



Inventory of Reptiles in Capitol Reef National Park



Long-nosed Leopard Lizard (*Gambelia wislizenii*) at Capitol Reef National Park.

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Inventory of Reptiles in Capitol Reef National Park

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Contents

	Page
Figures.....	iv
Tables.....	v
Abstract.....	vi
Acknowledgments.....	vii
Introduction.....	1
Background.....	1
Specific Project Goals	2
Methods.....	3
Literature and Data Review	3
Sample Design.....	4
Study Area	4
Transect Selection	6
Targeted Sampling Site Selection	6
Data Collection.....	8
Results.....	10
Ackland Springs	11
Bitter Springs Creek	14
Fremont River.....	16
Oak Creek.....	20
Pleasant Creek	22
Spring Canyon.....	25
Conclusions and Recommendations	27
Restoration and Invasive Species	27
Visitor Use.....	30
Literature Cited	32
Appendix.....	33

Figures

	Page
Figure 1. Capitol Reef survey locations and polygons.	5
Figure 2. Drift fence layout. Tubes passing through fence are 4" PVC with plastic funnels in the ends. Tubes running parallel to drift fence are metal minnow traps.	7
Figure 3. Image of drift fence from Capitol Reef National Park.	8
Figure 4. Survey area for the Ackland Springs survey location.	13
Figure 5. Survey area and polygon for Bitter Spring Creek survey location.	15
Figure 6. Survey area and polygon for the Fremont River survey location.	17
Figure 7. Zoomed in map of Fruita Campground section of the Fremont River corridor polygon.	18
Figure 8. Zoomed in image of the eastern half of the Fremont River corridor polygon.	19
Figure 9. Survey area and polygon for the Oak Creek survey location.	21
Figure 10. Survey area and polygon for the Pleasant Creek survey location.	23
Figure 11. Zoomed in map of the Pleasant Creek polygon.	24
Figure 12. Survey area and polygon for the Spring Canyon survey location.	26
Figure 13. Animals by Ecosystem Class.:	30
Figure 14. Photograph of <i>Aspidoscelis tigris</i>	33
Figure 15. Photograph of <i>Coluber taeniatus</i>	34
Figure 16. Photograph of <i>Gambelia wislizenii</i>	34
Figure 17. Photograph of <i>Pituophis catenifer</i>	35
Figure 18. Photograph of <i>Sceloporus graciosus</i>	35
Figure 19. Photograph of <i>Sceloporus tristichus</i>	36
Figure 20. Photograph of <i>Thamnophis elegans</i>	36
Figure 21. Photograph of <i>Uta stansburiana</i>	37

Tables

	Page
Table 1. Predicted or possible reptile species present in surveyed areas based on multiple sources.....	3
Table 2. Summary of Capitol Reef National Park reptile survey.....	10
Table 3. Survey type, effort, and results for Capitol Reef National Park reptile survey.....	10
Table 4. Total number of individual animals by species found in Capitol Reef National Park reptile survey.	11
Table 5. List of species observed by location.	12
Table 6. Number of animals per ecosystem class.	29

Abstract

Reptile fauna of Eastern Utah are historically understudied and yet represent important components of desert ecosystems. The Northern Colorado Plateau Network (NCPN) parks developed an inventory needs list in 2007 identifying amphibians and reptiles as high priority; this need was reaffirmed as a high priority in 2017 as a component of Inventories 2.0 scoping. Because these parks are managed for multiple uses (e.g., grazing as well as human visitation and recreation), lack of good data associated with herpetofauna could place local populations at risk. Key pieces of information such as species presence and distribution data are required for risk management decisions and to enhance management of these taxa. Grazing pre- National Environmental Policy Act analysis and lack of data have been identified as key needs at multiple NCPN localities. Capitol Reef National Park (CARE) was included in earlier herpetofauna inventory efforts by the NCPN (Platenberg and Graham 2003). However, CARE has identified the absence of good herpetofauna species presence and distribution data in riparian and water features as potential data gaps that might hinder management associated with visitation, restoration, and climate change. Work reported here was supported by the Inventory and Monitoring program and provides these critical data for CARE. We used a combination of standardized herpetological inventory tools as well as transect-based sampling to assess reptile presence at six locations identified by park personnel. These included areas around Ackland Springs, Spring Canyon, Pleasant Creek, Oak Creek, Bitter Spring Creek, and the Fremont River. As per recommendations in previous herpetofauna inventories and park personnel requests we used the presence of water features, riparian zones and other unique habitat elements to maximize the effectiveness of surveys and meet CARE management needs. We identified the presence of nine reptile species in target sites during a single field season in 2024. We also documented a range extension of the Long-nosed Leopard lizard (*Gambelia wislizenii*) at the Ackland Spring site. Our results suggest that water features and riparian zones at CARE appear to be important habitat for reptiles at CARE.

Acknowledgments

This project was made possible through the support from the National Park Service Inventory and Monitoring Division.

Introduction

Background

Reptiles and amphibians (herpetofauna) represent ecologically important fauna in terrestrial and aquatic habitats (Christoffel and Lepczyk 2012). However, these taxa are typically under-represented in wildlife studies, and their distribution and population status are poorly understood relative to groups such as large mammals or fish (Christoffel and Lepczyk 2012). Land managers now recognize the importance of assessing herpetofauna species as components of integrated management plans and there is increasing interest in generating species inventories and assessment of herpetofauna to prevent data gaps.

Capitol Reef National Park (CARE) is a member of the Northern Colorado Plateau Network (NCPN). CARE was included in the 2001–2002 NCPN Herpetofauna Inventory and was the subject of a two-year survey to develop a master inventory of reptiles and amphibians (Platenberg and Graham 2003). This study documented the presence of fifteen reptiles and four amphibians (Platenberg and Graham 2003). They recommended that three lizard species, Night lizard (*Xantusia vigilis*), Western Skink (*Eumeces skiltonianus*), and Chuckwalla (*Sauromalus obesus*), be placed on the park watch list for future inventory work and estimated that their inventory completeness was 83% for both reptiles and amphibians. They also reported that the completion of a herpetofauna inventory at CARE would likely require extensive survey person-hours and recommended species-focused habitat surveys to complete inventory work.

An NCPN inventory needs list developed in 2007 identified amphibians and reptiles as high priorities and this need was reaffirmed in 2017 as a component of Inventories 2.0 scoping. Because parks located in the NCPN are managed for multiple uses (e.g., grazing as well as human visitation and recreation) lack of good data associated with herpetofauna could place local populations at risk. Key pieces of information such as species presence and distribution data are required for risk management decisions and to ensure that loss of native herpetofauna species do not negatively impact ecosystem functioning. Current resource management at CARE identified the need for improved data on reptiles in critical areas of the park as part of the development of this project with the NCPN. Absence of good herpetofauna species presence and distribution data in specific areas of the park were identified as potential data gaps that might present risks associated with increased visitation and use of riparian zones and water features at CARE. In addition, current management concerns recognize potential conflicts between grazing and other human impacts with herpetofauna as well as the potential for negative impacts on native reptiles and amphibians in response to grazing and use. Work completed under this agreement expands efforts to close these data gaps and provide CARE and other NPS personnel with improved data and tools for herpetofauna assessment as well as meet specific management needs for individual management units.

This habitat survey addresses several management needs at CARE regarding disturbance from livestock, restoration and invasive species, and human visitation. Climate change is an overarching concern that affects many of these management applications. Information on reptiles will contribute to upcoming decisions related to climate change such as identifying climate refugia, managing

resilience and prioritizing management actions. Many reptile species are insectivorous and may be impacted by changes to insect availability or phenology associated with drought, habitat conversion to invasive plants, or climate change. Seeps, springs, and wetlands in desert environments may be hotspots of reptile diversity and may represent critical microhabitat for reptiles. Habitat changes associated with drought, habitat conversion to invasive plants, or climate change have the potential to negatively impact reptile populations and data reported here can be used to identify potential restoration areas for reptiles with an eye toward protection of climate refugia for wildlife like reptiles.

Specific Project Goals

The goals of this project were to conduct amphibian and reptile inventories in riparian/wetland areas to provide the park with spatially explicit data on the presence of these species to inform the proposed management activities below.

Restoration

Personnel at CARE are developing critical seep, spring, and wetland inventories to assess impact by livestock grazing and risk from climate change as well as identified targets for either restoration and/or protection. Habitat and site-specific data on CARE reptiles presented here will assist in the development of management plans associated with these sites.

Invasive Species

Personnel at CARE are also developing a long-term management plan associated with removal of invasive species and recovery of native vegetation. Data generated by this project can be used by CARE personnel to assess impacts of invasive removal as well as native recovery on reptiles at CARE.

Visitor Use

CARE is also in the process of developing front country and backcountry management plans. Spatially explicit reptile distribution and diversity data generated here will aid in the development of desired conditions, indicators, thresholds, and monitoring strategies, which are necessary for effective management plans.

Methods

Efforts associated with this project focused on quantifying species presence and distributions in specific selected areas at CARE rather than generating a final inventory of reptiles in the park. Work under this agreement incorporated three phases: (1) literature reviews of herpetofauna records from eastern/central Utah and Colorado and coordination with NPS personnel to finalize the sampling design and establish feasibility of access and timing to those sites, (2) field work and data collection in 2024, (3) data organization and analysis and generation of final species lists and distribution maps, as well as completion of this report. Initial literature reviews were used to identify changes to species taxonomy and/or nomenclature for NPS records, and we generated a list of species predicted to be present in study sites.

Literature and Data Review

Initial literature and data review included NPS materials (e.g., checklists), regional guidebooks, examination of naturalist records (inaturalist.org), as well as published scientific literature and agency reports when appropriate. We used best practices and accepted resources to ensure current taxonomy and nomenclature (e.g., Society for the Study of Amphibians and Reptiles: <https://ssarherps.org/>; The Center for North American Herpetology: <http://www.cnah.org/>) in generating predicted species lists (and final inventories).

Capitol Reef was formally surveyed as part of the 2001–2002 NCPN Herpetofauna Inventory (Platenberg and Graham 2003). We used their master list along with the park master species list, data from the iNaturalist and IUCN databases, as well as other published materials (e.g., McGinnis and Stebbins 2018) to generate a list of predicted herpetofauna species (Table 1). From this list we developed appropriate surveys and tools to assess those species and worked with NPS personnel to identify appropriate sites for assessments (GBIF 2024; IUCN 2024; NPS 2023). Global Biodiversity Information Facility (GBIF) data includes data from [GBIF.org](https://gbif.org) and inaturalist.org. We prioritized inventory assessments and habitat sampling over developing estimates of population size or density. Similarly, we focused on surveying multiple habitat types rather than exhaustive surveys of a single habitat. The exception to this strategy focused on habitats and sampling strategies that maximized the likelihood of identifying rare or cryptic species.

Table 1. Predicted or possible reptile species present in surveyed areas based on multiple sources. Species with two names list the accepted current nomenclature first, followed by the older name.

Family	Scientific Name	Common Name
Colubridae	<i>Coluber taeniatus</i> (Older name: <i>Mastecophis taeniatus</i>)	Striped Whipsnake
	<i>Hypsiglena chlorophaea</i> (Older name: <i>Hypsiglena torquata</i>)	Desert Night Snake
	<i>Lampropeltis californiae</i> (Older name: <i>Lampropeltis getula</i>)	California Kingsnake

Table 1 (continued). Predicted or possible reptile species present in surveyed areas based on multiple sources. Species with two names list the accepted current nomenclature first, followed by the older name.

Family	Scientific Name	Common Name
Colubridae (continued)	<i>Lampropeltis gentilis</i> (Older name: <i>Lampropeltis Triangulum</i>)	Milk Snake
	<i>Pituophis catenifer</i>	Gopher Snake
	<i>Rhinocheilus lecontei</i>	Long-nosed Snake
	<i>Tantilla hobartsmithi</i>	Smiths Black-headed Snake
	<i>Thamnophis elegans</i>	Terrestrial Garter Snake
Crotaphytidae	<i>Crotaphytus bicinctores</i>	Great Basin Collared Lizard
	<i>Gambelia wislizenii</i>	Long-nosed Leopard Lizard
Iguanidae	<i>Sauromalus ater</i>	Common Chuckwalla
	<i>Sceloporus graciosus</i>	Sagebrush Lizard
	<i>Sceloporus magister</i>	Desert Spiny Lizard
	<i>Sceloporus tristichus</i> (Older name: <i>Sceloporus undulatus</i>)	Plateau Fence Lizard
	<i>Urosaurus ornatus</i>	Ornate Tree Lizard
	<i>Uta stansburiana</i>	Common Side-blotched Lizard
Phrynosomatidae	<i>Phrynosoma hernandesi</i> (Older name: <i>Phrynosoma douglasii</i>)	Greater Short Horned Lizard
Scincidae	<i>Plestiodon skiltonianus</i> (Older name: <i>Eumeces skiltonianus</i>)	Western Skink
Teiidae	<i>Aspidoscelis tigris</i> (Older name: <i>Cnemidophorus tigris</i>)	Western Whiptail
	<i>Aspidoscelis velox</i>	Plateau Striped Whiptail
Viperidae	<i>Crotalus oreganus concolor</i> (Older name: <i>Crotalus viridis concolor</i>)	Midget Faded Rattlesnake
	<i>Crotalus viridis</i>	Prairie Rattlesnake
Xantusiidae	<i>Xantusia vigilis</i>	Desert Night Lizard

Sample Design

Study Area

Capitol Reef National Park is a 97,895-ha park in southern Utah. Capitol Reef National Park was established to protect the desert landscape, which includes the colorful canyons, the Fremont River, Navajo Sandstone formations, historical orchards, and the Waterpocket Fold – the largest exposed monocline in North America. The geographic scope of this project was limited to valleys and canyons which contained waterways and/or springs, including Ackland Springs, Bitter Spring Creek, Fremont River, Oak Creek, Pleasant Creek, and Spring Canyon (Figure 1).

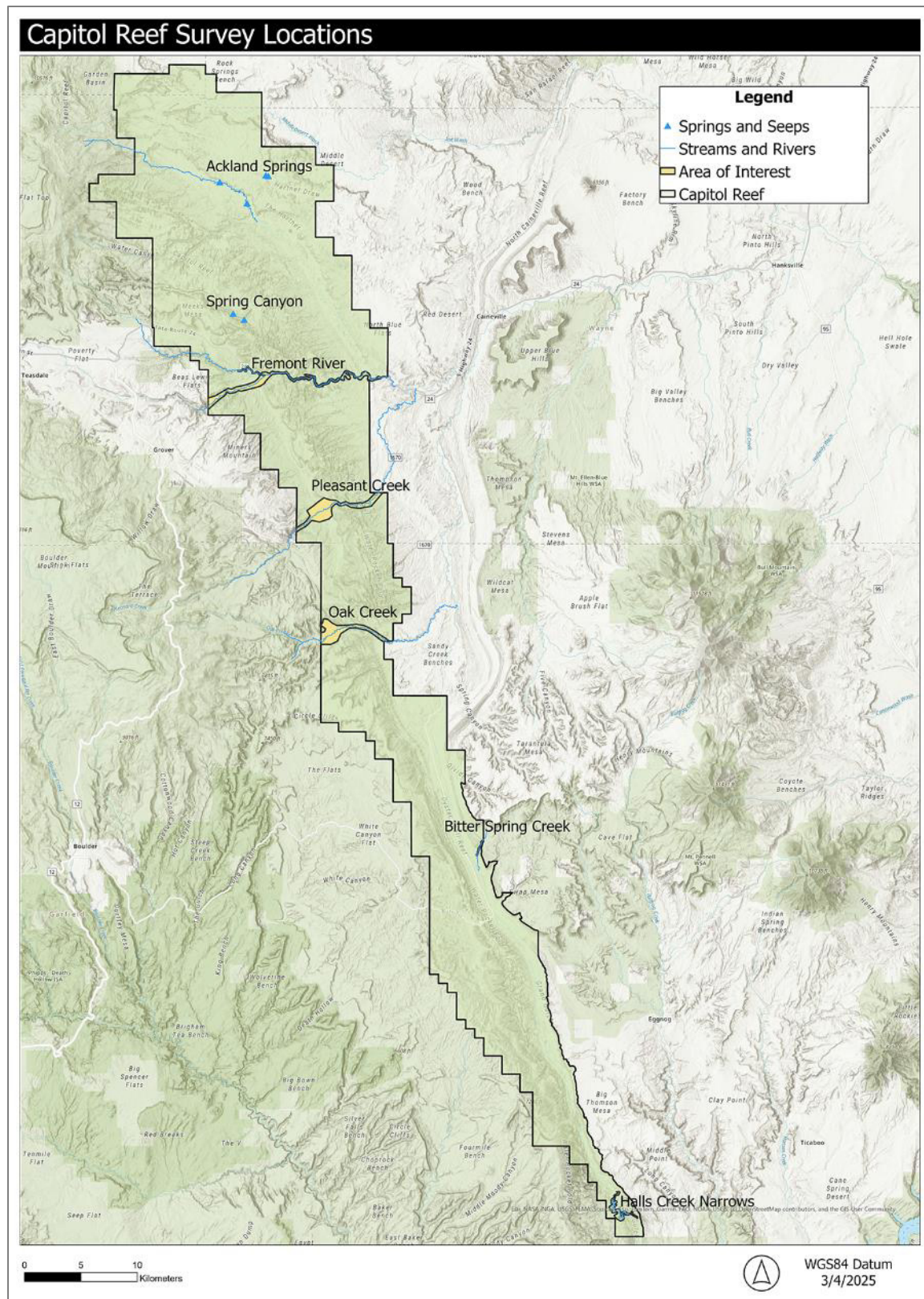


Figure 1. Capitol Reef survey locations and polygons.
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Areas of interest were provided by the park service. Specific sampling approaches were created in consultation with the park based on need and management questions. Two sample design approaches were used in this study: (1) transect surveys that cover areas of interest identified by the park, and (2) targeted habitat sampling with cover objects and drift fences.

Transect surveys allowed coverage of a wide range of microhabitats in survey regions and provided rigorous sub-sampling of large areas, whereas targeted sampling maximized the probability of finding rare or cryptic species. Broadly, efforts consisted of 75% effort associated with transects and 25% of survey effort dedicated to targeted sampling. Although outside the scope of this project, transect sampling provides data for future analyses to compare different areas of the park and could be used to generate predictive models of reptile distribution within CARE. Transect approaches are generally less effective at identifying rare or cryptic reptile species but data generated here provide a classic approach to sample microhabitats and reptile use of those habitats. We used targeted habitat sampling with artificial cover objects and drift fences with funnel traps to maximize capture rate of rare or cryptic species. These approaches maximized our chances of finding and identifying rare species that are also of potential management concern.

Transect Selection

Transect surveys covered roughly 235 hectares of the areas of interest (Figure 1). Areas of interest were chosen by park personnel and emphasized sites with water features such as riparian zones, seeps, and springs. Transects followed these water features when they were associated with riparian zones or were located around springs and seeps. Transects were created in ArcGIS Pro. Transects were up to 1000 meters in length. Where feasible, we placed parallel transects approximately 100 meters apart. We used ground truthing at locations to select which transects could be completed. The directional component of the vector was chosen to allow us to follow the topology of the location and avoid barriers such as canyon walls. If the shape of the polygon prevented transects from being 1000 m (e.g., sharp bends) they were shortened. Transects typically had three to five (up to seven) surveyors present. A transect lead followed a straight transect line using GPS. The remaining surveyors were spaced out from the lead, maintaining a distance between 15–30 meters between surveyors. Surveyors weaved along their lines, particularly to check unique microhabitats along the survey line (e.g., rock outcrops, fallen logs, etc.). We surveyed the full length of each transect unless it was unsafe to do so due to terrain or weather.

Targeted Sampling Site Selection

We used targeted sampling to determine placement of artificial cover objects (ACOs) and drift fences. Targeted sampling considered landscape features (e.g., rock formations or edge habitats) as well as habitat type at a given site or allotment (Lemm and Tobler 2021). This kind of targeted placement can increase the chance of identifying rare or cryptic species with low discovery rates and/or identifying species that are habitat limited.

We placed 30 cover objects within the park: nine in the Pleasant Creek drainage and 21 in the Fruita Orchards. We checked cover objects approximately every other week from March to May. Cover

object checks typically occurred in the evening beginning approximately two hours before dusk. We also included an end of season check of the Fruita orchards in September.

We placed three drift fences in the Pleasant Creek drainage. Drift fence traps were checked twice daily while deployed, except for the first and last days when they were checked once in the morning and once in the afternoon, respectively. We placed six plastic funnel traps through the drift fences, with eight metal minnow traps running along the fence (Figures 2 and 3). Cloth with sand was placed going up the slope of the funnels to create a more natural entrance into the traps. Drift fences near Pleasant Creek were approximately 30 m in length. To avoid archeological sites, and avoid permanent damage to a solid rock wash, we cut the Capitol Reef Field Station drift fence down to approximately 20 meters.

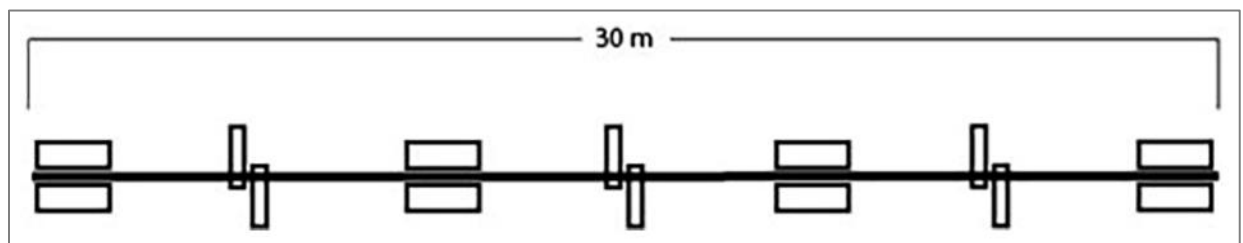


Figure 2. Drift fence layout. Tubes passing through fence are 4" PVC with plastic funnels in the ends. Tubes running parallel to drift fence are metal minnow traps.

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Figure 3. Image of drift fence from Capitol Reef National Park.
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Data Collection

Each unique survey was collected as an event as per National Park Service (NPS) guidelines. Events included start times, end times, and a GPS starting point. Transects also included a start and end location. Animals were recorded as an occurrence, as per NPS guidelines. Each occurrence was linked to the event in which they occurred. Occurrences also included time of occurrence and GPS location.

We collected temperature, biometric data (i.e., mass, snout to vent length, sex), and photographic vouchers for each occurrence when possible. Photos were taken on a white board with a black and white measuring ruler. We also collected up to two tail clips per species, one male and one female. Tail clips were stored in 90% EtOH and placed into a -80°C freezer as soon as possible (usually within a few days). Tail clips and photographs were collected as a non-lethal alternative to full specimen collection. This allowed us to collect vouchers and DNA for future study without euthanizing and removing animals from the park. Photographs and tail clips are stored at the Monte L. Bean Life Science Museum at Brigham Young University along with relevant geospatial data.

Survey area polygons were created in Google Earth using a combination of GPS data from landmarks, as well as GPS data from occurrences and events. Survey area polygons were created as soon as possible after finishing surveys (typically within 24 hours). Hectares surveyed and hectares of eco class were calculated in ArcGIS Pro.

Results

We conducted 44 walking transects between 21 March and 30 May 2024 for a total of 44.33 hours (192.75 person hours), covering a total of 235.26 hectares (Table 2). We also conducted five artificial cover object (ACO) checks and five drift fence trap checks (Table 3). We observed 196 animals representing nine of the 22 reptile species identified as being possible within the park (Table 4). We found 181 animals during transects, four animals under ACOs, one animal in a drift fence trap, and ten animals outside of normal survey methods (Table 3). We collected six tail clips and 59 photographic specimen vouchers (Table 4).

Table 2. Summary of Capitol Reef National Park reptile survey. Findings are separated by location. Number of species in parentheses indicate total number of possible species within the park.

Location	Hectares Sampled	Number of Animals	Animals per Hectare	Number of Species
Ackland Springs	10.9	19	1.7	5
Bitter Springs Creek	5.94	5	0.9	3
Fremont River	113.6	38	0.3	5
Oak Creek	9.42	5	0.5	2
Pleasant Creek	88.3	115	1.3	6
Spring Canyon	7.1	14	2.0	3
Total	235.26	196	0.8	9(22)

Table 3. Survey type, effort, and results for Capitol Reef National Park reptile survey.

Type	Number of Surveys	Time Spent	Percent of Effort	Number of Animals	Animals per Hour Surveyed
Transect	44	192.8	73.3	181	0.93
Artificial Cover Object	6	48.7	18.5	4	0.08
Drift Fence	5	18.9	7.2	1	0.05
Ad Hoc	9	2.6	1.0	10	3.85
Total	64	263.0	100	196	0.75

Table 4. Total number of individual animals by species found in Capitol Reef National Park reptile survey. M = male and F = female.

Species	Number of Animals	Tail Clip	Photographs
<i>Aspidoscelis tigris</i>	38	M	Y
<i>Aspidoscelis velox</i>	0	–	N
<i>Coluber taeniatus</i>	2	–	Y
<i>Crotalus oreganus</i>	0	–	N
<i>Crotalus viridis</i>	0	–	N
<i>Crotaphytus bicinctores</i>	0	–	N
<i>Gambelia wislizenii</i>	3	M/F	Y
<i>Hypsiglena chlorophaea</i>	0	–	N
<i>Lampropeltis californiae</i>	0	–	N
<i>Phrynosoma hernandesi</i>	0	–	N
<i>Pituophis catenifer</i>	1	–	Y
<i>Plestiodon skiltonianus</i>	0	–	N
<i>Rhinocheilus lecontei</i>	0	–	N
<i>Sauromalus ater</i>	0	–	N
<i>Sceloporus graciosus</i>	29	–	Y
<i>Sceloporus magister</i>	2	–	Y
<i>Sceloporus tristichus</i>	72	M/F	Y
<i>Tantilla hobartsmithi</i>	0	–	N
<i>Thamnophis elegans</i>	3	F	Y
<i>Urosaurus ornatus</i>	0	–	N
<i>Uta stansburiana</i>	46	–	Y
<i>Xantusia vigilis</i>	0	–	N
Total	196	6	59

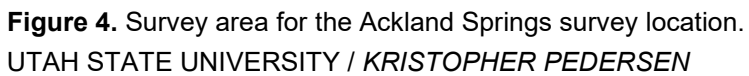
Ackland Springs

Ackland Springs consisted of two ephemeral springs located along Hartnet Cathedral Road. The habitat was a combination of semidesert shallow loam, semidesert gravelly loam, and alkali flat. We conducted surveys around the springs on 15 and 16 May 2024. We conducted a total of three transects, covering approximately 10.9 hectares (Table 2 and Figure 4). We observed a total of 19 reptiles, representing five species: Western Whiptail (*Aspidoscelis tigris*), Long-nosed Leopard Lizard (*Gambelia wislizenii*), Sagebrush Lizard (*Sceloporus graciosus*), Plateau Fence Lizard (*Sceloporus tristichus*), and Side-blotched Lizard (*Uta stansburiana*) (Table 5). We observed two *Gambelia wislizenii*, which is of particular interest as this is approximately 35 km outside of their listed range (IUCN 2024). This is consistent with data from [iNaturalist.org](https://www.iNaturalist.org), which shows multiple research grade observations of *G. wislizenii* in Cathedral Valley (GBIF 2024). We also collected

location data on tadpoles near the springs. While amphibians were not target species, they were considered targets of opportunity by the park.

Table 5. List of species observed by location.

Location	Species
Ackland Springs	<i>Aspidoscelis tigris</i>
	<i>Gambelia wislizenii</i>
	<i>Sceloporus graciosus</i>
	<i>Sceloporus tristichus</i>
	<i>Uta stansburiana</i>
Bitter Spring Creek	<i>Aspidoscelis tigris</i>
	<i>Coluber taeniatus</i>
	<i>Gambelia wislizenii</i>
	<i>Uta stansburiana</i>
Fremont River	<i>Aspidoscelis tigris</i>
	<i>Sceloporus magister</i>
	<i>Sceloporus tristichus</i>
	<i>Uta stansburiana</i>
	<i>Thamnophis elegans</i>
Oak Creek	<i>Aspidoscelis tigris</i>
	<i>Sceloporus tristichus</i>
Pleasant Creek	<i>Aspidoscelis tigris</i>
	<i>Coluber taeniatus</i>
	<i>Pituophis catenifer</i>
	<i>Sceloporus graciosus</i>
	<i>Sceloporus tristichus</i>
	<i>Uta stansburiana</i>
Spring Canyon	<i>Aspidoscelis tigris</i>
	<i>Sceloporus tristichus</i>
	<i>Uta stansburiana</i>



Bitter Springs Creek

Bitter Springs Creek consisted of a partially dry creek bed. The habitat was a combination of semidesert loam, semidesert gravelly loam, and semidesert shallow clay. Most of the creek bed was dry, but some slow flowing water was present near the eastern edge of the park boundary. We conducted surveys along the creek on 29 May 2024. We conducted a total of four transects, covering approximately 5.94 hectares of land (Table 2 and Figure 5). We found 5 animals, representing three species of reptiles: Western Whiptail, Striped Whipsnake (*Coluber taeniatus*), and Side-blotched Lizard (Table 5). We also collected location data on tadpoles, as well as collecting a single specimen identified under a microscope as Red-spotted Toad (*Anaxyrus punctatus*) (not listed in tables). While not a target of this study, amphibians were considered targets of opportunity to assist with an amphibian eDNA study also occurring within the monument.

Fremont River

Fremont River consisted of the Fremont River and the Fruita Orchards, located along the Fruita Campground and Highway 24. The habitat was a combination of semidesert stony loam, semidesert shallow loam, Colorado Plateau riparian complex, desert shallow loam, shallow sand rock pocket, and semidesert sand. We conducted surveys between 21 March and 17 May 2024. We conducted a total of 21 transects, covering approximately 113.6 hectares (Table 2 and Figures 6, 7, and 8). We also placed 21 artificial cover objects (ACOs) in and around the Fruita Orchards and Campground (Figure 6). We observed 38 animals, representing five species of reptiles: Western Whiptail, Desert Spiny Lizard (*Sceloporus magister*), Plateau Fence Lizard, and Side-blotched Lizard (Table 5). Interestingly, Western Terrestrial Garter Snakes (*Thamnophis elegans*) were not observed within the Fruita orchards during spring or summer surveys, but were repeatedly observed in the fall of 2023 during planning, and found under cover objects in the fall of 2024. This implies *T. elegans* disperse during the spring and summer but return to the orchards during the fall.

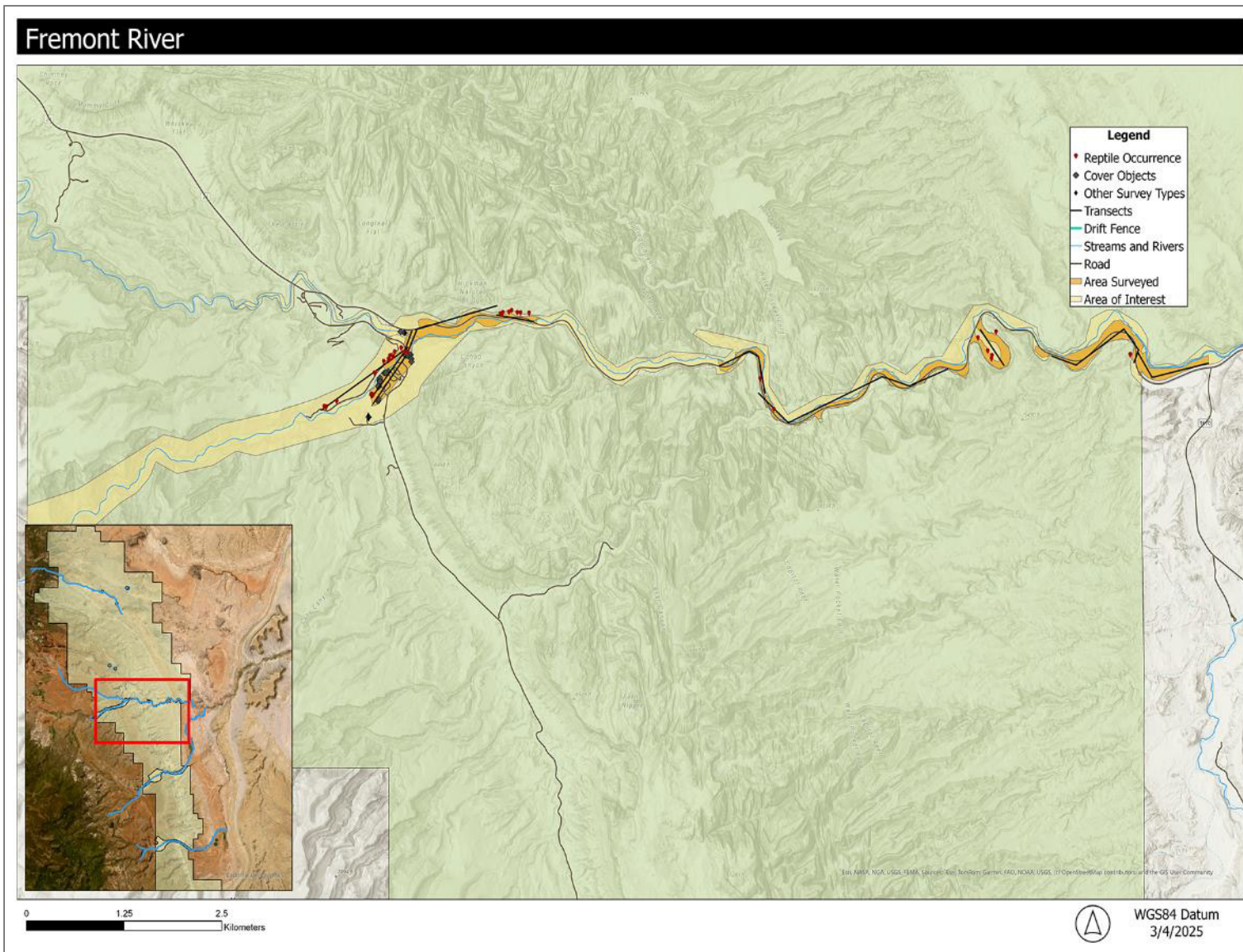


Figure 6. Survey area and polygon for the Fremont River survey location.
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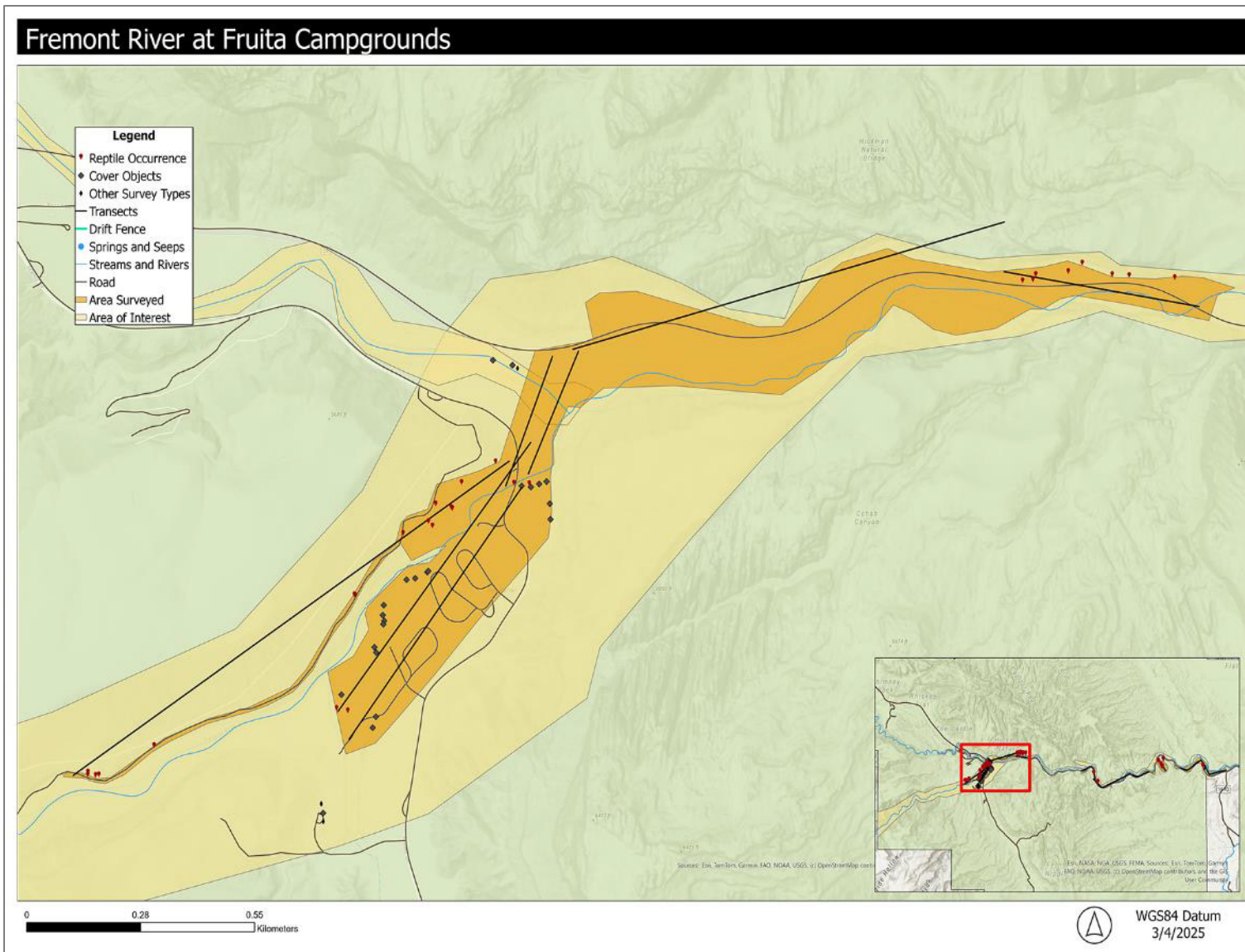


Figure 7. Zoomed in map of Fruita Campground section of the Fremont River corridor polygon.
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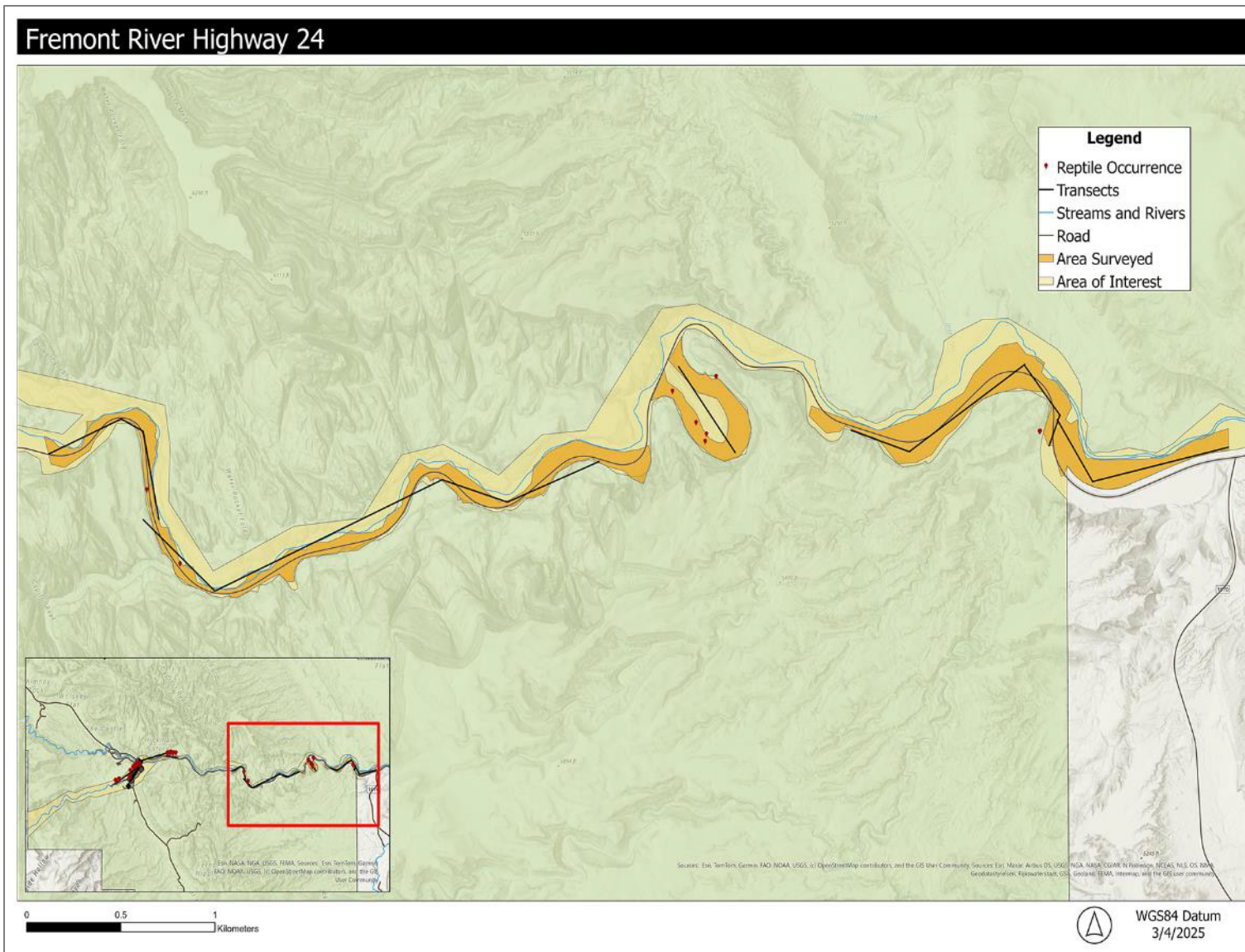


Figure 8. Zoomed in image of the eastern half of the Fremont River corridor polygon.
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Oak Creek

Oak creek consisted of the Oak Creek riparian zone. The habitat consisted of Colorado Plateau riparian complex and loamy bottom. We conducted surveys on 7 May 2024. We completed one transect, covering approximately 9.42 hectares (Table 2 and Figure 9). We found five animals, representing two reptile species: Western Whiptail and Plateau Fence Lizard. Surveys at Oak Creek were limited by a lack of access due to a combination of high water levels and sinking sand. In addition, we experienced weather hazards, such as high winds. Access from the western side of the park was limited by a control burn along the access route.

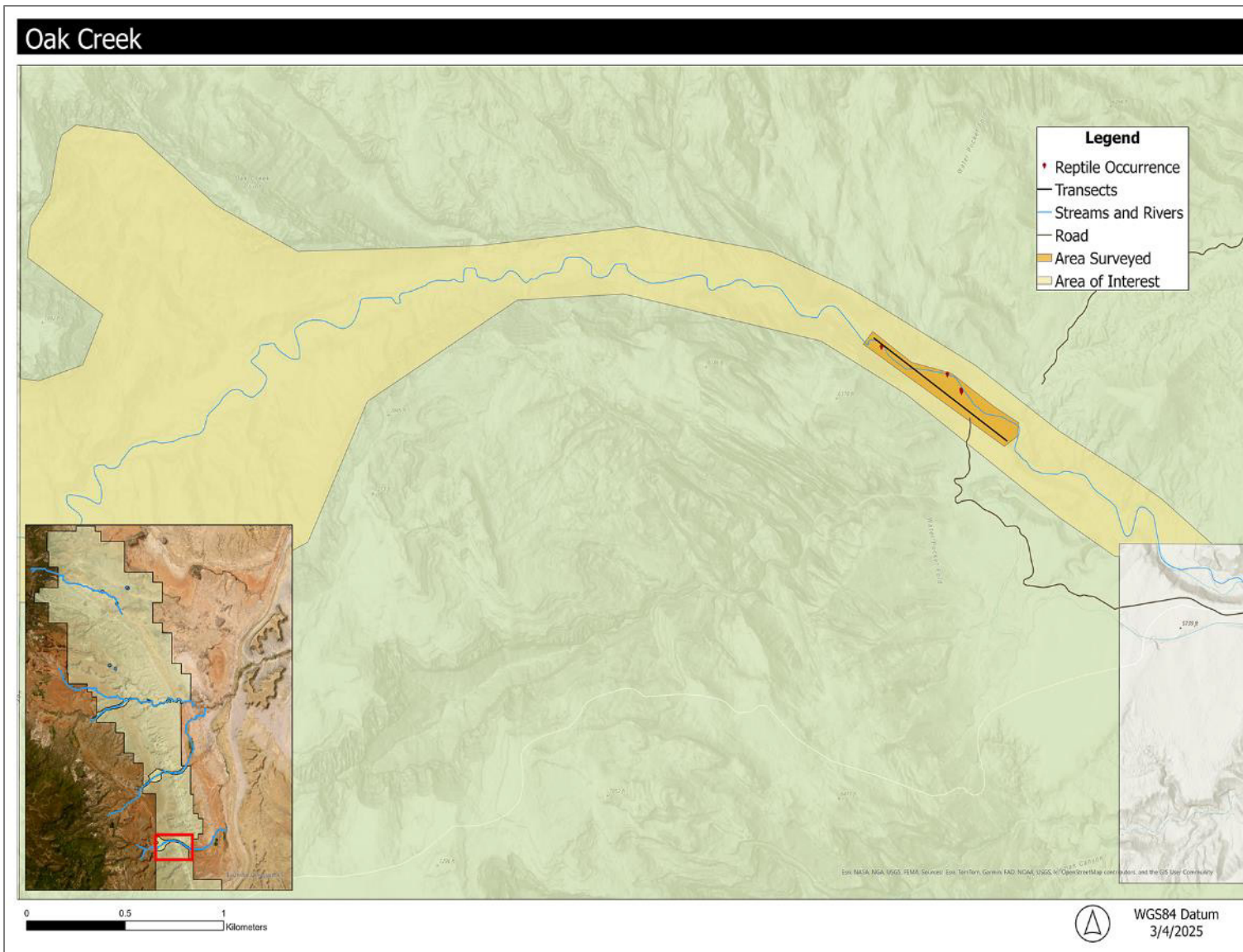


Figure 9. Survey area and polygon for the Oak Creek survey location.
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Pleasant Creek

Pleasant Creek consisted of the Pleasant Creek riparian zone, nearby sagebrush habitat, and the area near the Capitol Reef Field Station. The habitat consisted of Colorado Plateau riparian complex, semidesert stony loam, semidesert steep shallow loam, semidesert shallow loam, semidesert sandy loam, and desert shallow loam. We conducted surveys between 6 April and 18 May 2024. We conducted nine transects, covering approximately 88.3 hectares (Table 2 and Figure 10 and 11). We also placed nine cover objects and three drift fences in this location (Figure 10 and 11). We observed 118 animals, representing six species of reptiles: Western Whiptail, Striped Whipsnake, Gopher Snake, Sagebrush Lizard, Plateau Fence Lizard and Side-blotched Lizard (Table 5). Most animals observed in this location were in or near the riparian zone of the creek.

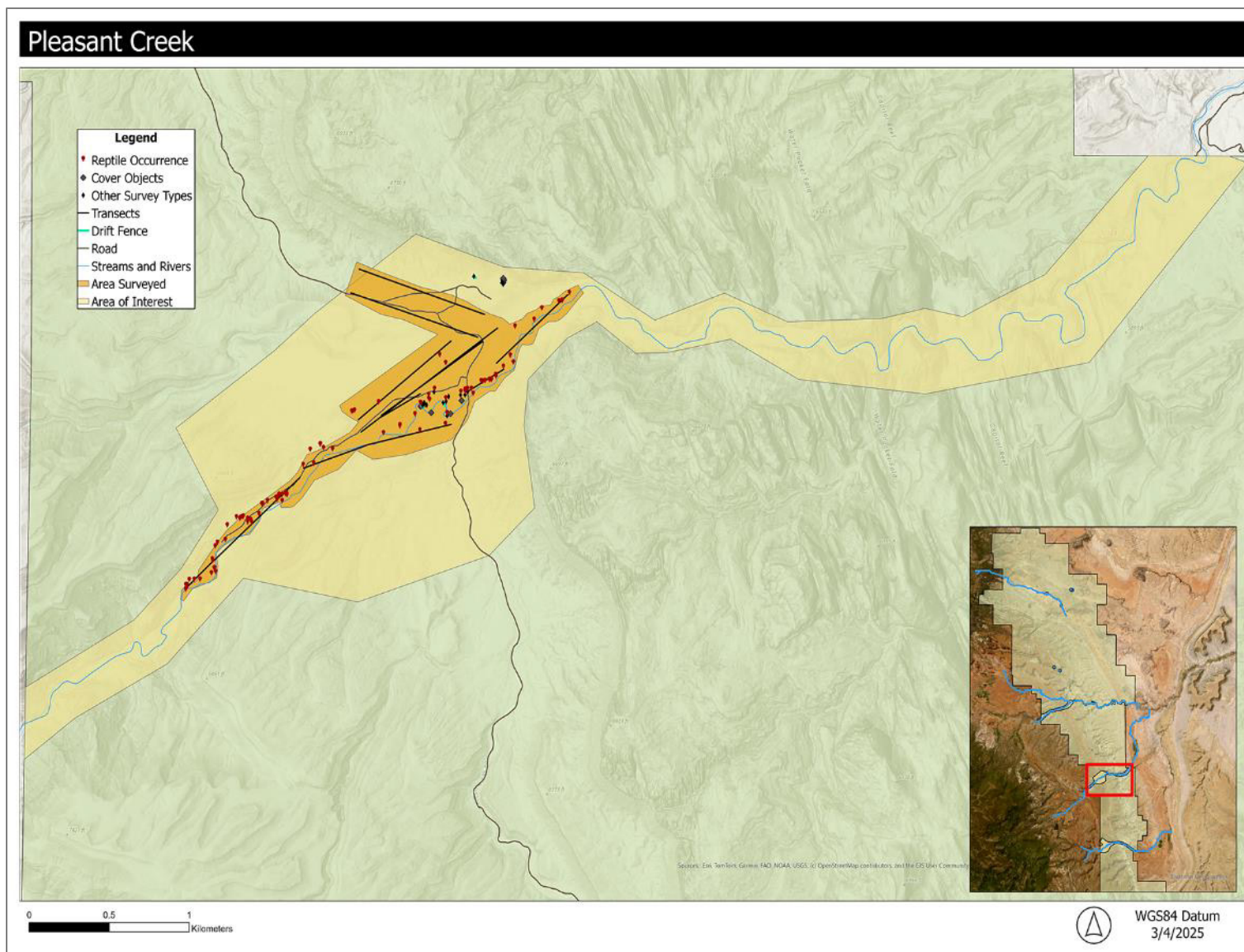


Figure 10. Survey area and polygon for the Pleasant Creek survey location.
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Spring Canyon

Spring Canyon consisted of Upper Spring Canyon from the Junction with Chimney Rock Canyon to approximately 200 meters past Spring Canyon Spring. The habitat consisted of ephemeral canyon scrub and semidesert shallow loam. The canyon was dry around the junction but had standing water closer to the spring. We conducted two transects, covering approximately 7.1 hectares (Table 2 and Figure 12). We observed 14 animals representing three species of reptiles: Western Whiptail, Plateau Fence Lizard, and Side-blotched Lizard (Table 5).

Conclusions and Recommendations

This habitat assessment will help address several management needs at CARE regarding potential disturbance from livestock, restoration efforts, invasive species, and human visitation. Work at CARE documented nine of the 23 possible species present on our CARE master species list (Tables 1 and 4). These species included common diurnal lizards that likely make up the largest component of reptile species and populations at CARE: Western Whiptail, *Aspidoscelis tigris*; Sagebursh Lizard, *Sceloporus graciosus*; Plateau Fence Lizard, *Sceloporus tristichus*; Side-blotched Lizard, *Uta stansburiana*. We also identified the presence of two less common species: Desert Spiny Lizard, *Sceloporus magister*, and Long-Nosed Leopard Lizard, *Gambelia wisilizenii*. All six of these species are present on the CARE master species list. The 2002 NCPN Herpetofauna Inventory (Platenberg and Graham 2003) also documented these as present at CARE although they used the older taxonomic descriptions: *Sceloporus undulatus* rather than *S. tristichus* for the Plateau Fence lizard (revised in 2009) and *Cnemidophorus tigris* instead of *Aspidoscelis tigris* for the Western Whiptail. Surveys at CARE identified three species of snakes: Gopher snake (*Pituophis catenifer*), Striped Whipsnake (*Coluber taeniatus*), and Terrestrial Gartersnake (*Thamnophis elegans*). All three of these species are on the CARE master list as well as documented in the 2002 NCPN inventory.

Restoration and Invasive Species

One of the goals of this project was to help guide potential restoration areas for reptiles and develop reptile inventories in critical seeps, springs, and wetlands. Data reported here will allow park personnel to assess potential impacts associated with livestock grazing and risk from climate change. Reptiles have traditionally been thought of as benefiting from climate change. More recent data, however, suggests warming temperatures can cause thermal stress to animals, which can reduce activity time and overall fitness. Data provided in Figures 5–12 and Table 5 provide site specific details about reptile presence/absence and distribution in target sites. The low species diversity identified in our surveys limits our ability to make broad recommendations about restoration and/or the impact of invasive species. However, our results suggest that seeps, springs, and riparian zones at CARE are important habitats for reptiles and that restoration of these sites would likely have positive effects on reptile populations. Of particular interest was Ackland Springs. We found multiple Long-nosed Leopard Lizards at this site during surveys. This location represents a small, approximately 35 km, expansion of the documented range of this species. As with many reptile species in the intermountain west, Long-nosed Leopard Lizards are understudied. The simplest explanation of our results is that the previous northern range of the species was incomplete and that more areas of CARE may provide suitable habitat for the species and maintain populations of this species. We specifically suggest that equivalent seeps at CARE may represent possible habitat for this species. Restoration efforts associated with Ackland and other seeps and springs might improve habitat for this species.

Also of note was the Freemont River corridor. This region included three species of common diurnal lizards—Western Whiptail (*Aspidoscelis tigris*), Plateau Fence Lizard (*Sceloporus tristichus*), and Side-blotched Lizard (*Uta stansburiana*)—as well as the less common diurnal Desert Spiny Lizard

(*Sceloporus magister*, Table 5). However, capture rates per hectare surveyed for all three species of common lizards were much lower (0.3 animals per hectare) than the Pleasant Creek site (1.3 animals per hectare, Table 2). Additionally, the main habitat type in the Fremont River corridor along highway 24 was Colorado Plateau Riparian Complex Perennial (Valley Type IV - C5/F5 Stream Types) which has a reptile density of 0.163 animals per hectare. Our other riparian zones, Colorado Plateau Riparian Complex Perennial (Valley Type IV - B4C Stream Type) and Colorado Plateau Riparian Complex Perennial (Valley Type VIII - B4C Stream Type) had reptile densities of 2.78 and 1.65 animals per hectare respectively (Table 6 and Figure 13). An explanation of these differences is beyond the scope of our data, but field crews identified two possible causes. First, the Fremont River corridor is the location of highway 24, the main travel route connecting the eastern and western halves of the park. Roads are known to have, through multiple mechanisms, detrimental effects on lizard populations (Paterson et al. 2021). Second, survey crews observed sections of Russian Thistle (*Salsola tragus*) and Tamarisk (*Tamarix chinesins*) throughout the Fremont River corridor. These invasive species were not observed in the Pleasant Creek corridor. Invasive plants have been shown to have negative effects on reptiles (Hall et al. 2009; Valentine et al. 2007). The Fremont River oxbow was also identified by Platenberg and Graham (2003) as historical habitat for two amphibian species no longer found within the park. While studies on desert habitat restoration are limited, the studies that exist show removal of Tamarisk in combination with restoration of native shrubs and trees can have positive effects on reptile populations (Mosher and Bateman 2016). Additionally, the patchy distribution of reptiles along this corridor means development, such as road improvements, should take high quality reptile habitat into consideration, as to not further reduce reptile populations.

Table 6. Number of animals per ecosystem class.

Ecosystem Class	Number of Animals	Area Surveyed	Animals per Hectare
Alkali Flat (Greasewood)	6	6.32	0.94
Colorado Plateau Riparian Complex Perennial (Valley Type IV - B4C Stream Type)	4	2.42	1.65
Colorado Plateau Riparian Complex Perennial (Valley Type IV - C5/F5 Stream Types)	17	104.03	0.163
Colorado Plateau Riparian Complex Perennial (Valley Type VIII - B4C Stream Type)	91	32.72	2.78
Desert Loam (Shadscale)	0	0.40	0
Desert Shallow Loam (Shadscale)	0	0.88	0
Desert Very Shallow Gypsum (Torrey's Jointfir)	0	0.14	0
Ephemeral Canyon Scrub	10	6.28	1.59
Semidesert Gravelly Loam (Shadscale)	18	9.58	1.88
Semidesert Sand (Fourwing Saltbush)	2	4.99	0.40
Semidesert Sandy Loam (Wyoming Big Sagebrush)	3	31.57	0.10
Semidesert Shallow Clay (Mat Saltbush)	0	0.01	0
Semidesert Shallow Loam (Utah Juniper-Pinyon)	6	9.71	0.62
Semidesert Steep Shallow Loam (Utah Juniper-Two-Needle Pinyon)	11	3.00	3.67
Semidesert Stony Loam (Utah Juniper-Pinyon)	22	19.98	1.11
Semidesert Very Steep Stony Loam (Two-Needle Pinyon, Utah Juniper)	0	0.2	0
Shallow Sand Rock Pocket (Utah Juniper/Two-Needle Pinyon)	3	2.84	1.06
Total	193	235.07	0.82

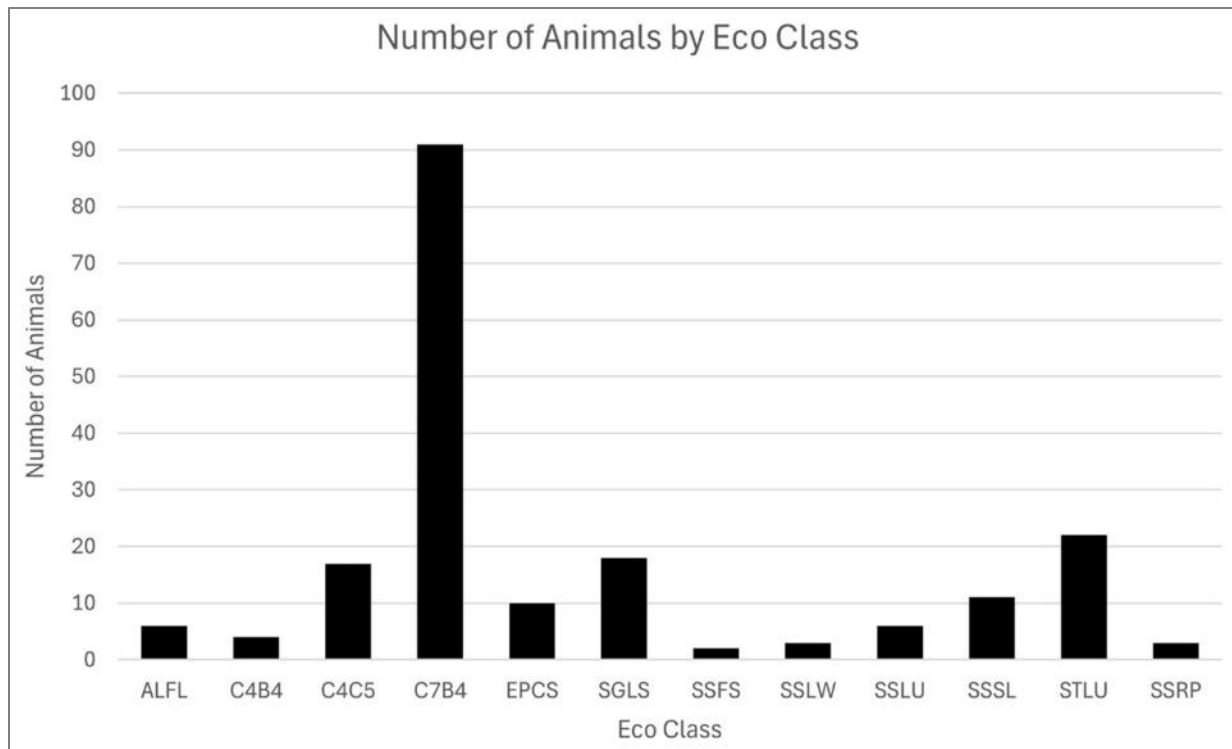


Figure 13. Animals by Ecosystem Class. Class abbreviations are ALFL: Alkali Flat (Greasewood), C4B4: Colorado Plateau Riparian Complex Perennial (Valley Type IV - B4C Stream Type), C4C5: Colorado Plateau Riparian Complex Perennial (Valley Type IV - C5/F5 Stream Types), C7B4: Colorado Plateau Riparian Complex Perennial (Valley Type VIII - B4C Stream Type), EPCS: Ephemeral Canyon Scrub, SGLS: Semidesert Gravelly Loam (Shadscale), SSFS: Semidesert Sand (Fourwing Saltbush), SSLW: Semidesert Sandy Loam (Wyoming Big Sagebrush), SSLU: Semidesert Shallow Loam (Utah Juniper-Pinyon), SSSL: Semidesert Steep Shallow Loam (Utah Juniper-Two-Needle Pinyon), STLU: Semidesert Stony Loam (Utah Juniper-Pinyon), SSRP: Shallow Sand Rock Pocket (Utah Juniper/Two-Needle Pinyon).

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Visitor Use

CARE is in the process of developing front country and backcountry management plans. Spatially-explicit reptile distribution and diversity data provided here will aid in the development of desired conditions, indicators, thresholds, and monitoring strategies, by providing a clearer picture of reptiles present at CARE, habitats that may be preferred by particular species as well habitats or sites that are being used by species of potential concern (e.g., Long-nosed Leopard Lizards). These data are provided in the results section and provide explicit information on species presence/absence and habitat associations. As expected, our use of targeted sampling and transects provided extensive data on common diurnal species in target sites at CARE. Except for Long-nosed Leopard Lizards and possibly Desert Spiny Lizards (see above), we did not identify the presence of species of concern such as the Greater Short-horned Lizard or the Great Basin Collared Lizard in our surveys.

Furthermore, road construction during the 2024 field season prevented ad-hoc road surveys along the Scenic Byway Road which prevented us from assessing reptile use of paved roads leading to areas of

concern such as the Pleasant Creek site. As a result, our ability to make recommendations associated with increased visitation are somewhat limited. However, we did identify back country regions of Pleasant Creek as areas with substantial reptile presence. Our recommendation would be for CARE personnel to potentially support longitudinal studies of reptile density in areas of increased visitation if species of concern are present.

While road running (driving slowly along paved roads looking for reptiles) was not possible due to construction, travel on the scenic byway was still required as part of the survey effort at Pleasant Creek. When travelling on the scenic byway, surveyors watched for basking snakes and/or roadkill. No reptiles were observed on the scenic byway during these trips. One possible reason for the absence of reptiles, and particularly snakes, on this road is the presence of slickrock. Platenburg and Graham (2003) noted that night road running in areas of slickrock yielded low results, likely due to slickrock maintaining higher temperatures than roads at night. However, a more accurate assessment of the effects of the scenic byway on reptiles would require further study.

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Appendix

Figures 14–21 show examples of species sampled during this study.



Figure 14. Photograph of *Aspidoscelis tigris*.
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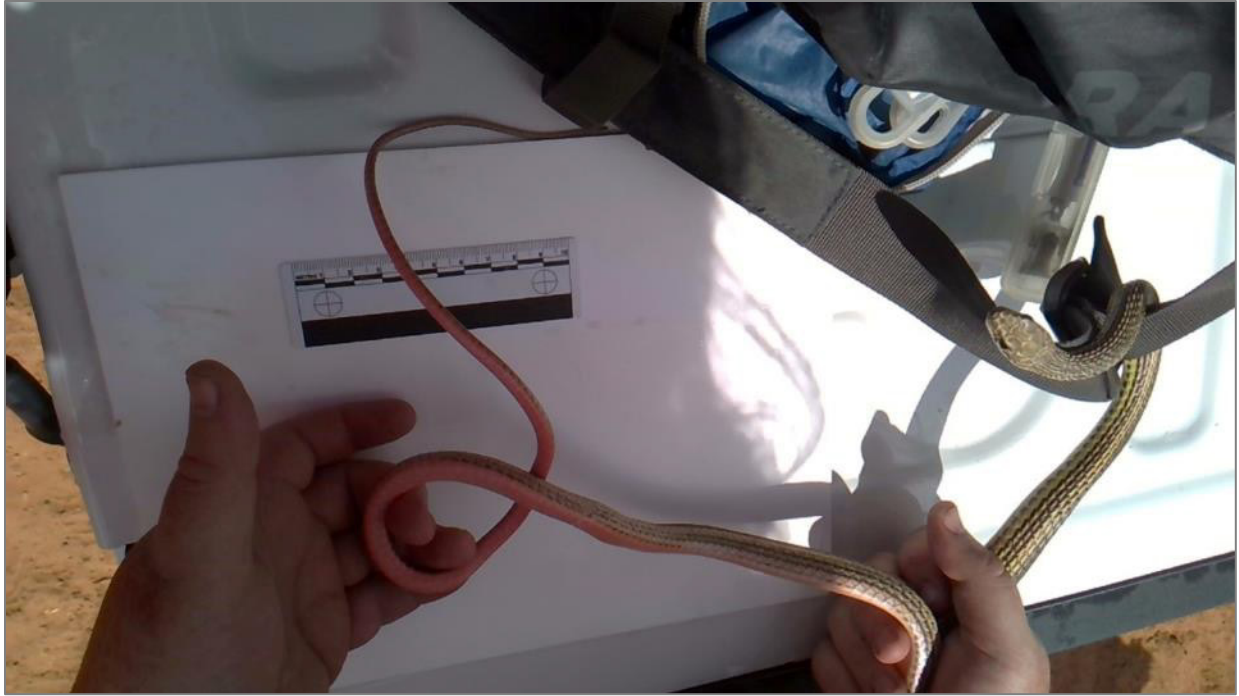


Figure 15. Photograph of *Coluber taeniatus*.
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Figure 16. Photograph of *Gambelia wislizenii*.
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Figure 17. Photograph of *Pituophis catenifer*.
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Figure 18. Photograph of *Sceloporus graciosus*.
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Figure 19. Photograph of *Sceloporus tristichus*.
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Figure 20. Photograph of *Thamnophis elegans*.
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Figure 21. Photograph of *Uta stansburiana*.
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