

A Herpetological Survey of Mole Hill in Rockingham County, Virginia



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Introduction

The Virginia Herpetological Society (VHS) Mole Hill Survey was held at Mole Hill in Rockingham County, Virginia on 14 May 2017. This was the first herpetological survey held at this site (Gerald Knicely, pers comm). There were several different types of habitat on Mole Hill: rocky outcrops, upland forests, forested hillsides, and open meadows. The plethora of habitats are optimal for documenting different species of herpetofauna. Mole Hill is 18.6 hectares of privately owned land that is protected through a conservation easement with the Virginia Outdoors Federation (Kelly, 2012). The parking area was at 476 m elevation and the summit was just over 580 m.

Mole Hill was selected as a survey site because of its unique geology, being an extinct volcano. The last time Mole Hill erupted was over 46-48 million years ago (Kelly, 2012). Mole Hill is located in the Valley and Ridge province of Virginia (Fleming, 2016). Key features of the northern and central Ridge and Valley Province are shale ridges and knobs with limestone and karst formations below (Mitchell and Reay, 1999). Mole Hill is a unique area in this province because it is made of a type of rock called basalt, which forms due to cooling magma, and stands taller than the surrounding valley of limestone (Brent, 1960). These type of rocks can also be found in the nearby Shenandoah Mountains and Blue Ridge (Sherwood, n.d.), which is also home to endemic salamanders. While it is not thought there is a new species of salamander there, it is possible some of the local salamanders may have adapted to live in this unique environment. Mole Hill is owned and maintained by Mole Hill Bikes in Dayton, Virginia.

Study Site

Site 1 – Mole Hill (38°27'8.6"N 78°57'7.3"W)

This site started in the parking area and followed the road up to the summit and back down the other way. The Trail used is seen in Figure 1 below.

Figure 1. Map showing area surrounding Mole Hill and survey path



Materials and Methods

On Sunday, 14 May 2017 survey participants were together as one group for the entirety of the survey. Methods used to find animals included hand capture, visual observation, and flipping over cover objects. All animals were photographed as voucher specimens and animals with signs of disease, or injury were especially noted. Group leaders filled out survey data sheets to record all animals encountered on standardized recording sheets. Data sheets included information on: the physical environment, weather, animal health, and microhabitat. Other data collected included morphometric measurements of rare species, age, and sex. Site 1 was surveyed from 0945hr – 1345hr (see Table 1 for amount of survey effort expended at each site).

Table 1. The amount of survey effort per site for the Mole Hill Survey.

	Site 1
Number of Surveyors	13
Hours Surveyed	4
Person Hours of Survey effort	52

Mole Hill Survey

Results

There were 13 participants in attendance for the Mole Hill Survey conducted 14 May 2017 with a total of 52 person hours. Over 140 individual animals of 3 species of herpetofauna were documented (see Table 2). A pre-survey was conducted of the same survey site on 15 April 2017 by 4 participants for a total of 13 person hours; and 132 animals were observed (130 *Plethodon cinereus* and 2 *Thamnophis sirtalis sirtalis*). The results from the pre-survey are not included in Table 2.

Table 2. Summary of the number of amphibians and reptiles observed at each site.

	Total
<u>Amphibians</u>	
<i>Plethodon cinereus</i>	138
<u>Reptiles</u>	
<i>Diadophis punctatus edwardsii</i>	1
<i>Thamnophis sirtalis sirtalis</i>	2
Total:	141

Annotated Checklist

Amphibians

1. *Plethodon cinereus* (Eastern Red-backed Salamander) A total of 138 *P. cinereus* were found under cover objects such as boards, logs, and rocks throughout the study site.



Reptiles

2. *Diadophis punctatus edwardsii* (Northern Ring-necked Snake) One *D. p. edwardsii* was found under a log while leading up to the summit.



3. *Thamnophis sirtalis sirtalis* (Eastern Gartersnake) Two *T. s. sirtalis* were noted heading up towards the summit. One individual was basking and another was seen slithering away.



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Discussion

Mole Hill is an 18.6 hectare privately owned site in Rockingham County, Virginia. What is neat about this site is that it is an extinct volcano that last erupted 49-47 million years ago (Kelly, 2012). Mole Hill is made up a metamorphic rock which is different from the surrounding limestone valley (Brent, 1960). There was a variety of habitats at Mole Hill such as: upland forests, forested hillsides, rocky outcroppings, and an open meadow at the summit. This was the first herpetological survey conducted at Mole Hill, however the area is frequently used by the Geology Department at James Madison University (JMU) (Gerald Knicely, pers comm).

Rockingham County has been surveyed before by Harry Jopson of the VHS from 1936-1984 (Jopson, 1984). Over the course of 48 years Jopson documented over 50 species of herps: 11 anurans, 17 salamanders, 5 turtles, 2 lizards, and 15 snakes (Jopson, 1984). He surveyed a majority of the land in the county from rivers around 270 meters in elevation to mountains above 1200 meters. It should be noted that Jopson found *Pituophis melanoleucus melanoleucus* (Northern Pine Snake), which is now believed to be extirpated from Virginia (Tobey, 1985). Mitchell also mentions the Rockingham population of *P. m. melanoleucus* and lists it as unvouchered (Mitchell, 1994). Also, of the 17 salamanders Jopson found, one was *Desmognathus monticola jeffersoni* (Virginia Seal Salamander) which is not currently recognized today. The Virginia Seal Salamander was thought to be a different subspecies of the Seal Salamander based on a difference in color that is unique to the region of the Shenandoah River where they were believed to be geographically isolated (Hoffman, 1951). Petranka mentions this subspecies under his account of *D. monticola* and does not agree with the designation based off dorsal patterning since their pattern is variable throughout their range (Petranka, 1998).

It was surprising that only three species of herps were documented at the Mole Hill Survey when there has been over 55 species of herpetofauna observed in Rockingham County, Virginia (VHS Database). There was ample habitat for basking reptiles and plenty of moist, shaded habitat for salamanders in the genus *Plethodon*. That being said, there were not any bodies of water such as creeks, seeps, or ponds, so that could eliminate the possibility of observing stream-dwelling salamanders and aquatic turtles.

As mentioned, Rockingham County has a pretty robust number of herp species documented. It can be assumed that because of Rockingham's proximity to the City of Harrisonburg and to James Madison University many species have already been documented, however there are still a few species to be observed. One is *Anaxyrus fowleri* (Fowler's Toad). Although there was not any breeding habitat observed at Mole Hill, nearby properties had farmland which contained ponds that would be suitable for amphibian breeding. *Anaxyrus fowleri* has been documented in the surrounding counties of: Augusta, Albemarle, Page, and Shenandoah. It should be noted, Jopson confirmed this species in Rockingham County (Jopson, 1984), but there is a possibility it was unvouchered. Another species that is thought to be in Rockingham, but is still not documented is *Plestiodon fasciatus* (Common-Five Lined Skink). There was abundant habitat for this species at the summit of Mole Hill as well as open sunny patches along the trail leading to the summit. *Plestiodon fasciatus* can be found in nearby Augusta, Albemarle, Greene, and Shenandoah counties. Another species that went undiscovered in Rockingham until late last year is *Virginia valeriae valeriae* (Eastern Smooth Earthsnake). Jopson noted that although he had not

observed *V. v. valeriae* over 30 years ago, he assumed it to exist in Rockingham County (1984) and it was finally found in a garden in Rockingham County (Bolgiano, 2017). Future surveys in Rockingham may uncover the fairly widespread *A. fowleri* and *P. fasciatus*.

A fair number of the *P. cinereus* found at this site were noted having an interesting reddish-brown coloration during the survey 14 May 2017. Similarly, an odd coloration was noted on a number of *P. cinereus* during the pre-survey on 15 April 2017. These *P. cinereus* were brown and had a greenish iridescence. This greenish iridescence may have been apparent on the pre-survey and not the actual survey possibly due to excess light from the leaves on the trees having not grown in yet. Also an interesting note, the two main color-phases of *P. cinereus* (the red-striped form and the un-striped lead-back form) found were at the roughly the same proportions on both the pre-survey (80:50) and the survey (86:51); around 62% were the red-striped form. Although *P. cinereus* was found in these ratios at this site, they vary widely from locality to locality. In some studies there have been as many as 85% red-striped variants in a population (Highton, 1959) where other localities see as many as 71% unstriped morphs (Burger, 1935). Highton has found that their pattern has a genetic basis, but how these multiple genes interact and how they are affected by environmental factors remains to be seen (Highton, 1974). Some studies have shown differences in behavior between the two morphs, such as habitat preference (Moreno, 1989) and predator responses (Venesky and Anthony, 2007). Moreno found that dryer, warmer habitats supported more unstriped variants, whereas cooler, wetter habitats supported more striped variants (Moreno, 1989). This could support why there were more red-striped variants found than lead-backed forms. Venesky and Anthony found that red-backed variants tended to stay motionless and postured versus their lead-backed counterparts that were more likely to flee when faced with a snake predator. That study also observed that the lead-backed forms tended to have their tails in the process of regenerating in the wild more than the red-backed counterparts (Venesky and Anthony, 2007). Could this suggest the presence of salamander-consuming snakes influence the color ratios of *P. cinereus* in the wild as well? Although *P. cinereus* are fairly common salamanders, there is still much more to be learned about them.

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