Zootaxa 3664 (3): 312–320
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

http://dx.doi.org/10.11646/zootaxa.3664.3.2
http://zoobank.org/urn:lsid:zoobank.org:pub:ABF842F6-14C0-42AA-BA8C-358187E31A6C

Review of the systematic status of *Sceloporus arenicolus* Degenhardt and Jones, 1972 with an estimate of divergence time

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Abstract

The sagebrush lizards (*Sceloporus graciosus* group) consist of four taxa (*S. graciosus graciosus*, *S. graciosus gracilis*, *S. graciosus vandenburgianus*, and *S. arenicolus*) distributed in western North America. Of these, *S. arenicolus* is morphologically, behaviorally, and ecologically distinct as well as geographically disjunct from the other taxa, occurring only in the Mescalero-Monahans Sandhills of southeastern New Mexico and adjacent Texas. *Sceloporus arenicolus* is a taxon of concern because of its small range and habitat alteration due to land use practices. Understanding evolutionary relationships among members of the *S. graciosus* group, and especially *S. arenicolus*, has important implications for conservation. We examine the phylogenetic relationship of *S. arenicolus* relative to the three recognized subspecies of *S. graciosus* at mitochondrial and nuclear loci for populations sampled throughout the ranges of these taxa. Additionally, we estimate the divergence time and clade age of *S. arenicolus*. We find that the *S. graciosus* group is in need of major taxonomic revision, and also confirm that *S. arenicolus* is a genetically distinct and divergent lineage. These results bear important consequences for conservation and management.

Key words: *Sceloporus graciosus*, Mescalero-Monahans Sand Dunes, Phrynosomatidae, shinnery oak, evolutionarily significant unit (ESU), sagebrush lizard

Introduction

The sagebrush lizards are comprised of two species in the *graciosus* group of the phrynosomatid genus *Sceloporus* Wiegmann (1828)—*Sceloporus graciosus* Baird and Girard (1852) containing three subspecies *S. g. graciosus* Baird and Girard (1852), *S. g. gracilis* Baird and Girard (1852), and *S. g. vandenburgianus* Cope (1896) and *S. arenicolus* Degenhardt and Jones (1972). The taxonomy of this group has fluctuated considerably; *Sceloporus g. vandenburgianus* has previously been considered a distinct species from *S. graciosus* (Collins 1991), and likewise, *S. arenicolus* has previously been considered a geographical variant and subspecies of *S. graciosus* (Degenhardt & Jones 1972). As currently defined, *Sceloporus graciosus* occurs through most of the Great Basin of the western USA, to the coast of California, to northern Arizona and northwestern New Mexico (Figure 1; Stebbins 2003; Ryan 2009). The geographic range of *Sceloporus arenicolus* is disjunct from the ranges of the *S. graciosus* subspecies and occurs in southeastern New Mexico and adjacent Texas (Stebbins 2003; Fitzgerald & Painter 2009; Laurencio & Fitzgerald 2010).

The morphological and ecological distinctiveness of *S. arenicolus* from *S. graciosus* is well-studied. Specimens of *S. arenicolus* were originally identified by Sabath (1960), who reported it from Texas and New Mexico as a range extension of *S. graciosus* with distinct coloration patterns and femoral pore counts. Kerfoot (1968) conducted a comprehensive study of morphological variation among 1,311 specimens from throughout the eastern portion of the range of *S. graciosus* including the "southeastern sand dune isolates" which were populations

 Accepted by S. Carranza: 9 Apr. 2013; published: 27 May 2013