

Foundational Checklist of the Amphibians of Wise County, Virginia

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ABSTRACT

The Appalachian Mountains are arguably home to the highest degree of amphibian diversity in the world, particularly caudate (salamander) biodiversity. Despite the high degree of amphibian endemism in the Appalachians, several regions remain unsurveyed for amphibian species. In addition to this knowledge gap, we are in the midst of alarming amphibian biodiversity loss. Thus, it is of the utmost importance to bridge this knowledge gap by conducting surveys before some of these amphibian species are lost. We surveyed Wise County (previously unsurveyed county in the Appalachian Mountains with no records existing in the primary literature) over two years to assess amphibian species presence. We found 23 different species of amphibians (eight species of frogs and toads; 15 species of salamanders). In addition, we report five new amphibian species occurrences previously unreported in the primary literature within Wise County. However, not all amphibian species expected to occur in Wise County were observed. The primary suspected reason for their lack of occurrence involves habitat loss and/or modification, since the region is heavily exploited for coal and lumber. Overall, our study provides invaluable data in current times of amphibian biodiversity concern as they clarify and expand our knowledge of known amphibian species within the area. Using our work as a foundation, future surveying could assess whether amphibian biodiversity of Wise County are experiencing growth, stability, or decline.

INTRODUCTION

In the wake of accelerated anthropogenic disturbances to nearly every ecosystem on the planet (Walker et al. 2005), population monitoring has never been more critical. Most scientists would argue that we are currently in the wake of the sixth major extinction in Earth's history (Wake and Vredenburg 2008). For example, approximately 33% of all extant amphibian species are facing declining populations (Stuart et al. 2004). Such a dramatic loss of amphibian biodiversity has been linked to several events, including habitat loss and disease (Kiesecker et al. 2001; Mendelson et al. 2006). While the majority of amphibian populations declines appear to be occurring in the tropics (Wake and Vredenburg 2008), amphibian species in the more temperate

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regions are not without their vulnerabilities. However, detecting population declines, while being vitally important, is not easily done – particularly in amphibians. Most amphibian populations are constantly in a state of natural flux (Pechmann and Wilbur 1994), and are highly dependent on uncontrollable environmental influences (such as food abundance, climate, and predation). Nevertheless, the preservation and conservation of amphibians is dependent upon population data. Unfortunately, such data are rarely seen in the primary literature; or if they are reported, it is likely because the population has already declined.

Concerning amphibian diversity in temperate North America, the Appalachian Mountains are arguably the most diverse – especially concerning caudate (salamander) diversity. The Appalachians are home to several endemic caudate species (see Lannoo 2005). Because of this high degree of endemism, monitoring populations over time is essential in conservation efforts of these rare and unique species. However, before extensive monitoring programs can be initiated, foundational groundwork concerning the list of native species must be documented. Herein, we report the first list (to the best of our knowledge) of amphibians occurring in Wise County, Virginia in the primary literature. There are, however, works that report the historic distribution of herpetofauna (amphibians and reptiles) in the Commonwealth (see Mitchell and Reay 1999). However, Mitchell and Reay (1999) explicitly state, on several occasions, that extensive fieldwork needs to be conducted in southwest Virginia (including Wise County) to further clarify the unknown distributions of several herpetofaunal species. The goal of this project was to answer this direct call.

METHODS

All amphibian species observations were within Wise County, Virginia (USA) borders during the summer and fall months of 2009, and spring, summer, and fall months of 2010. Wise County is located in southwest Virginia. It is bordered by Pike County, Kentucky (north), Dickenson County, Virginia (northeast), Russell County, Virginia (east), Scott County, Virginia (south), Lee County, Virginia (southwest), Harlan County, Kentucky (west), and Letcher County, Kentucky (northwest). Wise County covers approximately 1050 km², including approximately 3 km² of water coverage.

Wise County offers truly unique heterogeneous habitats all along elevation gradients since it is situated in the midst of the Appalachian Mountains. These habitats include coniferous, deciduous, and mixed forests and old fields, coupled with urbanized areas. We sought to survey all habitat types that would yield potential amphibian species observations. As a result, careful and thorough reference book and atlas reviews (e.g., Hulse et al. 2001; Lannoo 2005; Mitchell and Reay 1999; Petranka 1998) were conducted in order to identify preferred habitat types of all amphibian species historically known to occur within Wise County. Specifically, we surveyed both public and private land areas (with permission from land owner(s)). However, the vast majority of this study was conducted on public-use land. The bulk of our public-use land surveys were within various regions of the Jefferson National Forest. Indeed, a large portion of Wise County is part of the Jefferson National Forest. Specifically concerning the Jefferson National Forest, we surveyed the following areas and their immediate surroundings: Cave Springs Recreation Area (near Big Stone Gap, Virginia;

including its Loop Trail and numerous adjacent springs), Stone Mountain Trail (near Big Stone Gap, Virginia; including the numerous small streams and small waterfalls adjacent to the trail), High Knob Recreation Area (near Norton, Virginia; including its wooded Day-Use Areas, Lake Trail, Lake Loop Trail, and the numerous adjacent small streams to these trails), Flag Rock Recreation Area (near Norton, Virginia), Guest River Gorge Trail (near Coeburn, Virginia; including the Clinch River and its following branches: Jaybird, Crab Orchard, Pine Orchard, Hurricane, Flat, Lick Log, and Lick), Little Stony Falls (near Coeburn, Virginia; including the small streams along the Little Stony Falls Trail), Red Fox Trail (near Pound, Virginia; including its numerous small streams adjacent to the trail), Pound Lake (near Pound, Virginia; including its numerous small streams flowing in and out of the lake), Cane Patch Recreation Area (near Wise, Virginia; including areas surrounding/in Bad Creek and North Fork Creek), and Phillips Creek Recreation Area (near Wise, Virginia; including Phillips Creek Trail Loop and the numerous small creeks and waterfalls adjacent to the trail). In addition to these public-use localities within the Jefferson National Forest, we surveyed various public-use regions on the approximately 1.6 km² campus of the University of Virginia's College at Wise (including its wetlands, three ponds, numerous small streams, and the surrounding wooded area). Opportunistic amphibian species captures, such as chance encounters while driving to and/or from targeted field sites, accounted for a minute portion of our survey.

Most of our amphibian species observations were direct. When surveying terrestrial habitats, we captured amphibians by hand by lifting cover objects (natural cover objects, such as logs and rocks; or unnatural, such as mattresses and tires). The same strategy was employed for surveying most aquatic habitats, with cover objects on stream banks being lifted. However, in some instances, we used dip-nets in aquatic habitats that had a high degree of leaf litter compared to cover object availability along the bank margins. In some instances involving anuran (frog and toad) species, observations were indirect and accomplished by listening for species-specific calls. To further increase our observation success of targeted species, surveys were conducted at various times of the day/night – depending upon the exact ecological niche of each target species. All scientific and standard English names (common names) of each species follow Crother et al. (2000; 2003).

RESULTS

In total, we observed 23 amphibian species in Wise County, Virginia (see Table 1 for complete list). Specifically, we observed eight anuran (frogs and toads) and 15 caudate species. According to Mitchell and Reay (1999), we observed 18 of their 23 (approximately 78%) previously known amphibian species within the county (see Table 1). In addition, we report new occurrences of *Ambystoma maculatum* (Spotted Salamander), *Desmognathus quadramaculatus* (Black-bellied Salamander), *Eurycea l. longicauda* (Long-tailed Salamander), *Hemidactylium scutatum* (Four-toed Salamander), and *Plethodon cinereus* (Red-backed Salamander) within Wise County, Virginia.

TABLE 1: Comparison of all Amphibian Species Known to Occur in Wise County, Virginia.

Amphibian Species	Mitchell and Reay(1999)	This Study
Anura		
<i>Bufo a. americanus</i> (Eastern American Toad)	X	X
<i>B. fowleri</i> (Fowler's Toad)	X	X
<i>Hyla chrysoscelis</i> (Cope's Gray Treefrog)	X	X
<i>Pseudacris brachyphona</i> (Mountain Chorus Frog)	X	
<i>P. c. crucifer</i> (Northern Spring Peeper)	X	X
<i>Rana catesbeiana</i> (American Bullfrog)	X	X
<i>R. clamitans melanota</i> (Northern Green Frog)	X	X
<i>R. palustris</i> (Pickerel Frog)	X	X
<i>R. sylvatica</i> (Wood Frog)	X	X
Caudata		
<i>Ambystoma jeffersonianum</i> (Jefferson Salamander)	X	
<i>A. maculatum</i> (Spotted Salamander)		X*
<i>Aneides aeneus</i> (Green Salamander)	X	
<i>Desmognathus f. fuscus</i> (Northern Dusky Salamander)	X	X
<i>D. monticola</i> (Seal Salamander)	X	X
<i>D. ochrophaeus</i> (Allegheny Mountain Dusky Salamander)	X	X
<i>D. quadramaculatus</i> (Black-bellied Salamander)		X*
<i>D. walteri</i> (Black Mountain Salamander)	X	
<i>Eurycea cirrigera</i> (Southern Two-lined Salamander)	X	X
<i>E. l. longicauda</i> (Long-tailed Salamander)		X*
<i>E. lucifuga</i> (Cave Salamander)	X	X
<i>Gyrinophilus p. porphyriticus</i> (Northern Spring Salamander)	X	X
<i>Hemidactylum scutatatum</i> (Four-toed Salamander)		X*
<i>Notophthalmus v. viridescens</i> (Red-spotted Newt)	X	X
<i>Plethodon cinereus</i> (Eastern Red-backed Salamander)		X*
<i>P. glutinosus</i> (Northern Slimy Salamander)	X	X
<i>P. kentucki</i> (Cumberland Plateau Salamander)	X	
<i>P. richmondi</i> (Southern Ravine Salamander)	X	X
<i>Pseudotriton r. ruber</i> (Northern Red Salamander)	X	X

*Denotes new county record for Wise County, Virginia

DISCUSSION

Among the 23 amphibian species documented in this study, we interestingly report the first documented occurrences of *A. maculatum*, *D. quadramaculatus*, *E. l. longicauda*, *H. scutatatum*, and *P. cinereus* in Wise County, Virginia (to the best of our knowledge). Though these species have not been reported previously, their occurrence within the county is not altogether surprising. The preferred habitats of mixed

deciduous forests (*A. maculatum* and *P. cinereus*), hardwood or coniferous forests (*H. scutatum*), and mountain stream (*D. quadramaculatus* and *E. l. longicauda*) are all found within Wise County, Virginia borders. In fact, Mitchell and Reay (1999) suspected that *A. maculatum*, *D. quadramaculatus*, and *H. scutatum* could be found once regions in southwest Virginia were properly surveyed. Our study directly answered this survey call.

Mitchell and Reay (1999) report the occurrence of four species that we did not find in our Wise County, Virginia survey. These species include: *Pseudacris brachyphona* (Mountain Chorus Frog), *Aneides aeneus* (Green Salamander), *D. welleri* (Black Mountain Salamander), and *P kentucki* (Cumberland Plateau Salamander). Altogether, the lack of discovery of these species in our study was not surprising. For example, *P. brachyphona* populations across its entire range are in apparent population decline due to deforestation and urbanization (Murdock 1994). Partially because of population decline concerns, the Commonwealth has strict regulations concerning *P. brachyphona* commercialization (Mitchell and Pauley 2005). *Aneides aeneus* is also heavily impacted by anthropogenic disturbances, partially because of its highly specific preferred habitat consisting of rocky outcrops (Pauley and Watson 2005a). While it is not considered a species of concern in the Commonwealth, adjacent states have *A. aeneus* listed as endangered or threatened. *Plethodon kentucki* prefer to occupy pristine, mature hardwood forests. Overexploitation of hardwood resources for commercial products has significantly impacted *P. kentucki* populations across its already small home-range (Pauley and Watson 2005b). Future studies and surveys could attempt to ascertain the population status of these anurans and caudates in Wise County, and southwest Virginia as a whole, since much of the region has herpetological unknowns.

While exceedingly rare in the primary literature, studies such as this survey are vital for amphibian population monitoring efforts. Thus, this study contributes to the herpetofaunal list of Wise County, Virginia, and to the Commonwealth itself, by potentially acting as a foundational baseline of data. However, much more work is needed in future years to monitor Wise County, Virginia amphibians. Population trends can only be established with several years of surveying. Even then, population declines may not be obvious (Hairston and Wiley 1993). Nevertheless, these efforts are warranted because of the high degree of amphibian biodiversity and endemism within Wise County, Virginia and the surrounding Appalachian Mountains.

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LITERATURE CITED

- Hulse, A.C., C.J. McCoy, and E.J. Censky. 2001. Amphibians and Reptiles of Pennsylvania and the Northeast. Cornell University Press. 419 p.
- Kiesecker, J.M., A.R. Blaustein, and L.K. Belden. 2001. Complex Causes of Amphibian Population Declines. *Nature* 410:681-684.
- Lannoo, M. 2005. Amphibian Declines: The Conservation Status of United States Species. University of California Press, Berkeley. 1094 p.
- Mendelson III, J.R., K.R. Lips, R.W. Gagliardo, G.B. Rabb, J.P. Collins, J.E. Diffendorfer, P. Daszak, R. Ibanez D., K.C. Zippel, D.P. Lawson, K.M. Wright, S.N. Stuart, C. Gascon, H.R. da Silva, P.A. Burrowes, R.L. Joglar, E. La Marca, S. Lotters, L. H. du Preez, C. Weldon, A. Hyatt, J.V. Rodriguez-Mahecha, S. Hunt, H. Robertson, B. Lock, C.J. Raxworthy, D.R. Frost, R.C. Lacy, R.A. Alford, J.A. Campbell, G. Parra-Olea, F. Bolanos, J.J.C. Domingo, T. Halliday, J.B. Murphy, M.H. Wake, L.A. Coloma, S.L. Kuzmin, M.S. Price, K.M. Howell, M. Lau, R. Pethiyagoda, M. Boone, M.J. Lannoo, A.R. Blaustein, A. Dobson, R.A. Griffiths, M.L. Crump, D.B. Wake, and E.D. Brodie, Jr. 2006. Confronting Amphibian Declines and Extinctions. *Science* 313:48.
- Mitchell, J.C., and K.K. Reay. 1999. Atlas of Amphibians and Reptiles in Virginia. Special Publication Number 1. Virginia Department of Game and Inland Fisheries, Richmond, Virginia. 122 p.
- Murdock, N.A. 1994. Rare and Endangered Plants and Animals of Southern Appalachian Wetlands. *Water, Air and Soil Pollution* 77:385-405.
- Pechmann, J.H.K., and H.M. Wilbur. 1994. Putting Declining Amphibian Populations in Perspective: Natural Fluctuations and Human Impacts. *Herpetologica* 50:65-84.
- Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press. 587 p.
- Stuart, S.N., J.S. Chanson, N.A. Cox, B.E. Young, A.S.L. Rodrigues, D.L. Fischman, and R.W. Waller. 2004. Status and Trends of Amphibian Declines and Extinctions Worldwide. *Science* 306:1783-1786.
- Wake, D.B., and V.T. Vredenburg. 2008. Are We in the Midst of the Sixth Mass Extinction? A View from the World of Amphibians. *Proceedings of the National Academy of Sciences* 105:11466-11473.
- Walker, B.G., P.D. Boersma, and J.C. Wingfield. 2005. Field Endocrinology and Conservation Biology. *Integrative and Comparative Biology* 45:12-18.