MORPHOLOGICAL VARIATION BETWEEN TWO WIDELY DISTRIBUTED POPULATIONS OF *PLETHODON ALBAGULA* (CAUDATA: PLETHODONTIDAE)

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Abstract

The Western Slimy Salamander (*Plethodon albagula*) is a species of lungless plethodontid salamander with two broadly separated ranges: one is in the Edwards Plateau of Central Texas and the second is in the Interior Highlands of Arkansas, Missouri, and Oklahoma. Recent studies have demonstrated that Central Texas *P. albagula* includes multiple mtDNA clades, many of which are also morphologically distinct from one another. Given this unexpected diversity within the Edwards Plateau, even greater differences between the Edwards Plateau and Interior Highlands populations seem probable. We examined 12 morphological characters, including both body shape and size characters, in 343 adult *P. albagula* from across both geographic ranges. Principal component analysis and discriminant function analysis suggest that there are strong morphological differences between these two populations, with both males and females from the Interior Highlands being larger in body size and shape characters than Edwards Plateau individuals. These results suggest that there are indeed morphological differences between these disjunct populations and additional molecular information is needed to detect potential cryptic species.

Background

- The Western Slimy Salamander (*Plethodon albagula*) is the westernmost species of the *Plethodon glutinosus* Group, which is broadly distributed throughout much of the eastern United States
- *Plethodon albagula* has two disjunct known ranges: one on the Edwards Plateau (EP) of Central Texas and another in the Interior Highlands (IH) of Arkansas, Missouri, and Oklahoma (Fig. 1)
- Previous research has identified five mtDNA lineages within Central Texas and that several of these lineages are morphologically distinct (Fig. 2)[1,2]
- Studies have long questioned the placement of both EP and IH populations as *P. albagula*[3,4,5]; however, no comprehensive morphological study has occurred

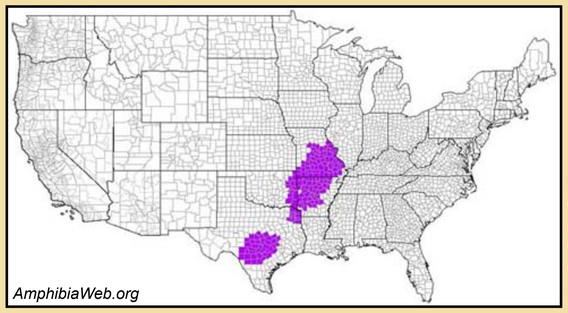
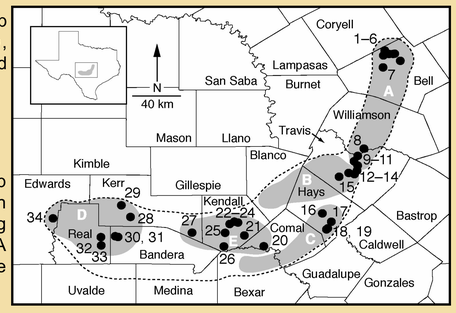


Figure 1 (left). Range map of *Plethodon albagula*, showing the both the EP and IH populations.

Figure 2 (right). Range map of *Plethodon albagula* in central Texas. Gray shading depicts the range of mtDNA groups[1], many of which are morphologically distinct[2].



Questions

1. Are there morphological differences between EP and IH populations of *Plethodon albagula*?
2. Are there morphological differences within the IH population of *Plethodon albagula*?

Materials and Methods

- Examined fluid-preserved, adult *Plethodon albagula* from the Interior Highlands (n = 237)
  - Combined with existing morphological data on Edwards Plateau salamanders (n = 106)[2]
- For each individual, we measured 12 morphological characters
  - SVL, head length, head width, head depth, snout length, inter-orbital distance, orbit width, pectoral width, fore-limb length, hind limb length, tail width, tail depth
- Sex determined via presence/absence of a mental gland and cloacal papillae
- Tested for morphological differences using multivariate analyses (MANCOVA, MANOVA)
- Assessed sexual size dimorphism using ANCOVAs on log-transformed measurements and Principal Components (PC) scores

Results

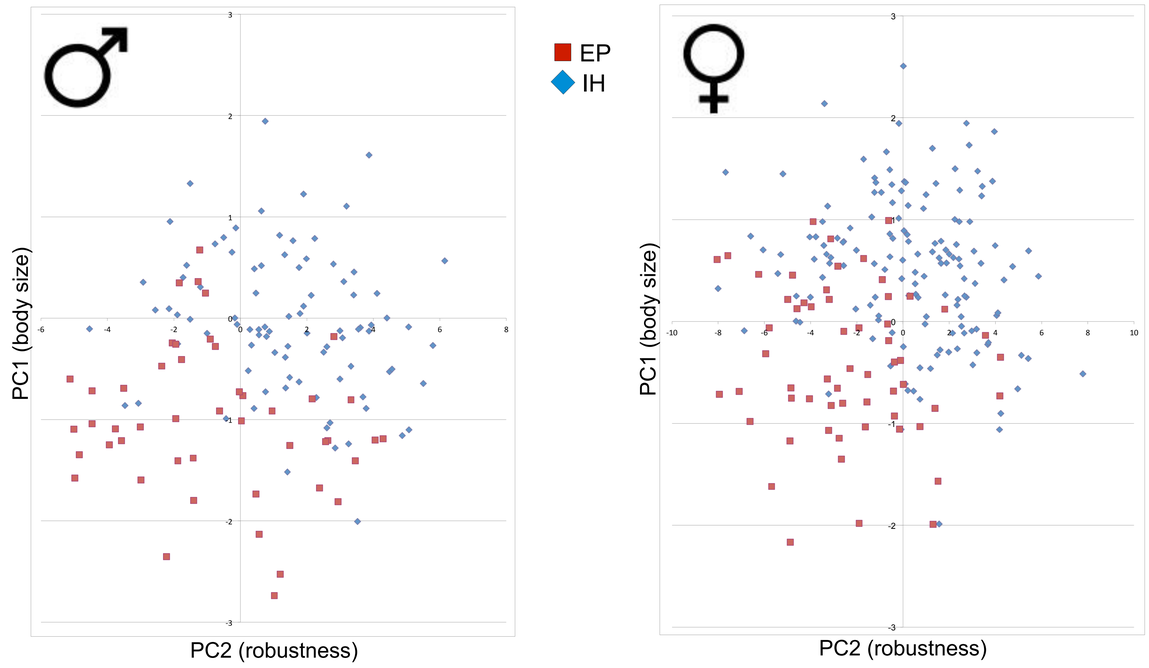


Figure 3. Scatter plots of PC1 versus PC2 for male (left) and female (right) *Plethodon albagula*.

Multivariate Statistical Tests

Body size and shape:

- MANOVA of PCs 1−4: Wilks' Lambda = 0.50, $F_{4,336}$ = 82.37, ***P* < 0.001**

Body shape only:

- MANOVA of PCs 2−4: Wilks' Lambda = 0.64, $F_{3,337}$ = 63.60, ***P* < 0.001**
- MANCOVA of characters (SVL as covariate): Wilks' Lambda = 0.42, $F_{11,328}$ = 41.60, ***P* < 0.001**

Table 1. Mean SVL ± 1 SD (mm) for males and females of each group examined. P-values are from t-tests.

	Male	Female	*P*
Plethodon albagula (EP)	n = 47	n = 59	***P* = 0.0002**
	59.65 ± 5.76	56.08 ± 6.69	
Plethodon albagula (IH)	n = 90	n = 147	***P* = 0.0095**
	62.55 ± 5.40	60.58 ± 7.52	
Plethodon grobmani	n = 51	n = 64	*P* = 0.6667
	55.14 ± 3.01	54.91 ± 3.88	
Plethodon kisatchie	n = 8	n = 17	*P* = 0.7219
	59.75 ± 6.50	60.67 ± 5.90	

Conclusions

- Despite the general, but largely untested, opinion that the *Plethodon glutinosus* Group is morphologically conservative[6], the disjunct populations of *P. albagula* appear to be morphologically distinct from one another
- Both the Edwards Plateau and the Interior Highlands populations show male-biased sexual size dimorphism, unique among examined *Plethodon*[7]
- These morphological data adds to a growing body of evidence that suggests these populations are in distinct clades; however, to more fully resolve this issue, a more robust molecular dataset from these populations is needed

References

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