FINAL PERFORMANCE REPORT

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Seasonal Variation in Emergent Amphibian and Turtle Infectious Diseases in Oklahoma and Temporal Risk Assessment for Wildlife Conservation

Oklahoma Department of Wildlife Conservation

January 1, 2020 through June 30, 2024

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Grant Title: Seasonal Variation in Emergent Amphibian and Turtle Infectious Diseases in Oklahoma and Temporal Risk Assessment for Wildlife Conservation

Grant Period: January 1, 2020 – June 30, 2024

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Executive Summary:

This study, conducted from January 2020 to June 2024, represents the first comprehensive assessment of seasonal variation in amphibian and turtle infectious diseases in Oklahoma, with a focus on *Batrachochytrium dendrobatidis* (*Bd*) and ranavirus (RV). The research aimed to address critical knowledge gaps regarding the prevalence, seasonal trends, and taxonomic susceptibility of these pathogens, particularly among amphibian and turtle Species of Greatest Conservation Need (SGCN). Between 2021 and 2023, we conducted repeated seasonal surveys at two focal sites: the Ouachita National Forest and the Cookson Hills Wildlife Management Area, screening 917 amphibians and 20 turtles for *Bd* and/or RV. This work provided important insights into pathogen prevalence and the ecological dynamics shaping disease risks in Oklahoma's herpetofauna.

The findings revealed significant seasonal trends, with *Bd* prevalence peaking in spring and RV prevalence highest during summer. Taxonomic differences were notable, with amphibian families like Hylidae and Ranidae exhibiting higher susceptibility to *Bd*. Coinfections of *Bd* and RV, although less frequent, were documented, which highlighted the potential for compounded health impacts on vulnerable species. For turtles, RV was detected in 45% of the sampled individuals, with all three of the screened species having some individuals that tested positive. These results underscore the need for broader pathogen surveillance across amphibian and reptile populations in the state, particularly among pre-metamorphic amphibians and both aquatic and non-aquatic turtle species.

Overall, the results of this project underscore the critical importance of continued, long-term monitoring, targeted conservation strategies, and public education to mitigate disease impacts on native amphibians and reptiles in Oklahoma. Future efforts should prioritize expansion of wildlife pathogen surveillance initiatives in the state, along with habitat restoration, development of localized management practices, and increased public awareness, to address the dual

challenges of infectious diseases and environmental change that threaten Oklahoma's biodiversity.

BACKGROUND AND NEED:

The Oklahoma Department of Wildlife Conservation has designated 16 amphibian species as "Oklahoma's Species of Greatest Conservation Need" (SGCN) (Appendix E: Oklahoma Comprehensive Wildlife Conservation Strategy, 2015). Among these, six species are listed as Tier I (Grotto Salamander, Kiamichi Slimy Salamander, Oklahoma Salamander, Rich Mountain Salamander, Ringed Salamander, and Sequoyah Slimy Salamander), and seven as Tier II (Crawfish Frog, Many-ribbed Salamander, Ouachita Dusky Salamander, Ozark Zigzag Salamander, Southern Red-backed Salamander, Three-toed Amphiuma, and Western Lesser Siren). Additionally, nine native turtles in Oklahoma are designated as SGCN species, including one Tier I (Alligator Snapping Turtle), one Tier II (Chicken Turtle), and seven Tier III (False Map Turtle, Northern Map Turtle, Ouachita Map Turtle, Razor-backed Musk Turtle, River Cooter, Smooth Softshell Turtle, and Spiny Softshell Turtle) species. Despite the recognized global threat of infectious diseases on the survival of amphibians and reptiles, until recently, baseline information on any infectious diseases in Oklahoma was limited or nonexistent (Watters et al., 2016, 2018, 2019; Marhanka et al., 2017; Davis et al., 2019; Smith et al., 2019).

On a worldwide scale, approximately one-third of amphibian species and one-quarter of reptile species are facing endangerment or extinction (Stuart et al., 2004; IUCN, 2013). As an example, in the United States alone, one-quarter of all turtle species are currently protected under the Endangered Species Act (IUCN, 2013). Many factors are contributing to this global biodiversity crisis, including habitat loss and alteration most notably (Homan et al., 2013), and one of the growing concerns has been the emergence of infectious diseases, particularly the fungi *Batrachochytrium dendrobatidis* (*Bd*, infecting all amphibians) and *Batrachochytrium salamandrivorans* (*Bsal*, infecting salamanders only), and a group of viruses known as ranaviruses (RV) (Daszak et al., 2003; Schloegel et al., 2010; Miller et al., 2011). Most alarming is how both fungal and viral pathogens are linked to amphibian population declines in some seemingly pristine habitats (Wake & Vredenburg, 2008). Furthermore, ranaviruses are now known to infect three distinct classes of ectothermic vertebrates, with transmission between all three groups (amphibians, reptiles, and bony fish; Brenes et al., 2014; Currylow et al., 2014) and have been linked to die-offs and population declines in turtle populations in the United States (Johnson et al., 2008; Chinchar et al., 2009, 2014).

In North America, the strains of chytrid fungus detrimental to frogs (*Bd*) have been present for at least the last half century (Ouellet et al. 2005), and in the United States, both *Bd* and ranavirus have been documented at sites from sea level to high elevations (Lannoo et al., 2011). Following a three-year research project on Oklahoma amphibian infectious diseases, funded through the State Wildlife Grants program (grant F14F01225 / T-80-1), we have confirmed a high prevalence of disease among amphibian populations across much of the state. Unfortunately, even with the growing body of literature documenting both *Bd* and ranavirus among amphibian species in the region (Watters et al., 2016, 2018, 2019; Marhanka et al., 2017; Davis et al., 2019; Smith et al., 2019), this baseline information represents only a *snapshot* of disease prevalence and infection load. Although we know these two pathogens are present in the state, we have no data regarding the long-term impact these diseases will have on native populations. Additionally, little is known about how the two pathogens work in conjunction within individuals who are infected with both simultaneously (Watters et al., 2018), and no studies to date have screened for ranavirus in turtle populations in Oklahoma.

For ectotherms such as amphibians and turtles, seasonal fluctuations in environmental conditions can affect their ability to respond to external stressors (Maniero and Carey, 1997; Jozkowicz and Plytycz, 1998; Raffel et al., 2006; Terrell et al., 2013). For such organisms, abiotic conditions strongly influence immune system function and may affect the susceptibility of these terrestrial vertebrates to infectious disease (Maniero and Carey, 1997; Carey et al., 1999; Rojas et al., 2005; Raffel et al., 2006). For example, changes in temperature and humidity can cause a temporary suppression of amphibian immune systems, leading to a weakened immune response during periods of extreme temperature variation (Maniero and Carey, 1997; Rollins-Smith et al., 2002; Raffel et al., 2006). Studies have shown that colder temperatures suppress amphibian immune responses by reducing antibody production and inhibiting the activity of specific vital organs, such as the thymus, spleen, and jugular bodies (Green and Cohen, 1977; Cooper et al., 1992; Miodonski et al., 1996; Maniero and Carey, 1997; Carey et al., 1999). Furthermore, a recent study revealed that mortality rates among salamander hosts were highest at lower environmental temperatures, as their immune responses were suppressed, allowing for pathogen virulence to increase despite depressed infection loads (Rojas et al., 2005; Todd-Thompson, 2010). With a recognized relationship between climatic variation and immune response, investigating seasonal patterns of pathogen infection among amphibian and turtle populations in Oklahoma is of critical importance to conservation assessments and strategic planning for small or vulnerable populations.

Through this multi-year, repeated, seasonal (Spring, Summer, Fall) screening effort at focal sites in Oklahoma, our project aimed to address gaps in our understanding of seasonal trends of infectious diseases among amphibian and turtle populations and their implications. Specifically, the goals of this study were to address two core questions: *(1) Are there seasonal patterns in amphibian and turtle infectious disease prevalence in Oklahoma? (2) Are infection rates stable, increasing, or decreasing among native species in the state?*

This study expanded upon the findings of our previously-funded amphibian disease grant that carried out a series of one-time assessments of *Bd* and ranavirus in amphibian populations across most of the state. In this current study, the two surveillance sites were surveyed repeatedly across seasons and years, and they were selected to represent different ends of a perceived spectrum of pathogen threat based upon our previous work. One site previously showed a lower overall disease prevalence (Ouachita National Forest, Le Flore Unit) and the other site had moderate infection rates for both chytrid and ranavirus (Cookson Hills Wildlife Management Area).

OBJECTIVE:

<u>Objective 1</u> (TRACS Strategy – Research, Survey, Data Collection and Analysis)
Conduct 1 investigation by June 30, 2023.

- Activity Tag 1: Fish/wildlife disease assessment data acquisition and analysis
    - Target Species Types: Frogs, salamanders and aquatic turtles

Specific Sub-Objectives

Objective 1: To conduct a multi-year study of disease prevalence and load at three distinct sites in Oklahoma.

Objective 2: Track seasonal patterns in the presence and emergence of amphibian and turtle infectious disease, with particular emphasis on species of greatest conservation concern.

Objective 3: To monitor focal communities of organisms for increasing signatures of disease threat (increased prevalence) over time.

APPROACH:

Field surveys

The PIs, along with graduate and undergraduate research assistants, coordinated activities with Cookson Wildlife Management Area and Ouachita National Forest biologists to determine the timing of surveys each year. Independent disease surveys were conducted at the two primary focal sites between the spring of 2021 and the fall of 2023. Fourteen of the originally planned 18 seasonal pathogen surveillance surveys were completed (seven at Cookson WMA and seven on the Ouachita National Forest) as follows: Cookson WMA: 2021 (April, June), 2022 (April, July, October), 2023 (April/May, October); Ouachita National Forest: 2021 (April, June, October), 2022 (April, June, October), 2023 (March). For illustrative purposes and to help visualize the temporal patterns of amphibian diseases across a longer sampling period, we included additional data in some of our analyses. We compiled data that had been collected at both study sites in April of 2015 under our previous grant (F14F01225 / T-80-1) and screened swabs that were collected during a museum-funded, independent survey to Cookson WMA in April of 2018 and included those data. We did this in order to increase the sample sizes for the analysis of *Bd* and ranavirus prevalence in amphibians. Originally, we had planned to conduct seasonal surveillance surveys at three study sites; however, we discontinued our planned surveys at the study site in south-central Oklahoma as described in the **Significant Deviations** section of this report.

Each pathogen surveillance trip lasted 4 - 5 days, with a minimum of three researchers participating in each trip. Each field team was composed of Cameron Siler, Jessa Watters, Katharine Marske, and two or more graduate students, and/or undergraduate students from the University of Oklahoma. Students were trained fully by Cameron Siler and Jessa Watters in methods for amphibian and turtle capture as recommended by the Partners in Amphibian and Reptile Conservation partnership (Graeter et al., 2013), species identification, disease sampling, and tissue and specimen preservation prior to their first trip.

Amphibian and turtle populations at each focal site were surveyed during each seasonal site visit, and each captured individual was swabbed so that those swabs could be screened for *Bd* and ranavirus (amphibians) or ranavirus only (turtles) infections. Most of the sampling occurred at night during peak amphibian activity; however, live turtle traps were set in the late afternoon/early evening and checked immediately the following morning. At each focal site, we sampled all accessible aquatic habitats (i.e., ponds, streams, wetlands). Surveys of amphibians involved the use of dipnets or seines in streams, ponds, and wetlands, or visual searches of terrestrial microhabitats in areas adjacent to the surveyed water sources. Surveys of turtles involved a combination of baited promar collapsible live crayfish traps, square turtle traps, and large hoop nets. These active sampling methods are recommended by researchers B. Todd, X. Glaudas, and the PARC partnership as effective techniques for determining species composition in homogeneous aquatic habitats (Graeter et al., 2013). We recorded and described all amphibians and reptiles that were encountered. For *Bd* and/or ranavirus screening, we made an effort to collect disease samples from at least 15 individuals per species at each site, allowing for a more statistically meaningful measure of disease prevalence (Lannoo et al., 2011).

Amphibians were placed individually into new plastic bags prior to tissue sampling to avoid cross-contamination between samples. Bags were disposed of after each use. Turtles were placed individually in buckets or cloth bags temporarily before screening. Amphibians were sampled for *Bd* using a noninvasive and widely used swabbing technique involving cotton tipped swabs and following published methodologies (Boyle et al., 2004; Lannoo et al., 2011; Watters et al., 2016, 2018; Marhanka et al., 2017). For ranavirus screening, a single toe (amphibians), a small tail clip (amphibians/turtles), or a small clip of foot webbing (amphibians/turtles) was removed with sterile dissection scissors (Goodman and Ararso, 2012). Both the swab and tissue samples were placed into cryovials and immediately flash-frozen in liquid nitrogen after collection. All vials were stored in a -20°F freezer until DNA extraction and disease screening in the Sam Noble Museum's Genomics Core Facility.

Before release, notes on the general appearance and health of each individual amphibian were recorded, and individuals were weighed and photographed. Most of our sampling was non-destructive, and after screening for *Bd* and/or ranavirus, most specimens were released on site. A subset of individuals for some of the common species were preserved as voucher specimens and their associated liver tissues were preserved (flash frozen in liquid nitrogen) as genetic resources, using standard herpetological preservation methods (Graeter et al., 2013). These were deposited in the Sam Noble Museum's Herpetology Collection and Oklahoma Collection of Genomic Resources, respectively, and a spreadsheet of these specimens is included as Appendix 1. All sampling and field gear (e.g., waders, nets, traps) were cleaned between sample locations to remove mud and debris and then sterilized with a diluted bleach solution to prevent the potential spread of disease between sites (Gray et al., 2017; Watters et al., 2016, 2018; Marhanka et al., 2017).

Disease screening

The extraction of DNA from the *Bd* swabs employed the PrepMan Ultra (Life Technologies) reagent and protocol (Cheng et al. 2011). The DNA was extracted from tissue samples for RV screening via a high salt extraction method (Esselstyn et al. 2008). Swab and tissue genetic extracts from each amphibian were then stored at -20°C until they were used for pathogen screening. DNA extracts have been archived in the Sam Noble Museum's Herpetology Collection. Quantitative PCR (qPCR) techniques were utilized to determine the presence/absence of *Bd* or RV in each collect sample and to estimate the number of gene copies (infection load) per sample (Kerby et al., 2013; Davis and Kerby 2016). Prior to qPCR analysis, DNA extracts were diluted 1:10 for *Bd* swab samples and 1:2 for RV tissue samples. Dilution methodologies for both pathogens follow standardized, published protocols (Davis and Kerby 2016; Watters et al., 2016; Marhanka et al., 2017). Pathogen screening of field samples was completed on an Applied Biosystems QuantStudio 3 system at the Genomics Core Facility at the Sam Noble Museum. Each qPCR plate contained triplicate DNA extract samples, a negative control (ddH_2O), and four standards using diluted gBlocks of known DNA quantities ($1e^1$–$1e^4$) for each pathogen to create a standard curve. This allowed us to analyze the number of gene copies in the sample to quantify pathogen load, and the pathogen loads were quantified using QuantStudio Design and Analysis Software (Applied Biosystems). A sample was considered positive for a pathogen if at least two of the three wells were amplified, and the resulting mean gene copy number was above 1.0 (Watters et al., 2016; Marhanka et al., 2017). All laboratory activities for this project were carried out in the Sam Noble Museum's Genomics Core Facility and were supervised by Cameron Siler and/or Jessa Watters.

RESULTS:

Following project delays due to the global pandemic, we conducted repeated site surveys from 2021–2023 at two focal field sites: Ouachita National Forest and Cookson Wildlife Management Area. Summary tables of vouchered and field datasets are provided in Appendices 1 and 2. We collected and screened pathogen samples from 917 amphibians for *Bd* and RV and 20 turtles for RV. The sampled populations represented nine families, 13 genera, and 23 species or species pairs (we could not conclusively distinguish all Fowler's Toads from Woodhouse's Toads or all Gray Treefrogs from Cope's Gray Treefrogs). Sample sizes are shown in Tables 1, 2, 3, 4, Figure 8, and Appendix 2 at either the species or genus level. We were able to capture and collect swaps from 15 or more individuals per species per study site for most of the species that we encountered (15 out of 23 species). Across both of the surveillance sites, the average chytrid infection rate was observed to be 28%. Based on our pooled analyses of the resulting data, no significant difference in *Bd* ($p = 0.6472$, Wilcoxon Test) or RV ($p = 0.01942$, Wilcoxon Test) prevalence was observed between the two sites (Tables 1–5).

Of the 16 amphibian SGCN species recognized currently in Oklahoma, we encountered six of them during our surveys including three Tier I taxa (*Ambystoma annulatum*, *Eurycea spelaea*, *Eurycea tynerensis*) and three Tier II taxa (*Eurycea multiplicata*, *Plethodon angusticlavius*, *Plethodon serratus*). Summary results for these SGCN taxa are as follows :

- Taxonomy (family, genus, species) is significant for *Bd* prevalence (all $p < 0.05$), but not RV prevalence (all $p > 0.05$) when looking at all species. Analysis includes samples from 2015 and 2018.
- *Ambystoma annulatum*: 22% Bd prevalence, 44% RV prevalence, N = 9
- *Eurycea spelaea*: 0% Bd prevalence, 0% RV prevalence, N = 2
- *Eurycea tynerensis*: 22% Bd prevalence, 6% RV prevalence, N = 95
- *Eurycea multiplicata*: 26.49% Bd prevalence, 6.67% RV prevalence, N = 34
- *Plethodon angusticlavius*: 6.25% Bd prevalence, 0% RV prevalence, N = 21
- *Plethodon serratus*: 30.43% Bd prevalence, 0% RV prevalence, N = 23

<u>Seasonal Patterns (Sub-objective 2)</u>

Statistical analyses revealed significant patterns in the prevalence of *Bd* across seasons, families, and genera. A Kruskal-Wallis test identified significant differences in *Bd* prevalence among seasons ($H=30.16$, $p<0.001$), with higher infection rates observed during the spring as compared to the fall and summer. Post-hoc Tukey HSD tests further confirmed that animals sampled during the spring had significantly higher *Bd* prevalence ($p<0.05$) than other seasons (Figures 1 and 3), which could indicate that environmental factors are more favorable for pathogen growth and transmission. Similarly, statistical analyses of seasonal ranavirus infection revealed significant patterns across seasons, with Kruskal-Wallis tests identifying significant differences in RV prevalence among seasons ($H=11.12$, $p=0.004$); post-hoc Tukey HSD tests indicated that the summer season exhibited significantly higher RV prevalence ($p<0.05$) compared to the spring and fall (Figures 2 and 4). Further analysis of seasonal patterns of *Bd* infection employing Dunn Tests support the hypothesis that the spring season had the highest prevalence for infection when compared to either the fall ($Z = -5.167$, $p<0.05$) or summer ($Z = 5.046$, $p<0.05$), with fall and summer not significantly different from one another ($Z = -0.182$, $p>0.05$). Comparatively, Dunn Tests for RV infection patterns supported spring and summer as having a higher infection prevalence than the fall ($Z = -3.2906$, $p = 0.00299$; $Z = -3.2365$, $p = 0.00363$), but not significantly different from one another ($Z = -0.4893$, $p > 0.05$). This seasonal pattern suggests that warmer temperatures or ecological conditions during spring and summer may facilitate RV transmission. Among the turtle populations that we screened, RV positive individuals were observed only during summer survey periods (Tables 3 and 4); however, sampling size overall remains low and broader conclusions cannot be drawn at this time.

TAXONOMIC DIFFERENCES

Pathogen prevalence was substantial for *Bd* among both amphibian orders (Anura, Caudata), with both showing overall *Bd* infection prevalence above 25% (Figure 5). Although lower, RV infection prevalence was at or close to 5% for both amphibian orders (Figure 5). Differences in *Bd* prevalence also were significant among amphibian families ($H=16.60$, $p=0.011$), with the Families Bufonidae and Hylidae exhibiting the highest mean prevalence (Table 8). This pattern suggests that host susceptibility or behavior may influence infection dynamics at the family level. Genera within families also varied significantly in *Bd* prevalence ($H=23.15$, $p=0.006$). Genera such as *Acris* and *Lithobates* displayed higher infection rates compared to others (Tables 1 and 2), as confirmed by Tukey HSD tests ($p<0.05$). In contrast, no significant differences were detected in *Bd* infection load across families or genera. Our analyses of ranavirus infection did not detect significant patterns among families ($H=1.62$, $p=0.951$) or genera ($H=6.89$, $p=0.648$) for pathogen prevalence, and no significant differences were detected for RV infection load among these taxonomic levels of analysis (Figures 2 and 4). Together, these results suggest that while prevalence varies among taxonomic groups (pathogen prevalence in populations), we have not detected statistically significant patterns associated with infection severity (pathogen infection load). These findings highlight the importance of seasonal and taxonomic factors in shaping the epidemiology of *Bd* and RV, with implications for understanding host-pathogen dynamics and developing targeted conservation strategies. There were substantial differences in the prevalence of Bd and ranavirus between species, although samples sizes for some species were too small to make statistically valid comparisons. Figure 8 and Table 7 depict the Bd and ranavirus prevalence for every species and species group that was sampled between 2021 and 2023. Species such as *Pseudacris crucifer*, *Notophthalmus viridescens*, *Eurycea multiplicata*, *Lithobates catesbeianus*, *Lithobates sphenocephalus*, and *Anaxyrus americanus* showed the highest percentage of *Bd* prevalence. Ranavirus prevalence was highest with *Lithobates sphenocephalus*, *Hyla cinerea*, and the *Hyla chrysoscelis/versicolor* complex. The species with the highest percentage of co-infection by Bd and ranavirus simultaneously were *Lithobates sphenocephalus*, *Anaxyrus americanus*, and the *Hyla chrysoscelis/versicolor* complex.

Although *Bd* continues to be a pathogen of concern for amphibian populations, RV was detected in many cases. This necessitates greater attention to the impact of coinfection on the health of native populations. We conducted an assessment of co-infection rates observed among the screened individuals. The co-infection rate refers to the proportion of individuals within a population or sample that are simultaneously infected by two or more pathogens. In this context, it is the proportion of sampled amphibians infected by both *Batrachochytrium dendrobatidis* and ranavirus at the same time. Although lower in frequency, we did observe co-infection rates between 0.86% and 4.55% for 11 species of amphibians (Table 6). Although sample sizes are much smaller for the turtles that we screened during the project, RV prevalence was detected at a rate of 45% (Table 9). Of the 20 individuals screened across the two focal sites, nine were detected as positive for RV, with all three of the species screened, *Terrapene carolina*, *Trachemys scripta*, and *Sternotherus odoratus*, showing some level of pathogen infection by ranavirus (Table 9).

TEMPORAL TRENDS (SUB-OBJECTIVE 3)

Temporal analyses across years demonstrated notable fluctuations in the prevalence and infection dynamics of both *Batrachochytrium dendrobatidis* and ranavirus (Figures 6 and 7). For *Bd*, prevalence varied significantly across years (H=6.39, p=0.041), suggesting that external factors such as climate variability, host population density, or shifts in habitat conditions may influence annual infection rates. Despite these fluctuations in prevalence, no significant differences were detected in *Bd* infection load across years (H=2.09, p=0.352) when pooling all amphibians together.

In contrast, RV exhibited pronounced year-to-year variability in both prevalence (H=10.14, p=0.006) and infection load (H=8.08, p=0.018). Higher RV prevalence and infection loads in certain years may reflect episodic outbreaks driven by environmental triggers, such as elevated temperatures or drought conditions that stress amphibian populations, thereby increasing susceptibility to infection. Conversely, years with lower prevalence and load might correspond to more favorable environmental conditions or reduced transmission opportunities due to lower host density or pathogen persistence. Sampling differences across seasons and years will need to be explored with further data collection to determine if these temporal patterns persist with larger sample sizes. Although there is cause for concern for RV infection prevalence among turtles (Table 9), our sampling size is too small currently to draw definitive conclusions about overall pathogen prevalence or temporal trends among turtle species in the state.

Together, these temporal patterns underscore the complex interplay between environmental conditions, host-pathogen dynamics, and disease outcomes. The potential for greater stochasticity in temporal fluctuations observed in RV compared with *Bd* may suggest that *Bd* exhibits a more consistent ecological interaction with amphibian hosts, whereas RV dynamics are potentially more sensitive to episodic changes. However, the dataset collected to date is not sufficiently large to draw firm conclusions. Regardless, understanding these differences is critical for predicting disease outbreaks and implementing effective conservation strategies, particularly under shifting environmental conditions associated with climate and land use change. Continued long-term monitoring and integration of environmental data will be essential to disentangle the factors driving these temporal trends.

RECOMMENDATIONS:

This report presents an analysis of amphibian and turtle infectious disease patterns for the pathogens *Batrachochytrium dendrobatidis* (*Bd*) and ranavirus (RV), focusing on temporal trends, taxonomic group differences, and spatiotemporal dynamics with the data that are available to date. Based on these data, we offer the following prioritized recommendations.

PRIORITY 1

Over the last decade, research has shown that infectious diseases are impacting more than just amphibian communities worldwide and turtle populations are potentially at risk for systemic infection by ranaviruses (Johnson et al. 2008; Chinchar et al. 2009; Chinchar & Waltzek 2014; Huang et al. 2009; Perpiñan et al. 2016). With nine native turtle species in Oklahoma designated as species of greatest conservation need (Tier I - Alligator Snapping Turtle; Tier II – Western Chicken Turtle, Tier III - False Map Turtle, Northern Map Turtle, Ouachita Map Turtle, Razor-backed Musk Turtle, River Cooter, Smooth Softshell Turtle, and Spiny Softshell Turtle), our observations offer some insights into the importance of continued turtle pathogen surveillance (Table 9). Among turtle populations at the two focal sites, RV prevalence was higher than expected, with infected individuals detected for all three species that were screened: *Terrapene carolina*, *Trachemys scripta*, and *Sternotherus odoratus*. Two out of the five Eastern Box Turtles (*T. carolina*) that we screened were found to be positive for RV infection, indicating that threat of this pathogen may extend beyond aquatic habitats and species. Of particular concern were observations of high pathogen prevalence within the Common Musk Turtle (*S. odoratus*), with all six individuals that were sampled during the summer of 2021 testing positive for RV infection (Table 9). Given the results of this project, efforts should be made to carry out baseline assessments of infectious diseases among native reptiles in Oklahoma, particularly turtles, as there exists a paucity of information currently on disease prevalence and distribution among these taxonomic groups.

PRIORITY 2

The data collected during this project and the results of our analyses on patterns of infection prevalence and distribution highlight critical conservation priorities for future investigations to address amphibian and reptile susceptibility to infectious diseases, particularly *Batrachochytrium dendrobatidis* (*Bd*) and ranavirus (RV), two pathogens now known to be prevalent among native populations in the state. The significant seasonal and species-specific differences in pathogen prevalence indicate that conservation efforts must account for temporal, spatial, and taxonomic variability. For instance, *Bd* prevalence varies significantly across seasons, with peaks likely tied to environmental conditions such as temperature and humidity that facilitate pathogen growth. Species like *Lithobates clamitans*, *Pseudacris crucifer*, and *Eurycea multiplicata* demonstrate pronounced seasonal dynamics in *Bd* prevalence and infection load, suggesting that these species may be particularly vulnerable during specific times of the year. Conservation programs should prioritize monitoring during breeding seasons or wetter months when that pathogen's prevalence is highest to mitigate disease impacts effectively.

The variability in pathogen prevalence also may underscore the importance of local environmental conditions and habitat quality in influencing disease dynamics. Sites with elevated *Bd* and/or RV prevalence may have environmental characteristics supporting increased pathogen persistence and spread. Habitat restoration, such as improving water flow or reducing habitat fragmentation, could be effective in mitigating pathogen risks in these high-prevalence areas. However, insufficient data are available at this time to determine whether specific environmental factors are contributing to the observed variation in infection prevalence. Future work is needed to improve our understanding of site-specific factors, such as host density, temperature, and water quality before informed, localized management practices can be developed to address the root causes of pathogen spread.

PRIORITY 3

The preliminary patterns detected from this study underscore significant taxonomic differences that may be present in pathogen susceptibility, further emphasizing the need for targeted conservation strategies. Families such as Ranidae and Hylidae (although not the genus *Hyla*, which showed low rates of *Bd* infection) exhibited higher *Bd* prevalence, highlighting these groups as priority targets for conservation interventions. Similarly, genera like *Lithobates* and *Pseudacris* show patterns indicative of elevated susceptibility to *Bd*, suggesting that certain evolutionary or ecological traits may increase their vulnerability. Conservation strategies tailored to these taxa should be explored to help protect the most at-risk populations. In contrast, the relatively low RV prevalence across families and genera indicates that this pathogen may currently have a less pervasive impact. As we have reported previously, although ranavirus prevalence was lower among our screened samples than *Bd* prevalence, it is known that RV infection in amphibians is often greatest in pre-metamorphic (and aquatic) larval stages of development. Adult amphibians that survive RV infection during early development more often show lower infection loads than pre-metamorphic individuals. We made a special effort to screen pre-metamorphic individuals when feasible throughout the study; however, most of our screening was conducted on post-metamorphic individuals (adults or subadults) because these were more readily detected and captured at our survey sites. Therefore, the lower observed RV infection rates across sites and species may be an artifact of the developmental stage we most often have access to during surveys and can readily include in pathogen surveillance efforts. We continue to feel strongly that it is important that future studies find ways to screen more pre-metamorphic individuals to determine if RV infection is having a greater impact than observed. If higher rates of infection are observed in tadpole and larval salamanders than adults, this could indicate that species are either capable of tolerating and surviving RV infection to some extent, or that there are more pre-metamorphic die-offs than we understand currently.

The species with the highest rates of co-infection between *Batrachochytrium dendrobatidis* (Bd) and ranavirus (RV) have been identified and summarized. The top species include:

1. Gray Treefrogs (*Hyla chrysoscelis/versicolor*) – Co-infection rate: 4.55%
2. Green Frog (*Lithobates clamitans*) – Co-infection rate: 3.57%
3. Cave Salamander (*Eurycea lucifuga*) – Co-infection rate: 3.13%
4. Southern Leopard Frog (*Lithobates sphenocephalus*) – Co-infection rate: 2.86%
5. Eastern Newt (*Notophthalmus viridescens*) – Co-infection rate: 2.50%

These species appear at greatest conservation risk due to their higher susceptibility to co-infection. Such patterns suggest potential ecological or physiological vulnerabilities, warranting focused monitoring and conservation efforts.

Future research should focus on the ecological and evolutionary drivers of pathogen dynamics, particularly the interplay between climate fluctuations and disease. Continued habitat modification and changing precipitation patterns could alter the distribution and severity of *Bd* and RV infections, potentially exposing previously unaffected populations to new risks. Investigating how amphibians and reptiles in different regions respond to these changes will be essential for developing adaptive management strategies. Additionally, studies that integrate molecular, ecological, and epidemiological approaches could provide a more comprehensive understanding of disease mechanisms and inform the development of innovative mitigation strategies. By continuing to address the important spatiotemporal and taxonomic patterns revealed during this project, conservation biologists and wildlife managers can take meaningful steps toward safeguarding amphibian and reptile populations and in the face of emerging infectious diseases.

PRIORITY 4

Public outreach and education continue to play a major role in conservation efforts. This is particularly true for wildlife disease awareness. We continue to advocate for increased education campaigns to raise public awareness about wildlife diseases and appropriate steps that can be taken by state park, wildlife management area, and refuge managers, wildlife biologists, students and the public to minimize the spread of infectious disease and invasive species of plants and animals across Oklahoma. To prevent the spread of infectious diseases, it is critical that all people clean all nets, waders, boots, etc. between visiting sites and at the end of each day's activities in any aquatic or semi-aquatic habitat by one or both of the following two methods:

1. Spray down the equipment with 10% bleach solution and allow it to dry for one hour prior to putting the equipment away.
2. Allow the equipment to dry in the sun for a full day.

Additionally, all individuals should avoid the use of felt-bottomed waders, which can trap disease spores, microbes and invasive plant material and inadvertently transfer these threats across aquatic habitats. In addition to increased communication and education campaigns with wildlife managers, state biologists, park rangers, etc., we believe that posting notices on public land websites and adding posters or informational signs at park and WMA entrances and headquarters would contribute to improved awareness.

SIGNIFICANT DEVIATIONS:

The grant faced several scheduling setbacks and limitations related to the global COVID 19 pandemic in 2020 and 2021. We were unable to initiate the first round of disease surveillance surveys in 2020 as originally planned because of campus and laboratory closures and restrictions that were imposed on fieldwork and the use of university vehicles by the University of Oklahoma from March through October of 2020. This resulted in a one-year extension to the grant beyond the original project timeline and one-year setback in the grant's timeline. Following the initial six months of campus closures that resulted from the pandemic, we faced continued restrictions on laboratory access and the university's qPCR equipment that were critical for our disease screening. From the mid-fall of 2020 through the fall of 2021, we were limited to one person in the lab facilities at a time and were given a limited amount of time to use the lab and equipment per week because of the increased demands for the equipment for other PCR analyses including COVID screening. Additionally, the increased demand for the reagents and other supplies needed for the PCR analysis resulted in increased lab costs from 2021 through 2023 that exceeded our budget. Because of these increased costs, we scaled our study back from three surveillance sites to two sites by eliminating the south-central Oklahoma site surrounding the University of Oklahoma Biological Station (UOBS). We chose to remove this site because it had the lowest amphibian species diversity and abundance of the three sites and had a minimal salamander population. We conducted one disease surveillance survey there in June of 2022 and completed the disease screening on the 64 amphibians that were swabbed in that study are to provide a cursory comparison to the summer surveys that we completed at the Cookson WMA and the Ouachita National Forest LeFlore County Unit sites. The UOBS and vicinity survey site had a similar moderate rate of *Bd* infection, primarily in the *Acris blanchardi* population, and a low incidence of RV infection (one *Acris blanchardi* and one *Hyla cinerea*) (Table 10). A positive aspect of removing one of the study areas is that it allowed us the flexibility to rerun the qPRC process on samples that were questionable (e.g., samples in which only one of the three triplicate samples indicated a positive result) and we were to reduce the potential number of false negatives and false positives. Furthermore, we were not able to complete nine surveillance surveys at the remaining two study sites. We conducted only seven surveys at the Cookson WMA site (three spring, two summer, and two fall surveys), and seven surveys at the Ouachita National Forest site (three spring, two summer, and two fall surveys). At the Cookson WMA site, we did not conduct a survey during the fall of 2021 or the summer of 2023 because of regional drought conditions that substantially reduced habitat availability and amphibian activity. Similarly, we did not conduct surveys at the Ouachita National Forest site during the summer and fall of 2023 because of a persistent regional drought that affected all of southern Oklahoma and reduced the availability of suitable habitat and amphibian activity. In an attempt to offset the reduction in in data from these suspended surveys, we decided to include the data that were collected from both study areas during the spring of 2015 as part of our previously-funded disease study, and also to run the disease screen protocol on a series of swabs that we had collected incidentally on Cookson WMA during the spring of 2018 as part of an independent project.

EQUIPMENT:

No equipment exceeding $5,000 in cost was purchased for this project. All equipment used for this project was previously purchased and owned by the Sam Noble Museum and/or University of Oklahoma.

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Table 1. Average *Bd* Prevalence among Amphibian Populations at Cookson Wildlife Management Area. Pathogen Screening Results Shown by Season and Year.

	Fall 2022	Fall 2023	Fall Total	Spring 2015	Spring 2018	Spring 2021	Spring 2022	Spring 2023	Spring Total	Summer 2021	Summer 2022	Summer Total	Cookson Total
Ambystomatidae		**0.00%**	**0.00%**	**75.00%**					**60.00%**				**50.00%**
Ambystoma		0.00%	0.00% (n=5)	75.00%					60.00% (n=5)				30.00% (n=10)
Bufonidae	**0.00%**		**0.00%**	**66.67%**		**0.00%**	**40.00%**	**10.53%**	**32.40%**	**50.00%**	**0.00%**	**16.67%**	**22.22%**
Anaxyrus	0.00%		0.00% (n=4)	66.67%		0.00%	40.00%	10.53%	32.40% (n=37)	50.00%	0.00%	16.67% (n=4)	22.22% (n=45)
Hylidae	**8.03%**	**0.00%**	**4.02%**	**60.00%**	**100.00%**	**40.00%**	**100.00%**	**0.00%**	**66.67%**	**50.00%**	**4.76%**	**22.86%**	**31.67%**
Acris	15.00%	0.00%	7.50% (n=41)	60.00%	100.00%	40.00%	100.00%	0.00%	60.00% (n=14)	100.00%	14.29%	57.14% (n=23)	47.70% (n=78)
Hyla	0.00%		0.00% (n=4)							0.00%	0.00%	0.00% (n=12)	0.00% (n=16)
Pseudacris	9.09%	0.00%	3.03% (n=13)				100.00%		100.00% (n=1)		0.00%	0.00% (n=1)	21.82% (n=15)
Microhylidae											**0.00%**	**0.00%**	**0.00%**
Gastrophryne											0.00%	0.00% (n=1)	0.00% (n=1)
Plethodontidae	**0.00%**	**8.33%**	**6.67%**	**29.51%**	**9.33%**	**7.25%**	**16.25%**	**30.67%**	**19.85%**	**0.00%**	**0.00%**	**0.00%**	**14.71%**
Eurycea	0.00%	16.67%	11.11% (n=11)	33.33%	15.56%	7.25%	23.45%	32.08%	23.55% (n=205)	0.00%	0.00%	0.00% (n=17)	17.58% (n=233)
Plethodon		0.00%	0.00% (n=11)	21.88%	0.00%		1.85%	25.00%	10.35% (n=65)	0.00%		0.00% (n=2)	7.25% (n=78)
Ranidae	**18.60%**	**50.00%**	**34.30%**	**98.08%**	**66.67%**	**100.00%**	**69.05%**	**100.00%**	**80.33%**	**57.14%**	**12.50%**	**34.82%**	**57.42%**
Lithobates	18.60%	50.00%	34.30% (n=57)	98.08%	66.67%	100.00%	69.05%	100.00%	80.33% (n=51)	57.14%	12.50%	34.82% (n=23)	57.42% (n=131)
Salamandridae		**20.00%**	**20.00%**	**100.00%**			**85.71%**	**100.00%**	**95.24%**		**0.00%**	**0.00%**	**61.14%**
Notophthalmus		20.00%	20.00% (n=15)	100.00%			85.71%	100.00%	95.24% (n=45)		0.00%	0.00% (n=5)	61.14% (n=65)
Grand Total	**7.99%**	**16.94%**	**12.87%**	**58.33%**	**38.52%**	**26.96%**	**48.49%**	**34.04%**	**43.96%**	**29.37%**	**3.57%**	**15.18%**	**30.70%**

Table 2. Average *Bd* Prevalence among Amphibian Populations at the Ouachita National Forest Site. Pathogen Screening Results Shown by Season and Year.

	Fall 2021	Fall 2022	Fall Total	Spring 2015	Spring 2021	Spring 2022	Spring 2023	Spring Total	Summer 2021	Summer 2022	Summer Total	Ouachita Total
Bufonidae	**0.00%**	**0.00%**	**0.00%**	**100.00%**		**5.41%**	**64.94%**	**58.82%**	**25.00%**	**0.00%**	**16.67%**	**25.93%**
Anaxyrus	0.00%	0.00%	0.00% (n=7)	100.00%		5.41%	64.94%	58.82% (n=78)	25.00%	0.00%	16.67% (n=18)	25.93% (n=103)
Hylidae	**0.00%**	**0.00%**	**0.00%**	**40.00%**	**36.75%**	**22.22%**	**66.03%**	**41.25%**	**25.00%**	**0.00%**	**12.50%**	**27.14%**
Acris	0.00%	0.00%	0.00% (n=17)	80.00%	33.33%	0.00%	23.08%	34.10% (n=40)	0.00%	0.00%	0.00% (n=3)	17.05% (n=60)
Hyla	0.00%		0.00% (n=4)	20.00%	0.00%	0.00%		10.00% (n=22)	37.50%	0.00%	18.75% (n=26)	12.78% (n=52)
Pseudacris					76.92%	66.67%	87.50%	79.65% (n=39)				79.65% (n=39)
Microhylidae									**100.00%**		**100.00%**	**100.00%**
Gastrophryne									100.00%		100.00% (n= 3)	100.00% (n=3)
Plethodontidae	**0.00%**	**0.00%**	**0.00%**			**42.86%**	**36.83%**	**38.34%**				**25.56%**
Eurycea	0.00%	0.00%	0.00% (n=8)			42.86%	56.25%	49.55% (n=23)				24.78% (n=31)
Plethodon							27.12%	27.12% (n=65)				27.12% (n=65)
Ranidae	**5.56%**	**4.44%**	**12.41%**	**25.00%**	**100.00 %**	**100.00%**	**87.50%**	**77.78%**	**21.88%**	**0.00%**	**10.94%**	**43.06%**
Lithobates	5.56%	4.44%	12.41% (n=46)	25.00%	100.00 %	100.00%	87.50%	77.78% (n=36)	21.88%	0.00%	10.94% (n=32)	43.06% (n=114)
Salamandridae				**55.56%**				**55.56%**				**55.56%**
Notophthalmus				55.56%				55.56% (n=9)				55.56% (n=9)
Grand Total	**1.59%**	**1.90%**	**4.96%**	**46.51%**	**42.05%**	**39.37%**	**65.70%**	**51.22%**	**24.43%**	**0.00%**	**14.14%**	**30.04%**

Table 3. Average RV Prevalence among Amphibian and Reptile Populations at Cookson Wildlife Management Area. Pathogen Screening Results Shown by Season and Year. Turtle Taxa Highlighted in Green.

	Fall 2022	**Fall 2023**	**Fall Total**	**Spring 2015**	**Spring 2018**	**Spring 2021**	**Spring 2022**	**Spring 2023**	**Spring Total**	**Summer 2021**	**Summer 2022**	**Summer Total**	**Cookson Total**
Ambystomatidae		**0.00%**	**0.00%**	**100.00%**					**100.00%**				**50.00%**
Ambystoma		0.00%	0.00% (n=5)	100.00%					100.00% (n=5)				50.00%
Bufonidae	**0.00%**		**0.00%**	**0.00%**		**0.00%**	**20.00%**	**0.00%**	**3.33%**	**0.00%**	**0.00%**	**0.00%**	**1.82%**
Anaxyrus	0.00%		0.00% (n=4)	0.00%		0.00%	20.00%	0.00%	3.33% (n=37)	0.00%	0.00%	0.00% (n=4)	1.82% (n=45)
Hylidae	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**
Acris	0.00%	0.00%	0.00% (n=41)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00% (n=14)	0.00%	0.00%	0.00% (n=23)	0.00% (n=78)
Hyla	0.00%		0.00% (n=4)							0.00%	0.00%	0.00% (n=12)	0.00% (n=16)
Pseudacris	0.00%	0.00%	0.00% (n=13)				0.00%		0.00% (n=1)		0.00%	0.00% (n=1)	0.00% (n=15)
Microhylidae											**0.00%**	**0.00%**	**0.00%**
Gastrophryne											0.00%	0.00% (n=1)	0.00% (n=1)
Plethodontidae	**0.00%**	**0.00%**	**0.00%**	**30.90%**	**0.00%**	**0.00%**	**5.75%**	**0.00%**	**8.80%**	**0.00%**	**6.25%**	**2.08%**	**6.46%**
Eurycea	0.00%	0.00%	0.00% (n=11)	35.42%	0.00%	0.00%	3.07%	0.00%	8.55% (n=205)	0.00%	6.25%	2.50% (n=17)	6.40% (n=233)
Plethodon		0.00%	0.00% (n=11)	21.88%	0.00%		11.11%	0.00%	9.42% (n=65)	0.00%		0.00% (n=2)	6.60% (n=78)
Ranidae	**0.00%**	**0.00%**	**0.00%**	**32.69%**	**0.00%**	**0.00%**	**15.87%**	**0.00%**	**11.30%**	**0.00%**	**0.00%**	**0.00%**	**5.65%**
Lithobates	0.00%	0.00%	0.00% (n=57)	32.69%	0.00%	0.00%	15.87%	0.00%	11.30% (n=51)	0.00%	0.00%	0.00% (n=23)	5.65% (n=131)
Salamandridae		**0.00%**	**0.00%**	**8.00%**			**14.29%**	**0.00%**	**7.43%**		**0.00%**	**0.00%**	**4.46%**
Notophthalmus		0.00%	0.00% (n=15)	8.00%			14.29%	0.00%	7.43% (n=45)		0.00%	0.00% (n=5)	4.46% (n=65)
Emydidae	**0.00%**		**0.00%**					**0.00%**	**0.00%**				**0.00%**
Terrapene	0.00%		0.00% (n=1)					0.00%	0.00% (n=2)				0.00% (n=3))
Grand Total	**0.00%**	**0.00%**	**0.00%**	**32.77%**	**0.00%**	**0.00%**	**8.95%**	**0.00%**	**10.85%**	**0.00%**	**1.14%**	**0.63%**	**6.19%**

Table 4. Average RV Prevalence among Amphibian and Turtle Populations at the Ouachita National Forest Site. Pathogen Screening Results Shown by Season and Year. Turtle Taxa Highlighted in Green.

	Fall 2021	Fall 2022	Fall Total	Spring 2015	Spring 2021	Spring 2022	Spring 2023	Spring Total	Summer 2021	Summer 2022	Summer Total	Ouachita Total
Bufonidae	**0.00%**	**0.00%**	**0.00%**	**0.00%**		**13.51%**	**0.00%**	**3.38%**	**8.33%**	**20.00%**	**12.22%**	**4.56%**
Anaxyrus	0.00%	0.00%	0.00% (n=7)	0.00%		13.51%	0.00%	3.38% (n=78)	8.33%	20.00%	12.22% (n=18)	4.56% (n=103)
Hylidae	**0.00%**	**8.33%**	**2.78%**	**27.78%**	**0.00%**	**0.00%**	**2.56%**	**7.59%**	**47.22%**	**21.43%**	**34.33%**	**14.54%**
Acris	0.00%	8.33%	4.17% (n=17)	33.33%	0.00%	0.00%	7.69%	10.26% (n=40)	100.00%	0.00%	50.00% (n=3)	18.67% (n=60)
Hyla	0.00%		0.00% (n=4)	25.00%	0.00%	0.00%		12.50% (n=22)	20.83%	32.14%	26.49% (n=26)	17.33% (n=52)
Pseudacris					0.00%	0.00%	0.00%	0.00% (n=39)				0.00% (n=39)
Microhylidae									**0.00%**		**0.00%**	**0.00%**
Gastrophryne									0.00%		0.00% (n=3)	0.00% (n=3)
Plethodontidae	**0.00%**	**0.00%**	**0.00%**			**0.00%**	**0.00%**	**0.00%**				**0.00%**
Eurycea	0.00%	0.00%	0.00% (n=8)			0.00%	0.00%	0.00% (n=23)				0.00% (n=31)
Plethodon							0.00%	0.00% (n=65)				0.00% (n=65)
Ranidae	**0.00%**	**0.00%**	**0.00%**	**29.17%**	**0.00%**	**50.00%**	**2.08%**	**18.52%**	**6.25%**	**33.04%**	**19.64%**	**12.91%**
Lithobates	0.00%	0.00%	0.00% (n=46)	29.17%	0.00%	50.00%	2.08%	18.52% (n=36)	6.25%	33.04%	19.64% (n=32)	12.91% (n=112)
Salamandridae				**0.00%**				**0.00%**				**0.00%**
Notophthalmus				0.00%				0.00% (n=9)				0.00% (n=9)
Emydidae									**100.00%**	**0.00%**	**66.67%**	**66.67%**
Terrapene									100.00%		100.00% (n=2)	100.00% (n=2)
Trachemys									100.00%	0.00%	50.00% (n=4)	50.00% (n=4)
Kinosternidae					**0.00%**	**0.00%**		**0.00%**	**100.00%**	**0.00%**	**66.67%**	**54.54%**
Sternotherus					0.00%	0.00%		0.00% (n=2)	100.00%	0.00%	66.67% (n=9)	54.54% (n=11)
Grand Total	**0.00%**	**1.19%**	**0.56%**	**20.24%**	**0.00%**	**14.19%**	**1.34%**	**8.48%**	**42.80%**	**18.79%**	**32.69%**	**13.65%**

Table 5. Combined Summary of Pathogen Positivity, Average Infection Load, and Prevalence by Season in the Two Focal Sites Sampled across the Study.

Site	Season	N	*Bd*+	*Bd* average infection load	RV+	RV average infection load	*Bd* prevalence (%)	RV prevalence (%)
Cookson	Fall	161	25	1994.49	0	0.00	15.53%	0.00%
Cookson	Spring	247	88	10955.26	14	1192.79	35.63%	5.67%
Cookson	Summer	88	15	1829.34	1	0.12	17.05%	1.14%
Ouachita	Fall	82	6	5156.53	1	0.00	7.32%	1.22%
Ouachita	Spring	257	114	4766.72	8	229.72	44.36%	3.11%
Ouachita	Summer	82	19	191.34	16	3853.41	23.17%	19.51%

Table 6. Summary of Observed Pathogen Co-infections among Screened Amphibian Species, with Co-infections Defined as Individuals Confirmed to be Infected with Both *Bd* and RV.

Species	Total Screened	Total Co-infections	Co-Infection Rate
Hyla chrysoscelis/versicolor	22	1	4.55%
Lithobates clamitans	84	3	3.57%
Eurycea lucifuga	32	1	3.13%
Lithobates sphenocephalus	35	1	2.86%
Notophthalmus viridescens	40	1	2.50%
Anaxyrus americanus	122	3	2.46%
Eurycea longicauda	54	1	1.85%
Lithobates catesbeianus	67	1	1.49%
Eurycea tynerensis	71	1	1.41%
Plethodon albagula	79	1	1.27%
Acris blanchardi	116	1	0.86%

Table 7. Species Vulnerability Rankings for the Top Five Most Vulnerable Amphibian Species with Regard to *Bd* Versus RV Infection Based on Analysis of Pooled Multi-year Data.

***Bd* Vulnerability Ranking**	**Species**	**N**	**Bd+**	**Bd average infection load**	**Bd prevalence (%)**
1	*Gastrophyne carolinensis*	4	3	177.20	75.00%
2	*Pseudacris fouquettei*	3	2	1002.24	66.67%
3	*Pseudacris crucifer*	51	30	9344.05	58.82%
4	*Notophthalmus viridescens*	40	22	4769.86	55.00%
5	*Eurycea multiplicata*	31	12	591.59	38.71%

RV Vulnerability Ranking	**Species**	**N**	**RV+**	**RV average infection load**	**RV prevalence (%)**
1	*Hyla cinerea*	26	3	10.24	11.54%
2	*Lithobates sphenocephalus*	35	4	49.29	11.43%
3	*Hyla chrysoscelis/versicolor*	22	2	9996.65	9.09%
4	*Plethodon albagula*	79	6	1705.79	7.59%
5	*Anaxyrus americanus*	122	9	265.27	7.38%

Table 8. Combined Summary of Amphibian Pathogen Positivity, Average Infection Load, and Prevalence by Family and Species for Pooled Samples across 2021 - 2023.

Family	Species	N	*Bd*+	*Bd* average infection load	RV+	RV average infection load	*Bd* prevalence (%)	RV prevalence (%)
Bufonidae	*Anaxyrus americanus*	122	41	838.16	9	265.27	33.61%	7.38%
	Anaxyrus fowleri/woodhousii	21	4	334.83	1	22.05	19.05%	4.76%
Hylidae	*Acris blanchardi*	116	19	14688.01	3	262.26	16.38%	2.59%
	Hyla chrysoscelis/versicolor	22	3	182.63	2	9996.65	13.64%	9.09%
	Hyla cinerea	26	0	0	3	10.24	0.00%	11.54%
	Pseudacris crucifer	51	30	9344.05	0	0	58.82%	0.00%
	Pseudacris fouquettei	3	2	1002.24	0	0	66.67%	0.00%
Microhylidae	*Gastrophryne carolinensis*	4	3	177.2	0	0	75.00%	0.00%
Plethodontidae	*Ambystoma annulatum*	5	0	0	0	0	0.00%	0.00%
	Eurycea longicauda	54	16	461.39	1	142.92	29.63%	1.85%
	Eurycea lucifuga	32	7	151.87	1	9.83	21.88%	3.13%
	Eurycea multiplicata	31	12	591.59	0	0	38.71%	0.00%
	Eurycea spelaeus	2	0	0	0	0	0.00%	0.00%
	Eurycea tynerensis	71	20	2150.53	2	2.43	28.17%	2.82%
	Plethodon albagula	79	12	278.69	6	1705.79	15.19%	7.59%
	Plethodon angusticlavius	13	0	0	0	0	0.00%	0.00%
	Plethodon serratus	23	7	599.22	0	0	30.43%	0.00%
Ranidae	*Lithobates catesbeianus*	67	25	14327.39	1	337.89	37.31%	1.49%
	Lithobates clamitans	84	26	1026.64	6	187.88	30.95%	7.14%
	Lithobates palustris	16	5	1159.34	0	0	31.25%	0.00%
	Lithobates sphenocephalus	35	13	17594.08	4	49.29	37.14%	11.43%
Salamandridae	*Notophthalmus viridescens*	40	22	4769.86	1	5651.19	55.00%	2.50%

Table 9. Combined Summary of Turtle Pathogen Positivity for RV, RV Prevalence, and Average RV Infection Load by Site and Turtle Species for Pooled Samples across 2021 - 2023. Study Sites Identified by Shades of Gray Highlighting.

Year	Site	Season	Order	Family	Genus	Species	N	RV+	RV%	Average infection load
2022	Cookson	Fall	Testudines	Emydidae	Terrapene	carolina	1	0	0.00%	0.00
2023	Cookson	Spring	Testudines	Emydidae	Terrapene	carolina	2	0	0.00%	0.00
2021	Ouachita	Summer	Testudines	Emydidae	Terrapene	carolina	2	2	100.00%	12350.33
2021	Ouachita	Summer	Testudines	Emydidae	Trachemys	scripta	1	1	100.00%	52656.67
2022	Ouachita	Summer	Testudines	Emydidae	Trachemys	scripta	3	0	0.00%	0.00
2021	Ouachita	Spring	Testudines	Kinosternidae	Sternotherus	odoratus	1	0	0.00%	0.00
2021	Ouachita	Summer	Testudines	Kinosternidae	Sternotherus	odoratus	6	6	100.00%	23959.06
2022	Ouachita	Spring	Testudines	Kinosternidae	Sternotherus	odoratus	1	0	0.00%	0.00
2022	Ouachita	Summer	Testudines	Kinosternidae	Sternotherus	odoratus	3	0	0.00%	0.00
						TOTAL:	**20**	**9**	**45.00%**	**9885.12**

Table 10: Summary for OU Biological Station (UOBS) and Vicinity Prevalence Results for Chytrid (*Bd*) and Ranavirus 2022. Samples were collected from 64 amphibians comprised by *Anaxyrus woodhousii* (2), *Acris blanchardi* (29) *Hyla chrysoscelis/ versicolor* (7), *Hyla cinerea* (23), *Lithobates catesbeianus* (2), and *Lithobates sphenocephalus* (1) captured between June 1 and 8.

	2022			
	N	***Bd* %**	**N**	***RV* %**
Briar Creek	1	100.00%	1	100.00%
Buncombe Creek (PUA/Golf Course)	24	45.83%	27	0.00%
Fobb Bottom WMA	23	0.00%	24	0.00%
UOBS	12	8.33%	11	9.09%

Figure 1. Summary of seasonal trends in *Bd* prevalence.

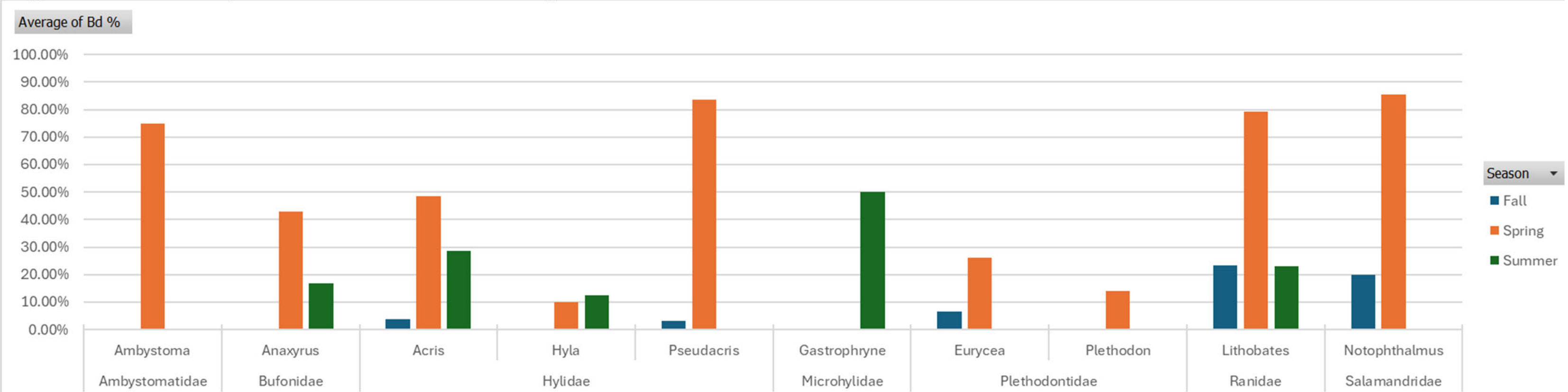


Figure 2. Summary of seasonal trends in RV prevalence.

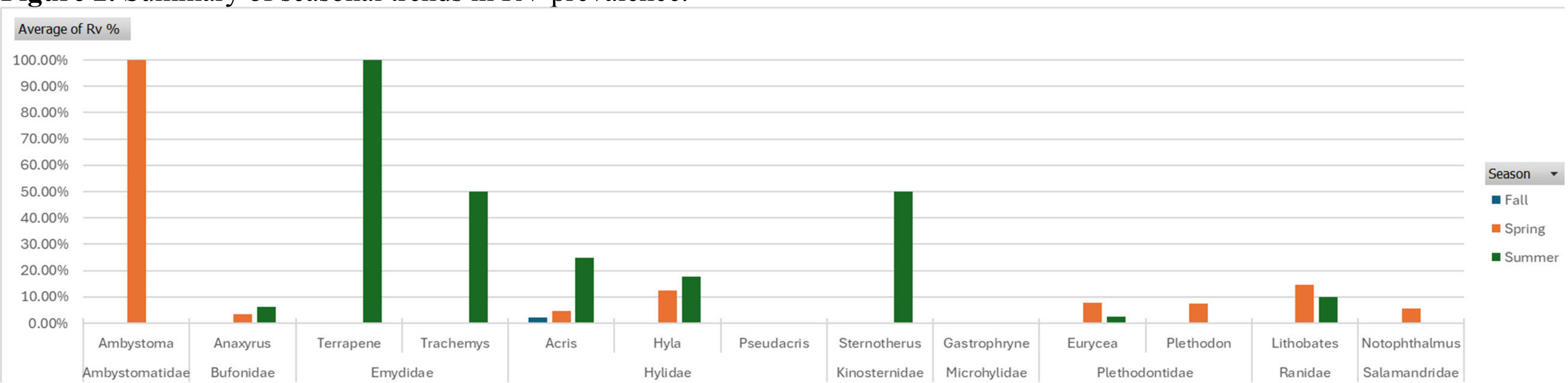


Figure 3. Summary of seasonal trends in *Bd* prevalence among amphibians sampled at the study's focal sites. Prevalence results shown across from sample sizes for reference, as high disease prevalence in some cases may be an artifact of small sample sizes screened during the project period for some taxa encountered less often.

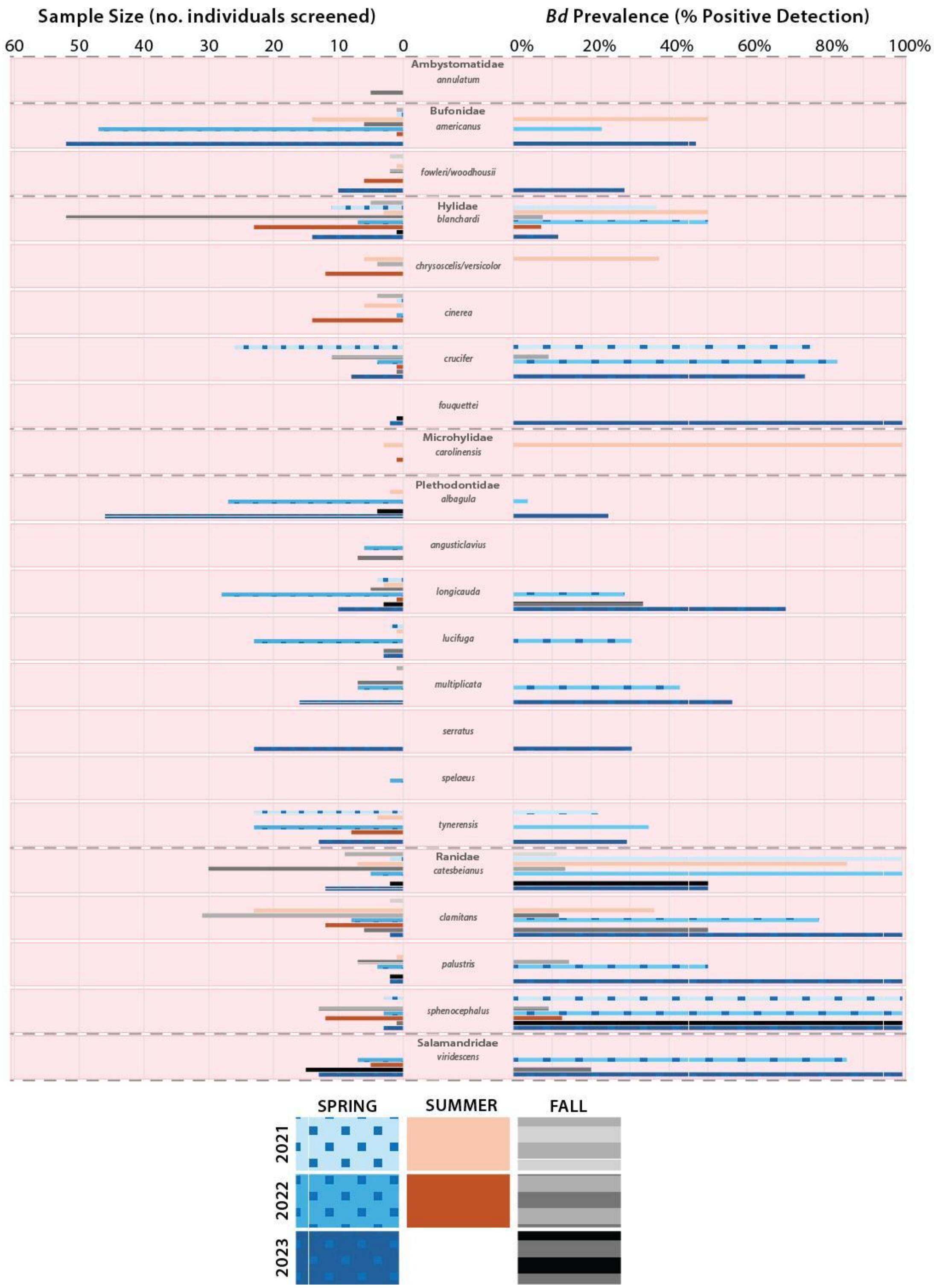


Figure 4. Summary of seasonal trends in RV prevalence among amphibians sampled at the study's focal sites. Prevalence results shown across from sample sizes for reference, as high disease prevalence in some cases may be an artifact of small sample sizes screened during the project period for some taxa encountered less often.

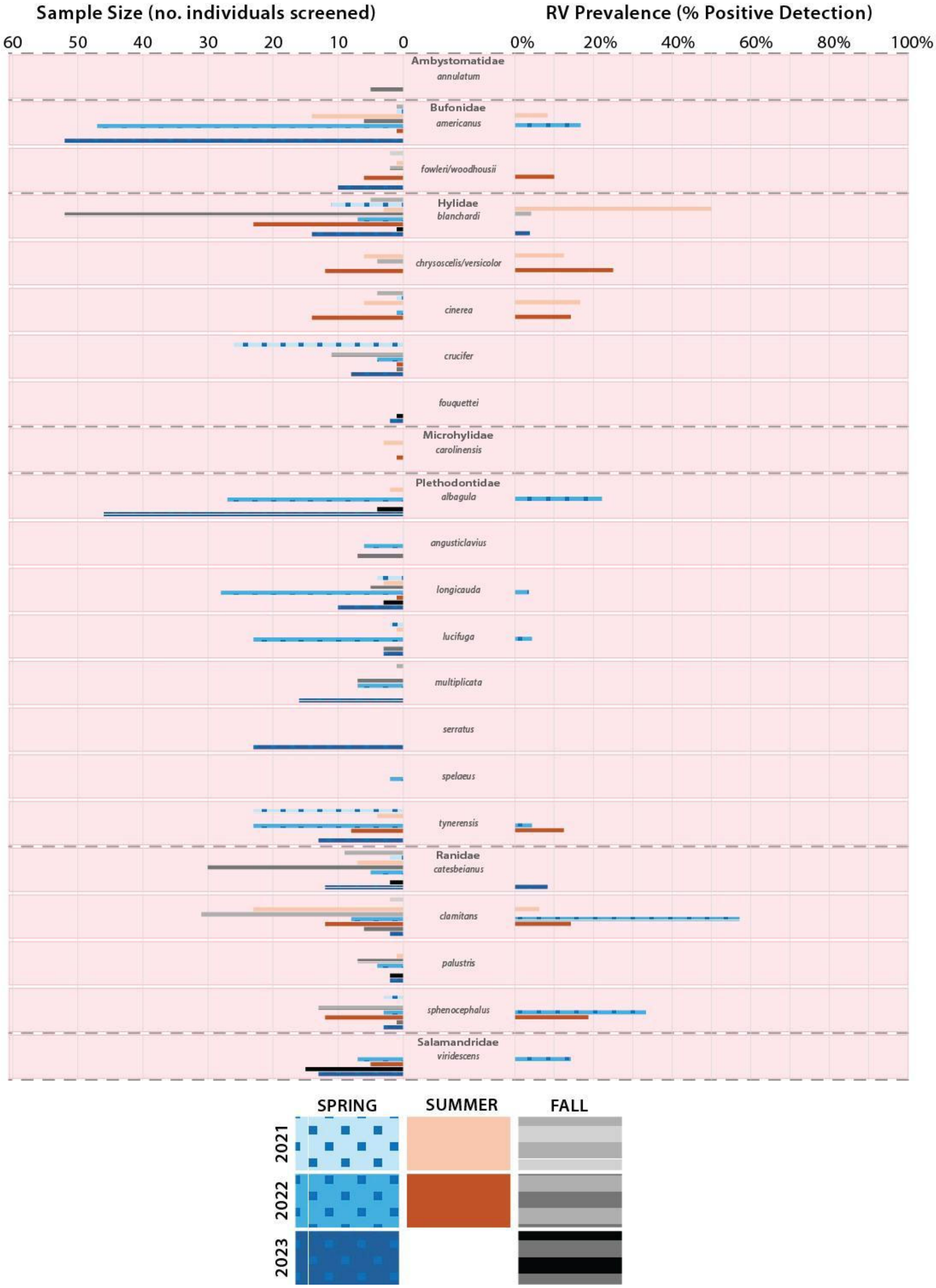


Figure 5. Comparison of *Bd* and RV Prevalence among All Pooled Samples of Amphibians, Separated by Order (Anura and Caudata), Screened Between 2021 and 2023.

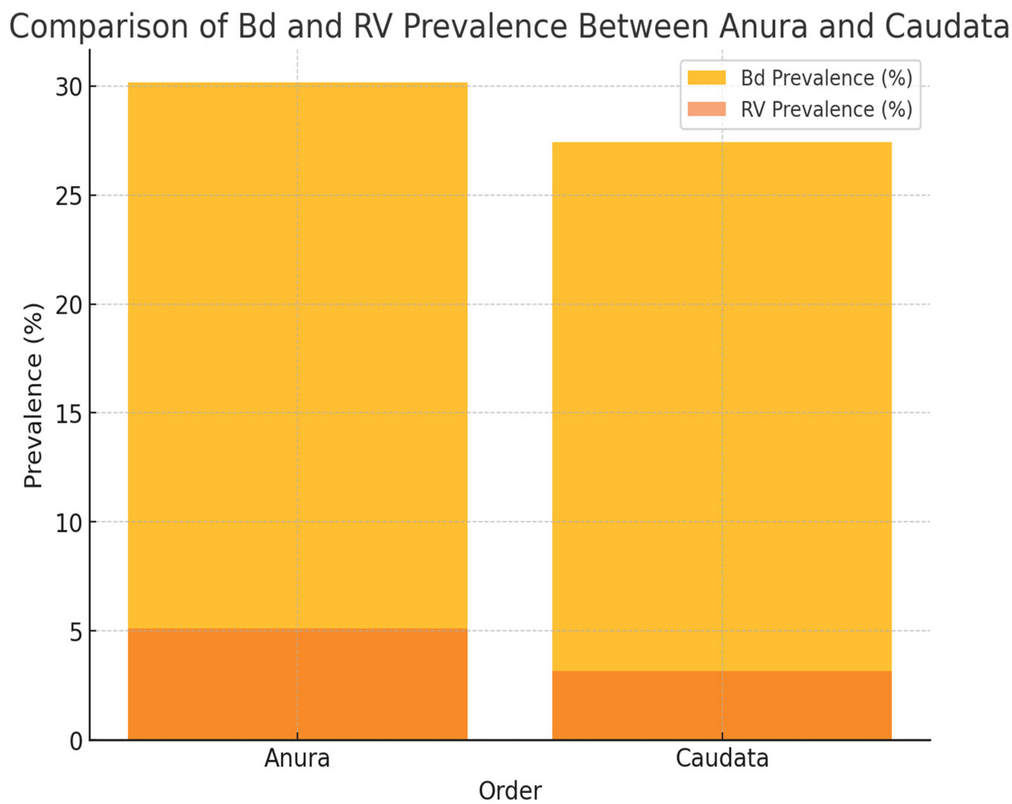
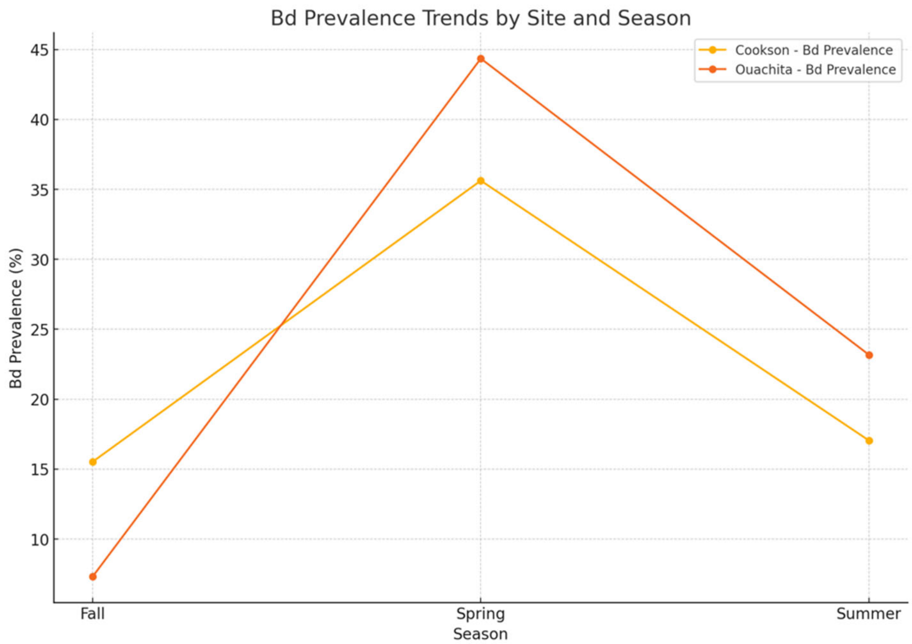


Figure 6. Visualization of Temporal Trends of *Bd* and RV Infection Loads (top) and Prevalence (bottom) from 2021 to 2023.

Figure 7. Visualization of Temporal Trends of *Bd* (top) and RV (bottom) Prevalence by Focal Sampling Site Across the Study Period.



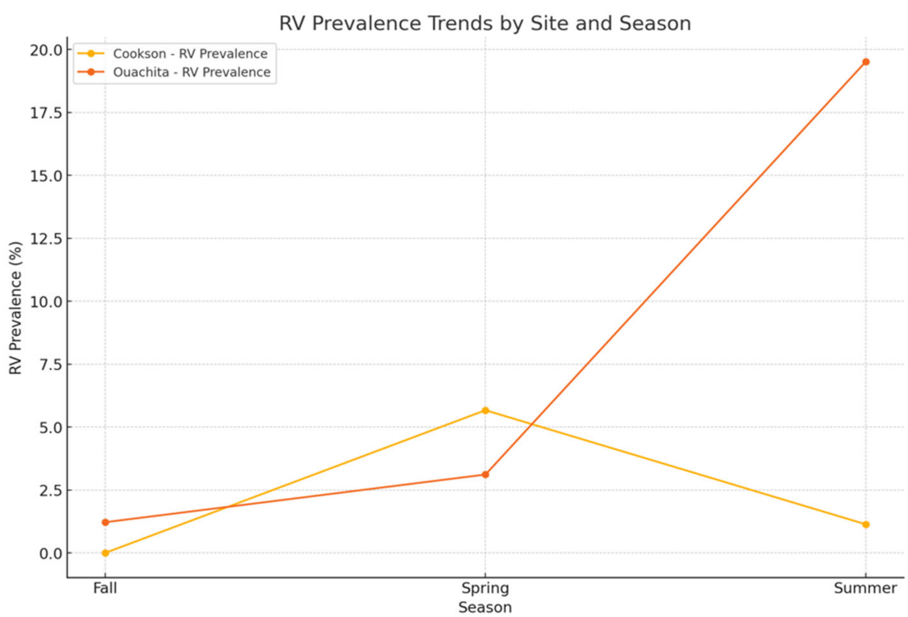
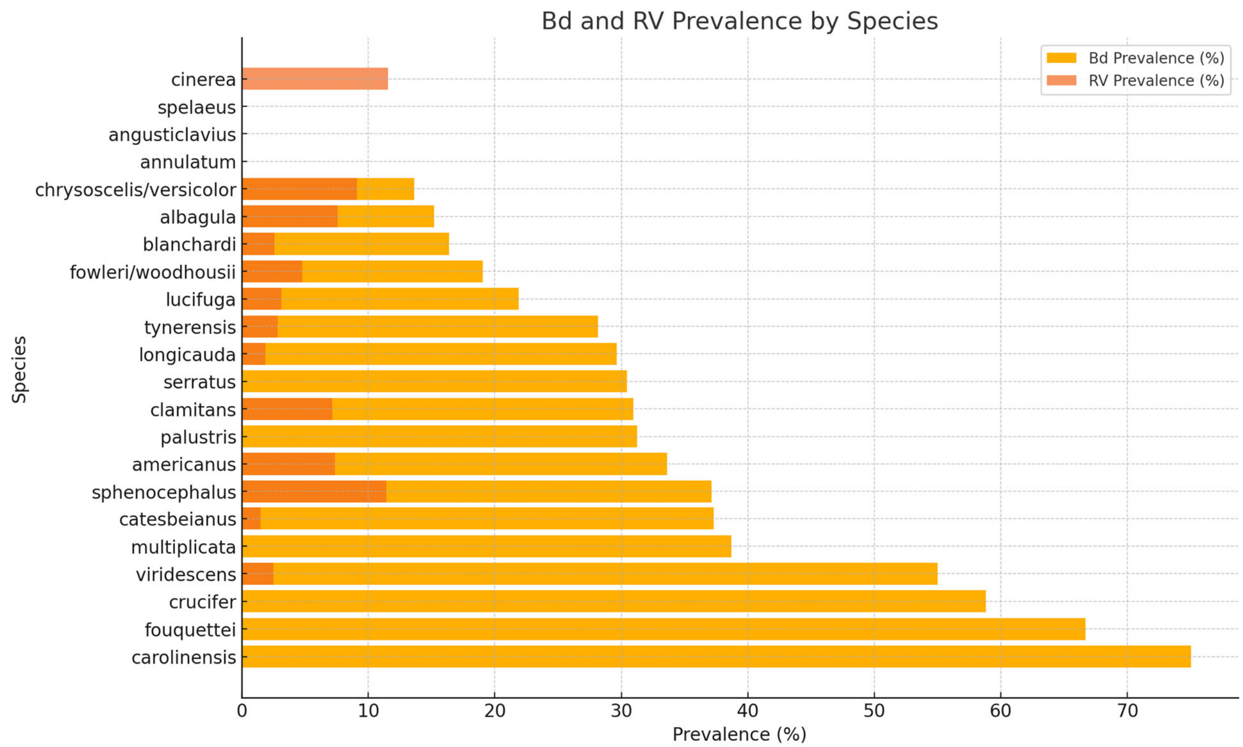


Figure 8. Graph of Pooled Infection Patterns by Amphibian Species Observed during the 2021 – 2023 period.* Note that *Hyla cinerea* is unique; in a sample of 26 individuals, none were positive for Bd but three were positive for RV.



* Sample sizes listed largest to smallest: *A. americanus* (n=122), *A. blanchardi* (n=116), *L. clamitans* (n=84), *P. albagula* (n=79), *E. tynerensis* (n=71), *L. catesbeianus* (n=67), *E. longicauda* (n=54), *P. crucifer* (n=51), *N. viridescens* (n=40), *L. sphenocephalus* (n=35), *E. lucifuga* (n=32), *E. multiplicata* (n=30), *H. cinerea* (n=26), *P. serratus* (n=23), *H. chrysoscelis/versicolor* (n=22), *A. fowleri/woodhousii* (n=21), *L. palustris* (n=16), *P. angusticlavius* (n=13), *A. annulatum* (n=5), *G. carolinensis* (n=4), *P. fouquettei* (n=3), and *E. spelaeus* (n=2).

OMNH ID	Order	Family	Genus	Species	:ate_or_Provin	County	Locality	Latitude	Longitude
49280	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA, .	35.68972	-94.8425
49340	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA, .	35.68972	-94.8425
48273	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Le Flore	Ouachita NF WN	34.7803	-94.69347
48274	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Le Flore	Ouachita NF WN	34.7803	-94.69347
48279	Anura	Bufonidae	Anaxyrus	woodhousii	Oklahoma	Le Flore	Ouachita NF WN	34.7803	-94.69347
49389	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA, .	35.68972	-94.8425
48271	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Cherokee	Cookson WMA, .	35.69655	-94.83254
48283	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Ouachita Nationa	34.76917	-94.71061
48284	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Ouachita Nationa	34.78434	-94.69495
48297	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Ouachita Nationa	34.76896	-94.71066
48321	Caudata	Plethodontidae	Eurycea	multiplicata	Oklahoma	Le Flore	Ouachita Nationa	34.76594	-94.67789
48324	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68892	-94.84399
48903	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49264	Anura	Bufonidae	Anaxyrus	woodhousii	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49341	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49342	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49343	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49344	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49260	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Le Flore	Ouachita Nationa	34.79422	-94.74095
49345	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49352	Anura	Ranidae	Lithobates	palustris	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49265	Anura	Bufonidae	Anaxyrus	woodhousii	Oklahoma	Le Flore	Ouachita Nationa	34.7803	-94.69347
49353	Anura	Ranidae	Lithobates	palustris	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49271	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Ouachita Nationa	34.79354	-94.74619
49359	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49360	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49361	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49362	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49373	Caudata	Plethodontidae	Eurycea	longicauda	Oklahoma	Cherokee	Cookson WMA,	35.68892	-94.84399
49374	Caudata	Plethodontidae	Eurycea	longicauda	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49383	Caudata	Plethodontidae	Plethodon	albagula	Oklahoma	Cherokee	Cookson WMA,	35.68892	-94.84399
49411	Caudata	Plethodontidae	Eurycea	longicauda	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49412	Caudata	Plethodontidae	Eurycea	longicauda	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49421	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49536	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49337	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Ouachita Nationa	34.79354	-94.74619
49338	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Ouachita Nationa	34.79354	-94.74619
49339	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Ouachita Nationa	34.79354	-94.74619
49537	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49538	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49539	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376

49540	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49541	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49544	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49545	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49546	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49547	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49701	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
49771	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.68887	-94.84376
48280	Anura	Hylidae	Acris	blanchardi	Oklahoma	Cherokee	Cookson WMA,	35.67444	-94.84029
48317	Caudata	Plethodontidae	Eurycea	longicauda	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
48318	Caudata	Plethodontidae	Eurycea	lucifuga	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
48322	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.67444	-94.84029
48323	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.67444	-94.84029
49377	Caudata	Plethodontidae	Eurycea	lucifuga	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
49381	Caudata	Plethodontidae	Eurycea	tynerensis	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
49384	Caudata	Plethodontidae	Plethodon	albagula	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
49385	Caudata	Plethodontidae	Plethodon	albagula	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
49369	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Ouachita Nationa	34.79354	-94.74619
49386	Caudata	Plethodontidae	Plethodon	albagula	Oklahoma	Cherokee	Cookson WMA,	35.67421	-94.83999
49390	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49391	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49392	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49393	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49394	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49395	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49380	Caudata	Plethodontidae	Eurycea	multiplicata	Oklahoma	Le Flore	Ouachita Nationa	34.76896	-94.71066
49403	Caudata	Ambystomatida	Ambystoma	maculatum	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49281	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49282	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49283	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49284	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49285	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49286	Anura	Hylidae	Hyla	chrysoscelis/ve	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49301	Anura	Microhylidae	Gastrophryne	carolinensis	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49396	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49423	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49548	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49549	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49550	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49551	Caudata	Salamandridae	Notophthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49702	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49741	Caudata	Ambystomatida	Ambystoma	annulatum	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343

49742	Caudata	Ambystomatida	Ambystoma	annulatum	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49762	Caudata	Salamandridae	Notophalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49763	Caudata	Salamandridae	Notophalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49764	Caudata	Salamandridae	Notopthalmus	viridescens	Oklahoma	Cherokee	Cookson WMA,	35.68657	-94.84343
49694	Caudata	Plethodontidae	Plethodon	serratus	Oklahoma	Le Flore	Poteau Mountair	34.92959	-94.52731
49695	Caudata	Plethodontidae	Plethodon	serratus	Oklahoma	Le Flore	Poteau Mountair	34.92959	-94.52731
49725	Anura	Hylidae	Pseudacris	fouquettei	Oklahoma	Le Flore	Ouachita Nationa	34.7945	-94.71632
49726	Anura	Hylidae	Pseudacris	fouquettei	Oklahoma	Le Flore	Ouachita Nationa	34.7945	-94.71632
49732	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Le Flore	Ouachita Nationa	34.7945	-94.71632
49738	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Ouachita Nationa	34.7945	-94.71632
49750	Caudata	Plethodontidae	Eurycea	multiplicata	Oklahoma	Le Flore	Ouachita Nationa	34.73287	-94.70867
49751	Caudata	Plethodontidae	Eurycea	multiplicata	Oklahoma	Le Flore	Ouachita Nationa	34.73287	-94.70867
49760	Caudata	Plethodontidae	Plethodon	serratus	Oklahoma	Le Flore	Ouachita Nationa	34.72958	-94.70633
49761	Caudata	Plethodontidae	Plethodon	serratus	Oklahoma	Le Flore	Ouachita Nationa	34.72958	-94.70633
48275	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48276	Anura	Bufonidae	Anaxyrus	americanus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48285	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
48286	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48298	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48299	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
48300	Anura	Ranidae	Lithobates	catesbeianus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48303	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48304	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
48305	Anura	Ranidae	Lithobates	clamitans	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48307	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.7945	-94.71632
48308	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
48309	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
48310	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.79459	-94.71591
48311	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
48320	Caudata	Plethodontidae	Eurycea	multiplicata	Oklahoma	Le Flore	Homer Johnson	34.78287	-94.71841
49268	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49269	Anura	Hylidae	Acris	blanchardi	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49363	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49364	Anura	Ranidae	Lithobates	sphenocephalu	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49257	Serpentes	Viperidae	Agkistrodon	piscivorus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49258	Serpentes	Viperidae	Agkistrodon	piscivorus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484
49259	Serpentes	Viperidae	Agkistrodon	piscivorus	Oklahoma	Le Flore	Homer Johnson	34.78162	-94.71484

Day	Month	Year	Collectors
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
26	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
26	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Forrest Nielsen, Ashlyn Donaho
3	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
17	April	2021	Jessa L. Watters, Katherine Stroh, Emma Clary, Jordon Henderson
17	April	2021	Katherine Stroh
17	April	2021	Jessa L. Watters, Katherine Stroh, Emma Clary, Jordon Henderson
23	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
3	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
29	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
22	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
28	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
29	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
22	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
22	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
22	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
14	October	2022	Jessa L. Watters, Forrest Nielsen, Jordon Henderson, Emma Franklin
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
29	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
29	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
29	October	2022	Jessa L. Watters, Cameron R. Forehand, Claudia R. Goss
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho

24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
24	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Ashlyn Donaho
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
22	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
28	April	2023	Jessa L. Watters, Claudia Goss, Jordon Henderson, Emma Franklin, Julianne Li
28	April	2023	Jessa L. Watters, Claudia Goss, Jordon Henderson, Emma Franklin, Julianne Li
2	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
2	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
2	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
2	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
2	April	2021	Jessa L. Watters, Alexandria Fulton, Jordon Henderson, Gracie Hedgepeth
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
2	April	2022	Alexandria Fulton, Katherine Stroh, Madelyn Kirsch, Emma Clary
23	April	2022	Cameron D. Siler, Madelyn Kirsch, Forrest Nielsen, Emma Clary, Gracie Hedgpeth, Ashlyn Donaho
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
23	July	2022	Jessa L. Watters, Gracie Hedgpeth, Jordon Henderson
28	April	2023	Jessa L. Watters, Claudia Goss, Jordon Henderson, Emma Franklin, Julianne Li
27	October	2023	Jessa L. Watters, Cameron Forehand, Julianne Li, Vince Cantrell

27	October	2023	Jessa L. Watters, Cameron Forehand, Julianne Li, Vince Cantrell
28	April	2023	Jessa L. Watters, Claudia Goss, Jordon Henderson, Emma Franklin, Julianne Li
28	April	2023	Jessa L. Watters, Claudia Goss, Jordon Henderson, Emma Franklin, Julianne Li
27	October	2023	Jessa L. Watters, Cameron Forehand, Julianne Li, Vince Cantrell
29	November	2022	Donald B. Shepard and Makenzie L. Meacham
29	November	2022	Donald B. Shepard and Makenzie L. Meacham
24	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
24	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
24	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
24	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
25	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
25	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
25	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
25	March	2023	Cameron D. Siler, Sierra N. Smith, Herpetology class
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
26	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
26	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
17	April	2021	Jessa L. Watters, Katherine Stroh, Emma Clary, Jordon Henderson
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
25	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
26	June	2021	Jessa L. Watters, Jordon Henderson, Gracie Hedgpeth, Emma Clary
22	October	2021	Sierra N. Smith, Gracie Hedgpeth, Emma Clary, Madelyn Kirsch
17	April	2021	Jessa L. Watters, Katherine Stroh, Emma Clary, Jordon Henderson
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
1	April	2022	Alexandria Fulton, Katherine Stroh, Madelyn Kirsch, Emma Clary
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch
24	June	2022	Sierra N. Smith, Forrest Nielsen, Gracie Hedgpeth, Madelyn Kirsch

Encountered Amphibians - Cookson WMA

Site	Locality	Latitude	Longitude	Season	Year	Genus	Species	N
	Cookson WMA, along Headquarters Rd.	35.69655	-94.83254	Spring	2021	Anaxyrus	americanus	1
						Eurycea	tynerensis	5
	Cookson WMA, creek along Bolin Hollow Rd just off Blue Top Rd.	35.66319	-94.82766	Spring	2021	Eurycea	longicauda	2
						Eurycea	tynerensis	1
				Summer	2022	Eurycea	tynerensis	4
						Eurycea	longicauda	1
				Spring	2023	Eurycea	tynerensis	1
				Fall	2023	Eurycea	sp. [unID larvae]	1
						Lithobates	clamitans	2
	Cookson WMA, follow headquarters road until it ends at Bolin Hollow Rd.	35.67246	-94.83694	Summer	2021	Anaxyrus	americanus	1
						Hyla	chrysoscelis/versicolor	2
						Plethodon	albagula	2
						Eurycea	lucifuga	1
						Lithobates	catesbeianus	1
	Cookson WMA, Elk Creek, near old bridge, second pull-off after headquarters on Blue Top Rd.	35.67421	-94.83999	Spring	2021	Acris	blanchardi	1
						Eurycea	lucifuga	3
						Eurycea	tynerensis	3
						Eurycea	longicauda	3
				Spring	2022	Eurycea	lucifuga	17
						Plethodon	albagula	7
						Plethodon	angusticlavius	1
						Eurycea	tynerensis	5
				Summer	2022	Lithobates	clamitans	1
						Lithobates	sphenocephalus	1
	Cookson WMA, Elk Creek, near old bridge	35.67444	-94.84029	Spring	2021	Acris	blanchardi	4
						Eurycea	tynerensis	3

	Cookson WMA, second pull-off on right after Cookson headquarters. Parked in front of gate and walked	35.6754	-94.84237	Summer	2021	Acris	blanchardi	2
						Eurycea	tynerensis	4
						Lithobates	clamitans	5
						Lithobates	catesbeianus	2
				Fall	2022	Lithobates	sp. [unID tadpole]	1
				Spring	2023	Eurycea	lucifuga	3
						Eurycea	tynerensis	8
						Plethodon	albagula	3
				Fall	2023	Acris	blanchardi	1
						Ambystoma	annulatum	2
						Eurycea	lucifuga	3
						Lithobates	clamitans	1
						Lithobates	palustris	2
						Plethodon	albagula	4
						Plethodon	angusticlavius	3
	Cookson WMA, first pond on Headquarters Rd. after Walnut Rd. jct	35.68657	-94.84343	Spring	2022	Ambystoma	sp. [unID larvae]	3
						Ambystoma	maculatum	1
						Anaxyrus	sp. [unID tadpole]	1
						Lithobates	sp. [unID tadpole]	3
						Notophthalmus	viridescens	6
				Summer	2022	Acris	blanchardi	8
						Gastrophryne	carolinensis	1
						Hyla	chrysoscelis/versicolor	7
						Lithobates	clamitans	1
						Lithobates	sphenocephalus	1
						Notophthalmus	viridescens	5
				Fall	2022	Acris	blanchardi	3
				Spring	2023	Anaxyrus	americanus	4
						Notophalmus	viridescens	14
				Fall	2023	Ambystoma	annulatum	2

Cookson				Fall	2023	Notopthalmus	viridescens	15
	Cookson WMA, creek crossing Headquarters Rd., just before Pipe Springs Rd. jct	35.68887	-94.84376	Spring	2021	Eurycea	tynerensis	11
				Spring	2022	Anaxyrus	americanus	3
						Eurycea	longicauda	11
						Eurycea	lucifuga	1
						Eurycea	tynerensis	8
						Eurycea	sp. [unID larvae]	1
						Lithobates	clamitans	3
						Lithobates	palustris	1
						Lithobates	sphenocephalus	2
						Lithobates	sp. [unID tadpole]	1
						Plethodon	albagula	13
						Plethodon	angusticlavius	4
				Summer	2022	Eurycea	tynerensis	4
						Lithobates	clamitans	1
						Lithobates	sphenocephalus	2
				Fall	2022	Acris	blanchardi	5
						Anaxyrus	americanus	1
						Anaxyrus	woodhousii	1
						Hyla	chrysoscelis/versicolor	3
						Lithobates	clamitans	17
						Lithobates	palustris	1
						Lithobates	sphenocephalus	7
						Lithobates	sp. [unID tadpole]	5
						Pseudacris	crucifer	7
				Spring	2023	Anaxyrus	americanus	5
						Anaxyrus	woodhousii	2
						Eurycea	tynerensis	1
				Fall	2023	Ambystoma	annulatum	1
						Lithobates	clamitans	2
						Plethodon	angusticlavius	3
						Ambystoma	sp. [unID larvae]	3

	Cookson WMA, 2nd pond along Headquarters Rd., after intersection with Pipe Springs Rd.	35.68972	-94.8425	Spring	2022	Anaxyrus	americanus	1
						Anaxyrus	sp. [unID tadpole]	3
						Lithobates	sp. [unID tadpole]	3
						Notophthalmus	viridescens	1
				Summer	2022	Lithobates	clamitans	1
						Lithobates	sp. [unID tadpole]	7
				Fall	2022	Acris	blanchardi	1
						Hyla	chroscelis/versicolor	1
						Lithobates	clamitans	3
						Lithobates	sphenocephalus	3
						Pseudacris	crucifer	1
				Spring	2023	Acris	blanchardi	1
						Ambystoma	sp. [unID larvae]	13
							[unID tadpole]	9
						Lithobates	sp. [unID tadpole]	5
				Fall	2023	Lithobates	sp. [unID tadpole]	2
	Cookson WMA, pond along Headquarters Rd.	35.69008	-94.84254	Spring	2021	Ambystoma	sp. [unID larvae]	2
						Lithobates	sphenocephalus	3
	Cookson WMA, N edge, stream crossing along Pipe Springs Rd., next to agricultural field	35.70851	-94.83516	Summer	2021	Anaxyrus	americanus	1
						Eurycea	longicauda	3
						Lithobates	catesbeianus	4
						Lithobates	clamitans	2
				Fall	2022	Acris	blanchardi	31
						Anaxyrus	americanus	2
						Eurycea	longicauda	5
						Lithobates	clamitans	11
						Lithobates	palustris	6
						Lithobates	sphenocephalus	1
						Pseudacris	crucifer	3
							[unID tadpole]	6
						Anaxyrus	americanus	10
						Anaxyrus	woodhousii	1

				Spring	2023	Eurycea	longicauda	10
						Lithobates	palustris	1
						Plethodon	albagula	1
				Fall	2023	Eurycea	longicauda	3
						Plethodon	angusticlavius	1
						Pseudacris	fouquettei	1
							[unID tadpole]	2
							TOTAL	**488**

Encountered Amphibians - Ouachita NF

Site	Locality	Latitude	Longitude	Season	Year	Genus	Species	N
	Ouachita National Forest, salamander side stream 2	34.72102	-94.70722	Spring	2023	Eurycea	multiplicata	1
						Plethodon	albagula	15
						Plethodon	serratus	1
	Ouachita National Forest, salamander side stream 1	34.72958	-94.70633	Spring	2023	Eurycea	multiplicata	2
						Plethodon	albagula	10
						Plethodon	serratus	16
						Plethodon	sp. [unID larvae]	1
	Ouachita National Forest, salamander side stream 3	34.73287	-94.70867	Spring	2023	Anaxyrus	americanus	1
						Eurycea	multiplicata	3
						Plethodon	albagula	2
	Ouachita National Forest, salamander side stream 4	34.73744	-94.71129	Spring	2023	Eurycea	multiplicata	10
						Plethodon	albagula	15
						Plethodon	serratus	6
				Spring	2021	Acris	blanchardi	3
						Hyla	cinerea	1
						Pseudacris	crucifer	21
						Pseudacris	fouquettei	1
				Summer	2021	Anaxyrus	americanus	6
						Hyla	chrysoscelis/versicolor	4
						Hyla	cinerea	6

	Ouachita NF WMA, pond along Holson Valley Rd., just West of Cedar Lake Rd.	34.76464	-94.69873	Summer	2021	Gastrophryne	carolinensis	3
						Lithobates	clamitans	16
						Lithobates	palustris	1
				Fall	2021	Acris	blanchardi	2
						Hyla	cinerea	4
				Spring	2022	Acris	blanchardi	2
						Anaxyrus	americanus	1
						Hyla	cinerea	1
						Lithobates	catesbeianus	2
						Pseudacris	crucifer	2
				Summer	2022	Hyla	chrysoscelis/versicolor	2
						Hyla	cinerea	13
						Lithobates	clamitans	4
				Fall	2022	Acris	blanchardi	2
						Anaxyrus	americanus	2
						Eurycea	multiplicata	2
						Lithobates	catesbeianus	6
						Lithobates	clamitans	1
						Lithobates	sphenocephalus	1
				Spring	2023	Anaxyrus	americanus	28
						Anaxyrus	cf. fowleri	5
						Lithobates	catesbeianus	7
						Lithobates	sphenocephalus	2
						Pseudacris	crucifer	7
	Ouachita National Forest WMA, Hoot Hollow, dry creek under Holson Valley Road with small pools	34.76594	-94.67789	Fall	2021	Anaxyrus	americanus	1
						Eurycea	multiplicata	1
						Lithobates	clamitans	2
	Ouachita National Forest WMA, along Holson Valley Rd., East of Cedar Lake Rd., horse trail ditch	34.7679	-94.71014	Spring	2021	Acris	blanchardi	2
						Lithobates	catesbeianus	1
						Pseudacris	crucifer	4
				Spring	2021	Acris	blanchardi	1
						Lithobates	sp. [unID tadpole]	1

Ouachita	Ouachita National Forest, stream in small ravine, crossing horse trail, below turn off at codes #14, #16	34.76896	-94.71066			Lithobates	catesbeianus	1
				Spring	2022	Acris	blanchardi	2
						Eurycea	multiplicata	7
						Lithobates	catesbeianus	2
						Lithobates	clamitans	1
	Ouachita National Forest WMA, Cedar Lake campground on the bank of lake inlet	34.78027	-94.69345	Summer	2021	Anaxyrus	americanus	4
						Anaxyrus	woodhousii	1
				Fall	2021	Acris	blanchardi	5
						Anaxyrus	fowleri/woodhousii	1
						Anaxyrus	woodhousii	1
						Lithobates	catesbeianus	9
	Homer Johnson WMA, 1st creek crossing main road	34.78162	-94.71484	Summer	2021	Acris	blanchardi	10
						Anaxyrus	americanus	6
						Lithobates	catesbeianus	6
						Lithobates	clamitans	2
				Fall	2021	Acris	blanchardi	1
						Anaxyrus	americanus	1
						Lithobates	catesbeianus	10
						Lithobates	clamitans	17
						Lithobates	sphenocephalus	1
				Summer	2022	Acris	blanchardi	2
						Hyla	chrysoscelis/versicolor	1
						Lithobates	catesbeianus	3
						Lithobates	sphenocephalus	1
				Spring	2021		[unID tadpole]	1
						Pseudacris	crucifer	1
				Summer	2021	Acris	blanchardi	1
						Anaxyrus	americanus	2
				Spring	2022	Anaxyrus	americanus	36
						Lithobates	catesbeianus	1
						Pseudacris	crucifer	1
						Acris	blanchardi	2

	Ouachita National Forest, lake inlet by Cedar Lake campground	34.78253	-94.69347	Summer	2022	Anaxyrus	fowleri/woodhousi	1
						Anaxyrus	woodhousi	4
						Hyla	cinerea	1
						Lithobates	clamitans	3
						Lithobates	palustris	1
						Lithobates	sphenocephalus	8
				Spring	2023	Acris	blanchardi	13
						Anaxyrus	americanus	3
						Anaxyrus	cf. fowleri	2
						Lithobates	catesbeianus	3
						Lithobates	clamitans	1
						Lithobates	palustris	1
						Pseudacris	crucifer	1
	Homer Johnson WMA, 2nd creek crossing main road	34.78279	-94.71905	Spring	2021	Acris	blanchardi	1
						Eurycea	multiplicata	1
						Lithobates	catesbeianus	2
						Lithobates	sp. [unID tadpole]	1
				Summer	2021	Acris	blanchardi	7
						Hyla	chrysoscelis/versicolor	3
						Lithobates	catesbeianus	3
						Lithobates	clamitans	1
						Lithobates	sphenocephalus	2
						Lithobates	sp. [unID tadpole]	2
				Fall	2021	Acris	blanchardi	2
						Anaxyrus	americanus	2
						Lithobates	catesbeianus	5
						Lithobates	clamitans	6
						Lithobates	sphenocephalus	3
				Summer	2022	Acris	blanchardi	2
						Lithobates	catesbeianus	5
						Lithobates	sphenocephalus	5
				Fall	2022	Eurycea	multiplicata	4

				Fall	2022	Lithobates	catesbeianus	1
				Spring	2023		[unID larvae]	5
						Lithobates	catesbeianus	2
	Ouachita National Forest WMA, Cedar Lake campground near site 51 and picnic shelter	34.78437	-94.69737	Spring	2021		[unID tadpole]	2
	Ouachita National Forest WMA, trail along Cedar Lake	34.78434	-94.69495	Spring	2021	Acris	blanchardi	1
	Ouachita National Forest, Homer Johnson WMA, ~2 mile down to left at Y intersection	34.79354	-94.74619	Spring	2022	Acris	blanchardi	1
						Lithobates	catesbeianus	10
						Lithobates	clamitans	1
						Lithobates	sphenocephalus	1
				Summer	2022	Acris	blanchardi	1
						Hyla	cinerea	6
						Lithobates	catesbeianus	4
						Lithobates	sphenocephalus	3
				Fall	2022	Acris	blanchardi	9
						Lithobates	catesbeianus	24
						Lithobates	sp. [unID tadpole]	6
	Ouachita National Forest, Homer Johnson WMA, along road near "Swampy Lake"	34.79422	-94.74095	Fall	2022	Anaxyrus	americanus	1
	Ouachita National Forest, Homer Johnson WMA, third stream crossing the road	34.7945	-94.71632	Spring	2021	Lithobates	catesbeianus	1
						Lithobates	sphenocephalus	1
				Summer	2021	Lithobates	catesbeianus	2
						Lithobates	sphenocephalus	8
				Fall	2022	Eurycea	multiplicata	1
						Lithobates	sphenocephalus	1
				Spring	2023	Lithobates	catesbeianus	5
						Lithobates	clamitans	6
						Lithobates	sphenocephalus	1
						Pseudacris	fouquettei	2
							TOTAL	**599**

Encountered Reptiles - Cookson WMA

Site	Locality	Latitude	Longitude	Season	Year	Genus	Species	N
Cookson	Cookson WMA, creek along Bolin Hollow Rd just off Blue Top Rd.	35.66319	-94.82766	Spring	2021	Storeria	occipitomaculata	1
						Agkistrodon	piscivorus	1
						Diadophis	punctatus	1
				Summer	2022	Crotalus	horridus	1
				Spring	2023	Storeria	dekayi	1
						Terrapene	carolina	1
	Cookson WMA, second pull-off on right after Cookson headquarters. Parked in front of gate and walked	35.6754	-94.84237	Spring	2021	Nerodia	erythrogaster	2
						Storeria	occipitomaculata	1
	Cookson WMA, first gate along Headquarters Rd.	35.680325	-94.845075	Spring	2022	Diadophis	punctatus	1
	Cookson WMA, creek crossing Headquarters Rd., just before Pipe Springs Rd. jct	35.68887	-94.84376	Spring	2022	Agkistrodon	contortrix	1
				Fall	2023	Diadophis	punctatus	1
	Cookson WMA, pond along Headquarters Rd.	35.68972	-94.8425	Spring	2021	Nerodia	erythrogaster	3
	Cookson WMA, along Headquarters Rd.	35.692626	-94.836995	Spring	2022	Pantherophis	obsoletus	1
	Cookson WMA, N edge, stream crossing along Pipe Springs Rd., next to agricultural field	35.70851	-94.83516	Summer	2021	Agkistrodon	piscivorus	1
						Nerodia	erythrogaster	1
				Fall	2022	Nerodia	erythrogaster	1
						Sceloporus	consobrinus	1
						Nerodia	sipedon	3
				Spring	2023	Nerodia	erythrogaster	1
	along Cookson Bend Rd., between campground and Hwy 82/100	35.711143	-94.26161	Fall	2022	Terrapene	carolina	1
	Cookson WMA, on road near HQ of WMA	35.68041	-94.84684	Spring	2023	Terrapene	carolina	1
							TOTAL	**26**

Encountered Reptiles - Ouachita NF

Site	Locality	Latitude	Longitude	Season	Year	Genus	Species	N
Ouachita	Ouachita National Forest, salamander side stream 2	34.72102	-94.70722	Spring	2023	Carphophis	vermis	2
	Ouachita National Forest, salamander side stream 4	34.73744	-94.71129	Spring	2023	Plestiodon	fasciatus	2
	Ouachita National Forest, first right-hand pull-off from Holson Valley Rd from Cedar Lake campground, heading W	34.76464	-94.69873	Summer	2021	Terrapene	carolina	2
				Spring	2023	Agkistrodon	piscivorus	2
	Ouachita National Forest WMA, Cedar Lake campground on the bank of lake inlet	34.78027	-94.69345	Fall	2021	Scincella	lateralis	1
	Homer Johnson WMA, 1st creek crossing main road	34.78162	-94.71484	Summer	2021	Nerodia	erythrogaster	1
				Summer	2022	Agkistrodon	piscivorus	3
	Ouachita National Forest, cedar lake campground around lake inlet	34.78253	-94.69347	Summer	2021	Sternotherus	odoratus	6
						Trachemys	scripta	1
				Spring	2022	Sternotherus	odoratus	1
				Summer	2022	Sternotherus	odoratus	3
						Trachemys	scripta	3
				Fall	2022	Sternotherus	odoratus	11
				Spring	2023	Agkistrodon	piscivorus	1
						Anolis	carolinensis	1
						Diadophis	punctatus	4
						Plestiodon	anthracinus	1
						Plestiodon	fasciatus	2
						Sceloporus	consubrinus	1
						Tantilla	gracilis	2
						Thamnophis	proximus	1
	Ouachita National Forest WMA, Cedar Lake campground near site 51 and picnic shelter	34.78279	-94.69408	Spring	2021	Agkistrodon	piscivorus	1
						Sternotherus	odoratus	1
	Homer Johnson WMA, second stream crossing road in WMA	34.78281	-94.71892	Spring	2021	Diadophis	punctatus	1
	Ouachita National Forest, Homer Johnson WMA, ~2 mile down to left at Y intersection	34.79354	-94.74619	Summer	2022	Nerodia	erythrogaster	1
							TOTAL	**55**

Site	Year	Season	Month	Family	Genus	Species	N	Bd+	Bd %	Bd average infection load	RV+	Rv %	RV average infection load
Cookson	2021	Spring	April	Bufonidae	Anaxyrus	americanus	1	0	0%		0	0%	
Cookson	2021	Spring	April	Hylidae	Acris	blanchardi	5	2	40%	118047.3836	0	0%	
Cookson	2021	Spring	April	Plethodontidae	Eurycea	longicauda	4	0	0%		0	0%	
Cookson	2021	Spring	April	Plethodontidae	Eurycea	tynerensis	23	5	22%	9760.584517	0	0%	
Cookson	2021	Spring	April	Plethodontidae	Eurycea	lucifuga	2	0	0%		0	0%	
Cookson	2021	Spring	April	Ranidae	Lithobates	sphenocephalus	3	3	100%	90735.83573	0	0%	
Cookson	2021	Summer	June	Bufonidae	Anaxyrus	americanus	2	1	50%	297.9872437	0	0%	
Cookson	2021	Summer	June	Hylidae	Acris	blanchardi	2	2	100%	4874.535592	0	0%	
Cookson	2021	Summer	June	Hylidae	Hyla	chrysoscelis/ versicolor	2	0	0%		0	0%	
Cookson	2021	Summer	June	Plethodontidae	Eurycea	longicauda	3	0	0%		0	0%	
Cookson	2021	Summer	June	Plethodontidae	Eurycea	tynerensis	4	0	0%		0	0%	
Cookson	2021	Summer	June	Plethodontidae	Eurycea	lucifuga	1	0	0%		0	0%	
Cookson	2021	Summer	June	Plethodontidae	Plethodon	albagula	2	0	0%		0	0%	
Cookson	2021	Summer	June	Ranidae	Lithobates	catesbeianus	7	6	86%	806.8114499	0	0%	
Cookson	2021	Summer	June	Ranidae	Lithobates	clamitans	7	2	29%	1240.016937	0	0%	
Ouachita	2021	Spring	April	Hylidae	Acris	blanchardi	6	2	33%	12679.84281	0	0%	
Ouachita	2021	Spring	April	Hylidae	Hyla	cinerea	1	0	0%		0	0%	
Ouachita	2021	Spring	April	Hylidae	Pseudacris	crucifer	26	20	77%	43659.75005	0	0%	
Ouachita	2021	Spring	April	Kinosternidae	Sternotherus	odoratus	1	0	0%		0	0%	
Ouachita	2021	Spring	April	Ranidae	Lithobates	catesbeianus	2	2	100%	18847.45458	0	0%	
Ouachita	2021	Summer	June	Bufonidae	Anaxyrus	americanus	12	6	50%	297.9872437	2	17%	1484.1
Ouachita	2021	Summer	June	Bufonidae	Anaxyrus	fowleri/woodhousii	1	0	0%		0	0%	
Ouachita	2021	Summer	June	Emydidae	Trachemys	scripta	1	0	0%		1	100%	52656.66667
Ouachita	2021	Summer	June	Emydidae	Terrapene	carolina	2	0	0%		2	100%	123503282
Ouachita	2021	Summer	June	Hylidae	Acris	blanchardi	1	0	0%		1	100%	1139.333333
Ouachita	2021	Summer	June	Hylidae	Hyla	cinerea	6	0	0%		1	17%	
Ouachita	2021	Summer	June	Hylidae	Hyla	chrysoscelis/ versicolor	4	3	75%	913.1497701	1	25%	497927.2
Ouachita	2021	Summer	June	Kinosternidae	Sternotherus	odoratus	6	0	0%		6	100%	239590.5889
Ouachita	2021	Summer	June	Microhylidae	Gastrophryne	carolinensis	3	3	100%	354.3906927	0	0%	
Ouachita	2021	Summer	June	Ranidae	Lithobates	clamitans	16	7	44%	1113.202081	2	13%	792.0666667
Ouachita	2021	Summer	June	Ranidae	Lithobates	palustris	1	0	0%		0	0%	

Ouachita	2021	Fall	October	Bufonidae	Anaxyrus	americanus	1	0	0%		0	0%	
Ouachita	2021	Fall	October	Bufonidae	Anaxyrus	fowleri/woodhousii	2	0	0%		0	0%	
Ouachita	2021	Fall	October	Hylidae	Acris	blanchardi	5	0	0%		0	0%	
Ouachita	2021	Fall	October	Hylidae	Hyla	cinerea	4	0	0%		0	0%	
Ouachita	2021	Fall	October	Plethodontidae	Eurycea	multiplicata	1	0	0%		0	0%	
Ouachita	2021	Fall	October	Ranidae	Lithobates	catesbeianus	9	1	11%	2748.677317	0	0%	
Ouachita	2021	Fall	October	Ranidae	Lithobates	clamitans	2	0	0%		0	0%	
Cookson	2022	Spring	April	Bufonidae	Anaxyrus	americanus	10	4	40%	3376.466667	2	20%	1118.937302
Cookson	2022	Spring	April	Hylidae	Pseudacris	crucifer	1	1	100%	11819.8	0	0%	
Cookson	2022	Spring	April	Hylidae	Acris	blanchardi	1	1	100%	247044.2667	0	0%	
Cookson	2022	Spring	April	Plethodontidae	Eurycea	longicauda	28	8	29%	662.3036807	1	4%	1000.42038
Cookson	2022	Spring	April	Plethodontidae	Plethodon	albagula	27	1	4%	184.2	6	22%	8528.941204
Cookson	2022	Spring	April	Plethodontidae	Plethodon	angusticlavius	6	0	0%		0	0%	
Cookson	2022	Spring	April	Plethodontidae	Eurycea	tynerensis	23	8	35%	1706.5	1	4%	12.26666667
Cookson	2022	Spring	April	Plethodontidae	Eurycea	lucifuga	23	7	30%	759.3444444	1	4%	49.13010141
Cookson	2022	Spring	April	Plethodontidae	Eurycea	spelaeus	2	0	0%		0	0%	
Cookson	2022	Spring	April	Ranidae	Lithobates	clamitans	7	4	57%	2217.81315	1	14%	977.4666667
Cookson	2022	Spring	April	Ranidae	Lithobates	sphenocephalus	3	3	100%	255452.9085	1	33%	299.0666667
Cookson	2022	Spring	April	Ranidae	Lithobates	palustris	4	2	50%	1867.464371	0	0%	
Cookson	2022	Spring	April	Salamandridae	Notophthalmus	viridescens	7	6	86%	1444431.187	1	14%	22604745.83
Cookson	2022	Summer	July	Bufonidae	Anaxyrus	americanus	1	0	0%		0	0%	
Cookson	2022	Summer	July	Bufonidae	Anaxyrus	fowleri/woodhousii	1	0	0%		0	0%	
Cookson	2022	Summer	July	Hylidae	Pseudacris	crucifer	1	0	0%		0	0%	
Cookson	2022	Summer	July	Hylidae	Acris	blanchardi	21	3	14%	13188.06467	0	0%	
Cookson	2022	Summer	July	Hylidae	Hyla	chrysoscelis/ versicolor	10	0	0%		0	0%	
Cookson	2022	Summer	July	Microhylidae	Gastrophryne	carolinensis	1	0	0%		0	0%	
Cookson	2022	Summer	July	Plethodontidae	Eurycea	longicauda	1	0	0%		0	0%	
Cookson	2022	Summer	July	Plethodontidae	Eurycea	tynerensis	8	0	0%		1	13%	2.333333333
Cookson	2022	Summer	July	Ranidae	Lithobates	clamitans	5	0	0%		0	0%	
Cookson	2022	Summer	July	Ranidae	Lithobates	sphenocephalus	4	1	25%	16179.41895	0	0%	
Cookson	2022	Summer	July	Salamandridae	Notophthalmus	viridescens	5	0	0%		0	0%	
Cookson	2022	Fall	October	Bufonidae	Anaxyrus	americanus	3	0	0%		0	0%	

Cookson	2022	Fall	October	Bufonidae	Anaxyrus	fowleri/woodhousii	1	0	0%		0	0%	
Cookson	2022	Fall	October	Emydidae	Terrapene	carolina	1	0	0%		0	0%	
Cookson	2022	Fall	October	Hylidae	Pseudacris	crucifer	11	1	9%	74.46666667	0	0%	
Cookson	2022	Fall	October	Hylidae	Acris	blanchardi	40	6	15%	295260.0602	0	0%	
Cookson	2022	Fall	October	Hylidae	Hyla	chrysoscelis/ versicolor	4	0	0%		0	0%	
Cookson	2022	Fall	October	Plethodontidae	Eurycea	longicauda	5	0	0%		0	0%	
Cookson	2022	Fall	October	Ranidae	Lithobates	clamitans	30	7	23%	2943.187802	0	0%	
Cookson	2022	Fall	October	Ranidae	Lithobates	sphenocephalus	11	2	18%	3078.671145	0	0%	
Cookson	2022	Fall	October	Ranidae	Lithobates	palustris	7	1	14%	93.50827535	0	0%	
Ouachita	2022	Spring	April	Bufonidae	Anaxyrus	americanus	37	2	5%	48	5	14%	314.9440587
Ouachita	2022	Spring	April	Hylidae	Pseudacris	crucifer	3	2	67%	7603.857168	0	0%	
Ouachita	2022	Spring	April	Hylidae	Acris	blanchardi	6	0	0%		0	0%	
Ouachita	2022	Spring	April	Hylidae	Hyla	cinerea	1	0	0%		0	0%	
Ouachita	2022	Spring	April	Kinosternidae	Sternotherus	odoratus	1	0	0%		0	0%	
Ouachita	2022	Spring	April	Plethodontidae	Eurycea	multiplicata	7	3	43%	1316.355556	0	0%	
Ouachita	2022	Spring	April	Ranidae	Lithobates	clamitans	1	1	100%	479.4	1	100%	71.05888526
Ouachita	2022	Spring	April	Ranidae	Lithobates	catesbeianus	5	5	100%	785.2866491	0	0%	
Ouachita	2022	Summer	June	Bufonidae	Anaxyrus	fowleri/woodhousii	5	0	0%		1	20%	176.4
Ouachita	2022	Summer	June	Emydidae	Trachemys	scripta	3	0	0%		0	0%	
Ouachita	2022	Summer	June	Hylidae	Acris	blanchardi	2	0	0%		0	0%	
Ouachita	2022	Summer	June	Hylidae	Hyla	cinerea	14	0	0%		2	14%	51.20815425
Ouachita	2022	Summer	June	Hylidae	Hyla	chrysoscelis/ versicolor	2	0	0%		1	50%	190.5333333
Ouachita	2022	Summer	June	Kinosternidae	Sternotherus	odoratus	3	0	0%		0	0%	
Ouachita	2022	Summer	June	Ranidae	Lithobates	clamitans	7	0	0%		2	29%	226.0333333
Ouachita	2022	Summer	June	Ranidae	Lithobates	sphenocephalus	8	0	0%		3	38%	95.28888889
Ouachita	2022	Fall	October	Bufonidae	Anaxyrus	americanus	3	0	0%		0	0%	
Ouachita	2022	Fall	October	Bufonidae	Anaxyrus	fowleri/woodhousii	1	0	0%		0	0%	
Ouachita	2022	Fall	October	Hylidae	Acris	blanchardi	12	0	0%		1	8%	
Ouachita	2022	Fall	October	Plethodontidae	Eurycea	multiplicata	7	0	0%		0	0%	
Ouachita	2022	Fall	October	Ranidae	Lithobates	clamitans	1	0	0%		0	0%	
Ouachita	2022	Fall	October	Ranidae	Lithobates	catesbeianus	30	4	13%	7185424217	0	0%	

Ouachita	2022	Fall	October	Ranidae	Lithobates	sphenocephalus	2	0	0%		0	0%	
Cookson	2023	Spring	April	Bufonidae	Anaxyrus	fowleri/woodhousii	3	0	0%		0	0%	
Cookson	2023	Spring	April	Bufonidae	Anaxyrus	americanus	19	4	21%	2624.698512	0	0%	
Cookson	2023	Spring	April	Emydidae	Terrapene	carolina	2	0	0%		0	0%	
Cookson	2023	Spring	April	Hylidae	Acris	blanchardi	1	0	0%		0	0%	
Cookson	2023	Spring	April	Plethodontidae	Eurycea	tynerensis	12	7	58%	1436.070342	0	0%	
Cookson	2023	Spring	April	Plethodontidae	Plethodon	albagula	4	1	25%	437.8153165	0	0%	
Cookson	2023	Spring	April	Plethodontidae	Eurycea	longicauda	10	7	70%	2525.501179	0	0%	
Cookson	2023	Spring	April	Plethodontidae	Eurycea	lucifuga	3	0	0%		0	0%	
Cookson	2023	Spring	April	Ranidae	Lithobates	palustris	1	1	100%	2644.717153	0	0%	
Cookson	2023	Spring	April	Salamandridae	Notophthalmus	viridescens	13	13	100%	2202.111758	0	0%	
Cookson	2023	Spring	May	Plethodontidae	Eurycea	tynerensis	1	0	0%		0	0%	
Cookson	2023	Fall	October	Ambystomatidae	Ambystoma	annulatum	5	0	0%		0	0%	
Cookson	2023	Fall	October	Hylidae	Acris	blanchardi	1	0	0%		0	0%	
Cookson	2023	Fall	October	Hylidae	Pseudacris	crucifer	1	0	0%		0	0%	
Cookson	2023	Fall	October	Hylidae	Pseudacris	fouquettei	1	0	0%		0	0%	
Cookson	2023	Fall	October	Plethodontidae	Plethodon	angusticlavius	7	0	0%		0	0%	
Cookson	2023	Fall	October	Plethodontidae	Plethodon	albagula	4	0	0%		0	0%	
Cookson	2023	Fall	October	Plethodontidae	Eurycea	longicauda	3	1	33%	41.95628357	0	0%	
Cookson	2023	Fall	October	Plethodontidae	Eurycea	lucifuga	3	0	0%		0	0%	
Cookson	2023	Fall	October	Ranidae	Lithobates	sphenocephalus	1	1	100%	2764.442952	0	0%	
Cookson	2023	Fall	October	Ranidae	Lithobates	clamitans	6	3	50%	929.0915786	0	0%	
Cookson	2023	Fall	October	Ranidae	Lithobates	palustris	2	0	0%		0	0%	
Cookson	2023	Fall	October	Salamandridae	Notophthalmus	viridescens	15	3	20%	2433.016798	0	0%	
Ouachita	2023	Spring	March	Bufonidae	Anaxyrus	americanus	33	24	73%	2574.620164	0	0%	
Ouachita	2023	Spring	March	Bufonidae	Anaxyrus	fowleri/woodhousii	7	4	57%	2678.610992	0	0%	
Ouachita	2023	Spring	March	Hylidae	Acris	blanchardi	13	3	23%	2611.833445	1	8%	2532.333333
Ouachita	2023	Spring	March	Hylidae	Pseudacris	crucifer	8	6	75%	2250.502247	0	0%	
Ouachita	2023	Spring	March	Hylidae	Pseudacris	fouquettei	2	2	100%	2004.4782	0	0%	
Ouachita	2023	Spring	March	Plethodontidae	Plethodon	albagula	42	10	24%	771.4545314	0	0%	
Ouachita	2023	Spring	March	Plethodontidae	Plethodon	serratus	23	7	30%	599.2178508	0	0%	
Ouachita	2023	Spring	March	Plethodontidae	Eurycea	multiplicata	16	9	56%	1050.017936	0	0%	
Ouachita	2023	Spring	March	Ranidae	Lithobates	catesbeianus	12	6	50%	2504.253515	1	8%	2365.240224
Ouachita	2023	Spring	March	Ranidae	Lithobates	sphenocephalus	3	3	100%	2448.947144	0	0%	

Ouachita	2023	Spring	March	Ranidae	Lithobates	clamitans	2	2	100%	2370.358149	0	0%	
Ouachita	2023	Spring	March	Ranidae	Lithobates	palustris	1	1	100%	2350.358327	0	0%	
Ouachita	2023	Fall	October	Ranidae	Lithobates	catesbeianus	2	1	50%	2744.998169	0	0%	
Ouachita	2015	Spring	May	Hylidae	Hyla	cinerea	10	0	0		4	40%	8.79933542
Ouachita	2015	Spring	May	Hylidae	Hyla	chrysoscelis/ versicolor	10	4	40%	20100.29019	1	10%	1.55215168
Ouachita	2015	Spring	May	Ranidae	Lithobates	catesbeianus	4	0	0		1	25%	2.539148808
Ouachita	2015	Spring	May	Hylidae	Acris	blanchardi	15	12	80%	131375.1776	5	33%	6.378958225
Ouachita	2015	Spring	May	Salamandridae	Notophthalmus	viridescens	9	5	55%	8570.804736	0	0%	
Ouachita	2015	Spring	May	Ranidae	Lithobates	clamitans	6	3	50%	6591.267334	2	33%	2.50495851
Ouachita	2015	Spring	May	Bufonidae	Anaxyrus	americanus	1	1	100%	613647.9375	0	0%	
Cookson	2015	Spring	April	Ranidae	Lithobates	catesbeianus	26	25	96%	19931.10276	17	65%	5.262011276
Cookson	2015	Spring	April	Hylidae	Acris	blanchardi	5	3	60%	1521596.58	0	0%	
Cookson	2015	Spring	April	Salamandridae	Notophthalmus	viridescens	25	25	100%	4617.86486	2	8%	2.276607038
Cookson	2015	Spring	April	Ranidae	Lithobates	clamitans	2	2	100%	59008.36475	0	0%	
Cookson	2015	Spring	April	Bufonidae	Anaxyrus	americanus	1	1	100%	41676.01953	0	0%	
Cookson	2015	Spring	April	Plethodontidae	Eurycea	lucifuga	6	1	16%	3608.576904	3	50%	5.855870167
Cookson	2015	Spring	April	Plethodontidae	Plethodon	albagula	16	3	19%	2190.664179	7	44%	5.234303457
Cookson	2015	Spring	April	Plethodontidae	Eurycea	longicauda	28	14	50%	3411.505817	7	25%	12.27902872
Cookson	2015	Spring	April	Plethodontidae	Plethodon	angusticlavius	4	1	25%	131.1955719	0	0%	
Cookson	2015	Spring	April	Plethodontidae	Eurycea	multiplicata	3	1	33%	211.2123566	1	33%	8.370827675
Cookson	2015	Spring	April	Plethodontidae	Eurycea	tynerensis	9	3	33%	114.8531024	3	33%	2.420865138
Cookson	2015	Spring	April	Bufonidae	Anaxyrus	woodhousii	3	1	33%	228.2112427	0	0%	
Cookson	2015	Spring	April	Ambystomatidae	Ambystoma	texanum	1	1	100%	35.89	1	100%	2.082625151
Cookson	2015	Spring	April	Ambystomatidae	Ambystoma	annulatum	4	2	50%	5775.87912	4	100%	2.982448965
Cookson	2018	Spring	April	Plethodontidae	Eurycea	longicauda	10	2	20%	4.748000562	0	0%	
Cookson	2018	Spring	April	Plethodontidae	Eurycea	tynerenis	15	4	26%	66.10467465	0	0%	
Cookson	2018	Spring	April	Hylidae	Acris	blanchardi	2	2	100%	236.4818459	0	0%	
Cookson	2018	Spring	April	Ranidae	Lithobates	clamitans	3	3	100%	55.69240228	0	0%	
Cookson	2018	Spring	April	Ranidae	Lithobates	sphenocephalus	1	1	100%	6434.929199	0	0%	
Cookson	2018	Spring	April	Plethodontidae	Plethodon	angusticlavius	4	0	0%	0	0	0%	
Cookson	2018	Spring	April	Plethodontidae	Plethodon	albagula	4	0	0%	0	0	0%	
Cookson	2018	Spring	April	Plethodontidae	Eurycea	lucifuga	3	0	0%	0	0	0%	
Cookson	2018	Spring	April	Ranidae	Lithobates	palustris	1	0	0%	0	0	0%	