

NOTES ON THE PARADOX FROG, *PSEUDIS PARADOXA*, IN BOLIVIA

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INTRODUCTION

The South American Paradox Frog, *Pseudis paradoxa* (Plate. 1) is primarily a dweller of open, lowland areas, where it inhabits marshes, ponds and other types of lentic water bodies. It has a discontinuous distribution from Colombia to Argentina. Inter-population differences primarily in colour pattern, as well as in some other features, have led to the recognition of seven subspecies [*P. p. bolbodactyla* and *P. p. fusca* were recently proposed to be elevated to specific status (Caramaschi and Cruz, 1998)].

DISTRIBUTION AND SUBSPECIES IN BOLIVIA

For taxonomic and biogeographical reasons, the lowlands of Bolivia are an interesting area with respect to this frog. The distribution of the species in this country is poorly known. The first Bolivian record of *P. paradoxa* was provided by Müller and Hellmich (1936) at San Fermiín, Department of Santa Cruz. Since then, it was reported at some other localities, mostly in the Department of Santa Cruz [see De la Riva (1990) and below]. It was interesting that it was also discovered at two localities in southeastern Peru (Duellman and Salas, 1991; Henle, 1992). These discoveries made plausible that it ranges throughout the intermediate area of extensive, suitable habitat of humid savannas in the Bolivian Department of Beni. However, there is a surprising scarcity of published records for this huge and relatively (by Bolivian standards) well surveyed zone. Bosch *et al.* (1996), pointed out that there was a gap of about 800 km between the Peruvian populations and the westernmost Bolivian record of *P. paradoxa*, Nueva Moka, a locality in the Department of Santa Cruz reported by Gallardo (1964). De la Riva (1990) and Bosch *et al.* (1996) overlooked Cochran's (1955) record of the species in the Department of Beni based on a specimen housed at the Museum of Zoology of the University of Michigan (UMMZ 57527) collected at Rurrenabaque and tentatively considered as *Pseudis bolbodactyla* (= *P. paradoxa bolbodactyla*). Reichle (1997), provided the second record of the species in Beni, at the Estación Beni, in the southwestern part of the Department. To date, *P. paradoxa* has been reported at seven localities in Bolivia. In this paper I summarize these published records and report additional localities based on personal observations and specimens housed at the American Museum of Natural History (AMNH), Carnegie Museum (CM), Colección Boliviana de Fauna (CBF), and Natural History Museum of the University of Kansas (KU). In all, there are now 16 records, six of them in the Department of Beni (see Fig. 1), which represent a further step towards a more realistic picture of the distribution of the Paradox Frog in the country. However, at the regional level, it still seems that this species has a patchy distribution, paralleling that shown at continental level. For example, despite some survey efforts, it has not been found in the suitable area of the Pampas del Heath, on the Peruvian-



Plate 1: Calling male of *Pseudis paradoxa occidentalis* at La Bola, Department of Santa Cruz, Bolivia.



Plate 2: Giant tadpole of *Pseudis paradoxa* (CBF 694) from Estancia Espiritu, Department of Beni, Bolivia (total length, 260 mm).

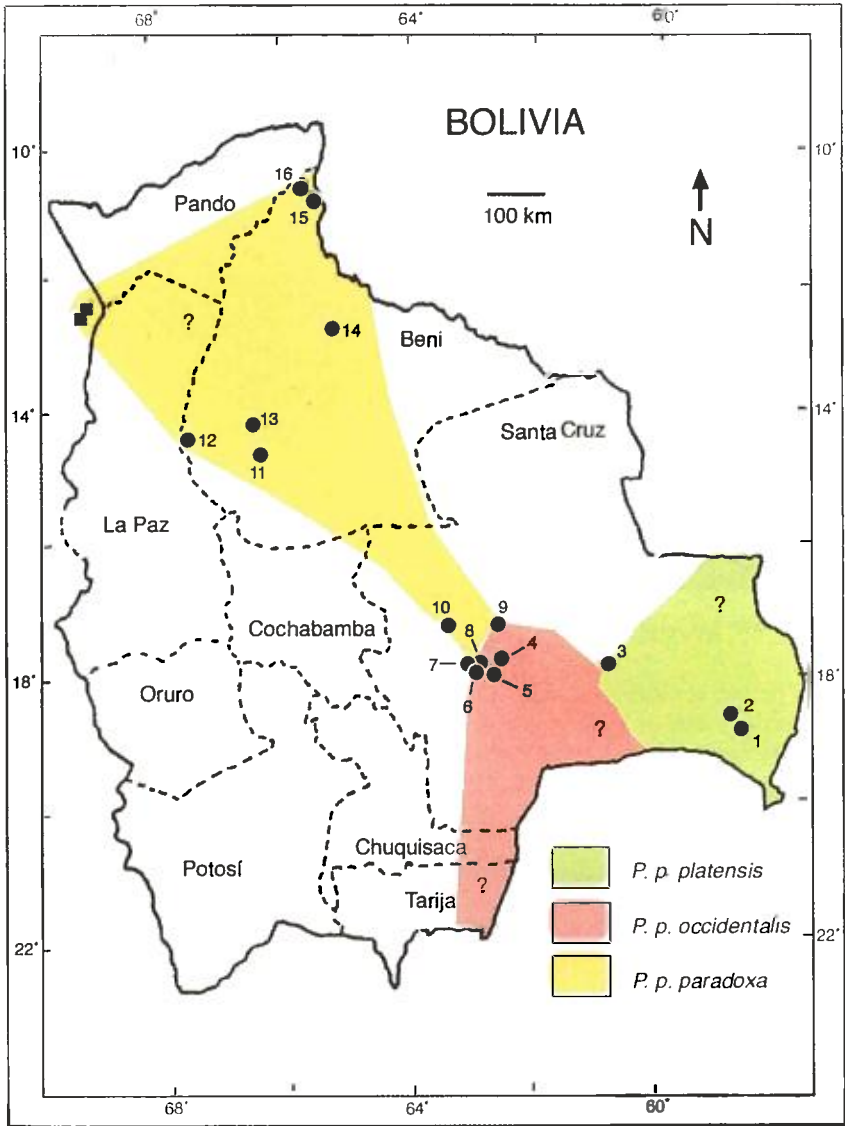


Fig. 1: Localities and putative distribution of the three subspecies of *Pseudis paradoxa* reported in Bolivia. 1) El Carmen (Gans, 1960); 2) San Fermín (Müller and Hellmich, 1936); 3) San José de Chiquitos (this paper; 4) El Pailón (Gans, 1960); 5) La Bola (Bosch *et al.*, 1996); 6) El Palmar del Oratorio (this paper); 7) Estancia Cedrito (this paper); 8) Santa Cruz (CM); 9) Okinawa 1 (KU); 10) Nueva Moka (Gallardo, 1964); 11) Estación Biológica Beni (Reichle, 1997); 12) Rurrenabaque (Cochran, 1955); 13) Espíritu (this paper); 14) Puerto Siles (AMNH); 15) Guayaramerín (AMNH); 16) Río Yata, on road from Guayaramerín to Cachueta Esperanza (AMNH). The squares represent Cuzco Amazónico (Duellman and Salas, 1991) and Lower Tambopata River (Henle, 1992), in the Department of Madre de Dios, Peru.

Bolivian border (Icochea, 1992; Pérez, 1997). Likewise, the species is present in the northern Chaco of Bolivia and in the Argentinian and Paraguayan chaco but there are no records from the intermediate Bolivian area [it has not been found even in marshy, suitable places as the Banados del Izozog (González, 1997)].

In spite of the few records known previously, up to four subspecies of *P. paradoxa* have been recognized in Bolivia. Gans (1960) considered the eastern Santa Cruz populations as *P. p. bolbodactyla*, probably following Cochran's (1955) tentative identification of the Rurrenabaque specimen. This subspecies is now restricted to the San Francisco River basin, in eastern Brazen (Gallardo, 1961). Gallardo (1961) stated that, in Bolivia, *P. p. occidentalis* occurs in the Chaco, and *P. p. platensis* in the subhumid tropical lowlands (Cerrado formation) north and east of the Chaco. Later, Gallardo (1964) referred the Nueva Moka population to *P. p. paradoxa* and stated the Beni populations would belong to this subspecies as well. Henle (1992) commented on the supratympanic fold and colour pattern of the Peruvian specimens and suggested (apparently overlooking Gallardo's statement on the subspecific status of Beni populations) that they might be *P. p. occidentalis*; however, he found some differences such as, for example, the presence of patterned throat and venter, rather than immaculate. This last character would suggest that these populations are referable to *P. p. paradoxa*. It is not clear where would be the boundaries separating these three subspecies (Fig. 1).

THE TADPOLE

The Paradox Frog is famous because it has a huge tadpole, whereas the adult is medium-sized, a fact to which the species owes its common name. However, accurate data on the maximum size attained by the larvae are scarce. For instance, Goin & Goin (1962) stated that they can reach "more than 25 cm long,..."; Kenny (1969) reported "230 mm"; Cochran (1961), "more than 25 cm"; Cogger & Zweifel (1992), "up to 25 cm"; Zug (1993), "220 mm"; Pough *et al.* (1998), "250 mm". Most of these reports are not based on particular specimens, or at least no voucher specimens were cited. The most comprehensive study on this topic is Emerson's (1988). She clearly stated that *P. paradoxa* has the largest tadpole of any species of Anuran, and reported a museum specimen of 220.5 mm as the largest examined by her (but she did not report the voucher specimen). The largest larvae ever reported is that of Bokerman (1967) (Bokerman's collection number, WCAB 38700), from Macapá (on the north bank of the Amazon river, close to its mouth), which attained 270 mm. This author stated that the specimen has the tail broken and it might have attained 320-330 mm in total length when it was still alive.

Cei (1980) and Emerson (1988) commented on the geographic variation in tadpole size of *P. paradoxa*, and stated that the largest tadpoles are from the Guianas and Trinidad [where, respectively, the subspecies *P. p. paradoxa* and *P. p. caribensis* occur; Bokerman's (1967) tadpole, collected near the Guianas, would belong to the nominal subspecies] and the smallest tadpoles are from Paraguay and Bolivia. There are some precise data on tadpole sizes for the two subspecies of this last region. Gallardo (1964) reported a maximum tadpole size of 169 mm for *P. p. platensis* and 117 mm for *P. p. occidentalis*. Dixon, *et al.* (1955) reported tadpoles of *P. p. platensis* of 135 mm in northern Argentina.

Taking these data into account, it was surprising that Reichle (1997) commented on a huge Bolivian larvae of *P. paradoxa* approaching 30 cm housed at the Colección Boliviana de Fauna, La Paz. This specimen (CBF 694) (Plate 2), was also examined by me. It was collected on 11 May, 1986 by W. Hanagarth, J. Sarmiento and J. Salazar at Espíritu, Provincia Ballivián, Department of Beni. It has well developed hind limbs and

its total length is 260 mm. The tail, measured from the starting point of the musculature, is 200 mm long; the body high is 72 mm and the tail high 92 mm. This tadpole is almost four centimetres longer than Emerson's largest one, and only one centimetre shorter than Bokerman's (1967) absolute record. Apparently, it was almost 30 cm long at the time of collection (Reichle, personal communication), and perhaps it shrunk afterwards as a consequence of the processes of fixation and preservation.

DISCUSSION

This huge tadpole from Espíritu represents one more record for the Department of Beni but, what is more important, it also provides new information concerning two issues commented above, that of the geographic variation in larval size, and the subspecific status of the populations occurring in the Beni area. The fact that this specimen represents by far the largest tadpole of *P. paradoxa* reported for central South America and that only northern populations attain a size comparable to it, might support the statement by Gallardo (1964) about the status of the Beni populations as belonging to the nominal subspecies. The same might be true for the Amazonian population reported by Vanzolini (1986) based on three tadpoles collected in Rôndonia (unfortunately, no data were provided on the size of these tadpoles). However, there is still a gap of more than 1000 km between these populations and those from northern South America. With some differences, the distribution of *P. paradoxa* could parallel that of other open formation species, as *Leptodactylus labyrinthicus*, which occurs in open areas of northern and central South America but also inhabits isolated patches of savanna within the domain of the central Amazon rainforest. Within this context, it could be that Beni populations of *P. paradoxa* are phylogenetically closer to northern populations than to neighbouring populations from the Chaco and Paraná basin. However, it is also necessary to gather more information on maximum tadpole size throughout the range of the species. Overall, there is still a great lack of knowledge on the biology and distribution of the species as a whole, the subspecific or specific units into which it should be split, and the distribution and phylogenetic relationships of the resulting lineages.

RESUMEN

La distribución de la rana paradójica, *Pseudis paradoxa*, en Bolivia es aún mal conocida. La falta de citas en el Departamento de Beni, donde hay hábitats ideales para la especie, era particularmente difícil de explicar teniendo en cuenta que es bien conocida en Santa Cruz y se halla también en el sudoeste de Perú. En este trabajo se dan nuevas citas en Beni que llenan parcialmente este vacío informativo. No obstante, la distribución de *P. paradoxa* en el país es desigual. Se aportan asimismo datos sobre un enorme renacuajo de 260 mm que apoyaría la hipótesis de que la subespecie que se encuentra en la región beniana es la misma que hay en el norte de Sudamérica, *P. p. paradoxa*, o quizá una forma filogenéticamente más próxima a ella que a las vecinas subespecies *P. p. occidentalis* y *P. p. platensis*.

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REFERENCES

- Bokerman, W. C. (1967). Girinos de anfibios brasileiros; sobre un girino gigante de *Pseudis paradoxus*. *Revista Brasileira de Biologia* 27: 209-212.
- Bosch, J., I. De la Riva and R. Márquez (1996). The calling behaviour of *Lysapsus limellus* and *Pseudis paradoxa* (Amphibia: Anura: Pseudidae). *Folia Zoologica* 45 (1): 49-55.
- Caramaschi, U. and C. A. G. Cruz (1998). Notas taxonômicas sobre *Pseudis fusca* Garman e *P. bolbodactyla* A. Lutz, com a descrição de uma nova espécie correata (Anura, Pseudidae). *Revista Brasileira de Zoologia* 15(4): 929-944.
- Cei, J. M. (1980). Amphibians of Argentina. *Monitore Zoologico Italiano (N. S.) Monografia* 2: 1-609.
- Cochran, D. M. (1955) Frogs of southeastern Brazil. *Bulletin of the United States National Museum* 206: 1-423.
- Cochran, D. M. (1961). *Living Amphibians of the World*. Doubleday, Garden City, New York.
- Cogger, H. G. and R. G. Zweifel (editors). (1992). *Reptiles and Amphibians*. Smithsonian, New York.
- De la Riva, I. (1990). Lista preliminar comentada de los anfibios de Bolivia con datos sobre su distribución. *Bolletino del Museo regionale di Scienze naturali – Torino* 8(1): 261-319.
- Dixon, J. R., C. Mercolli and A. A. Yanosky (1995). Some aspects of the ecology of *Pseudis paradoxa* from Northeastern Argentina. *Herpetological Review* 26(4): 183-185.
- Duellman, W. E. and A. W. Salas (1991). Annotated checklist of the amphibians and reptiles of Cuzco Amazónico, Perú. *Occasional Papers of the Museum of Natural History, The University of Kansas* 143: 1-13.
- Emerson, S. B. (1988). The giant tadpole of *Pseudis paradoxa*. *Biological Journal of the Linnean Society* 34: 93-104.
- Gallardo, J. M. (1961). On the species of Pseudidae (Amphibia, Anura). *Bulletin of the Museum of Comparative Zoology, Harvard* 125(4): 111-134.
- Gallardo, J. M. (1964). Una nueva forma de Pseudidae (Amphibia, Anura). *Acta Zoologica Lilloana* 20: 193-209.
- Gans, C. (1960). Notes on a herpetological collecting trip through the Southeastern lowlands of Bolivia. *Annals of the Carnegie Museum* 35: 283-314.
- Goin C. J. and O. B. Goin (1962). *Introduction to Herpetology*. Freeman, San Francisco.
- González, L. (1998). La herpetofauna de Izozog. *Ecología en Bolivia* 31: 45-52.
- Henle, K. (1992). Zur Amphibienfauna Perus nebst Beschreibung eines neuen *Eleutherodactylus* (Leptodactylidae). *Bonner zoologische Beitrage* 43(1): 79-129.
- Icochea, J. (1992). Herpetofauna del Santuario Nacional Pampas del Heath, Madre de Dios, Perú: diversidad y conservación. In: Castillo, E. (Ed.), *Memorias X Congreso nacional de Biología*, Pp. 351-354. Lima.
- Kenny, J. S. (1969). The Amphibia of Trinidad. *Studies on the fauna of Curaçao and other Caribbean Islands* 29: 1-78.
- Müller, L. and W. Hellmich (1936). *Wissenschaftliche Ergebnisse der Deutschen Gran Chaco-Expedition. Amphibien und Reptilien. I. Amphibia, Chelonia, Loricata*. Strecker und Schröder, Stuttgart.
- Pérez, M. E. (1997). Una evaluación preliminar de los anfibios y reptiles de las Pampas del Heath (Provincia Inturralde, Departamento La Paz). *Ecología en Bolivia* 30: 43-54.
- Pough, F. H., R. M. Andrews, J. E. Cadle, M. L. Crump, A. H. Savitzky and K. D. Wells (1998). *Herpetology*. Prentice Hall, Upper Saddle River.
- Reichle, S. (1997). Frösche des Savannengebietes der Estación Biologica del Beni (EBB), Bolivien. I. *Herpetofauna* 19(106): 5-11.
- Vanzolini, P. E. (1986). Levantamento herpetológico da Area do estado de Rondônia sob a influência da rodovia BR 364. *Programa Polonoroeste, Subprograma Ecologia Animal. Relatório de Pesquisa* 1: 1-50.
- Zug, G. R. (1993). *Herpetology. An introductory biology of amphibians and reptiles*. Academic Press, San Diego.