

NOTES ON GEOGRAPHIC DISTRIBUTION

Amphibia, Plethodontidae, *Pseudoeurycea maxima*: Distribution extension.

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Since the pioneering work of Dunn (1926), there have been numerous contributions to our understanding of the biodiversity, geography, and evolution of Neotropical salamanders of the Tribe bolitoglossine (Plethodontidae) (Wake 1987; García-París et al. 2000; Wiens et al. 2007). Dunn (1926) listed only 30 species, placing them in a single genus (*Oedipus*), a striking contrast to the currently recognized 12 genera containing some 249 species (Frost 2007). Further advances in our understanding of the diversity and biogeography of bolitoglossine salamanders will likely continue as many regions lacking extensive herpetological exploration are surveyed and more complete collections are assembled.

Amongst the Neotropical plethodontids, salamanders of the genus *Pseudoeurycea* (Taylor 1944) are noted for their wide geographic range throughout Mexico and Guatemala, occupying a diversity of ecological situations ranging from tropical deciduous and dry/wet oak-coniferous forest to tropical wet and cloud forest, and even above tree-line in alpine bunchgrass situations (e.g. Stuart 1954; Shannon and Werler 1955; Wake and Lynch 1976; Flores-Villela and McCoy 1993; Adler 1996; Parra-Olea et al. 1999; 2004; 2005; Chan 2003; Lara-Góngora 2003). Though a few species are known from low elevations (below 1500 m), the majority inhabit mid to high elevations (up to 5000 m). In addition, most species appear to occupy narrow elevational belts, a pattern seen in other genera of Neotropical salamanders (Wake 1987; García-París et al. 2000; Wake 2005).

To date, there is no thorough work reviewing the geographic distribution of the genus *Pseudoeurycea*. However, many species seem to

have limited distributions (Wake and Lynch 1976; Parra-Olea et al. 1999). An examination of the distributional data registered on the IUCN online database offers some preliminary observations. Of the 45 species of *Pseudoeurycea* evaluated by the IUCN, 34 (75 %) are known to occupy an area under 1,000 km², and 42 % have a calculated area of occupancy under 50 km² (raw data from IUCN 2007). Although this database is often inaccurate and outdated, and should thus be treated with caution, its data suggests that many salamanders of this genus may have exceptionally small geographic ranges.

These distribution patterns are somewhat expected considering the geographic patterns of other amphibian groups and the topographical and ecological isolation that characterize much of Mexico and Guatemala. However, it is also likely that many range projections are significantly underestimated, given the void in our current knowledge of species' distributions. Herein we present new geographic information on *Pseudoeurycea maxima* (Parra-Olea, García-París, Papenfuss & Wake, 2005), a species of the *P. bellii* complex, extending its range by ca. 130 km east-southeast from previously known locations.

Specific locations and elevations were calculated by marking road mileage to the nearest town and by using a Kestrel 4000 field barometer, and then checked to a physical map with the software Global Mapper. Additional localities for *P. maxima* and *P. boneti* were obtained from the Museum of Vertebrate Zoology (MVZ, University of California, Berkeley). Habitat type/quality was examined using satellite projects on Google Earth. Voucher photos were deposited at the University of Texas Arlington, Arlington, Texas, U.S.A.

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Pseudoeurycea maxima is registered from several localities just south and northeast of Putla de Guerrero, Oaxaca, Mexico, at 750-1,030 m elevation along the Pacific versant of the Sierra Madre del Sur (Figure 1). On 09 June 2007 at 04:30 AM, an adult *P. maxima* (Figure 2) was observed active among leaf litter on the forest floor. This was along a narrow roadside ravine through a small patch of mature secondary forest, 15.9 km north of San Gabriel Mixtepec (16°05'40"

N, 97°04'55" W), on the Oaxaca-Puerto Escondido road (HW 131), at an elevation of 1,086 m on the Pacific versant of southern Oaxaca (Figure 1). The forest type is classified as Lower Montane Dry Forest (LMDF), which has a pronounced rainy season from May through October (for thorough descriptions, Stuart 1966; Caldwell 1974). This new record is approximately 130 km east-southeast from registered localities of the species.

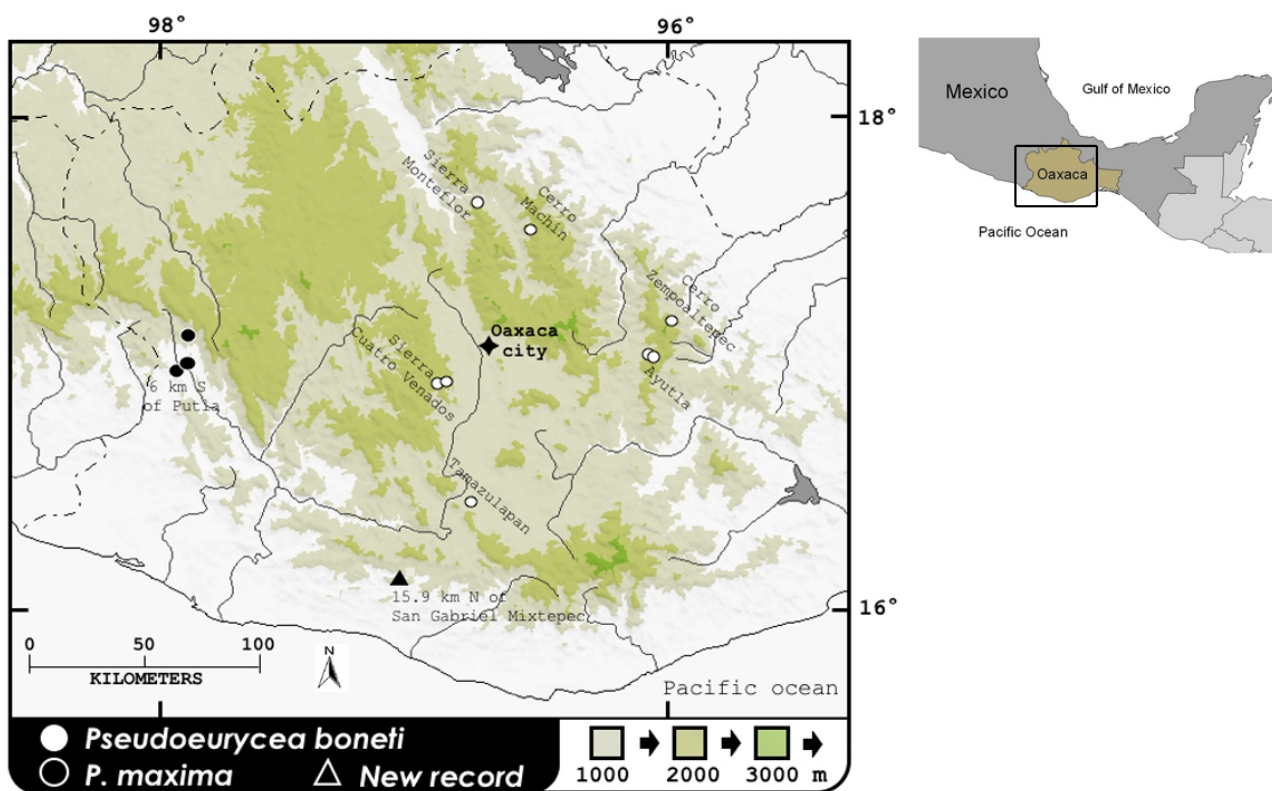


Figure 1. Registered localities of *Pseudoeurycea boneti* and *Pseudoeurycea maxima* in Oaxaca, Mexico.

While some members of the *Pseudoeurycea bellii* group exhibit strong elevation/vegetation associations (e.g. *P. boneti*, *P. gigantea*, and *P. naucampatepetl*), another (*P. bellii*) is reported as having both the widest distributional and elevation limits of any salamander in the world, occurring in a wide variety of habitats (Feder et al. 1982; Parra-Olea et al. 2005). However, all specimens from low elevations reported in Feder et al. (1982)

as *P. bellii* are now recognized as members of other taxa, including *P. maxima* (see Parra-Olea et al. 2005). Based on available information, it appears that *P. maxima* is associated with the LMDF formation, occurring within the elevational extent of this vegetation type. It is likely that this species occurs further east-southeast and west-northwest along the Pacific versant of Oaxaca and into Guerrero, following this LMDF.

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Figure 2. Adult *Pseudoeurycea maxima* located on 09 June 2007, near San Gabriel Mixtepec, Oaxaca, Mexico. Photo by J. Delia.

The current conservation status of *P. maxima* is listed by the IUCN as Data Deficient, with the possibility of qualifying it as Least Concern if its area of occupancy is more widespread than currently registered (IUCN 2007). While large expanses of LMDF have suffered alteration, with an increasing area subject to deforestation, large tracks of forest remain intact within the area occupied by this species. In addition, this species has been documented in altered areas like road cuts, banana plantations (Parra-Olea et al. 2005), and in fragmented secondary forest (this work).

Considering the increased area of occupancy, potential extent of occurrence, and its ability to tolerate disturbance, we recommend that *P. maxima* qualifies for the IUCN category of Least Concern. However, as this species was only recently described (2005), information on its population trends are non-existent, which could contribute a high degree of uncertainty in evaluating its conservation status. Therefore, future efforts are needed to evaluate population trends and better detect the occurrence of this species outside of its known range.

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Literature cited

- Adler, K. 1996. The salamanders of Guerrero, Mexico, with descriptions of five new species of *Pseudoeurycea* (Caudata: Plethodontidae). Occasional Papers of the Museum of Natural History of the University of Kansas 177: 1-28.
- Caldwell, J. P. 1974. Tropical tree frog communities: Patterns of reproduction, size, and utilization of structural habitat. PhD. Thesis. University of Kansas, Kansas.
- Chan, L. 2003. Seasonality, microhabitat and cryptic variation in tropical salamander reproductive cycles. Biological Journal of the Linnean Society 78: 489–496.
- Dunn, E. R. 1926. The salamanders of the family Plethodontidae. MA. Thesis. Smith College, Northampton, Massachusetts.
- Feder, M. E., T. J. Papenfuss, and D. B. Wake. 1982. Body size and elevation in Neotropical salamanders. Copeia 1982: 186-188.
- Flores-Villela, O. and C. J. McCoy (ed.). 1993. Herpetofauna Mexicana: Lista anotada de las especies de anfibios y reptiles de México, cambios taxonómicos recientes, y nuevas especies. Carnegie Museum of Natural History, Special Publication 17, 73 p.
- Frost, D. R. 2007. Amphibian Species of the World: an online reference. Version 5.0. Electronic Database accessible at <http://research.amnh.org/herpetology/amphibia/index.html>. American Museum of Natural History, New York. Captured on September 2007.
- García-París, M., D. A. Good, G. Parra-Olea, and D. B. Wake. 2000. Biodiversity of Costa Rican salamanders: Implications of high levels of genetic differentiation and phylogeographic structure for species formation. Proceedings of the National Academy of Sciences 97: 1640-1647.
- IUCN, Conservation International, and NatureServe. 2006. Global Amphibian Assessment. Electronic Database at <http://www.globalamphibians.org>. Captured on September 2007.
- Lara-Góngora, G. 2003. A new cryptic species of *Pseudoeurycea* (Amphibia, Caudata: Plethodontidae) of the leprosa group from central Mexico. Bulletin of the Maryland Herpetological Society 39: 21-52.
- Parra-Olea, G., M. García-París, and D. B. Wake. 1999. Status of some populations of Mexican salamanders (Amphibia: Plethodontidae). Revista de Biología Tropical 47: 217-223.
- Parra-Olea, G., M. García-París, J. Hankens, and D. B. Wake. 2004. A new species of arboreal salamander from the mountains of Oaxaca, Mexico. Journal of Natural History 38: 2119–2131.
- Parra-Olea G., M. García-París, T. J. Papenfuss, and D. B. Wake. 2005. Systematics of the *Pseudoeurycea bellii* species complex. Herpetologica 61: 145-158.
- Shannon, F. A. and Werler, J. E. 1955. Notes on amphibians of the Los Tuxtlas Range of Veracruz, Mexico. Transactions of the Kansas Academy of Science 58: 360-386.
- Stuart, L. C. 1954. Descriptions of some new amphibians and reptiles from Guatemala. Proceedings of the Biological Society of Washington 67: 159-178.
- Stuart, L. C. 1966. The environment of the Central American cold-blooded vertebrate fauna. Copeia 1966: 684-699.
- Taylor, E. H. 1941. New amphibians from the Hobart M. Smith Mexican collections. University of Kansas Scientific Bulletin 27: 141-167.
- Wake, D. B. and J. F. Lynch. 1976. The distribution, ecology and evolutionary history of plethodontid salamanders in tropical America. Natural History Museum of Los Angeles County Science Bulletin 25: 1-65.
- Wake, D. B. 1987. Adaptive radiation of salamanders in Middle American cloud forests. Annals of the Missouri Botanical Garden 74(2): 242-264.
- Wake, D. B. 2005. Diversity of Costa Rican salamanders, p. 65-80 In M. A. Donnelly, B. L. Crother, C. Guyer, M. H. Wake, and M. E. White (ed.). Ecology & Evolution in the Tropics: A Herpetological Perspective. Chicago, The University of Chicago Press.
- Wiens, J. J., G. Parra-Olea, M. García-París, and D. B. Wake. 2007. Phylogenetic history underlies elevational biodiversity patterns in tropical salamanders. Proceedings of the Royal Society, B 274: 919-928.

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