidae;Setophaga;Setophaga pinus	0%	0%	0%
No			Melospiza melodia	Song Sparrow	Eukaryota;Chordata;Aves;Passeriformes;Passerellidae;Melospiza;Melospiza melodia	0%	0%	0%
No			Melanerpes carolinus	Red-bellied Woodpecker	Eukaryota;Chordata;Aves;Piciformes;Picidae;Melanerpes;Melanerpes carolinus	0%	0%	0%
			MAMMALS					
No			Mammalia	Mammals	Eukaryota;Chordata;Mammalia	20%	0%	0%
No			Canis	Dog	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Canis	0%	0%	0%
Yes	medium	domestic cat	Felidae	cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae	20%	0%	0%
Yes	medium	raccoon	Procyon lotor	Raccoon	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae;Procyon;Procyon lotor	20%	40%	25%
Yes	medium	nine-banded armadillo	Dasypus novemcinctus	Nine-banded Armadillo	Eukaryota;Chordata;Mammalia;Cingulata;Dasypodidae;Dasypus;Dasypus novemcinctus	0%	40%	50%
Yes	medium	virginia opossum	Didelphis virginiana	Virginia Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelphis;Didelphis virginiana	20%	0%	25%
Yes	medium	Eastern Cottontail	Sylvilagus floridanus	Eastern Cottontail	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus;Sylvilagus floridanus	60%	60%	0%
No			Bovidae	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae	20%	40%	25%
No			Bos	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Bos	60%	100%	100%
No			Bos taurus	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Bos;Bos taurus	60%	80%	75%
No			Capra	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Capra	20%	0%	0%
No			Ovis	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Ovis	20%	0%	0%
No			Cervidae	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae	0%	0%	0%
No			Odocoileus	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae;Odocoileus	20%	40%	0%
No			Odocoileus virginianus	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae;Odocoileus;Odocoileus virginianus	0%	20%	50%
No			Sus	Mammals	Eukaryota;Chordata;Mammalia;NA;Suidae;Sus	20%	0%	25%
No			Sus scrofa	Wild Boar/Pig	Eukaryota;Chordata;Mammalia;NA;Suidae;Sus;Sus scrofa	20%	0%	0%
Yes	probable	deermouse	Peromyscus	Deer Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus	20%	40%	50%

Include?	Potential to occ	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
Yes	probable	North American Deermouse	Peromyscus maniculatus	North American Deermouse	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus;Peromyscus maniculatus	0%	20%	0%
Yes	probable	house mouse	Mus musculus	House Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus;Mus musculus	0%	0%	0%
Yes	Low	Eastern Gray Squirrel	Sciurus carolinensis	Eastern Gray Squirrel	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Sciurus;Sciurus carolinensis	20%	20%	25%
Yes	Low	Eastern Fox Squirrel	Sciurus niger	Eastern Fox Squirrel	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Sciurus;Sciurus niger	20%	20%	0%
			REPTILES					
Yes	probable	box turtle	Terrapene	American Box Turtles	Eukaryota;Chordata;NA;Testudines;Emydidae;Terrapene	0%	0%	0%
Yes	probable	red-eared slider	Trachemys	Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys	0%	0%	0%
Yes	probable	red-eared slider	Trachemys scripta	Common Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys;Trachemys scripta	0%	0%	0%
			ALL OTHER ORGANISMS					
No			Flavobacteriaceae	Bacteria	Bacteria;Bacteroidetes;Flavobacteriia;Flavobacteriales;Flavobacteriaceae	0%	0%	0%
No			Sphingobacteriaceae bact	Bacteria	Bacteria;Bacteroidetes;Sphingobacteriia;Sphingobacteriales;Sphingobacteriaceae;NA;Sphingobacteriaceae bacterium GW460-11-11-14-LB5	0%	0%	0%
No			Pedobacter steynii	Bacteria	Bacteria;Bacteroidetes;Sphingobacteriia;Sphingobacteriales;Sphingobacteriaceae;Pedobacter;Pedobacter steynii	0%	0%	0%
No			Sphingobacterium mizuta	Bacteria	Bacteria;Bacteroidetes;Sphingobacteriia;Sphingobacteriales;Sphingobacteriaceae;Sphingobacterium;Sphingobacterium mizutaii	0%	0%	25%
No			Eukaryota	Eukaryota	Eukaryota	80%	100%	100%
No			Lumbricidae	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae	20%	40%	25%
No			Aporrectodea	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Aporrectodea	0%	0%	0%
No			Aporrectodea caliginosa L	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Aporrectodea;Aporrectodea caliginosa L3	40%	0%	0%
No			Bimastos tumidus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Bimastos;Bimastos tumidus	0%	0%	0%
No			Lumbricus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus	0%	0%	0%
No			Lumbricus aff. rubellus L2	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus aff. rubellus L2	0%	0%	0%
No			Lumbricus rubellus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus rubellus	20%	20%	0%
No			Lumbricus rubellus compl	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus rubellus complex sp. A SM-2016	40%	0%	0%
No			Lumbricus terrestris	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus terrestris	0%	0%	0%
No			Megascolecidae	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Megascolecidae	0%	0%	0%
No			Dasybranchus sp. DH1	Bristle Worms	Eukaryota;Annelida;Polychaeta;Capitellida;Capitellidae;Dasybranchus;Dasybranchus sp. DH1	20%	0%	75%
No			Arthropoda	Arthropods	Eukaryota;Arthropoda	0%	20%	0%
No			Araneae	Spider	Eukaryota;Arthropoda;Arachnida;Araneae	0%	0%	0%
No			Erigone	Black Dwarf Spiders	Eukaryota;Arthropoda;Arachnida;Araneae;Linyphiidae;Erigone	0%	0%	0%
No			Attidops youngi	Jumping Spider	Eukaryota;Arthropoda;Arachnida;Araneae;Salticidae;Attidops;Attidops youngi	0%	0%	0%
No			Leucauge	Orchard Spider And Allies	Eukaryota;Arthropoda;Arachnida;Araneae;Tetragnathidae;Leucauge	0%	0%	0%
No			Aleuroglyphus ovatus	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Acaridae;Aleuroglyphus;Aleuroglyphus ovatus	40%	60%	0%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Caloglyphus berlesei	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Acaridae;Caloglyphus;Caloglyphus berlesei	0%	0%	0%
No			Analges sp. JS-2011	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Analgidae;Analges;Analges sp. JS-2011	0%	20%	0%
No			Dermatophagoides pteror	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Pyroglyphidae;Dermatophagoides;Dermatophagoides pteronyssinus	0%	0%	0%
No			Suidasia	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Suidasiidae;Suidasia	0%	60%	25%
No			Amblyomma americanum	Lone Star Tick	Eukaryota;Arthropoda;Arachnida;Ixodida;Ixodidae;Amblyomma;Amblyomma americanum	0%	0%	0%
No			Leiobunum sp. BOLD:ACL	Daddy Longlegs	Eukaryota;Arthropoda;Arachnida;Opiliones;Leiobunidae;Leiobunum;Leiobunum sp. BOLD:ACL7580	0%	0%	25%
No			Leiobunum sp. RRSSA10	Daddy Longlegs	Eukaryota;Arthropoda;Arachnida;Opiliones;Leiobunidae;Leiobunum;Leiobunum sp. RRSSA1036-15	0%	0%	0%
No			Trombidiformes	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes	20%	0%	0%
No			Abacarus lolii	Eriophyid Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Eriophyidae;Abacarus;Abacarus lolii	20%	0%	0%
No			Penthaleidae sp. Q091	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Penthaleidae;NA;Penthaleidae sp. Q091	0%	0%	0%
No			Rhagidiidae sp. BOLD:AAZ	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Rhagidiidae;NA;Rhagidiidae sp. BOLD:AAZ6638	0%	20%	0%
No			Deuterosminthurus sp. B(	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Bourletiellidae;Deuterosminthurus;Deuterosminthurus sp. BOLD:AAB7915	0%	0%	0%
No			Entomobryidae	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae	20%	20%	0%
No			Entomobrya proxima	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;Entomobrya;Entomobrya proxima	20%	0%	0%
No			Homidia socia	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;Homidia;Homidia socia	0%	0%	0%
No			Lepidocyrtus	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;Lepidocyrtus	0%	20%	0%
No			Entomobryidae sp. BOLD:/	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;NA;Entomobryidae sp. BOLD:ACF9575	0%	0%	0%
No			Ceratophysella	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Hypogastruridae;Ceratophysella	0%	0%	0%
No			Hypogastruridae sp. BOLI	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Hypogastruridae;NA;Hypogastruridae sp. BOLD:ACE1775	0%	0%	0%
No			Insecta	Insect	Eukaryota;Arthropoda;Insecta	0%	20%	0%
No			Coleoptera	Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera	0%	0%	0%
No			Carabidae	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae	0%	0%	25%
No			Amara	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Amara	0%	0%	0%
No			Amara sp. 1 CMG-2012	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Amara;Amara sp. 1 CMG-2012	0%	0%	0%
No			Anisodactylus sanctaecru	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Anisodactylus;Anisodactylus sanctaecrusis	0%	20%	0%
No			Bembidion impotens	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Bembidion;Bembidion impotens	0%	0%	0%
No			Calathus opaculus	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Calathus;Calathus opaculus	0%	0%	0%
No			Cratacanthus dubius	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Cratacanthus;Cratacanthus dubius	0%	0%	0%

Include?	Potential to occ	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Orthosoma brunneum	Brown Prionid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Cerambycidae;Orthosoma;Orthosoma brunneum	20%	0%	0%
No			Prionus insularis	Longhorn Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Cerambycidae;Prionus;Prionus insularis	20%	20%	0%
No			Chrysomelidae	Indet Leaf Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Chrysomelidae	20%	0%	25%
No			Coccinellidae	Indet. Ladybird	Eukaryota;Arthropoda;Insecta;Coleoptera;Coccinellidae	0%	0%	0%
No			Harmonia axyridis	Harlequin Ladybird	Eukaryota;Arthropoda;Insecta;Coleoptera;Coccinellidae;Harmonia;Harmonia axyridis	0%	0%	0%
No			Aeolus	Wireworm	Eukaryota;Arthropoda;Insecta;Coleoptera;Elateridae;Aeolus	0%	0%	0%
No			Aeolus sp. BOLD-2016	Wireworm	Eukaryota;Arthropoda;Insecta;Coleoptera;Elateridae;Aeolus;Aeolus sp. BOLD-2016	0%	0%	0%
No			Cercyon haemorrhoidalis	Water scavenger beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Hydrophilidae;Cercyon;Cercyon haemorrhoidalis	0%	0%	0%
No			Latridiidae	Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Latridiidae	0%	0%	0%
No			Cartodere constricta	Plaster beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Latridiidae;Cartodere;Cartodere constricta	0%	0%	0%
No			Corticarina	Minute Brown Scavenger Bee	Eukaryota;Arthropoda;Insecta;Coleoptera;Latridiidae;Corticarina	0%	0%	0%
No			Coleoptera sp. BOLD:AAN	Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;NA;NA;Coleoptera sp. BOLD:AAN6182	20%	20%	0%
No			Scarabaeidae	Dung Beetles	Eukaryota;Arthropoda;Insecta;Coleoptera;Scarabaeidae	0%	0%	0%
No			Aphodius	Dung Beetles	Eukaryota;Arthropoda;Insecta;Coleoptera;Scarabaeidae;Aphodius	0%	20%	25%
No			Onthophagus taurus	Bullhorned Dung Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Scarabaeidae;Onthophagus;Onthophagus taurus	0%	20%	0%
No			Ahasverus advena	Foreign grain beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Silvanidae;Ahasverus;Ahasverus advena	0%	0%	0%
No			Aleochara	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;Aleochara	0%	0%	25%
No			Staphylinidae sp. BOLD-2	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;NA;Staphylinidae sp. BOLD-2016	0%	0%	0%
No			Staphylinidae sp. BOLD:A	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;NA;Staphylinidae sp. BOLD:AAN6211	0%	0%	0%
No			Staphylinidae sp. BOLD:A	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;NA;Staphylinidae sp. BOLD:ACI8932	0%	20%	0%
No			Oligota parva	Rove beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;Oligota;Oligota parva	0%	0%	0%
No			Stenus punctatus	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;Stenus;Stenus punctatus	0%	0%	0%
No			Euborellia femoralis	Earwig	Eukaryota;Arthropoda;Insecta;Dermaptera;Anisolabididae;Euborellia;Euborellia femoralis	0%	0%	0%
No			Diptera	Fly	Eukaryota;Arthropoda;Insecta;Diptera	40%	20%	25%
No			Anthomyiidae	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae	0%	0%	0%
No			Delia	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;Delia	0%	40%	25%
No			Hylemya	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;Hylemya	0%	0%	0%
No			Anthomyiidae	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;NA	0%	0%	0%
No			Diogmites grossus	Hanging Thief Robber Flies	Eukaryota;Arthropoda;Insecta;Diptera;Asilidae;Diogmites;Diogmites grossus	20%	0%	0%
No			Calliphoridae	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae	0%	0%	0%
No			Cochliomyia	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Cochliomyia	0%	0%	0%
No			Cynomya	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Cynomya	0%	0%	0%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Pollenia	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Pollenia	20%	0%	0%
No			Cecidomyiidae	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Cecidomyiidae;NA	0%	20%	0%
No			Cecidomyiidae sp. BOLD-2	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Cecidomyiidae;NA;Cecidomyiidae sp. BOLD-2016	0%	0%	25%
No			Chaoboridae	Phantom Midge	Eukaryota;Arthropoda;Insecta;Diptera;Chaoboridae	0%	0%	0%
No			Chironomidae	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae	40%	80%	50%
No			Bryophaenocladius sp. 8E	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Bryophaenocladius;Bryophaenocladius sp. 8ES	20%	0%	0%
No			Chironomus	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Chironomus	0%	20%	0%
No			Chironomidae	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA	40%	80%	50%
No			Chironomidae sp. BOLD-2	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Chironomidae sp. BOLD-2016	0%	20%	0%
No			Chironomidae sp. BOLD:A	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Chironomidae sp. BOLD:AAG1019	20%	40%	0%
No			Chironomidae sp. BOLD:A	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Chironomidae sp. BOLD:ACC5347	0%	0%	0%
No			Orthocladiinae sp. BOLD-2	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Orthocladiinae sp. BOLD-2016	0%	0%	0%
No			Orthocladiinae sp. BOLD:A	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Orthocladiinae sp. BOLD:ACN7166	0%	20%	0%
No			Tanypodinae sp. BOLD-20	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Tanypodinae sp. BOLD-2016	0%	0%	0%
No			Orthocladius	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius	20%	0%	0%
No			Orthocladius oliveri	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius oliveri	20%	0%	0%
No			Orthocladius rivulorum	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius rivulorum	0%	0%	0%
No			Orthocladius sp. BOLD-20	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius sp. BOLD-2016	0%	0%	0%
No			Smittia	Gymnolaemates	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Smittia	0%	20%	0%
No			Smittia sp. 8ES	Gymnolaemates	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Smittia;Smittia sp. 8ES	0%	0%	0%
No			Tanypus neopunctipennis	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Tanypus;Tanypus neopunctipennis	0%	20%	0%
No			Chloropidae	Grass Flies	Eukaryota;Arthropoda;Insecta;Diptera;Chloropidae;NA	0%	0%	0%
No			Anopheles sinensis	Malaria Mosquitoes	Eukaryota;Arthropoda;Insecta;Diptera;Culicidae;Anopheles;Anopheles sinensis	0%	0%	0%
No			Drosophilidae	Fruit Fly	Eukaryota;Arthropoda;Insecta;Diptera;Drosophilidae	0%	0%	25%
No			Heleomyzinae sp. BOLD-2	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Heleomyzidae;NA;Heleomyzinae sp. BOLD-2016	0%	20%	0%
No			Keroplatidae	predatory fungus gnat	Eukaryota;Arthropoda;Insecta;Diptera;Keroplatidae;NA	0%	0%	0%
No			Limoniidae	Limoniid Crane Flies	Eukaryota;Arthropoda;Insecta;Diptera;Limoniidae	0%	20%	0%
No			Lonchaea	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Lonchaeidae;Lonchaea	0%	0%	0%
No			Muscidae	House Flies And Allies	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae	0%	0%	0%
No			Musca domestica	House fly	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae;Musca;Musca domestica	0%	0%	0%
No			Neomyia cornicina	House fly	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae;Neomyia;Neomyia cornicina	20%	20%	0%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Mycetophila ocellus	Fungus Gnat	Eukaryota;Arthropoda;Insecta;Diptera;Mycetophilidae;Mycetophila;Mycetophila ocellus	0%	0%	0%
No			Diptera	Fly	Eukaryota;Arthropoda;Insecta;Diptera;NA;NA	40%	20%	25%
No			Megaselia sp. BOLD-2016	scuttle fly	Eukaryota;Arthropoda;Insecta;Diptera;Phoridae;Megaselia;Megaselia sp. BOLD-2016	0%	0%	0%
No			Psychoda sp. BOLD-2016	Indet. Mothfly	Eukaryota;Arthropoda;Insecta;Diptera;Psychodidae;Psychoda;Psychoda sp. BOLD-2016	0%	0%	0%
No			Sciaridae	Dark-Winged Fungus Gnat	Eukaryota;Arthropoda;Insecta;Diptera;Sciaridae;NA	0%	20%	0%
No			Sepsidae	Black Scavenger Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sepsidae	0%	0%	0%
No			Sphaeroceridae sp. BOLD	Lesser Dung Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sphaeroceridae;NA;Sphaeroceridae sp. BOLD-2016	0%	0%	0%
No			Sargus cuprarius	Clouded Centurion	Eukaryota;Arthropoda;Insecta;Diptera;Stratiomyidae;Sargus;Sargus cuprarius	0%	0%	0%
No			Stratiomys sp. BOLD:ACE3	Soldierfly	Eukaryota;Arthropoda;Insecta;Diptera;Stratiomyidae;Stratiomys;Stratiomys sp. BOLD:ACE3439	0%	0%	0%
No			Syrphidae	Hoverfly	Eukaryota;Arthropoda;Insecta;Diptera;Syrphidae	0%	0%	25%
No			Archytas apicifer	Bristle Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tachinidae;Archytas;Archytas apicifer	0%	0%	0%
No			Tachinidae sp. BOLD-201	Bristle Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tachinidae;NA;Tachinidae sp. BOLD-2016	0%	0%	0%
No			Tephritidae	Fruit Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tephritidae	0%	0%	0%
No			Leptophlebia cupida	Prong-Gilled Mayflies	Eukaryota;Arthropoda;Insecta;Ephemeroptera;Leptophlebiidae;Leptophlebia;Leptophlebia cupida	20%	0%	0%
No			Alydus pilosulus	Broad-Headed Bug	Eukaryota;Arthropoda;Insecta;Hemiptera;Alydidae;Alydus;Alydus pilosulus	0%	0%	0%
No			Aphididae	Aphid	Eukaryota;Arthropoda;Insecta;Hemiptera;Aphididae	0%	20%	0%
No			Cicadidae	Bug	Eukaryota;Arthropoda;Insecta;Hemiptera;Cicadidae	0%	0%	0%
No			Neotibicen pruinosus	Dog-Day Cicadas	Eukaryota;Arthropoda;Insecta;Hemiptera;Cicadidae;Neotibicen;Neotibicen pruinosus	0%	0%	0%
No			Belonochilus numenius	Chinch Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Lygaeidae;Belonochilus;Belonochilus numenius	0%	0%	0%
No			Nysius	Chinch Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Lygaeidae;Nysius	20%	0%	0%
No			Miridae	Capsid Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Miridae	20%	0%	0%
No			Pentatomidae	Stinkbugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Pentatomidae	40%	0%	0%
No			Hymenoptera	Invertebrates (Bees & Wasps	Eukaryota;Arthropoda;Insecta;Hymenoptera	0%	0%	50%
No			Agaonidae	fig wasp	Eukaryota;Arthropoda;Insecta;Hymenoptera;Agaonidae	0%	0%	50%
No			Eulophidae	Invertebrates (Bees & Wasps	Eukaryota;Arthropoda;Insecta;Hymenoptera;Eulophidae	20%	20%	25%
No			Formicidae	Ant	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae	20%	20%	25%
No			Pheidole dentata	Ant	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae;Pheidole;Pheidole dentata	0%	0%	0%
No			Solenopsis carolinensis	Fire Ants And Thief Ants	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae;Solenopsis;Solenopsis carolinensis	0%	0%	0%
No			Ichneumonidae	Ichneumonid	Eukaryota;Arthropoda;Insecta;Hymenoptera;Ichneumonidae	0%	0%	0%
No			Dolichovespula	Aerial Yellowjackets	Eukaryota;Arthropoda;Insecta;Hymenoptera;Vespidae;Dolichovespula	0%	0%	0%
No			Lepidoptera	Butterflies	Eukaryota;Arthropoda;Insecta;Lepidoptera	20%	20%	0%
No			Udea rubigalis	Celery Leaftier Moth	Eukaryota;Arthropoda;Insecta;Lepidoptera;Crambidae;Udea;Udea rubigalis	0%	0%	0%
No			Agonopterix	Grass Miner Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Elachistidae;Agonopterix	0%	0%	0%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Antiblemma sp. BioLep13	Underwing, Tiger, Tussock, Ar	Eukaryota;Arthropoda;Insecta;Lepidoptera;Erebidae;Antiblemma;Antiblemma sp. BioLep13	0%	0%	0%
No			Idia aemula	Common Idia Moth	Eukaryota;Arthropoda;Insecta;Lepidoptera;Erebidae;Idia;Idia aemula	0%	0%	0%
No			Hesperiidae	Indet. Skipper	Eukaryota;Arthropoda;Insecta;Lepidoptera;Hesperiidae	0%	20%	0%
No			Agrochola	Cutworm Moths And Allies	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Agrochola	0%	0%	0%
No			Eupsilia	Cutworm Moths And Allies	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Eupsilia	0%	0%	0%
No			Eupsilia tristigmata	Three-Spotted Sallow	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Eupsilia;Eupsilia tristigmata	0%	0%	0%
No			Feltia	Cutworm Moths And Allies	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Feltia	0%	0%	0%
No			Panopoda	Underwing, Tiger, Tussock, Ar	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Panopoda	0%	20%	0%
No			Psaphida resumens	Figure-Eight Sallow	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Psaphida;Psaphida resumens	0%	0%	0%
No			Spodoptera	Armyworm Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Spodoptera	20%	40%	0%
No			Epicallima argenticinctella	Concealer Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Oecophoridae;Epicallima;Epicallima argenticinctella	0%	0%	0%
No			Manduca	Hawk Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Sphingidae;Manduca	0%	0%	0%
No			Homostinea curviliniella	Tineid Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Tineidae;Homostinea;Homostinea curviliniella	0%	0%	0%
No			Acrididae	grasshoppers	Eukaryota;Arthropoda;Insecta;Orthoptera;Acrididae	0%	20%	0%
No			Gryllus sp. BOLD:AAG067	true crickets	Eukaryota;Arthropoda;Insecta;Orthoptera;Gryllidae;Gryllus;Gryllus sp. BOLD:AAG0677	0%	0%	0%
No			Psocoptera	Insect	Eukaryota;Arthropoda;Insecta;Psocoptera	40%	0%	0%
No			Lachesilla sp. BOLD-2016	fateful barklouse	Eukaryota;Arthropoda;Insecta;Psocoptera;Lachesillidae;Lachesilla;Lachesilla sp. BOLD-2016	0%	0%	0%
No			Thripidae	Common Thrips	Eukaryota;Arthropoda;Insecta;Thysanoptera;Thripidae	0%	20%	0%
No			Frankliniella	Common Thrips	Eukaryota;Arthropoda;Insecta;Thysanoptera;Thripidae;Frankliniella	0%	0%	25%
No			Isopoda	Indet. Woodlouse	Eukaryota;Arthropoda;Malacostraca;Isopoda	0%	20%	0%
No			Armadillidium	Pill Bugs	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium	0%	0%	0%
No			Armadillidium nasatum	Isopod	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium;Armadillidium nasatum	40%	20%	100%
No			Armadillidium vulgare	Pillbug	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium;Armadillidium vulgare	0%	0%	0%
No			Isopoda	Indet. Woodlouse	Eukaryota;Arthropoda;Malacostraca;Isopoda;NA;NA	0%	20%	0%
No			Cyclopoida sp. AS28a6	Arthropods	Eukaryota;Arthropoda;Maxillopoda;Cyclopoida;NA;NA;Cyclopoida sp. AS28a6	0%	0%	0%
No			Ascomycota	Ascomycete	Eukaryota;Ascomycota	40%	80%	50%
No			Capnodiales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales	0%	40%	50%
No			Cladosporium	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium	80%	100%	100%
No			Cladosporium sp. BM-200	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium sp. BM-2009-3	40%	0%	0%
No			Cladosporium sp. BM-200	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium sp. BM-2009-5	80%	100%	100%
No			Cladosporium tenuissimu	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium tenuissimum	100%	100%	100%
No			Cercospora sojina	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Mycosphaerellaceae;Cercospora;Cercospora sojina	40%	40%	50%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Pleosporales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales	60%	60%	75%
No			Didymella pinodes	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales;Didymellaceae;Didymella;Didymella pinodes	80%	100%	100%
No			Pithomyces chartarum	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales;Pleosporaceae;Pithomyces;Pithomyces chartarum	20%	0%	25%
No			Eurotiales	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales	0%	40%	75%
No			Aspergillaceae	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae	40%	40%	100%
No			Aspergillus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus	60%	80%	25%
No			Aspergillus campestris	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus campestris	0%	20%	0%
No			Aspergillus fumigatus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus fumigatus	0%	20%	25%
No			Aspergillus nidulans	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus nidulans	0%	0%	0%
No			Aspergillus terreus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus terreus	20%	20%	0%
No			Aspergillus versicolor	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus versicolor	0%	40%	25%
No			Penicillium	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium	60%	40%	100%
No			Penicillium brevicompactu	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium brevicompactum	0%	20%	25%
No			Penicillium crustosum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium crustosum	0%	20%	50%
No			Penicillium fellutanum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium fellutanum	0%	0%	25%
No			Penicillium polonicum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium polonicum	0%	60%	50%
No			Penicillium roqueforti	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium roqueforti	0%	0%	0%
No			Penicillium rubens	Blue Mould Rot	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium rubens	0%	0%	25%
No			Penicillium sclerotiorum	Blue Mould Rot	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium sclerotiorum	80%	100%	100%
No			Penicillium verrucosum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium verrucosum	0%	0%	25%
No			Penicillium waksmanii	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium waksmanii	0%	20%	0%
No			Talaromyces	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Trichocomaceae;Talaromyces	0%	0%	0%
No			Talaromyces pinophilus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Trichocomaceae;Talaromyces;Talaromyces pinophilus	20%	20%	0%
No			Lecanora strobilina	Mealy Rim-Lichen	Eukaryota;Ascomycota;Lecanoromycetes;Lecanorales;Lecanoraceae;Lecanora;Lecanora strobilina	40%	20%	25%
No			Parmeliaceae	Shield Lichens And Allies	Eukaryota;Ascomycota;Lecanoromycetes;Lecanorales;Parmeliaceae	20%	20%	0%
No			Leotiomycetes	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA	0%	0%	25%
No			Pseudeurotiaceae	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae	20%	0%	100%

Include?	Potential to occ	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Pseudogymnoascus pann	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae;Pseudogymnoascus;Pseudogymnoascus pannorum	0%	0%	25%
No			Pseudogymnoascus sp. B	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae;Pseudogymnoascus;Pseudogymnoascus sp. BM-2009-4	0%	0%	25%
No			Tetracladium	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium	20%	20%	25%
No			Tetracladium apiense	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium;Tetracladium apiense	20%	0%	0%
No			Candida metapsilosis	Candidiasis	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Debaryomycetaceae;Candida;Candida metapsilosis	20%	40%	0%
No			Debaryomyces hansenii	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Debaryomycetaceae;Debaryomyces;Debaryomyces hansenii	0%	0%	25%
No			Galactomyces candidum	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Dipodascaceae;Galactomyces;Galactomyces candidum	40%	80%	50%
No			[Candida] intermedia	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Metschnikowiaceae;Clavispora;[Candida] intermedia	0%	0%	0%
No			Clavispora lusitaniae	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Metschnikowiaceae;Clavispora;Clavispora lusitaniae	40%	80%	100%
No			Candida sake	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;NA;Candida;Candida sake	60%	60%	75%
No			Ogataea angusta	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Pichiaceae;Ogataea;Ogataea angusta	0%	0%	0%
No			Kazachstania servazzii	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Kazachstania;Kazachstania servazzii	0%	0%	0%
No			Saccharomyces	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Saccharomyces	0%	0%	0%
No			Saccharomyces cerevisiae	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Saccharomyces;Saccharomyces cerevisiae	60%	40%	75%
No			Sordariomycetes	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes	40%	60%	50%
No			Diaporthe longicolla	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Diaporthales;Diaporthaceae;Diaporthe;Diaporthe longicolla	20%	20%	50%
No			Colletotrichum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum	0%	20%	0%
No			Colletotrichum incanum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum;Colletotrichum incanum	0%	20%	0%
No			Hypocreales	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales	0%	0%	25%
No			Clonostachys rosea	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Bionectriaceae;Clonostachys;Clonostachys rosea	0%	0%	0%
No			Metarhizium anisopliae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Clavicipitaceae;Metarhizium;Metarhizium anisopliae	0%	0%	25%
No			Cordycipitaceae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Cordycipitaceae	20%	60%	25%
No			Trichoderma	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Hypocreaceae;Trichoderma	20%	20%	25%
No			Acremonium cf. chrysoger	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;NA;Acremonium;Acremonium cf. chrysogenum DAOM 226667	40%	20%	75%
No			Sarocladium implicatum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;NA;Sarocladium;Sarocladium implicatum	0%	0%	25%
No			Nectriaceae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae	40%	60%	100%
No			Fusarium	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium	80%	100%	100%

Include?	Potential to occ	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Fusarium boothii	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium boothii	20%	20%	25%
No			Fusarium delphinoides	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium delphinoides	40%	80%	75%
No			Fusarium flocciferum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium flocciferum	0%	0%	0%
No			Fusarium incarnatum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium incarnatum	0%	0%	25%
No			Fusarium mangiferae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium mangiferae	40%	40%	25%
No			Fusarium solani	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium solani	20%	40%	50%
No			Fusarium subglutinans	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium subglutinans	0%	0%	0%
No			Nectria haematococca	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Nectria haematococca	0%	0%	25%
No			Thermothelomyces therm	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Sordariales;Chaetomiaceae;Thermothelomyces;Thermothelomyces thermophila	20%	20%	25%
No			Neurospora crassa	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Sordariales;Sordariaceae;Neurospora;Neurospora crassa	20%	0%	0%
No			Arthrinium arundinis	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Xylariales;Apiosporaceae;Arthrinium;Arthrinium arundinis	0%	20%	0%
No			Melosira ambiqua	Diatom	Eukaryota;Bacillariophyta;Coscinodiscophyceae;Melosirales;Melosiraceae;Melosira;Melosira ambiqua	0%	0%	0%
No			Pluteus	Deer Mushrooms	Eukaryota;Basidiomycota;Agaricomycetes;Agaricales;Pluteaceae;Pluteus	20%	20%	25%
No			Schizophyllum commune	Common Porecrust	Eukaryota;Basidiomycota;Agaricomycetes;Agaricales;Schizophyllaceae;Schizophyllum;Schizophyllum commune	0%	20%	0%
No			Xerocomus	Boletes	Eukaryota;Basidiomycota;Agaricomycetes;Boletales;Boletaceae;Xerocomus	0%	0%	0%
No			Suillus tomentosus	Bolete	Eukaryota;Basidiomycota;Agaricomycetes;Boletales;Suillaceae;Suillus;Suillus tomentosus	0%	20%	0%
No			Rhodotorula taiwanensis	Basidiomycete	Eukaryota;Basidiomycota;Microbotryomycetes;Sporidiobolales;Sporidiobolaceae;Rhodotorula;Rhodotorula taiwanensis	80%	100%	100%
No			Pseudomuriella schumacl	Chlorophycean Green Algae	Eukaryota;Chlorophyta;Chlorophyceae;Sphaeropleales;Pseudomuriellaceae;Pseudomuriella;Pseudomuriella schumacherensis	0%	0%	0%
No			Lobosphaera incisa	Green Alga Sp.	Eukaryota;Chlorophyta;Trebouxiophyceae;Chlorellales;Chlorellaceae;Lobosphaera;Lobosphaera incisa	40%	0%	0%
No			Trebouxia aggregata	Green Alga Sp.	Eukaryota;Chlorophyta;Trebouxiophyceae;Microthamniales;NA;Trebouxia;Trebouxia aggregata	40%	40%	50%
No			Eustigmatophyceae	Eustigmatophyceae	Eukaryota;Eustigmatophyceae;NA	0%	0%	0%
No			Mucorales	Mucorales	Eukaryota;Mucoromycota;NA;Mucorales	80%	60%	75%
No			Lichtheimia ramosa	Lichtheimia ramosa	Eukaryota;Mucoromycota;NA;Mucorales;Lichtheimiaceae;Lichtheimia;Lichtheimia ramosa	40%	40%	25%
No			Pedospumella encystans	A Chrysophyte	Eukaryota;NA;Chrysophyceae;Chromulinales;Chromulinaceae;Pedospumella;Pedospumella encystans	20%	0%	0%
No			Pedospumella sp. LG-201	A Chrysophyte	Eukaryota;NA;Chrysophyceae;Chromulinales;Chromulinaceae;Pedospumella;Pedospumella sp. LG-2014a	0%	0%	0%

Include?	Potential to oc	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Gymnodinium sp. NVA/RU	Dinoflagellates	Eukaryota;NA;Dinophyceae;Gymnodiniales;Gymnodiniaceae;Gymnodinium;Gymnodinium sp. NVA/RUS/2008	0%	0%	0%
No			Naegleria	Naegleria	Eukaryota;NA;Heterolobosea;Schizopyrenida;Vahlkampfiidae;Naegleria	0%	0%	0%
No			Cochliopodium	Cochliopodium	Eukaryota;NA;NA;Himatismenida;Cochliopodiidae;Cochliopodium	0%	0%	0%
No			Acanthamoeba castellanii	Acanthamoeba castellanii	Eukaryota;NA;NA;Longamoebia;Acanthamoebidae;Acanthamoeba;Acanthamoeba castellanii	0%	20%	0%
No			Acanthamoeba polyphaga	Acanthamoeba polyphaga	Eukaryota;NA;NA;Longamoebia;Acanthamoebidae;Acanthamoeba;Acanthamoeba polyphaga	0%	20%	0%
No			Vermamoeba vermiformis	Vermamoeba vermiformis	Eukaryota;NA;NA;NA;Hartmannellidae;Vermamoeba;Vermamoeba vermiformis	80%	80%	100%
No			Stemonitis flavogenita	Stemonitis flavogenita	Eukaryota;NA;NA;Stemonitida;Stemonitidae;Stemonitis;Stemonitis flavogenita	0%	0%	0%
No			Oomycetes	Oomycetes	Eukaryota;NA;Oomycetes	20%	20%	25%
No			Phytophthora	Phytophthora	Eukaryota;NA;Oomycetes;Peronosporales;NA;Phytophthora	0%	0%	25%
No			Pythium	Pythium	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium	60%	60%	75%
No			Pythium aff. acanthophor	Pythium aff. acanthophoron J	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium aff. acanthophoron JEB-2016	0%	0%	0%
No			Pythium camurandrum	Pythium camurandrum	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium camurandrum	80%	80%	100%
No			Pythium kandovanense	Pythium kandovanense	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium kandovanense	20%	20%	0%
No			Pythium rostratifingens	Pythium rostratifingens	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium rostratifingens	80%	0%	50%
No			Pythium sp. CAL-2011c	Pythium sp. CAL-2011c	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium sp. CAL-2011c	20%	20%	0%
No			Pythium urmianum	Pythium urmianum	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium urmianum	0%	0%	0%
No			Chromadorea	Nematode	Eukaryota;Nematoda;Chromadorea	20%	20%	75%
No			Rhabditida	Nematode	Eukaryota;Nematoda;Chromadorea;Rhabditida;NA;NA	0%	0%	25%
No			Aphelenchoididae	Nematode	Eukaryota;Nematoda;Chromadorea;Tylenchida;Aphelenchoididae	0%	0%	0%
No			Bursaphelenchus debrae	Nematode	Eukaryota;Nematoda;Chromadorea;Tylenchida;Aphelenchoididae;Bursaphelenchus;Bursaphelenchus debrae	0%	0%	0%
No			Bdelloidea	Rotifer	Eukaryota;Rotifera;Bdelloidea	60%	80%	100%
No			Adineta	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta	0%	20%	0%
No			Adineta sp. Adi5	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta sp. Adi5	20%	20%	75%
No			Adineta vaga	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta vaga	40%	80%	75%
No			Adineta vaga complex sp.	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta vaga complex sp. E JFF-2016	20%	20%	25%
No			Bdelloidea	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;NA	60%	80%	100%
No			Rotaria	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;Rotaria	60%	40%	100%
No			Rotaria rotatoria	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;Rotaria;Rotaria rotatoria	60%	40%	50%
No			Habrotrocha	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha	40%	0%	50%
No			Habrotrocha ligula	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha;Habrotrocha ligula	20%	20%	50%
No			Habrotrocha sp. Hab5	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha;Habrotrocha sp. Hab5	20%	40%	25%

Include?	Potential to occ	Probable Species	latin_name	common_name	taxonomic_path	2	3	4
No			Habrotrochidae sp. nd	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;NA;Habrotrochidae sp. nd	0%	20%	25%
No			Philodinidae	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae	20%	20%	25%
No			Macrotrachela quadricorn	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Macrotrachela;Macrotrachela quadricornifera	20%	0%	25%
No			Philodinidae	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA	20%	20%	25%
No			Philodinidae sp. BBc	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA;Philodinidae sp. BBc	0%	0%	0%
No			Philodinidae sp. CRf	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA;Philodinidae sp. CRf	20%	60%	25%
No			Philodinidae sp. CRg	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA;Philodinidae sp. CRg	0%	20%	0%
No			Philodina	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina	20%	20%	50%
No			Philodina acuticornis	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina acuticornis	0%	20%	75%
No			Philodina plena	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina plena	0%	0%	0%
No			Philodina vorax	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina vorax	0%	0%	0%

Include?	5	6	7	8	9	10	11	12	13	14
No	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	20%	0%	20%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
	60%	80%	60%	80%	75%	67%	100%	80%	100%	80%
No	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
No	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No	0%	20%	0%	20%	0%	0%	0%	40%	0%	0%
No	20%	80%	20%	20%	50%	33%	40%	40%	80%	40%
No	0%	0%	0%	0%	0%	0%	0%	20%	20%	0%
No	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
No	0%	20%	0%	20%	50%	33%	0%	0%	0%	0%
No	0%	20%	0%	0%	25%	0%	20%	20%	40%	0%
Yes	20%	0%	0%	20%	25%	0%	0%	0%	20%	0%
Yes	40%	40%	20%	20%	0%	0%	20%	20%	40%	0%
Yes	20%	20%	20%	0%	0%	0%	40%	0%	0%	60%
Yes	20%	20%	0%	20%	0%	0%	20%	40%	20%	0%
Yes	0%	0%	0%	0%	0%	0%	40%	20%	20%	0%
No	20%	20%	0%	20%	25%	0%	0%	20%	0%	0%
No	60%	100%	80%	100%	75%	100%	100%	100%	100%	80%
No	40%	100%	40%	40%	50%	67%	40%	40%	60%	60%
No	20%	20%	0%	0%	25%	0%	0%	20%	0%	0%
No	0%	0%	0%	0%	25%	0%	0%	0%	20%	20%
No	20%	0%	0%	0%	25%	0%	0%	0%	0%	0%
No	40%	20%	0%	40%	25%	0%	40%	60%	20%	20%
No	20%	20%	0%	20%	25%	0%	20%	80%	20%	0%
No	0%	20%	20%	20%	0%	0%	20%	20%	0%	20%
No	20%	40%	20%	60%	25%	0%	20%	0%	0%	0%
Yes	0%	20%	40%	0%	25%	0%	0%	0%	0%	0%

Include?	5	6	7	8	9	10	11	12	13	14
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	20%	0%	20%	20%	50%	0%	0%	0%	20%	0%
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No	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%
No	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
No	80%	20%	20%	40%	50%	33%	80%	20%	40%	40%
No	0%	40%	0%	0%	50%	33%	20%	40%	0%	20%
No	40%	40%	40%	20%	25%	33%	40%	60%	60%	60%
No	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	60%	60%	60%	60%	50%	0%	60%	60%	60%	100%
No	100%	100%	80%	80%	75%	100%	80%	100%	100%	100%

Include?	5	6	7	8	9	10	11	12	13	14
No	20%	20%	0%	20%	25%	0%	0%	20%	20%	20%
No	20%	60%	20%	20%	25%	0%	40%	20%	60%	40%
No	0%	0%	0%	0%	0%	33%	0%	0%	0%	40%
No	0%	40%	0%	0%	25%	0%	40%	20%	20%	0%
No	40%	60%	0%	40%	25%	0%	60%	60%	80%	0%
No	40%	0%	0%	20%	25%	0%	60%	100%	40%	20%
No	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	20%	40%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	0%	0%	20%
No	0%	40%	0%	0%	0%	0%	20%	0%	0%	0%
No	20%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No	100%	80%	100%	60%	75%	100%	100%	100%	100%	80%
No	0%	0%	0%	20%	0%	0%	0%	0%	0%	20%
No	0%	0%	0%	0%	0%	0%	20%	0%	0%	20%
No	0%	40%	0%	40%	25%	33%	100%	40%	40%	80%
No	20%	0%	0%	20%	0%	0%	0%	0%	0%	0%
No	60%	60%	60%	60%	75%	33%	20%	100%	80%	60%
No	0%	20%	0%	0%	0%	0%	0%	60%	60%	40%
No	20%	20%	0%	0%	0%	33%	0%	0%	0%	0%
No	20%	0%	20%	0%	0%	0%	0%	0%	20%	0%

Include?	5	6	7	8	9	10	11	12	13	14
	20%	20%	0%	0%	25%	0%	0%	0%	0%	0%
No										
No	0%	0%	0%	0%	0%	0%	20%	0%	20%	0%
No	0%	40%	0%	0%	0%	0%	20%	0%	20%	0%
	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No										
	40%	0%	0%	0%	0%	0%	0%	20%	0%	0%
No										
	80%	40%	60%	60%	75%	33%	60%	80%	80%	80%
No										
	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%
No										
No	60%	40%	20%	20%	0%	0%	20%	20%	20%	0%
No	20%	20%	0%	0%	25%	33%	20%	20%	0%	40%
No	60%	60%	40%	40%	25%	67%	60%	80%	80%	60%
	20%	20%	0%	0%	0%	0%	20%	0%	0%	0%
No										
	80%	80%	60%	60%	75%	67%	80%	100%	100%	100%
No										
	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%
No										
	20%	60%	20%	40%	25%	0%	60%	0%	20%	20%
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	80%	20%	0%	20%	0%	0%	20%	0%	0%	0%
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	0%	40%	0%	40%	0%	0%	0%	0%	0%	0%
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No	0%	0%	0%	0%	25%	0%	0%	0%	20%	40%
No	20%	0%	0%	0%	25%	0%	0%	0%	0%	0%
No	0%	0%	0%	0%	25%	33%	0%	0%	0%	20%
	0%	0%	0%	0%	0%	0%	0%	0%	40%	20%
No										
No	40%	40%	20%	60%	50%	33%	40%	80%	100%	100%
No	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
	40%	0%	20%	40%	50%	33%	20%	60%	60%	40%
No										
No	0%	80%	20%	0%	0%	0%	40%	40%	40%	60%
	0%	0%	20%	0%	50%	0%	0%	40%	80%	40%
No										
No	40%	40%	20%	60%	50%	33%	40%	80%	100%	100%
No	0%	20%	0%	0%	25%	0%	20%	20%	40%	60%
No	0%	40%	0%	0%	0%	0%	40%	40%	60%	20%
No	0%	20%	0%	0%	0%	0%	0%	20%	20%	0%
	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
No										
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No										

Include?	5	6	7	8	9	10	11	12	13	14
	60%	20%	0%	20%	25%	0%	0%	40%	0%	0%
No										
No	20%	0%	20%	20%	0%	33%	20%	20%	40%	20%
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
No										
No	20%	0%	20%	20%	0%	33%	20%	20%	40%	20%
	0%	0%	0%	20%	0%	0%	0%	0%	0%	20%
No										
	20%	20%	20%	0%	0%	0%	0%	0%	20%	0%
No										
	20%	0%	40%	20%	0%	33%	20%	20%	40%	0%
No										
No	0%	20%	0%	0%	25%	0%	20%	40%	40%	20%
	0%	0%	60%	40%	0%	67%	0%	20%	20%	0%
No										
	0%	0%	0%	0%	0%	0%	0%	0%	20%	0%
No										
	0%	0%	0%	0%	25%	0%	20%	20%	0%	0%
No										

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			FISH				
Yes	vicinity	Herring	Brevoortia tyrannus	Bugfish	Eukaryota;Chordata;Actinopteri;Clupeiformes;Clupeidae;Brevoortia;B	0%	0%
			BIRDS				
No			Aves	Birds	Eukaryota;Chordata;Aves	100%	100%
Yes	vicinity	turkey vulture	Cathartes aura	Storks	Eukaryota;Chordata;Aves;Ciconiiformes;Cathartidae;Cathartes;Catha	20%	0%
Yes	vicinity	dove	Columbidae	Dove	Eukaryota;Chordata;Aves;Columbiformes;Columbidae	0%	0%
Yes	vicinity	chicken	Gallus	Junglefowl	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus	0%	0%
Yes	vicinity	chicken	Gallus gallus	Chicken	Eukaryota;Chordata;Aves;Galliformes;Phasianidae;Gallus;Gallus	80%	40%
Yes	vicinity	blue jay	Cyanocitta cristata	Blue Jay	Eukaryota;Chordata;Aves;Passeriformes;Corvidae;Cyanocitta;Cyanoci	20%	0%
Yes	vicinity	northern cardinal	Cardinalis cardinalis	Finches	Eukaryota;Chordata;Aves;Passeriformes;Fringillidae;Cardinalis;Cardi	0%	0%
Yes	vicinity	Pine Warbler	Setophaga pinus	Pine Warbler	Eukaryota;Chordata;Aves;Passeriformes;Parulidae;Setophaga;Setop	0%	0%
Yes	vicinity	Song Sparrow	Melospiza melodia	Song Sparrow	Eukaryota;Chordata;Aves;Passeriformes;Passerellidae;Melospiza;Mel	0%	0%
			MAMMALS				
No			Mammalia	Mammals	Eukaryota;Chordata;Mammalia	0%	0%
Yes	location	Domestic dog	Canis	Dog	Eukaryota;Chordata;Mammalia;Carnivora;Canidae;Canis	40%	20%
Yes	location	domestic cat	Felidae	cats	Eukaryota;Chordata;Mammalia;Carnivora;Felidae	20%	0%
Yes	location	raccoon	Procyon lotor	Raccoon	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae;Procyon;Procy	40%	20%
Yes	location	Nine-banded Armadillo	Dasypus novemcinctus	Nine-banded Armadillo	Eukaryota;Chordata;Mammalia;Cingulata;Dasypodidae;Dasypus;Das	0%	40%
Yes	location	Virginia Opossum	Didelphis virginiana	Virginia Opossum	Eukaryota;Chordata;Mammalia;Didelphimorphia;Didelphidae;Didelph	20%	20%
Yes	location	Eastern Cottontail	Sylvilagus floridanus	Eastern Cottontail	Eukaryota;Chordata;Mammalia;Lagomorpha;Leporidae;Sylvilagus;Syl	20%	40%
Yes	vicinity	cattle	Bovidae	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae	0%	0%
Yes	vicinity	cattle	Bos	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Bos	100%	100%
Yes	vicinity	cattle	Bos taurus	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Bos;Bos taurus	60%	40%
Yes	vicinity	goat	Capra	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Capra	0%	0%
Yes	vicinity	sheep	Ovis	Mammals	Eukaryota;Chordata;Mammalia;NA;Bovidae;Ovis	20%	0%
Yes	vicinity	white-tailed deer	Cervidae	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae	0%	0%
Yes	vicinity	white-tailed deer	Odocoileus	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae;Odocoileus	20%	40%
Yes	vicinity	white-tailed deer	Odocoileus virginianus	Mammals	Eukaryota;Chordata;Mammalia;NA;Cervidae;Odocoileus;Odocoileus	20%	20%
Yes	vicinity	pig	Sus	Mammals	Eukaryota;Chordata;Mammalia;NA;Suidae;Sus	0%	20%
Yes	vicinity	wild pig	Sus scrofa	Wild Boar/Pig	Eukaryota;Chordata;Mammalia;NA;Suidae;Sus;Sus scrofa	0%	20%
Yes	location	Deer Mice	Peromyscus	Deer Mice	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus	0%	0%
Yes	location	North American Deermouse	Peromyscus maniculatus	North American Deermouse	Eukaryota;Chordata;Mammalia;Rodentia;Cricetidae;Peromyscus;Per	0%	0%
Yes	location	House Mouse	Mus musculus	House Mouse	Eukaryota;Chordata;Mammalia;Rodentia;Muridae;Mus;Mus	20%	0%
Yes	location	Eastern Gray Squirrel	Sciurus carolinensis	Eastern Gray Squirrel	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Sciurus;Sciurus	0%	20%
Yes	location	Eastern Fox Squirrel	Sciurus niger	Eastern Fox Squirrel	Eukaryota;Chordata;Mammalia;Rodentia;Sciuridae;Sciurus;Sciurus	0%	0%
			REPTILES				
Yes	location	red-eared slider	Trachemys	Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys	0%	0%
Yes	location	red-eared slider	Trachemys scripta	Common Slider	Eukaryota;Chordata;NA;Testudines;Emydidae;Trachemys;Trachemys scripta	0%	0%
			ALL OTHER ORGANISMS				

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Flavobacteriaceae	Bacteria	Bacteria;Bacteroidetes;Flavobacteriia;Flavobacteriales;Flavobacteriaceae	0%	0%
			Pedobacter steynii	Bacteria	Bacteria;Bacteroidetes;Sphingobacteriia;Sphingobacteriales;Sphingobacteriaceae;Pedobacter;Pedobacter steynii	0%	20%
			Sphingobacterium mizutaii	Bacteria	Bacteria;Bacteroidetes;Sphingobacteriia;Sphingobacteriales;Sphingobacteriaceae;Sphingobacterium;Sphingobacterium mizutaii	40%	0%
			Eukaryota	Eukaryota	Eukaryota	100%	80%
			Lumbricidae	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae	20%	20%
			Aporrectodea	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Aporrectodea	40%	20%
			Aporrectodea caliginosa L3	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Aporrectodea;Aporrectodea caliginosa L3	40%	20%
			Bimastos tumidus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Bimastos;Bimastos tumidus	0%	0%
			Lumbricus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus	0%	0%
			Lumbricus aff. rubellus L2	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus aff. rubellus L2	0%	0%
			Lumbricus rubellus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus rubellus	20%	20%
			Lumbricus rubellus complex sp. A SM	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus rubellus complex sp. A SM-2016	0%	0%
			Lumbricus terrestris	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus terrestris	0%	0%
			Megascolecidae	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Megascolecidae	20%	0%
			Dasybranchus sp. DH1	Bristle Worms	Eukaryota;Annelida;Polychaeta;Capitellida;Capitellidae;Dasybranchus;Dasybranchus sp. DH1	20%	20%
			Arthropoda	Arthropods	Eukaryota;Arthropoda	40%	0%
			Erigone	Black Dwarf Spiders	Eukaryota;Arthropoda;Arachnida;Araneae;Linyphiidae;Erigone	20%	0%
			Attidops youngi	Jumping Spider	Eukaryota;Arthropoda;Arachnida;Araneae;Salticidae;Attidops;Attidops youngi	0%	0%
			Leucauge	Orchard Spider And Allies	Eukaryota;Arthropoda;Arachnida;Araneae;Tetragnathidae;Leucauge	0%	0%
			Thomisidae	Spider	Eukaryota;Arthropoda;Arachnida;Araneae;Thomisidae	0%	0%
			Aleuroglyphus ovatus	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Acaridae;Aleuroglyphus;Aleuroglyphus ovatus	20%	20%
			Caloglyphus berlesei	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Acaridae;Caloglyphus;Caloglyphus berlesei	20%	0%
			Analges sp. JS-2011	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Analgidae;Analges;Analges sp. JS-2011	40%	0%
			Suidasia	Arachnid	Eukaryota;Arthropoda;Arachnida;Astigmata;Suidasiidae;Suidasia	80%	20%
			Amblyomma americanum	Lone Star Tick	Eukaryota;Arthropoda;Arachnida;Ixodida;Ixodidae;Amblyomma;Amblyomma americanum	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Trombidiformes	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes	0%	0%
			Abacarus lolii	Eriophyid Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Eriophyidae;Abacarus;Abacarus lolii	0%	0%
			Penthaleidae sp. Q091	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Penthaleidae;NA;Penthaleidae sp. Q091	20%	20%
			Rhagidiidae sp. BOLD:AAZ6638	Trombidiform Mites	Eukaryota;Arthropoda;Arachnida;Trombidiformes;Rhagidiidae;NA;Rhagidiidae sp. BOLD:AAZ6638	0%	0%
			Deuterosminthurus sp. BOLD:AAB79:	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Bourletiellidae;Deuterosminthurus;Deuterosminthurus sp. BOLD:AAB7915	0%	0%
			Entomobryidae	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae	0%	20%
			Entomobrya proxima	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;Entomobrya;Entomobrya proxima	0%	20%
			Lepidocyrtus	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;Lepidocyrtus	0%	0%
			Entomobryidae sp. BOLD:ACF9575	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Entomobryidae;NA;Entomobryidae sp. BOLD:ACF9575	0%	0%
			Ceratophysella	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Hypogastruridae;Ceratophysella	0%	0%
			Hypogastruridae sp. BOLD:ACE1775	Arthropods	Eukaryota;Arthropoda;Collembola;NA;Hypogastruridae;NA;Hypogastruridae sp. BOLD:ACE1775	0%	0%
			Insecta	Insect	Eukaryota;Arthropoda;Insecta	0%	20%
			Coleoptera	Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera	0%	0%
			Amara	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Amara	0%	0%
			Amara sp. 1 CMG-2012	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Amara;Amara sp. 1 CMG-2012	0%	0%
			Anisodactylus sanctaecrusis	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Anisodactylus;Anisodactylus sanctaecrusis	0%	0%
			Calathus opaculus	Carabid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Carabidae;Calathus;Calathus opaculus	0%	0%
			Orthosoma brunneum	Brown Prionid Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Cerambycidae;Orthosoma;Orthosoma brunneum	0%	0%
			Prionus insularis	Longhorn Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Cerambycidae;Prionus;Prionus insularis	0%	0%
			Chrysomelidae	Indet Leaf Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Chrysomelidae	0%	0%
			Coccinellidae	Indet. Ladybird	Eukaryota;Arthropoda;Insecta;Coleoptera;Coccinellidae	20%	20%
			Harmonia axyridis	Harlequin Ladybird	Eukaryota;Arthropoda;Insecta;Coleoptera;Coccinellidae;Harmonia;Harmonia axyridis	0%	0%
			Aeolus	Wireworm	Eukaryota;Arthropoda;Insecta;Coleoptera;Elateridae;Aeolus	0%	0%
			Aeolus sp. BOLD-2016	Wireworm	Eukaryota;Arthropoda;Insecta;Coleoptera;Elateridae;Aeolus;Aeolus sp. BOLD-2016	0%	0%
			Cercyon haemorrhoidalis	Water scavenger beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Hydrophilidae;Cercyon;Cercyon haemorrhoidalis	0%	20%
			Cartodere constricta	Plaster beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Latridiidae;Cartodere;Cartodere constricta	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Corticarina	Minute Brown Scavenger Bee	Eukaryota;Arthropoda;Insecta;Coleoptera;Latridiidae;Corticarina	0%	20%
			Coleoptera sp. BOLD:AAN6182	Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;NA;NA;Coleoptera sp. BOLD:AAN6182	0%	0%
			Onthophagus taurus	Bullhorned Dung Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Scarabaeidae;Onthophagu s;Onthophagus taurus	0%	0%
			Ahasverus advena	Foreign grain beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Silvanidae;Ahasverus;Ahas verus advena	20%	20%
			Staphylinidae sp. BOLD:AAN6211	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;NA;Staphylini dae sp. BOLD:AAN6211	20%	0%
			Staphylinidae sp. BOLD:ACI8932	Indet. Rove Beetle	Eukaryota;Arthropoda;Insecta;Coleoptera;Staphylinidae;NA;Staphylini dae sp. BOLD:ACI8932	0%	0%
			Euborellia femoralis	Earwig	Eukaryota;Arthropoda;Insecta;Dermaptera;Anisolabididae;Euborellia; Euborellia femoralis	0%	0%
			Diptera	Fly	Eukaryota;Arthropoda;Insecta;Diptera	60%	60%
			Delia	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;Delia	0%	40%
			Hylemya	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;Hylemya	0%	0%
			Anthomyiidae	Root-Maggot Flies	Eukaryota;Arthropoda;Insecta;Diptera;Anthomyiidae;NA	0%	0%
			Diogmites grossus	Hanging Thief Robber Flies	Eukaryota;Arthropoda;Insecta;Diptera;Asilidae;Diogmites;Diogmites grossus	0%	0%
			Calliphoridae	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae	20%	20%
			Cochliomyia	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Cochliomyia	20%	0%
			Cynomya	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Cynomya	20%	20%
			Pollenia	Blow Flies	Eukaryota;Arthropoda;Insecta;Diptera;Calliphoridae;Pollenia	20%	0%
			Cecidomyiidae	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Cecidomyiidae;NA	0%	0%
			Cecidomyiidae sp. BOLD-2016	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Cecidomyiidae;NA;Cecidomyiid ae sp. BOLD-2016	0%	0%
			Chironomidae	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae	80%	40%
			Bryophaenocladius sp. 8ES	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Bryophaenoclad ius;Bryophaenocladius sp. 8ES	0%	0%
			Chironomus	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Chironomus	0%	0%
			Chironomidae	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA	80%	40%
			Chironomidae sp. BOLD-2016	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Chironomida e sp. BOLD-2016	0%	0%
			Chironomidae sp. BOLD:AAG1019	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Chironomida e sp. BOLD:AAG1019	20%	20%
			Orthocladiinae sp. BOLD-2016	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Orthocladiin ae sp. BOLD-2016	0%	0%
			Orthocladiinae sp. BOLD:ACN7166	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Orthocladiin ae sp. BOLD:ACN7166	20%	0%
			Tanypodinae sp. BOLD-2016	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;NA;Tanypodinae sp. BOLD-2016	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Orthocladius	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius	0%	20%
			Orthocladius oliveri	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius oliveri	0%	20%
			Orthocladius rivulorum	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius rivulorum	0%	0%
			Orthocladius sp. BOLD-2016	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Orthocladius;Orthocladius sp. BOLD-2016	0%	20%
			Smittia	Gymnolaemates	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Smittia	0%	0%
			Smittia sp. 8ES	Gymnolaemates	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Smittia;Smittia sp. 8ES	0%	20%
			Tanypus neopunctipennis	Midges	Eukaryota;Arthropoda;Insecta;Diptera;Chironomidae;Tanypus;Tanypus neopunctipennis	0%	0%
			Anopheles sinensis	Malaria Mosquitoes	Eukaryota;Arthropoda;Insecta;Diptera;Culicidae;Anopheles;Anopheles sinensis	0%	0%
			Drosophilidae	Fruit Fly	Eukaryota;Arthropoda;Insecta;Diptera;Drosophilidae	0%	0%
			Heleomyzinae sp. BOLD-2016	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Heleomyzidae;NA;Heleomyzinae sp. BOLD-2016	0%	0%
			Limoniidae	Limoniid Crane Flies	Eukaryota;Arthropoda;Insecta;Diptera;Limoniidae	0%	0%
			Lonchaea	Fly	Eukaryota;Arthropoda;Insecta;Diptera;Lonchaeidae;Lonchaea	0%	0%
			Muscidae	House Flies And Allies	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae	0%	0%
			Musca domestica	House fly	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae;Musca;Musca domestica	0%	0%
			Neomyia cornicina	House fly	Eukaryota;Arthropoda;Insecta;Diptera;Muscidae;Neomyia;Neomyia cornicina	20%	40%
			Mycetophila ocellus	Fungus Gnat	Eukaryota;Arthropoda;Insecta;Diptera;Mycetophilidae;Mycetophila;Mycetophila ocellus	0%	0%
			Diptera	Fly	Eukaryota;Arthropoda;Insecta;Diptera;NA;NA	60%	60%
			Psychoda sp. BOLD-2016	Indet. Mothfly	Eukaryota;Arthropoda;Insecta;Diptera;Psychodidae;Psychoda;Psychoda sp. BOLD-2016	40%	0%
			Ravinia	Flesh Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sarcophagidae;Ravinia	20%	0%
			Ravinia stimulans	Flesh Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sarcophagidae;Ravinia;Ravinia stimulans	0%	0%
			Sciaridae	Dark-Winged Fungus Gnat	Eukaryota;Arthropoda;Insecta;Diptera;Sciaridae	0%	0%
			Sciaridae	Dark-Winged Fungus Gnat	Eukaryota;Arthropoda;Insecta;Diptera;Sciaridae;NA	0%	0%
			Sepsidae	Black Scavenger Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sepsidae	0%	20%
			Sphaeroceridae sp. BOLD-2016	Lesser Dung Flies	Eukaryota;Arthropoda;Insecta;Diptera;Sphaeroceridae;NA;Sphaeroceridae sp. BOLD-2016	0%	0%
			Sargus cuprarius	Clouded Centurion	Eukaryota;Arthropoda;Insecta;Diptera;Stratiomyidae;Sargus;Sargus cuprarius	0%	0%
			Syrphidae	Hoverfly	Eukaryota;Arthropoda;Insecta;Diptera;Syrphidae	0%	0%
			Archytas apicifer	Bristle Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tachinidae;Archytas;Archytas apicifer	0%	20%
			Tachinidae sp. BOLD-2016	Bristle Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tachinidae;NA;Tachinidae sp. BOLD-2016	0%	0%

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			Tephritidae	Fruit Flies	Eukaryota;Arthropoda;Insecta;Diptera;Tephritidae	0%	0%
			Leptophlebia cupida	Prong-Gilled Mayflies	Eukaryota;Arthropoda;Insecta;Ephemeroptera;Leptophlebiidae;Leptophlebia;Leptophlebia cupida	0%	20%
			Alydus pilosulus	Broad-Headed Bug	Eukaryota;Arthropoda;Insecta;Hemiptera;Alydidae;Alydus;Alydus pilosulus	0%	20%
			Aphididae	Aphid	Eukaryota;Arthropoda;Insecta;Hemiptera;Aphididae	0%	0%
			Cicadidae	Bug	Eukaryota;Arthropoda;Insecta;Hemiptera;Cicadidae	20%	0%
			Neotibicen pruinosus	Dog-Day Cicadas	Eukaryota;Arthropoda;Insecta;Hemiptera;Cicadidae;Neotibicen;Neotibicen pruinosus	20%	0%
			Liburniella ornata	Ornate Planthopper	Eukaryota;Arthropoda;Insecta;Hemiptera;Delphacidae;Liburniella;Liburniella ornata	0%	0%
			Belonochilus numenius	Chinch Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Lygaeidae;Belonochilus;Belonochilus numenius	0%	0%
			Nysius	Chinch Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Lygaeidae;Nysius	20%	20%
			Miridae	Capsid Bugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Miridae	0%	0%
			Pentatomidae	Stinkbugs	Eukaryota;Arthropoda;Insecta;Hemiptera;Pentatomidae	0%	0%
			Hymenoptera	Invertebrates (Bees & Wasps	Eukaryota;Arthropoda;Insecta;Hymenoptera	0%	0%
			Agaonidae	fig wasp	Eukaryota;Arthropoda;Insecta;Hymenoptera;Agaonidae	20%	0%
			Apanteles sp. Rodriguez61	Braconid Wasps	Eukaryota;Arthropoda;Insecta;Hymenoptera;Braconidae;Apanteles;Apanteles sp. Rodriguez61	0%	0%
			Eulophidae	Invertebrates (Bees & Wasps	Eukaryota;Arthropoda;Insecta;Hymenoptera;Eulophidae	0%	0%
			Formicidae	Ant	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae	40%	20%
			Pheidole dentata	Ant	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae;Pheidole;Pheidole dentata	20%	0%
			Solenopsis carolinensis	Fire Ants And Thief Ants	Eukaryota;Arthropoda;Insecta;Hymenoptera;Formicidae;Solenopsis;Solenopsis carolinensis	0%	20%
			Ichneumonidae	Ichneumonid	Eukaryota;Arthropoda;Insecta;Hymenoptera;Ichneumonidae	0%	20%
			Dolichovespula	Aerial Yellowjackets	Eukaryota;Arthropoda;Insecta;Hymenoptera;Vespidae;Dolichovespula	0%	0%
			Lepidoptera	Butterflies	Eukaryota;Arthropoda;Insecta;Lepidoptera	20%	0%
			Agonopterix	Grass Miner Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Elachistidae;Agonopterix	0%	0%
			Antiblemma sp. BioLep13	Underwing, Tiger, Tussock, Ar	Eukaryota;Arthropoda;Insecta;Lepidoptera;Erebidae;Antiblemma;Antiblemma sp. BioLep13	0%	0%
			Idia aemula	Common Idia Moth	Eukaryota;Arthropoda;Insecta;Lepidoptera;Erebidae;Idia;Idia aemula	0%	0%
			Hesperiidae	Indet. Skipper	Eukaryota;Arthropoda;Insecta;Lepidoptera;Hesperiidae	20%	20%
			Agrochola	Cutworm Moths And Allies	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Agrochola	0%	0%
			Eupsilia	Cutworm Moths And Allies	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Eupsilia	0%	0%
			Eupsilia tristigmata	Three-Spotted Sallow	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Eupsilia;Eupsilia tristigmata	0%	0%
			Panopoda	Underwing, Tiger, Tussock, Ar	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Panopoda	0%	0%

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			Spodoptera	Armyworm Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Noctuidae;Spodoptera	20%	0%
			Manduca	Hawk Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Sphingidae;Manduca	0%	20%
			Homostinea curviliniella	Tineid Moths	Eukaryota;Arthropoda;Insecta;Lepidoptera;Tineidae;Homostinea;Homostinea curviliniella	0%	0%
			Chrysopidae	Common Lacewings	Eukaryota;Arthropoda;Insecta;Neuroptera;Chrysopidae	0%	0%
			Acrididae	grasshoppers	Eukaryota;Arthropoda;Insecta;Orthoptera;Acrididae	0%	0%
			Gryllus sp. BOLD:AAG0677	true crickets	Eukaryota;Arthropoda;Insecta;Orthoptera;Gryllidae;Gryllus;Gryllus sp. BOLD:AAG0677	0%	0%
			Psocoptera	Insect	Eukaryota;Arthropoda;Insecta;Psocoptera	0%	0%
			Lachesilla sp. BOLD-2016	fateful barklouse	Eukaryota;Arthropoda;Insecta;Psocoptera;Lachesillidae;Lachesilla;Lachesilla sp. BOLD-2016	0%	20%
			Thripidae	Common Thrips	Eukaryota;Arthropoda;Insecta;Thysanoptera;Thripidae	20%	0%
			Frankliniella	Common Thrips	Eukaryota;Arthropoda;Insecta;Thysanoptera;Thripidae;Frankliniella	0%	0%
			Armadillidium	Pill Bugs	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium	20%	0%
			Armadillidium nasatum	Isopod	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium;Armadillidium nasatum	40%	0%
			Armadillidium vulgare	Pillbug	Eukaryota;Arthropoda;Malacostraca;Isopoda;Armadillidiidae;Armadillidium;Armadillidium vulgare	0%	0%
			Isopoda	Indet. Woodlouse	Eukaryota;Arthropoda;Malacostraca;Isopoda;NA;NA	0%	0%
			Ascomycota	Ascomycete	Eukaryota;Ascomycota	40%	60%
			Capnodiales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales	60%	60%
			Cladosporium	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium	100%	100%
			Cladosporium sp. BM-2009-3	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium sp. BM-2009-3	0%	40%
			Cladosporium sp. BM-2009-5	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium sp. BM-2009-5	100%	100%
			Cladosporium tenuissimum	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium tenuissimum	100%	100%
			Cercospora sojina	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Mycosphaerellaceae;Cercospora;Cercospora sojina	0%	40%
			Pleosporales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales	80%	80%
			Didymella pinodes	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales;Didymellaceae;Didymella;Didymella pinodes	100%	80%
			Pithomyces chartarum	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales;Pleosporaceae;Pithomyces;Pithomyces chartarum	40%	20%
			Eurotiales	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales	60%	60%
			Aspergillaceae	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae	40%	40%
			Aspergillus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus	60%	20%

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			Aspergillus campestris	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus campestris	0%	0%
			Aspergillus fumigatus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus fumigatus	0%	20%
			Aspergillus nidulans	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus nidulans	0%	0%
			Aspergillus terreus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus terreus	20%	0%
			Aspergillus versicolor	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Aspergillus;Aspergillus versicolor	0%	20%
			Penicillium	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium	60%	60%
			Penicillium brevicompactum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium brevicompactum	20%	40%
			Penicillium crustosum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium crustosum	20%	40%
			Penicillium fellutanum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium fellutanum	40%	0%
			Penicillium polonicum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium polonicum	40%	40%
			Penicillium roqueforti	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium roqueforti	20%	20%
			Penicillium rubens	Blue Mould Rot	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium rubens	0%	40%
			Penicillium sclerotiorum	Blue Mould Rot	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium sclerotiorum	100%	100%
			Penicillium verrucosum	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium verrucosum	0%	20%
			Penicillium waksmanii	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium waksmanii	0%	0%
			Talaromyces	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Trichocomaceae;Talaromyces	0%	0%
			Talaromyces pinophilus	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Trichocomaceae;Talaromyces;Talaromyces pinophilus	0%	0%
			Lecanora strobilina	Mealy Rim-Lichen	Eukaryota;Ascomycota;Lecanoromycetes;Lecanorales;Lecanoraceae;Lecanora;Lecanora strobilina	20%	20%
			Parmeliaceae	Shield Lichens And Allies	Eukaryota;Ascomycota;Lecanoromycetes;Lecanorales;Parmeliaceae	0%	0%
			Pseudeurotiaceae	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae	80%	40%
			Pseudogymnoascus pannorum	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae;Pseudogymnoascus;Pseudogymnoascus pannorum	0%	20%
			Pseudogymnoascus sp. BM-2009-4	Ascomycete	Eukaryota;Ascomycota;Leotiomycetes;NA;Pseudeurotiaceae;Pseudogymnoascus;Pseudogymnoascus sp. BM-2009-4	0%	0%
			Tetracladium	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium	20%	20%

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			Tetracladium apiense	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium;Tetracladium apiense	20%	0%
			Candida metapsilosis	Candidiasis	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Debaryomycetaceae;Candida;Candida metapsilosis	0%	0%
			Debaryomyces hansenii	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Debaryomycetaceae;Debaryomyces;Debaryomyces hansenii	0%	20%
			Galactomyces candidum	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Dipodascaceae;Galactomyces;Galactomyces candidum	40%	20%
			[Candida] intermedia	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Metschnikowiaceae;Clavispora;[Candida] intermedia	0%	0%
			Clavispora lusitaniae	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Metschnikowiaceae;Clavispora;Clavispora lusitaniae	0%	20%
			Candida sake	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;NA;Candida;Candida sake	20%	60%
			Ogataea angusta	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Pichiaceae;Ogataea;Ogataea angusta	0%	0%
			Kazachstania servazzii	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Kazachstania;Kazachstania servazzii	20%	0%
			Saccharomyces	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Saccharomyces	0%	0%
			Saccharomyces cerevisiae	Budding Yeasts	Eukaryota;Ascomycota;Saccharomycetes;Saccharomycetales;Saccharomycetaceae;Saccharomyces;Saccharomyces cerevisiae	80%	60%
			Sordariomycetes	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes	100%	80%
			Diaporthe longicolla	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Diaporthales;Diaporthaceae;Diaporthe;Diaporthe longicolla	20%	20%
			Colletotrichum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum	20%	20%
			Colletotrichum incanum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum;Colletotrichum incanum	0%	0%
			Hypocreales	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales	40%	20%
			Clonostachys rosea	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Bionectriaceae;Clonostachys;Clonostachys rosea	0%	20%
			Metarhizium anisopliae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Clavicipitaceae;Metarhizium;Metarhizium anisopliae	0%	0%
			Cordycipitaceae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Cordycipitaceae	40%	80%
			Trichoderma	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Hypocreaceae;Trichoderma	0%	20%
			Acremonium cf. chrysogenum DAOM	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;NA;Acremonium;Acremonium cf. chrysogenum DAOM 226667	60%	40%
			Nectriaceae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae	60%	60%
			Fusarium	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium	100%	80%

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			Fusarium boothii	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium boothii	20%	0%
			Fusarium delphinoides	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium delphinoides	60%	40%
			Fusarium flocciferum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium flocciferum	0%	0%
			Fusarium incarnatum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium incarnatum	20%	40%
			Fusarium mangiferae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium mangiferae	80%	60%
			Fusarium solani	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium solani	40%	60%
			Fusarium subglutinans	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium subglutinans	0%	0%
			Nectria haematococca	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Nectria haematococca	0%	20%
			Thelonectria veuillotiana	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Thelonectria;Thelonectria veuillotiana	0%	0%
			Thermothelomyces thermophila	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Sordariales;Chaetomiaceae;Thermothelomyces;Thermothelomyces thermophila	0%	0%
			Neurospora crassa	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Sordariales;Sordariaceae;Neurospora;Neurospora crassa	0%	0%
			Arthrinium arundinis	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Xylariales;Apiosporaceae;Arthrinium;Arthrinium arundinis	0%	0%
			Pluteus	Deer Mushrooms	Eukaryota;Basidiomycota;Agaricomycetes;Agaricales;Pluteaceae;Pluteus	0%	20%
			Schizophyllum commune	Common Porecrust	Eukaryota;Basidiomycota;Agaricomycetes;Agaricales;Schizophyllaceae;Schizophyllum;Schizophyllum commune	0%	0%
			Xerocomus	Boletes	Eukaryota;Basidiomycota;Agaricomycetes;Boletales;Boletaceae;Xerocomus	0%	0%
			Suillus tomentosus	Bolete	Eukaryota;Basidiomycota;Agaricomycetes;Boletales;Suillaceae;Suillus;Suillus tomentosus	0%	0%
			Rhodotorula taiwanensis	Basidiomycete	Eukaryota;Basidiomycota;Microbotryomycetes;Sporidiobolales;Sporidiobolaceae;Rhodotorula;Rhodotorula taiwanensis	100%	100%
			Pseudomuriella schumacherensis	Chlorophycean Green Algae	Eukaryota;Chlorophyta;Chlorophyceae;Sphaeropleales;Pseudomuriellaceae;Pseudomuriella;Pseudomuriella schumacherensis	0%	0%
			Lobosphaera incisa	Green Alga Sp.	Eukaryota;Chlorophyta;Trebouxiophyceae;Chlorellales;Chlorellaceae;Lobosphaera;Lobosphaera incisa	0%	20%
			Trebouxia aggregata	Green Alga Sp.	Eukaryota;Chlorophyta;Trebouxiophyceae;Microthamniales;NA;Trebouxia;Trebouxia aggregata	40%	100%
			Hydrozoa	Hydroid	Eukaryota;Cnidaria;Hydrozoa	0%	0%
			Colobonema sericeum	silky medusa	Eukaryota;Cnidaria;Hydrozoa;Trachymedusae;Rhopalonematidae;Colobonema;Colobonema sericeum	0%	0%
			Eustigmatophyceae	Eustigmatophyceae	Eukaryota;Eustigmatophyceae;NA	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Mucorales	Mucorales	Eukaryota;Mucoromycota;NA;Mucorales	80%	20%
			Lichtheimia ramosa	Lichtheimia ramosa	Eukaryota;Mucoromycota;NA;Mucorales;Lichtheimiaceae;Lichtheimia;Lichtheimia ramosa	60%	0%
			Pedospumella encystans	A Chrysophyte	Eukaryota;NA;Chrysophyceae;Chromulinales;Chromulinaceae;Pedospumella;Pedospumella encystans	0%	0%
			Pedospumella sp. LG-2014a	A Chrysophyte	Eukaryota;NA;Chrysophyceae;Chromulinales;Chromulinaceae;Pedospumella;Pedospumella sp. LG-2014a	20%	0%
			Gymnodinium sp. NVA/RUS/2008	Dinoflagellates	Eukaryota;NA;Dinophyceae;Gymnodiniales;Gymnodiniaceae;Gymnodinium;Gymnodinium sp. NVA/RUS/2008	0%	0%
			Naegleria	Naegleria	Eukaryota;NA;Heterolobosea;Schizopyrenida;Vahlkampfiidae;Naegleria	20%	20%
			Cochliopodium	Cochliopodium	Eukaryota;NA;NA;Himatismenida;Cochliopodiidae;Cochliopodium	20%	20%
			Cochliopodium plurinucleolum	Cochliopodium plurinucleolur	Eukaryota;NA;NA;Himatismenida;Cochliopodiidae;Cochliopodium;Cochliopodium plurinucleolum	0%	0%
			Acanthamoeba castellanii	Acanthamoeba castellanii	Eukaryota;NA;NA;Longamoebia;Acanthamoebidae;Acanthamoeba;Acanthamoeba castellanii	0%	0%
			Acanthamoeba polyphaga	Acanthamoeba polyphaga	Eukaryota;NA;NA;Longamoebia;Acanthamoebidae;Acanthamoeba;Acanthamoeba polyphaga	0%	0%
			Vermamoeba vermiformis	Vermamoeba vermiformis	Eukaryota;NA;NA;NA;Hartmannellidae;Vermamoeba;Vermamoeba vermiformis	80%	60%
			Stemonitis flavogenita	Stemonitis flavogenita	Eukaryota;NA;NA;Stemonitida;Stemonitidae;Stemonitis;Stemonitis flavogenita	0%	0%
			Oomycetes	Oomycetes	Eukaryota;NA;Oomycetes	20%	20%
			Phytophthora	Phytophthora	Eukaryota;NA;Oomycetes;Peronosporales;NA;Phytophthora	0%	20%
			Pythium	Pythium	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium	80%	60%
			Pythium aff. acanthophoron JEB-201(	Pythium aff. acanthophoron J	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium aff. acanthophoron JEB-2016	0%	20%
			Pythium camurandrum	Pythium camurandrum	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium camurandrum	100%	80%
			Pythium kandovanense	Pythium kandovanense	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium kandovanense	0%	0%
			Pythium rostratifingens	Pythium rostratifingens	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium rostratifingens	20%	60%
			Pythium sp. CAL-2011c	Pythium sp. CAL-2011c	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium sp. CAL-2011c	0%	20%
			Pythium urmianum	Pythium urmianum	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium urmianum	0%	0%
			Chromadorea	Nematode	Eukaryota;Nematoda;Chromadorea	20%	0%
			Rhabditida	Nematode	Eukaryota;Nematoda;Chromadorea;Rhabditida;NA;NA	0%	0%
			Aphelenchoididae	Nematode	Eukaryota;Nematoda;Chromadorea;Tylenchida;Aphelenchoididae	0%	0%
			Bursaphelenchus debrae	Nematode	Eukaryota;Nematoda;Chromadorea;Tylenchida;Aphelenchoididae;Bursaphelenchus;Bursaphelenchus debrae	40%	0%
			Bdelloidea	Rotifer	Eukaryota;Rotifera;Bdelloidea	100%	40%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	13	11
			Adineta	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta	20%	0%
			Adineta sp. Adi5	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta sp. Adi5	60%	20%
			Adineta vaga	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta vaga	40%	40%
			Adineta vaga complex sp. E JFF-2016	Rotifer	Eukaryota;Rotifera;Bdelloidea;Adinetida;Adinetidae;Adineta;Adineta vaga complex sp. E JFF-2016	80%	0%
			Bdelloidea	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;NA	100%	40%
			Rotaria	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;Rotaria	40%	20%
			Rotaria rotatoria	Rotifer	Eukaryota;Rotifera;Bdelloidea;NA;NA;Rotaria;Rotaria rotatoria	60%	40%
			Habrotrocha	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha	20%	0%
			Habrotrocha ligula	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha;Habrotrocha ligula	20%	0%
			Habrotrocha sp. Hab5	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;Habrotrocha;Habrotrocha sp. Hab5	0%	0%
			Habrotrochidae sp. nd	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Habrotrochidae;NA;Habrotrochidae sp. nd	0%	0%
			Philodinidae	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae	40%	20%
			Macrotrachela quadricornifera	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Macrotrachela;Macrotrachela quadricornifera	0%	0%
			Philodinidae	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA	40%	20%
			Philodinidae sp. CRf	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA;Philodinidae sp. CRf	20%	0%
			Philodinidae sp. CRg	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;NA;Philodinidae sp. CRg	40%	20%
			Philodina	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina	40%	20%
			Philodina acuticornis	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina acuticornis	20%	0%
			Philodina plena	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina plena	20%	0%
			Philodina vorax	Rotifer	Eukaryota;Rotifera;Bdelloidea;Philodinida;Philodinidae;Philodina;Philodina vorax	0%	20%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
Yes	0%	20%	0%	0%	0%	20%	0%	0%	0%	0%	0%
No	75%	80%	80%	67%	60%	80%	80%	0%	0%	100%	0%
Yes	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	0%	20%	40%	0%	0%	0%	0%
Yes	50%	40%	20%	33%	60%	80%	40%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
No	50%	20%	20%	33%	0%	20%	0%	0%	0%	0%	0%
Yes	25%	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%
Yes	25%	20%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	40%	40%	20%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	40%	20%	0%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	0%	20%	40%	0%	0%	0%	0%
Yes	0%	60%	0%	0%	60%	0%	20%	0%	0%	0%	0%
Yes	25%	20%	20%	0%	40%	20%	20%	0%	0%	0%	0%
Yes	75%	60%	100%	100%	100%	100%	100%	0%	100%	0%	100%
Yes	50%	60%	40%	67%	80%	100%	40%	0%	100%	0%	0%
Yes	25%	20%	0%	0%	0%	20%	20%	0%	0%	0%	0%
Yes	25%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	25%	20%	40%	0%	40%	20%	60%	0%	100%	0%	0%
Yes	25%	0%	20%	0%	20%	20%	80%	0%	0%	0%	0%
Yes	0%	20%	20%	0%	0%	20%	20%	0%	0%	0%	100%
Yes	25%	20%	60%	0%	0%	40%	0%	0%	0%	0%	100%
Yes	25%	20%	0%	0%	40%	20%	0%	0%	0%	100%	0%
Yes	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
Yes	50%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
Yes	25%	20%	0%	0%	20%	20%	0%	0%	0%	0%	0%
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Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%
Yes	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%
	100%	80%	80%	67%	100%	100%	100%	100%	100%	100%	100%
	25%	20%	20%	0%	40%	40%	40%	0%	0%	0%	0%
	25%	0%	0%	0%	0%	20%	20%	0%	0%	0%	0%
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	0%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%
	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%
	0%	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%
	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	0%	20%	20%	33%	0%	20%	40%	0%	0%	0%	0%
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	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%
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	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	0%	20%	20%	0%	0%	0%	0%	0%	0%	0%	0%
	0%	20%	0%	0%	0%	0%	20%	0%	0%	0%	0%
	0%	40%	20%	0%	0%	20%	0%	0%	0%	0%	0%
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	75%	40%	40%	67%	40%	40%	20%	0%	0%	100%	100%
	50%	60%	40%	33%	80%	40%	80%	0%	100%	100%	100%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	25%	0%	40%	33%	20%	40%	20%	0%	0%	100%	0%
	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	0%	20%	20%	0%	20%	20%	20%	0%	0%	0%	0%
	50%	0%	20%	33%	40%	0%	40%	0%	0%	0%	0%
	75%	60%	40%	33%	40%	20%	60%	0%	0%	100%	0%
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	25%	0%	0%	67%	20%	0%	0%	0%	0%	0%	0%
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
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	75%	80%	60%	100%	100%	100%	100%	0%	100%	100%	100%
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	50%	20%	40%	100%	0%	20%	60%	0%	0%	100%	100%
	25%	0%	20%	33%	0%	0%	40%	0%	100%	100%	0%
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	50%	40%	40%	33%	80%	60%	60%	0%	0%	0%	0%
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	75%	40%	40%	33%	80%	20%	20%	0%	0%	100%	0%
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	50%	60%	40%	0%	40%	80%	60%	0%	0%	100%	0%
	75%	40%	60%	33%	60%	60%	80%	0%	0%	100%	100%
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	50%	40%	60%	0%	60%	60%	60%	0%	0%	100%	0%
	75%	80%	80%	100%	100%	100%	100%	0%	100%	100%	100%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
	25%	20%	20%	0%	20%	20%	20%	0%	0%	100%	0%
	25%	40%	20%	0%	80%	60%	20%	0%	0%	0%	0%
	0%	0%	0%	33%	0%	0%	0%	0%	0%	100%	0%
	25%	0%	0%	0%	0%	40%	20%	0%	0%	0%	0%
	25%	40%	40%	0%	40%	60%	60%	0%	0%	0%	0%
	25%	20%	20%	0%	40%	0%	100%	0%	100%	0%	0%
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	0%	0%	0%	0%	0%	0%	40%	0%	0%	0%	0%
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	75%	80%	60%	100%	100%	80%	100%	0%	100%	100%	0%
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	0%	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	25%	40%	40%	33%	40%	40%	40%	0%	0%	100%	0%
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Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	0%	20%	0%	33%	0%	20%	0%	100%	0%	0%	100%
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	25%	0%	0%	0%	0%	20%	0%	0%	0%	100%	0%
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	0%	0%	0%	0%	0%	40%	0%	100%	0%	0%	0%
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	25%	0%	0%	33%	0%	20%	20%	0%	0%	100%	0%
	25%	60%	40%	67%	60%	60%	80%	100%	100%	100%	100%
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	25%	80%	40%	0%	0%	60%	0%	0%	100%	100%	100%
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	50%	60%	60%	33%	80%	40%	80%	0%	100%	100%	0%

Include?	9	2	8	10	3	6	12	Random 5	Random 4	Unknown 1	Random 2
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	50%	20%	40%	33%	20%	0%	60%	0%	100%	100%	0%
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	25%	0%	0%	0%	0%	0%	20%	0%	0%	0%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	W1	W2	W3
			VERTEBRATES					
Yes	Vicinity	Blue Jay	Cyanocitta cristata	Blue Jay	Eukaryota;Chordata;Aves;Passeriformes;Corvidae;Cyanocitta;Cyanocitta cristata	0%	100%	0%
Yes	Occupy	Raccoon	Procyon lotor	Raccoon	Eukaryota;Chordata;Mammalia;Carnivora;Procyonidae;Procyon;Procyon lotor	0%	0%	100%
			ALL OTHER ORGANISMS					
No			Eukaryota	Eukaryota	Eukaryota	0%	100%	100%
No			Lumbricus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus	0%	100%	0%
No			Lumbricus rubellus	Clitellata	Eukaryota;Annelida;Clitellata;Haplotaxida;Lumbricidae;Lumbricus;Lumbricus rubellus	0%	100%	0%
No			Arthropoda	Arthropods	Eukaryota;Arthropoda	0%	100%	0%
No			Culicidae	Mosquito	Eukaryota;Arthropoda;Insecta;Diptera;Culicidae	0%	100%	0%
No			Syrphidae	Hoverfly	Eukaryota;Arthropoda;Insecta;Diptera;Syrphidae	0%	100%	0%
No			Ichneumonidae	Ichneumonid	Eukaryota;Arthropoda;Insecta;Hymenoptera;Ichneumonidae	0%	0%	100%
No			Hesperiidae	Indet. Skipper	Eukaryota;Arthropoda;Insecta;Lepidoptera;Hesperiidae	0%	0%	100%
No			Decapoda	Crabs	Eukaryota;Arthropoda;Malacostraca;Decapoda	0%	100%	0%
No			Cyclopidae	Arthropods	Eukaryota;Arthropoda;Maxillopoda;Cyclopoida;Cyclopidae	0%	100%	0%
No			Acanthocyclops	Arthropods	Eukaryota;Arthropoda;Maxillopoda;Cyclopoida;Cyclopidae;Acanthocyclops	0%	100%	0%
No			Podocopida	Mussel Shrimp	Eukaryota;Arthropoda;Ostracoda;Podocopida	0%	100%	0%
No			Heterocypris incongruens	Mussel Shrimp	Eukaryota;Arthropoda;Ostracoda;Podocopida;Cyprididae;Heterocypris;Heterocypris incongruens	0%	100%	0%
No			Podocopida sp. BOLD:AAH0903	Mussel Shrimp	Eukaryota;Arthropoda;Ostracoda;Podocopida;NA;NA;Podocopida sp. BOLD:AAH0903	0%	100%	0%
No			Ascomycota	Ascomycete	Eukaryota;Ascomycota	0%	0%	100%
No			Opegrapha vulgata	Olive Scribble Lichen	Eukaryota;Ascomycota;Arthoniomycetes;Arthoniales;Opegraphaceae;Opegrapha;Opegrapha vulgata	0%	0%	100%
No			Capnodiales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales	0%	0%	100%
No			Cladosporium	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium	0%	100%	100%
No			Cladosporium sp. BM-2009-5	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium sp. BM-2009-5	0%	100%	100%
No			Cladosporium tenuissimum	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Cladosporiaceae;Cladosporium;Cladosporium tenuissimum	0%	100%	100%
No			Cercospora sojina	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Capnodiales;Mycosphaerellaceae;Cercospora;Cercospora sojina	0%	0%	100%
No			Pleosporales	Ascomycete	Eukaryota;Ascomycota;Dothideomycetes;Pleosporales	0%	0%	100%
No			Eurotiales	Ascomycete	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales	0%	0%	100%
No			Penicillium sclerotiorum	Blue Mould Rot	Eukaryota;Ascomycota;Eurotiomycetes;Eurotiales;Aspergillaceae;Penicillium;Penicillium sclerotiorum	100%	100%	100%
No			Tetracladium	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium	0%	0%	100%
No			Tetracladium furcatum	Ascomycete	Eukaryota;Ascomycota;NA;NA;NA;Tetracladium;Tetracladium furcatum	0%	0%	100%
No			Sordariomycetes	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes	0%	0%	100%
No			Colletotrichum	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum	0%	100%	0%
No			Colletotrichum acutatum	Hakea Gummosis Fungus	Eukaryota;Ascomycota;Sordariomycetes;Glomerellales;Glomerellaceae;Colletotrichum;Colletotrichum acutatum	0%	100%	0%
No			Hypocreales	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales	0%	0%	100%
No			Trichoderma	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Hypocreaceae;Trichoderma	0%	0%	100%
No			Cylindrodendrum hubeiense	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Cylindrodendrum;Cylindrodendrum hubeiense	0%	100%	0%
No			Fusarium	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium	100%	100%	100%
No			Fusarium mangiferae	Pyrenomycete	Eukaryota;Ascomycota;Sordariomycetes;Hypocreales;Nectriaceae;Fusarium;Fusarium mangiferae	0%	100%	0%

Include?	Potential to occur at scupper	Probable Species	latin_name	common_name	taxonomic_path	W1	W2	W3
No			Nitzschia	Diatom	Eukaryota;Bacillariophyta;Bacillariophyceae;Bacillariales;Bacillariaceae;Nitzschia	0%	100%	0%
No			Nitzschia palea	Diatom	Eukaryota;Bacillariophyta;Bacillariophyceae;Bacillariales;Bacillariaceae;Nitzschia;Nitzschia palea	0%	100%	0%
No			Chlamydomonadales	Chlorophycean Green Algae	Eukaryota;Chlorophyta;Chlorophyceae;Chlamydomonadales	0%	100%	0%
No			Dinophyceae	Dinoflagellates	Eukaryota;NA;Dinophyceae	0%	100%	0%
No			Ostreopsis	Dinoflagellates	Eukaryota;NA;Dinophyceae;Peridiniales;Ostreopsidaceae;Ostreopsis	0%	100%	0%
No			Pfiesteriaceae	Dinoflagellates	Eukaryota;NA;Dinophyceae;Peridiniales;Pfiesteriaceae	0%	100%	0%
No			Pfiesteriaceae sp. CCMP1879	Dinoflagellates	Eukaryota;NA;Dinophyceae;Peridiniales;Pfiesteriaceae;NA;Pfiesteriaceae sp. CCMP1879	0%	100%	0%
No			Pfiesteriaceae sp. CCMP1958	Dinoflagellates	Eukaryota;NA;Dinophyceae;Peridiniales;Pfiesteriaceae;NA;Pfiesteriaceae sp. CCMP1958	0%	100%	0%
No			Vermamoeba vermiformis	Vermamoeba vermiformis	Eukaryota;NA;NA;NA;Hartmannellidae;Vermamoeba;Vermamoeba vermiformis	0%	100%	0%
No			Lagenidium sp. DAOM 242348	Lagenidium sp. DAOM 242348	Eukaryota;NA;Oomycetes;Lagenidiales;Lagenidiaceae;Lagenidium;Lagenidium sp. DAOM 242348	0%	100%	0%
No			Pythium	Pythium	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium	0%	0%	100%
No			Pythium monospermum	Pythium monospermum	Eukaryota;NA;Oomycetes;Pythiales;Pythiaceae;Pythium;Pythium monospermum	0%	100%	0%
No			Bdelloidea	Rotifer	Eukaryota;Rotifera;Bdelloidea	0%	0%	100%
No			Tribonema aequale	Tribonema aequale	Eukaryota;Xanthophyceae;NA;Tribonematales;Tribonemataceae;Tribonema;Tribonema aequale	0%	100%	0%