

# Hybrids of imperiled salamanders in north Georgia: geographic distributions, range extensions, and conservation implications

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## INTRODUCTION

- Mountains of northeast Georgia reportedly inhabited by single species of slimy salamander: *Plethodon chattahoochee*, Chattahoochee slimy salamander<sup>1,2</sup>
- Other large *Plethodon* species inhabit the same area
  - Ranges are limited or not well documented
  - Evolutionary and ecological interactions with *P. chattahoochee* not extensively studied
- Plethodon shermani* (Red-legged salamander):
  - Occurs in northeastern Towns County along GA-NC border, hybridizes with *P. chattahoochee* along Tallulah River<sup>2,3,4</sup>
- Plethodon teyahalee* (Southern Appalachian salamander):
  - Hybridizes with *P. chattahoochee* in northwestern Towns County<sup>2,4</sup>
- Visual observations of aberrant *P. chattahoochee* individuals recorded outside published hybrid zone limits
  - Typical *P. chattahoochee* have extensive lateral spotting, dark cheeks, no dorsal spots, and no red on the legs
  - Abnormal individuals have distinct grey cheeks, minimal lateral spotting, metallic flecking on their heads or backs, or red pigmentation on their limbs
- Abnormalities in phenotype and inconsistencies regarding species distribution make it difficult to identify salamanders in the field

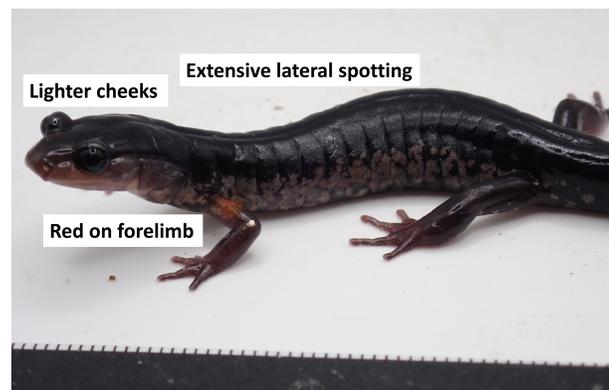


Figure 2. Adult *Plethodon chattahoochee* displaying hybrid characteristics

- Plethodon shermani* and *P. teyahalee* both added to Georgia's 2025 State Wildlife Action Plan (SWAP)<sup>5</sup>
  - Both listed as species of moderate conservation concern and 'Species of Greatest Conservation Need'<sup>5</sup>
  - State Rank S2 = imperiled in Georgia due to their rarity and vulnerability to be extirpated from the state<sup>5</sup>
- Goals of this project:
  - Determine if salamanders observed with aberrant characteristics are hybrids between *Plethodon chattahoochee*, *P. shermani*, and *P. teyahalee*
  - Provide insight into the geographic extent of the hybrid zone and how ancestry estimates vary based on geographic location
  - Examine how elevation affects the distribution of hybrid alleles along a transect.

## METHODS

- A total of 80 tail clips were obtained along routes in Union, Towns, and White County, GA and will be used for genetic analyses
- Each salamander was also phenotypically scored in five categories: lateral spotting, dorsal spotting, red pigment on legs, prominence of grey cheek, and amount of brassy flecking
- DNA will be extracted from the samples using standard methods
- 3RAD libraries will be prepared and sequenced using RADseq and analyzed using *ipyrad* software
- Results will show genetic makeup of salamanders sampled and help infer population-level genetic structure



Figure 1. Adult *Plethodon chattahoochee* displaying normal characteristics

## RESULTS

- Red pigmentation on the legs observed at one or more points along every survey route
  - Observed at the lowest elevation (915m) and the second highest elevation sampled (1340m)
- Data collected also shows wide range of scores in lateral spots, grey-cheek distinctness, and brassy flecking
- Only 4 salamanders of the ~80 scored had dorsal spotting and they were all from the same route

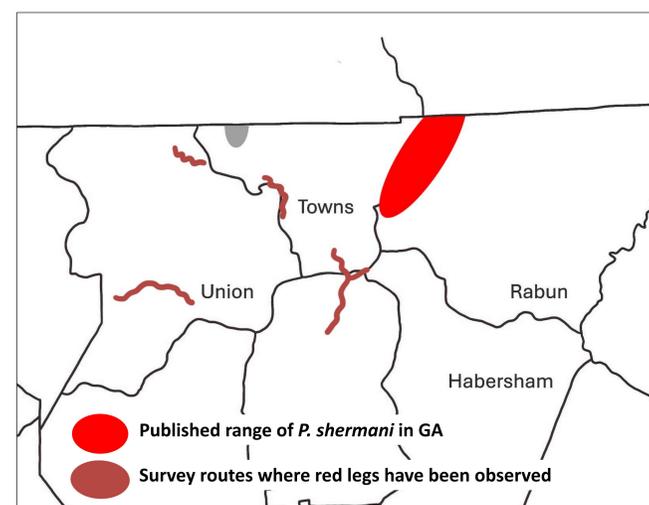


Figure 3. Map showing expected range of *P. shermani* in Georgia and survey routes where *P. shermani* traits have been observed



Figure 4. Photos displaying the range of grey cheek distinctness



Figure 5. Photos showing varying amounts of brassy flecking

## CONCLUSIONS

- Phenotypic data shows many individuals inconsistent with "pure" *P. chattahoochee* were observed
- Red pigment on the legs is a trait of *P. shermani*, a high-elevation species, but was found at low, intermediate, and high elevations
  - High elevation traits becoming widespread throughout all elevations not uncommon in hybrid zones<sup>6</sup>
- We don't know how these hybrids zones have changed over the last 50 years because of a lack of historical data
- Data presented here can act as a baseline for subsequent studies
  - Observe how the percentage of *P. shermani* and *P. teyahalee* traits change over time due to anthropogenic disturbances
- Genetic results could identify new areas their genes are found and help redefine boundaries of their hybrid zones with *P. chattahoochee*
- Increase discourse on how hybrids of imperiled species should be managed or protected

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