

INVENTORY OF THE AMPHIBIANS AND REPTILES FROM A LOCALITY IN THE KAA-IYA OF THE GRAN CHACO NATIONAL PARK, BOLIVIA

INVENTARIO DE LOS ANFIBIOS Y REPTILES EN UNA LOCALIDAD DEL PARQUE NACIONAL KAA-IYA DEL GRAN CHACO, BOLIVIA

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The Gran Chaco is an immense biogeographical province distributed spanning nearly 1,000,000 km² across the countries of Argentina, Bolivia, Brazil, and Paraguay. In his study of the biogeography of the Chacoan herpetofauna, Gallardo (1979) reported 79 species of reptiles and amphibians occurring across the region. There have been multiple surveys of herpetofauna conducted across the Chaco within the countries of Argentina (Ceï, 1980; Cruz et al., 1992), Paraguay (Scott & Lovett, 1975), Bolivia (Gonzales, 1998; Gonzales et al., 2006), and Brazil (Souza et al., 2010). Within Bolivia, the Chaco ecoregion distributed across the departments of Santa Cruz, Tarija, and Chuquisaca (Gonzales, 1998). Gonzales (1998) reported 21 species of frogs and 50 species of reptiles across five sites and five habitat types in the Izozog. In their survey of El Corbalán Reserve, Gonzales et al. (2006) found 20 species of frogs and 17 species of reptiles. Soria & Noss (2000) surveyed Cerro Cortado, a site on the limit of the Kaa-Iya del Gran Chaco National Park reporting 36 species of reptiles and 15 species of anurans.

While Gonzales et al. (2006) have reported a list of the species found within Kaa-Iya Park, details on the localities surveyed are lacking. Kaa-Iya of the Gran Chaco National Park is one of the largest protected areas in South America, encompassing over 3.4 million hectares of lowland tropical dry forest in southeastern Bolivia and protects nearly 22% of the total land area of the Bolivian Gran Chaco (Taber et al., 1997). Four macro-vegetational types are contained within the park's boundaries: 1) Chaco alluvial plain forest, 2) Chaco riverine forest, 3) Chaco transitional forest, and 4) Chiquitano transitional forest (Navarro & Fuentes, 1999). These vegetation types vary in their abiotic factors (e.g. precipitation; Navarro & Fuentes, 1999; Navarro & Maldonado, 2002), which is strongly correlated with the distribution of reptiles and amphibians (Vitt & Caldwell, 2009). A heterogeneous distribution of Chacoan reptiles and amphibians has been observed within the Izozog (Gonzales, 1998), thus, a similar pattern would be expected for the larger region. In an attempt to elucidate the distribution of the herpetofauna across the Kaa-Iya Park, we present the results from a 50 day survey conducted at a park guard

camp (Yande Yari) in the Kaa-Iya of the Gran Chaco National Park, Cordillera Province, Santa Cruz Department, Bolivia (S18° 41' 30.516", W62° 18' 6.9474"; Figure 1).

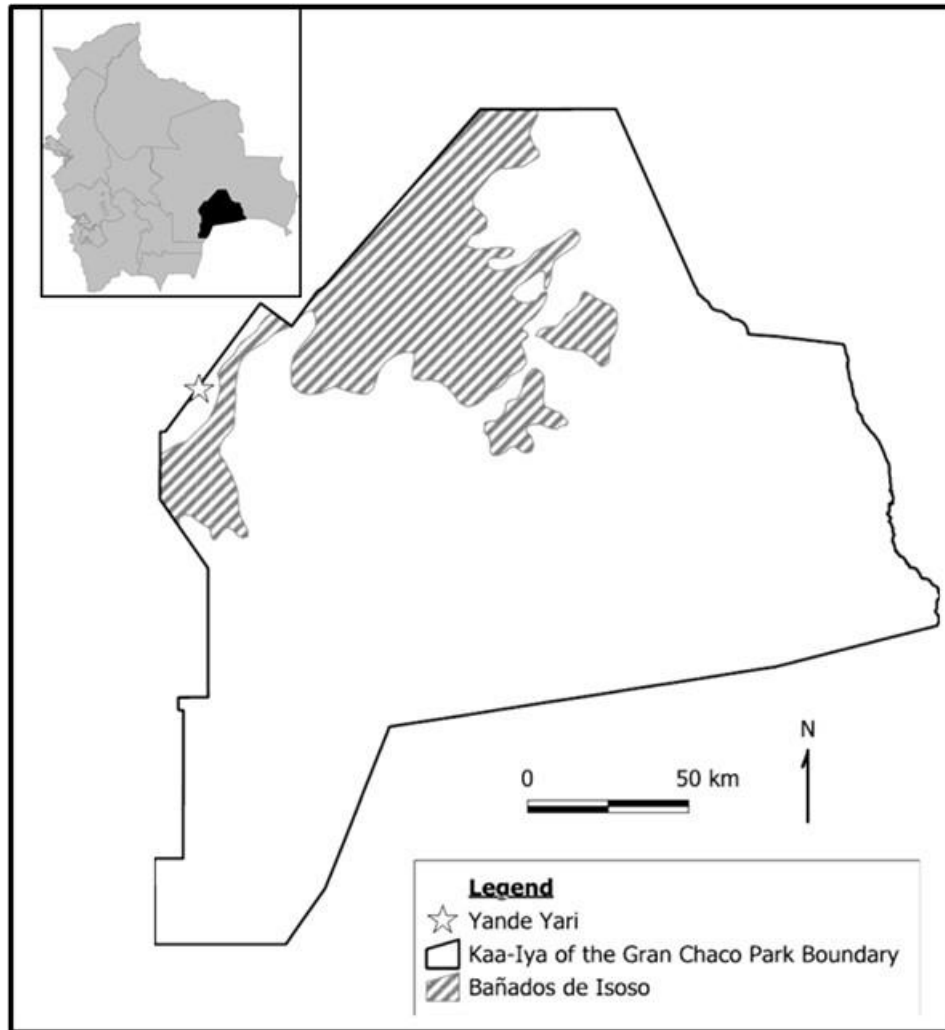


Figure 1. Map of study area: Reptiles and amphibians were surveyed within the vicinity of the Yande Yari guard camp, Kaa-Iya del Gran Chaco National Park, Cordillera Province, Department of Santa Cruz, Bolivia.

Figura 1. Mapa del área de estudio: Reptiles y anfibios se registraron en la vecindad del campamento de guarda parques Yande Yari, Parque Nacional Kaa-Iya del Gran Chaco, Provincia Cordillera, Departamento Santa Cruz, Bolivia.

STUDY AREA

The region's climate is seasonal, having a wet, hot summer (November – March), and a dry, cool winter (April – October). This survey occurred in one of the most arid regions of the Chaco (average rainfall and temperature are 513 mm and 24.6°C, respectively; Navarro and Maldonado, 2002) across two habitat types, Chaco alluvial plain forest and Chaco riverine forest. Xerophytic thorn forest trees such as *Schinopsis lorentzii* and *Aspidosperma quebracho-blanco* characterize these habitats. Shrubs (e.g. *Capparis* sp. and *Acacia* sp.) as well as bromeliads and cacti, (e.g. *Opuntia* sp., *Cleistocactus baumannii* and *Eriocereus guelichii*)

constitute the dense understory of the forest (Navarro and Maldonado, 2002). Yande Yari is located approximately seven kilometers from the Bañados of Isoso, and contains both Chaco alluvial plain forest and Chaco riverine forest, as designated by Navarro & Fuentes (1999).

We sampled both habitats (Chaco alluvial plain forest = 46 days; Chaco riverine forest = 4 days) within the vicinity of the Yande Yari camp of the Kaa-Iya of the Gran Chaco National Park for 50 consecutive days from 9 February 2012 to 29 March 2012. During the study period, we used pitfall traps, dipnet surveys, time-constrained visual surveys, and opportunistic encounters to survey the site. Four pitfall traps were deployed in a single Y-design array in the Chaco alluvial plain forest. The array contained three arms that extended six meters with an 18 L bucket at each end and a 25 L bucket in the center. The pitfall array was checked daily between 10 February 2012 and 26 March 2012. Dipnet dimensions used in the pond surveys measured 32 cm x 32 cm with a 0.1 cm mesh size. We conducted nightly time-constrained visual encounter surveys between 20:30 h – 01:00 h. Night survey effort was either 2 people (N = 46 nights) or 4 people (N = 3 nights). When an individual was encountered, attempts were made to capture it and take a photo voucher. When encountered, deceased individuals were salvaged and made into voucher specimens by fixing them in 10% formalin and transferred to 70% ethanol. Specimens were deposited in the Herpetology Collection at the Museo de Historia Natural Noel Kempff Mercado of the Universidad Autónoma Gabriel Rene Moreno in Santa Cruz de la Sierra, Bolivia (Appendix 1).

AMPHIBIANS AND REPTILES

We found 35 species during the survey period (Table 1; Figure 2). Seventeen species were anurans belonging to five families (Table 1). The remaining 18 species were reptiles from four orders, and included four families of snakes with ten species, three families of lizards with five species, two families of turtles with three species, and one family of crocodile with one species (Table 1). There were no new park, provincial, or departmental locality records documented from this survey when compared to Gonzales et al. (2006). The pitfall array captured four individuals belonging to three species; two *L. bufonius*, one *D. muelleri*, and a juvenile *A. ameiva*. Species caught in the dipnet surveys included *Kinosternon scorpioides*, *Lepidobatrachus laevis*, and tadpoles of *Phyllomedusa sauvagii*, *Scinax nasicus*, *Physalaemus biligonigerus*, and *Rhinella major*. All of the species of frogs were encountered during the nightly visual encounter surveys. The reptiles encountered during the nightly encounter surveys were *Caiman yacare*, *Kinosternon scorpioides*, *Erythrolamprus poecilogyrus*, *Oxyrhopus rhombifer*, *Phimophis vittatus*, *Xenodon pulcher*, and *Crotalus durissus*.

Of the five families of frogs, Leptodactylidae had the most species (n = 7), followed by Hylidae (n = 4), while Bufonidae, Ceratophryidae, and Microhylidae each had two species (Table 1). Eleven of the 17 species of anurans were heard calling during the survey period: *Leptodactylus bufonius*, *L. diptyx*, *L. elenae*, *L. fuscus*, *L. leptodactyloides*, *Physalaemus biligonigerus*, *Rhinella major*, *Scinax nasicus*, *Phyllomedusa sauvagii*, *Dermatonotus muelleri*, and *Elachistocleis ovalis*. However, we observed nests, egg masses, and/or tadpoles for only five of the eleven species: *L. bufonius*, *P. biligonigerus*, *R. major*, *S. nasicus*, and *P. sauvagii*. Dipsadidae was the most species-rich family of snakes (n = 7), followed by Boidae, Colubridae, and Viperidae (n = 1 species each). The only family of lizards with more than one species was Teiidae (two species), while the remaining three families (Gekkonidae, Scincidae, and

Tropiduridae) each had one species. Two of the three species of turtles were from the family Testudinidae, while the third belonged to Kinosternidae.



Figure 2. Typical amphibian and reptile species encountered during the study: a) *Lepidobatrachus laevis*, b) *Dermatonotus muelleri*, c) *Chelonoidis carbonaria*, d) *Crotalus durissus* (Photos: C.M. Schalk [a & b] and M. Senzano [c & d]).

Figura 2. Típicas especies de anfibios y reptiles encontradas en el estudio: a) *Lepidobatrachus laevis*, b) *Dermatonotus muelleri*, c) *Chelonoidis carbonaria*, d) *Crotalus durissus* (Fotos: C.M. Schalk [a & b] and M. Senzano [c & d]).

The majority of species were encountered in the Chaco alluvial plain forest habitat (Table 1). This is probably the result of concentrated search and trapping efforts in this habitat type, thus we cannot exclude the possibility of these species also occurring within the Chaco riverine forest habitat. Three species of anurans, *L. diptyx*, *L. leptodactyloides*, and *R. schneideri*, and one reptile, *C. yacare*, occurred exclusively within the Chaco riverine forest habitat (Table 1). The lack of occurrence of these species within the Chaco alluvial plain forest suggests these species are restricted to riverine forest. Gonzales (1998) observed a similar pattern of distribution for the two *Leptodactylus* species and *C. yacare*, but *R. schneideri* occurred across multiple habitat types in the survey. Why *R. schneideri* only occurred within the riverine forest habitat is puzzling, as this species can occur across a broad range of habitats (Ceï, 1980; Gonzales, 1998; Schalk and Ticona, 2013).

The results from our survey had lower total species richness as compared to other surveys in the region (Gonzales, 1998; Gonzales et al., 2006; Soria & Noss, 2000). However, it is important to note our survey was conducted over a much smaller area with fewer habitat types as compared to Gonzales (1998), and it is well documented that species richness is positively correlated with area and habitat heterogeneity (MacArthur & Wilson, 1967). While Soria and Noss (2000) surveyed a single habitat of similar area as this study, they documented double the number of species of reptiles ($n = 36$), but only found fifteen species of anurans. However, their results were part of a three year survey of the area. Our results for total species richness are comparable with the results documented by Gonzales et al. (2006) as they surveyed one habitat type of the Chaco across a similar timeframe.

The results from this survey provide important baseline data on the occurrence of amphibians and reptiles within the vicinity of the Yande Yari guard camp in the Kaa-Iya Park. The natural history and ecology of the herpetofauna in the Bolivian Gran Chaco is lacking. New observations on the natural history and ecology of the herpetofauna in the Bolivian Gran Chaco are continually being documented (Schalk, 2010 a,b,c,d; Schalk, 2012; Schalk & Montaña, 2011; Schalk & Montaña, 2012, Schalk & Morales, 2012; Sezano & Schalk, 2013; Schalk & Sezano, *in press*; Schalk et al., *in press*). These data combined together with other survey data from across the Kaa-Iya Park and Gran Chaco ecoregion contribute to our knowledge on the ecology of these species and our understanding of how these communities are organized.

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Table 1. List of the amphibian and reptiles species from Camp Yande Yari, Kaa-Iya National Park, Province Cordillera, Department Santa Cruz, Bolivia. Habitat is designates whether species were collected in Chaco Alluvial Plain Forest (CAPF) or Chaco Riverine Forest (CRF). Species names follow Frost (2013) and Uetz (2013).

Tabla 1. Lista de los anfibios y reptiles del Campamento Yande Yari, Parque Nacional Kaa-Iya, Provincia Cordillera, Departamento de Santa Cruz, Bolivia. Se indica el hábitat donde las especies fueron recolectadas, Bosque chaqueño de llanura aluvial (CAPF) o Bosque Chaqueño ribereño (CRF). Los nombres de las especies siguen Frost (2013) y Uetz (2013)

ANURA		HABITAT
Bufonidae	<i>Rhinella major</i>	CAPF
	<i>Rhinella schneideri</i>	CRF
Ceratophryidae	<i>Chacophrys pierottii</i>	CAPF
	<i>Lepidobatrachus laevis</i>	CAPF
Hylidae	<i>Phyllomedusa sauvagii</i>	CAPF
	<i>Scinax fuscovarius</i>	CAPF
	<i>Scinax nasicus</i>	CAPF
Leptodactylidae	<i>Trachycephalus typhonius</i>	CAPF
	<i>Leptodactylus bufonius</i>	CAPF
	<i>Leptodactylus chaqueensis</i>	CAPF
	<i>Leptodactylus diptyx</i>	CRF
	<i>Leptodactylus elenae</i>	CAPF, CRF
	<i>Leptodactylus fuscus</i>	CAPF, CRF
	<i>Leptodactylus leptodactyloides</i>	CRF
Microhylidae	<i>Physalaemus biligonigerus</i>	CAPF, CRF
	<i>Dermatonotus muelleri</i>	CAPF
	<i>Elachistocleis ovalis</i>	CAPF
SQUAMATA – SERPENTES		
Boidae	<i>Epicrates cenchria</i>	CAPF
Colubridae	<i>Leptophis ahaetulla</i>	CAPF
Dipsadidae	<i>Clelia</i> sp.	CAPF
	<i>Erythrolamprus poecilogyrus</i>	CAPF
	<i>Oxyrhopus rhombifer</i>	CAPF
	<i>Philodryas psammophidea</i>	CAPF
	<i>Phimophis vittatus</i>	CAPF
	<i>Xenodon merremi</i>	CAPF
	<i>Xenodon pulcher</i>	CAPF
Viperidae	<i>Crotalus durissus</i>	CAPF
SQUAMATA – SAURIA		
Gekkonidae	<i>Hemidactylus mabouia</i>	CAPF
Scincidae	<i>Notomabuya frenata</i>	CAPF
Teiidae	<i>Ameiva ameiva</i>	CAPF
	<i>Salvator rufescens</i>	CAPF
Tropiduridae	<i>Tropidurus spinulosus</i>	CAPF
TESTUDINES		
Kinosternidae	<i>Kinosternon scorpioides</i>	CAPF
Testudinidae	<i>Chelonoidis carbonaria</i>	CAPF
	<i>Chelonoidis chilensis</i>	CAPF
CROCODYLIA		
Alligatoridae	<i>Caiman yacare</i>	CRF

Appendix 1. Specimens collected from the Yande Yari camp, Kaa-Iya Park of the Gran Chaco National Park deposited in the Noel Kempff Mercado Museum of Natural History herpetology collection in Santa Cruz, Bolivia.

Apéndice 1. Especímenes coleccionados en el campamento Yande Yari, Parque Nacional Kaa-Iya del Gran Chaco y depositados en el Museo de Historia Natural Noel Kempff Mercado, colección de herpetología, Santa Cruz de la Sierra, Bolivia.

Dermatonotus muelleri: MNKA 10934, 10941; *Elachistocleis ovalis*: MNKA 10945; *Kinosternon scorpioides*: MNKR 5170; *Lepidobatrachus laevis*: MNKA 10940; *Leptodactylus bufonius*: MNKA 10939, 10942, 10944; *Leptodactylus elenae*: MNKA 10931; *Leptodactylus leptodactyloides*: MNKA 10932, 10933; *Phimophis vittatus*: MNKR 5171; *Physalaemus biligonigerus*: MNKA 10936, 10937, 10943; *Rhinella major*: 10935, 10938.