

ANEIDES AENEUS (Green Salamander). RARE OCCURRENCE AT A SITE WITHIN THE EASTERN HIGHLAND RIM THAT IS REGULARLY SURVEYED FOR AMPHIBIANS. The Green Salamander (*Aneides aeneus*) is a rarely encountered species in Tennessee that occurs across the Cumberland Plateau and Ridge and Valley physiographic regions; however, individuals are occasionally observed in the Eastern Highland Rim (Fig. 1). Populations have been declining in recent decades due to habitat destruction (Wilson 2003. *Contemp. Herpetol.* 2:1-10.). As such, the species is listed as threatened or endangered in most states in which it occurs (Thames et al. 2021. *Tenn. J. Herpetol.* 4:4-13.) and any information regarding its habits or distribution across the range is useful to understand the species' ecology and prevalence across the landscape.

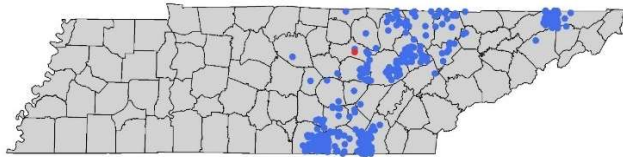


Figure 1. Known records of Green Salamanders (*Aneides aeneus*) in Tennessee per the Tennessee Herp Atlas (accessed by J. Grady 25 November 2024). Blue circles show all records from iNaturalist, GBIF, and APSU museum records which have GPS coordinates (n=359). Many APSU records (n=46) include county-level data only and are not shown. Four such records are from Putnam county, but field notes indicate these are from the Cumberland Plateau. The red circle approximates the location for the current record. The map was generated in R studio using the 'ggplot2', 'sf', 'tigris', and 'dplyr' packages.

On 5 July 2024, I discovered a juvenile Green Salamander at City Lake Natural Area (CLNA) in Cookeville, TN (36°07'58.2"N 85°26'40.8"W) within a rock crevice adjacent to a series of waterfalls (Fig. 2). Although the species is known from several records in Putnam County, this record is noteworthy because it occurs in the Eastern Highland Rim rather than the Cumberland Plateau where the species is more common. Per the Tennessee Herp Atlas (accessed 25 November 2024; Fig. 1), there is one other record of the Green Salamander in the Eastern Highland Rim of Putnam County. That record is 4 km north of CLNA. Moreover, there are fewer than 20 records of the salamander West of

the Cumberland Plateau in the Eastern Highland Rim with a single record from the inner Nashville Basin. Such rare occurrences indicate a few scenarios. First, the species may be present west of the plateau within only a few pockets of suitable habitat which are relatively isolated (Thames et al. 2021, *op. cit.*). Thus, specimens may be commonly encountered at specific locations should those locations be surveyed regularly. Alternatively, the species may be relatively widespread across the Eastern Highland Rim, but at very low densities. In this scenario, even sites regularly surveyed may fail to detect individuals. Finally, populations may be relatively sparse, and densities low. Regardless, this record is useful because it occurs at a location that has been regularly surveyed for salamanders across many decades with no previous report of the Green Salamander (see below).

CLNA is often used for field laboratory exercises for Tennessee Tech University courses (e.g. Herpetology). Indeed, faculty have consistently brought students to this site to look for salamanders since the 1960's, when Ray Jordan first joined the faculty of Tennessee Tech's biology department. Thus, the site has been searched by faculty and students regularly for many decades with no reported occurrence of the Green Salamander until now. Survey methods at this site typically instruct undergraduate students to gently turn rocks and logs in and around the stream and waterfalls and search crevices in rock outcroppings, using flashlights. Given the abundance of surveys over many years with no prior detection, a likely explanation is that the species has been present at the site but at very low abundance.

There are a few reasons why Green Salamanders have been previously undetected at CLNA. First, Green Salamanders are most active during the summer months, particularly during May and June (Petranka. 1998. *The Salamanders of the United States and Canada*, Smithsonian Books, Washington, D.C., USA); however, surveys usually occur in the Fall and Spring, corresponding with the university schedule. Additionally, the habitat searched may not correspond with habitat most used by Green Salamanders at this site due to competitive exclusion. Five species of salamander

are abundant at CLNA: Dusky Salamanders (*Desmognathus* sp.), the Two-lined salamander (*Eurycea bislineata*), Slimy Salamander (*Plethodon glutinosus*), Zig-zag Salamander (*Plethodon dorsalis*) and Cave Salamander (*Eurycea lucifuga*). Elsewhere, Green Salamanders may be encountered hiding within rock crevices which are not overly wet but are shaded by dense canopy cover (Petranka. 1998. *op. cit.*). At CLNA, these microhabitats are commonly occupied by the other species listed above, particularly Slimy Salamanders and Cave Salamanders. There is some evidence that Green Salamanders compete with *Plethodon* species and stratify habitat when they co-occur (Petranka. 1998. *op. cit.*), which may be an additional reason Green Salamanders are not abundant at the site or not abundant in locations commonly searched. Thus, the combination of low abundance, competitive exclusion from commonly searched microhabitats, and timing of surveys may have collectively resulted in the lack of detection of the Green Salamander at CLNA.

CLNA is in an area with moderate suitability for Green Salamander occurrence (Thames et al. 2021 *op. cit.*). Niemiller et al. (2022, Herpetol. Conserv. Biol. 17(2):249-265) predicted that Green Salamanders would occur in this transition zone

between the Eastern Highland Rim and Cumberland Plateau and noted the absence of records from Putnam County assuming it was due to a lack of surveys. My observation indicates that an increase in the number of surveys would not necessarily enhance the number of occurrences in this transition zone, particularly if those surveys are not tailored to the very specific habitat and seasonal activity of Green Salamanders. The surveys conducted at CLNA, though sufficient to detect the diversity and abundance of most species at the site, were not targeted searches for Green Salamanders. Indeed, detection probability of the species may be exceedingly low outside the Cumberland Plateau during such surveys if populations are sparse and densities low. Therefore, this occurrence emphasizes the importance of searching for Green Salamanders during the optimal detection period (likely May to July). Regardless, this sighting is encouraging because it supports the prediction of Niemiller et al. (2022, *op. cit.*), that populations are more common across the Eastern Highland Rim than previously thought.

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Figure 2. Juvenile Green Salamander (*Aneides aeneus*) discovered at City Lake Natural Area in Cookeville, TN on 5 July 2024.