

Final Report for the 2015 Chopsticks for Salamanders Grant

Conservation Genetics and Monitoring of the Rare Pigeon Mountain Salamander
(*Plethodon petraeus*) within a Highly Restricted Range

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Objectives: We sought to assess the genetic diversity and population structure of the Pigeon Mountain salamander across its known range. We approached this research objective by identifying polymorphic microsatellite loci for *P. petraeus* via cross-amplification of short tandem repeats of nucleotides in the DNA of a closely related species. In addition to the conservation genetic assessment, a mark recapture study was established to estimate population size, microhabitat use and monitor movement. Collaboration with Fernbank Museum of Natural History in Atlanta Georgia allowed us to educate the public about this research and provide museum guests with information on salamander conservation.

Results: In order to study fine-scale population genetics of the Pigeon Mountain salamander, we successfully cross-amplified eight polymorphic microsatellite regions previously identified in the Western Slimy and Northern Slimy salamander. Using these molecular markers, we investigated genetic diversity and population structure across the species 17-kilometer range using six sampling locations. The genetic diversity of the Pigeon Mountain salamander was found to be similar to other species within the genus *Plethodon* that have much larger ranges. However, genetic diversity, F_{st} , was found to be larger across shorter distances than other terrestrial salamander species with comparable life histories. Four populations across the sampling locations were identified. The genetic divergence between sampling locations showed a strong relationship with distance. High levels of genetic diversity and low gene flow across relatively short distances, 1-5 kilometers, suggests limited dispersal of individuals across the landscape.

Fig. 1 Population structure of the Pigeon Mountain salamander across the species range on Pigeon Mountain in Northwest Georgia.

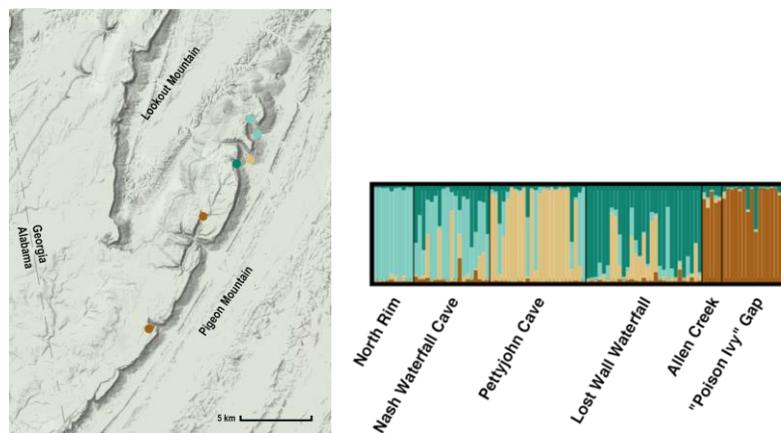
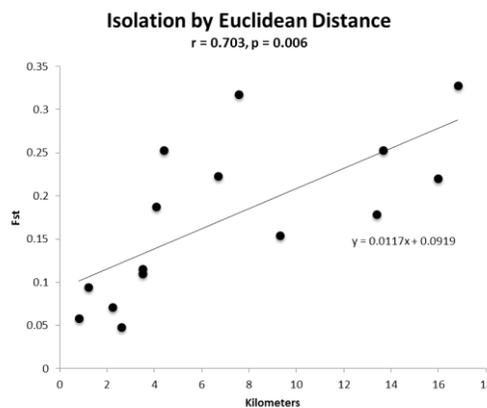


Fig. 2 There was a strong correlation between genetic divergence and distance between sampling locations.



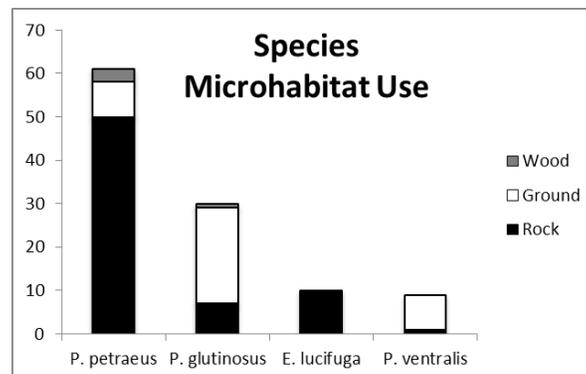
Visual implant elastomer (VIE) tags were used to mark a total of 93 salamanders captured within two 25 x 25 meter plots that were surveyed a total of 11 times from Fall 2015 to Spring 2016 (Table 1). Five species of salamander were captured within the sampling sites including southern zigzag salamanders, cave salamanders, green salamanders, northern slimy salamanders and Pigeon Mountain salamanders. 16 salamanders were recaptured during the sampling periods, including 12 Pigeon Mountain salamanders. The average abundance of salamanders inside both plots across the sampling periods was estimated to be around 107 individuals. Pigeon Mountain salamanders comprised roughly 40% of the salamanders captured. Also, results from mark-recapture study suggest that Pigeon Mountain salamanders have strong site fidelity. The average distance of movement between recapture events was only 2.28 meters. A significant difference ($P < 0.05$) in habitat use at the moment of capture by species was also identified. There was a clear differentiation in the habitat type between salamanders (Fig. 2). Pigeon Mountain salamanders were much more likely to be found among rocks while slimy salamanders seemed to inhabit the forest floor.

Table 1. Number of surveys within the two-tiered structure of the Robust Design for two mark recapture plots.

Plot		1		1 & 2	
Year		2015		2016	
Sampling Period	Primary	Oct	March	April	May
	Secondary *	3	3	2	3

*No. of times the study area was surveyed within the primary period

Fig 3. Habitat use for four salamander species at moment of capture within mark-recapture plots, $P < 0.05$.



The collaboration with the Fernbank Museum of Natural History in Atlanta Georgia gave us the opportunity to participate educational outreach for salamander conservation. For example, their 2015 Reptile and Amphibian Day brought over 1,200 visitors to the museum to learn about herpetology. Our lab participated and was able to bring a Pigeon Mountain salamander under a special collection permit. Other outreach highlighting salamander conservation and this research project has been developed and presented over the last year, including, salamander themed animal encounters, a seminar and interactive salamander hikes in Fernbank Forest on museum grounds.

Conservation Importance: The financial award by FCSal to this project funded an integrated approach to conservation. Population genetics and direct monitoring in the field were used to understand more about the biology and natural history of this fascinating species. The educational component was intended to introduce people to salamanders and salamander diversity, how research can be used to help conserve species and highlight our work with the Pigeon Mountain salamander. Public education and awareness can be just as vital to conservation efforts as the research itself.

Even though the Pigeon Mountain salamander is listed as a rare species and protected by the state of Georgia due to its highly restricted range, the salamander is found in high abundances in rocky habitat and even outnumbers other terrestrial salamander species. This is a rare species because of its small range but seemingly abundant where it is found. The large number of individuals within the studied populations undoubtedly contributes to amount of genetic diversity of the species. Due to the stressors amphibian populations are facing, we recommend the continuation and expansion of monitoring programs in order to detect variations in salamander abundance. A decrease in Pigeon Mountain salamander populations could significantly alter the population's genetic viability overtime, especially due to the salamanders seemingly limited dispersal capabilities.

Future Goals:

- Expand mark-recapture study and continue to sample sites in the future.
- Increase species awareness and the search for new populations.
- Publish the results of our research.