

## RESERVA NATURAL LAGUNA BLANCA, DEPARTAMENTO SAN PEDRO: PARAGUAY'S FIRST IMPORTANT AREA FOR THE CONSERVATION OF AMPHIBIANS AND REPTILES?

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Geographical sampling bias and restricted search methodologies have resulted in the distribution of Paraguayan reptiles and amphibians being patchily known. Available data is almost entirely based on brief collecting trips and rapid ecological inventories, often several decades apart, which inevitably struggle to detect more inconspicuous species and patterns of abundance. This has led to a deficit in our knowledge of the true distribution and abundance of Paraguayan reptiles and amphibians. The establishment of the NGO Para La Tierra at Reserva Natural Laguna Blanca (RNLB), Depto. San Pedro, Paraguay allowed the first modern sustained, multi-method inventory of Paraguayan reptiles and amphibians to be performed at a single site. Despite the small size of the reserve (804 ha), a total of 57 reptiles (12 of national conservation concern) and 32 amphibians (one of national conservation concern) were collected during five years of random sampling, qualifying RNLB as the most biodiverse reserve for reptiles and amphibians in the country. Six species occurring at RNLB have been found at no other Paraguayan locality. Legal protection for this private reserve expired in January 2015 and the conservation implications of the inventory results are discussed. It is proposed that the long term legal protection of the reserve be considered a national conservation priority and that the diversity of the herpetofauna be recognized with the designation of RNLB as Paraguay's first Important Area for the Conservation of Amphibians and Reptiles.

**Keywords:** amphibians; inventory; Neotropics; Para La Tierra; reptiles

### INTRODUCTION

Despite a long history of biological study dating back to the times of José Sánchez Labrador (1717 – 1798) and Félix de Azara (1746 – 1821), the herpetofauna of Paraguay remains poorly documented (Cacciali, 2011; Smith et al., 2012). A scarcity of financial and institutional support for field biologists mean that by necessity most biological inventories performed in Paraguay have taken the form of rapid ecological inventories supplemented by second hand reports, non-specimen based literature citations and irregular and uncoordinated collecting trips. Furthermore the results of these inventories have rarely found their way into the formal scientific literature, resulting in considerable confusion regarding the distribution of many species (Motte et al., 2009; Smith et al., 2012; Cacciali et al., in press). Such an approach has led

to a non-uniform documentation of the national fauna, with certain accessible areas being continually sampled whilst other, often more remote areas have been almost completely overlooked or lack proper documentation of records (Smith et al., 2012). The result of this unsystematic approach means that the national herpetofauna is generally poorly understood, and new species continue to be added to the country list with regularity (Cacciali and Scott, 2004; Brusquetti et al., 2007; Cacialli et al., 2007a-c; Céspedes and Motte, 2007; Brusquetti and Lavilla, 2008; Airaldi et al., 2009; Brusquetti et al., 2009; Cacciali et al., 2011; Cabral and Caballero, 2013; Cacciali et al., 2013; Smith et al., 2013a, 2013b; Caballero Gini et al., 2014; Smith et al., 2014). To date 85 species of amphibians (Lavilla and Brusquetti, 2010; Brouard et al., 2015) and 179 species of reptile have been documented as occurring in Paraguay (Cabral and Caballero, 2013; Cacciali et al., in press).

The location of Departamento San Pedro at the interface of the Cerrado and Atlantic Forest eco-regions, two of the most threatened and biologically diverse in the world, suggest that the area ought to be of national im-

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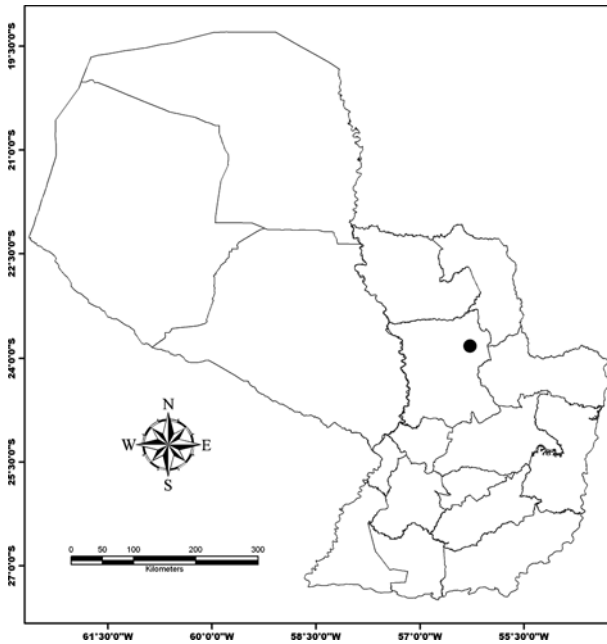


Fig. 1. Map showing the location of Reserva Natural Laguna Blanca, Departamento San Pedro, Paraguay.

portance for biodiversity and hence a priority for sampling (Myers et al., 2000). Though a large collection of more than 350 reptiles and 908 amphibians was sent to the British Museum between 1956 and 1971, by Eric J. Phillips, a member of The Society of Brothers religious colony based at Primavera, (Cacciali et al., in press) Departamento San Pedro remains one of the least well-sampled Paraguayan departments. With loss of habitat in the Oriental region of Paraguay an ongoing and urgent conservation issue and amphibians particularly considered good biological indicator species (Heyer et al., 1994) the thorough documentation of the herpetofauna now takes on critical importance.

The establishment of the self-sustaining Para La Tierra Ecological Station at Reserva Natural de Laguna Blanca (RNLB), Departamento San Pedro thus provided a unique modern opportunity in Paraguay to demonstrate the benefits of a more thorough and varied approach to inventory work. A permanent scientific team based year-round at the reserve allows for sustained systematic collecting at this single locality. The results of the five year herpetofaunal inventory performed at RNLB, the first modern, sustained, year-round sampling of a single site in Paraguay, are thus presented here making it, along with the Primavera collection, one of the few near complete herpetological collections taken from a single Paraguayan locality. The implications of these results for the

conservation of amphibians and reptiles in Paraguay are discussed.

### Study Area

Reserva Natural de Laguna Blanca ( $23^{\circ}48' S$   $56^{\circ}17' W$ ) is located in the Cerrado zone of northeastern Paraguay (Fig. 1). It is an 804 ha private reserve consisting of over 400 ha of near pristine Cerrado, a patch of degraded Atlantic Forest and areas of transitional semi-deciduous, semi-humid gallery forest. The four main Cerrado ecotopes are present at RNLB and grow on a predominately sandy substrate (Eiten, 1972, 1978) based around an eponymously-named freshwater lake of 157 ha which, geologically-speaking, is possibly the only true lake in Paraguay (Guyra Paraguay, 2008). The lake is low-nutrient with a sandy bed, and bordered by tall, flooded grassy vegetation, sandy beaches and gallery forest. Temporary pools form in bushy depressions at the edge of the humid forest after periods of heavy rain.

### MATERIAL AND METHODS

Sampling was performed by PLT representatives in every month from April 2010 to November 2014. Collection methods were varied but not standardized, including active searching by day and night, pitfall trap-lines with drift fences, provision of refuges, salvage of specimens found dead and oral and visual detection techniques. Sampling effort in terms of specimen collection and annual species accumulation is shown in Tables 1 and 2 along with national conservation status. Live specimens were humanely dispatched and preserved following Simmons (2002) and deposited in the herpetological section of the Colección Zoológica de Para La Tierra (CZPLT-H) located at RNLB, or in the principal national collection, the Museo Nacional de Historia Natural del Paraguay (MNHNP). All specimens deposited at the MNHNP were also given a CZPLT field number for cross-reference, and this field number is utilized here (*Appendix*). Specimens were collected under a series of permits provided by the Secretaria del Ambiente (SEAM).

### RESULTS

A total of 653 specimens (330 reptiles, 323 amphibians) of 88 species were collected during the inventory, and one additional species, the critically endangered *Eunectes murinus*, was documented photographically only. A list of the specimens examined is included in *Appendix*. Images of the vast majority of the species

TABLE 1. Sampling Effort: Number of Specimens of Reptiles Collected per Year per Species

Family, species	2010	2011	2012	2013	2014	Total
<b>Dactyloidae</b>						
<i>Norops meridionalis</i> <sup>EN</sup>	0	2	0	2	2	6
<b>Polychrotidae</b>						
<i>Polychrus acutirostris</i>	3	2	1	1	1	8
<b>Tropiduridae</b>						
<i>Stenocercus caducus</i>	2	5	1	1	1	10
<i>Tropidurus cf. xanthochilus</i>	2	1	5	3	0	11
<b>Gekkonidae</b>						
<i>Hemidactylus mabouia</i>	0	1	3	1	0	5
<b>Mabuyidae</b>						
<i>Aspronema dorsivittatum</i>	0	0	0	0	1	1
<i>Manciola cf. guaporicola</i>	0	0	0	3	0	3
<i>Notomabuya frenata</i>	2	2	0	3	2	9
<b>Gymnophthalmidae</b>						
<i>Cercosaura ocellata</i> <sup>VU</sup>	1	0	0	6	0	7
<i>Cercosaura schreibersii</i>	2	8	1	5	1	17
<i>Colobosaura modesta</i> <sup>DD</sup>	0	5	1	8	4	18
<i>Micrablepharus maximiliani</i> <sup>DD</sup>	2	3	0	7	5	17
<i>Vanzosaura rubricauda</i> <sup>DD</sup>	3	3	2	5	1	14
<b>Teiidae</b>						
<i>Ameiva ameiva</i>	0	4	2	1	0	7
<i>Ameivula abalosi</i>	9	10	0	4	2	25
<i>Kentropyx viridistriga</i>	0	0	3	1	1	5
<i>Teius teyou</i>	1	3	0	4	1	9
<i>Salvator merianae</i>	0	1	0	0	1	2
<b>Anguinidae</b>						
<i>Ophiodes intermedius</i>	0	2	4	4	1	11
<b>Amphisbaenidae</b>						
<i>Amphisbaena alba</i>	0	0	0	0	1	1
<i>Amphisbaena camura</i>	0	0	3	0	0	3
<i>Amphisbaena mertensii</i>	0	1	2	2	0	5
<i>Amphisbaena roberti</i> <sup>DD</sup>	0	1	0	3	1	5
<b>Typhlopidae</b>						
<i>Amerotyphlops brongersmianus</i> <sup>DD</sup>	0	10	0	2	1	13
<b>Boidae</b>						
<i>Boa constrictor amarali</i> <sup>VU</sup>	0	1	0	0	0	1
<i>Epicrates crassus</i> <sup>VU</sup>	0	1	1	0	2	4
<i>Eunectes murinus</i> <sup>CR</sup>	0	0	Ph	Ph	Ph	NA
<b>Colubridae</b>						
<i>Chironius quadricarinatus</i>	0	1	3	1	0	5
<i>Drymoluber brazili</i> <sup>VU</sup>	0	0	1	1	0	2
<i>Leptophis ahaetulla</i>	0	1	1	2	0	4
<i>Mastigodryas bifossatus</i>	0	2	0	2	1	5
<i>Spilotes pullatus</i>	0	2	0	1	0	3
<b>Dipsadidae</b>						
<i>Apostolepis dimidiata</i> <sup>DD</sup>	0	0	1	0	0	1
<i>Apostolepis intermedia</i> <sup>CR</sup>	0	1	3	2	1	7
<i>Erythrolamprus aesculapii</i>	1	0	1	1	0	3
<i>Erythrolamprus frenatus</i> <sup>DD</sup>	0	1	2	0	1	4

TABLE 1 (continued)

Family, species	2010	2011	2012	2013	2014	Total
<i>Erythrolamprus poecilogyrus</i>	0	4	3	2	0	9
<i>Erythrolamprus reginae</i>	0	0	0	2	1	3
<i>Hydrodynastes gigas</i>	0	0	1	0	0	1
<i>Lygophis meridionalis</i>	0	0	0	0	1	1
<b><i>Lygophis paucidens</i><sup>CR</sup></b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>4</b>
<i>Oxyrhopus guibeii</i>	1	0	1	1	0	3
<b><i>Phalotris cf. lativittatus</i><sup>VU</sup></b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>1</b>
<b><i>Philodryas livida</i><sup>CR</sup></b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>2</b>
<i>Philodryas mattogrossensis</i>	2	0	0	0	0	2
<i>Philodryas nattereri</i> <sup>VU</sup>	1	2	0	0	1	4
<i>Philodryas olfersii</i>	1	0	1	1	1	4
<i>Philodryas patagoniensis</i>	0	3	3	2	0	8
<i>Pseudoboa nigra</i> <sup>DD</sup>	0	1	0	1	2	4
<i>Pseudoeryx plicatilis</i> <sup>DD</sup>	2	1	1	2	1	7
<i>Rhachidelus brazilii</i> <sup>CR</sup>	1	0	0	0	0	1
<i>Taeniophallus occipitalis</i>	0	1	1	2	1	5
<i>Xenodon merremi</i>	1	1	0	0	0	2
<b>Elapidae</b>						
<i>Micrurus frontalis</i>	0	1	1	1	0	3
<b>Viperidae</b>						
<i>Bothrops alternatus</i>	0	1	0	1	0	2
<i>Bothrops diporus</i>	2	1	1	1	1	6
<i>Crotalus durissus</i>	0	5	1	1	0	7
<b>Species accumulation by year</b>	19	26	6	2	4	57
<b>Total species collected by year</b>	19	39	31	42	31	
<b>Total specimens collected by year</b>	39	98	55	96	42	330

**Notes.** Conservation status follows Motte et al. (2009) and is Least Concern unless noted. <sup>DD</sup> Data deficient, <sup>VU</sup> vulnerable, <sup>EN</sup> endangered, <sup>CR</sup> critically endangered. Conservation status given in bold for species not covered by that publication.

TABLE 2. Sampling Effort: Number of Amphibian Specimens Collected per Year per Species

	2010	2011	2012	2013	2014	Total
<b>Siphonopidae</b>						
<i>Siphonops paulensis</i> <sup>DD</sup>	0	0	1	0	0	1
<b>Hylidae</b>						
<i>Dendropsophus jimi</i>	0	3	1	0	0	4
<i>Dendropsophus minutus</i>	1	6	0	1	2	10
<i>Dendropsophus nanus</i>	0	4	2	2	1	9
<i>Hypsiboas albopunctatus</i>	0	5	0	0	0	5
<i>Hypsiboas punctatus</i>	6	3	0	2	0	11
<i>Hypsiboas raniceps</i>	5	2	0	0	0	7
<i>Scinax fuscmarginatus</i>	8	4	0	1	4	17
<i>Scinax fuscovarius</i>	2	3	0	2	3	10
<i>Scinax nasicus</i>	0	4	2	2	1	9
<i>Scinax squalirostris</i>	0	0	0	0	1	1
<i>Trachycephalus typhonius</i>	2	4	0	0	0	6
<i>Phyllomedusa azurea</i>	0	11	1	1	2	15
<b>Leptodactylidae</b>						
<i>Adenomera diptyx</i>	2	8	0	5	5	20
<i>Leptodactylus chaquensis</i>	2	3	0	1	0	6
<i>Leptodactylus elenae</i>	0	2	0	3	0	5

TABLE 2 (continued)

	2010	2011	2012	2013	2014	Total
<i>Leptodactylus fuscus</i>	0	5	0	1	1	7
<i>Leptodactylus labyrinthicus</i>	0	0	0	0	1	1
<i>Leptodactylus latrans</i>	0	0	0	1	0	1
<i>Leptodactylus mystacinus*</i>	3	6	0	1	0	10
<i>Leptodactylus podicipinus</i>	4	11	0	3	0	18
<b>Cycloramphidae</b>						
<i>Odontophrynus cf. americanus</i>	3	1	2	7	8	21
<b>Leiuperidae</b>						
<i>Eupemphix nattereri</i>	3	5	1	6	4	19
<i>Physalaemus albonotatus</i>	0	1	1	3	4	9
<i>Physalaemus centralis</i> <sup>VU</sup>	6	12	0	3	2	23
<i>Physalaemus cuvieri</i>	1	6	3	2	5	17
<i>Physalaemus marmoratus</i>	5	2	0	1	0	8
<b>Bufonidae</b>						
<i>Rhinella schneideri</i>	0	1	0	0	1	2
<i>Rhinella scitula</i> <sup>DD</sup>	1	2	8	2	0	13
<b>Microhylidae</b>						
<i>Chiasmocleis albopunctata</i>	0	2	7	5	4	18
<i>Elachistocleis bicolor</i>	3	1	1	4	1	10
<i>Elachistocleis matogrosso</i> <sup>DD</sup>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9</b>	<b>1</b>	<b>10</b>
<b>Species accumulation by year</b>	17	10	1	2	2	32
<b>Total species collected by year</b>	17	27	12	24	19	NA
<b>Total specimens collected by year</b>	57	117	30	68	51	323

**Notes.** Conservation status follows Motte et al. (2009) and is Least Concern unless noted. <sup>DD</sup> Data deficient, <sup>VU</sup> vulnerable, <sup>EN</sup> endangered, <sup>CR</sup> critically endangered. Conservation status given in bold for species not covered by this publication.

taken at RNLB can be consulted in Para La Tierra (2014a, 2014b, 2014c). Two reptile species (*Aspronema dorsivittatum* and *Lygophis meridionalis*) and two amphibians (*Leptodactylus labyrinthicus* and *Scinax squallirostris*) were captured too late for inclusion in these plates.

## DISCUSSION

We document 57 species of reptiles as present in RNLB, 23 of which represent new records for Departamento San Pedro and five of which have been recorded at no other Paraguayan locality (Smith et al., 2011; Cacciali et al., 2012; Smith et al., 2013b; Smith et al., 2014). This represents 31.8% of the 179 species known to occur in Paraguay (Cacciali et al., in press). The elusiveness and rarity of many reptile species means that these are chronically under-recorded by the traditionally employed rapid assessment techniques, resulting in a persistent under-estimation of reptile diversity across Paraguay. This scarcity of specimen records led to over a quarter of the reptile taxa assessed (28.7%) being declared data deficient at the national level (Motte et al.,

2009). The sustained, long term and variable approach to sampling employed here however has resulted in a more complete and diverse list for RNLB, making it, one of the most well-documented single localities in the country in terms of its herpetofauna.

Three species of reptile could not be conclusively identified to species level. *Tropidurus cf. xanthochilus* is apparently an undescribed species that is widespread throughout the Cerrado of Paraguay, but the taxonomy of the genus is confused and a review is currently underway (Andre Carvalho, personal communication). *Manciola cf. guaporicola* and *Phalotris cf. lativittatus* conform at least superficially to descriptions and specimens of these species but show clear morphological differences that are perhaps of taxonomic significance. Taxonomic work on these specimens is ongoing in order to elucidate or confirm their identity.

Motte et al. (2009) considered nine of the reptile species recorded at RNLB to be data deficient, four vulnerable, one endangered and two critically endangered (Table 1). Furthermore five species recorded for the first time in Paraguay must also be considered to be of conservation concern pending further data on their distribution.

Smith et al. (2014) proposed that the globally vulnerable *Philodryas livida* be considered critically endangered B1a at the national level and a similar categorization is probably warranted for *Lygophis paucidens* and *Apostolepis intermedia*, all being species that are rare in collections, endemic to Cerrado habitats and known only from this single location in Paraguay. *Philodryas nattereri* is a more widespread species that is less dependent on Cerrado and appears to be frequent at RNLB. Though currently known only from this one site, it may be assumed to be more widely distributed in the country and so we tentatively propose that this species be considered vulnerable B2b(iii), but warranting downgrading should it eventually prove to be more wide-ranging. A similar designation is provisionally recommended for *Phalotris* cf. *lativittatus*, pending the result of taxonomic studies on these specimens. Consequently 12 species of reptile present at RNLB (21.1% of the total) may be considered threatened nationally.

Of the nine reptile species considered data deficient by Motte et al. (2009) five of these have proved to be common or abundant at the study site. However all of these are species that are frequently captured using techniques not commonly employed during rapid ecological evaluations (Smith et al., 2011) and we suspect that they will subsequently prove to be widespread and common throughout the Cerrado zone. We thus recommend downgrading to least concern for the following species: *Colobosaura modesta*, *Micrablepharus maximiliani*, *Vanzosaura rubricauda*, *Amerotyphlops brongersmianus*, and *Pseudoeryx plicatilis*.

Waller et al. (1995) noted the presence of a breeding population of the critically endangered *Eunectes murinus* at Laguna Blanca, and the finding and photographing of adults and juveniles of this species confirms that the species continues to breed here. Threats to this population include the increase in beach tourism and people pressure in the area around the reserve, as well as a negative local attitude towards snakes in general. PLT is currently developing education and outreach programs aimed at locals and visitors which are designed to create awareness of the importance of the reserve for this species. No population estimate is available for the species in the catchment area of the reserve, but initial public response has been positive and one specimen was relocated to RNLB from outside the reserve area after local people captured it and contacted PLT staff requesting its removal.

A total of 32 species of amphibians has been documented as occurring in the RNLB. Thirteen of these species represented new records for Departamento San Pedro (Smith et al., 2012) and a further species, *Elachistocleis matogrosso*, was reported for the first time in Paraguay (Brouard et al., 2015). The amphibian list for

RNLB represents 37.7% of the 85 species now known to occur in Paraguay. Although the visibility and audibility of most amphibians makes them comparatively easy to detect in well-planned rapid ecological inventories, the known distribution of most Paraguayan species is adversely affected by chronic geographical sampling bias (Smith et al., 2012).

One species of amphibian *Odontophrynus* cf. *americanus* was not identified to species level because of the existence of a hitherto unknown tetraploid karyotype within Paraguayan populations which is currently being described as a new species (Diego Baldo, personal communication). One specimen from Laguna Blanca was found to be of this tetraploid type, but we refrain from assigning all specimens to this undescribed form until further work can be carried out on the populations within the reserve.

Four amphibian species are of national conservation concern (Motte et al., 2009), three being data deficient and one vulnerable (Table 2). *Physalaemus centralis* was classed as vulnerable B2b(iii) by Motte et al. (2009), but the presumed Paraguayan range is poorly sampled, and the abundance of the species in the study area and in the rest of its global range suggest that it is probably liable for downgrading to least concern (Smith, 2014). The explosive breeding cycles of *Rhinella scitula* mean that it may be consistently overlooked by short term monitoring, giving an appearance of extreme rarity or abundance depending on the sampling time. Though temporarily common, we suggest that its close association with streams in semi-humid forest within the threatened Cerrado habitat warrants recognition in its conservation status and propose that it be upgraded to vulnerable B2b(iii). The collecting of a single specimen of *Siphonops paulensis* does not allow further conclusions to be drawn on the conservation status of the species.

In Paraguay *Elachistocleis matogrosso* is currently known only from RNLB where populations appear to be healthy (Brouard et al., 2015). Pending its discovery at other Paraguayan localities we propose that the species be considered data deficient at the national level, but liable for downgrading to least concern should it prove to be more widespread (IUCN, 2003).

The species lists for this comparatively small private reserve are considerably greater than those for other, briefer inventories performed in Paraguay to date, even when the sampled area is much greater (Scott and Lovett, 1975; McDiarmid and Foster, 1987; Motte and Núñez, 2002; Caballero Gini et al., 2011; Núñez, 2012). The advantages of sustained year-round inventories employing a variety of collection techniques are clearly illustrated by the fact that the reptile list for RNLB is more than twice that of the 27 species recorded in the regularly sam-



pled Área para Parque Nacional San Rafael (Motte and Núñez, 2002), considered the most biodiverse protected area in Paraguay, whilst the San Rafael amphibian list of 33 species is comparable to that of RNLB (32 species) despite the much larger area of the former (73,000 ha).

Though small, the extremely high levels of occurrence of threatened herpetofauna even when compared with other areas considered of national importance for conservation (Núñez, 2012) warrants RNLB's immediate recognition as an area of national and international importance for the conservation of reptiles and amphibians. RNLB has already been declared an Important Bird Area by Birdlife International (IBA PY021 — Guyra Paraguay, 2008) due to the similarly high number of globally (11) and nationally (47) threatened bird species occurring within the reserve. The results presented here support the claim that the reserve also deserves recognition as Paraguay's first Important Amphibian and Reptile Area.

Despite the unquestionable importance of RNLB to Paraguayan biodiversity, its long term conservation is far from assured. The reserve was declared a Reserva Natural on 3 February 2010 (Decreto 3893 under Artículo 26 of Protected Areas Law 352/94) for a period of five years (protection that has since expired), and the lake was declared a Monumento Natural on 12 November 2009 (Decreto 3998 under Protected Areas Law 352/94). Though both these categories theoretically provide legal protection, the former falls under the subsystem of private reserves, whilst the latter falls under that of public reserves.

Since the declaration of the reserve the catchment area has seen a dramatic increase in the local population and, with the lake establishing itself as one of the premier destinations for beach tourism in the country, a large influx of tourists particularly during the high season (December to February and Easter week). To cater for this lucrative demand the lake shore has seen a marked increase in development. Though the category of Monumento Natural is applicable to the lake only, the properties bordering the lake are regarded as the catchment area and thus under legal restrictions of usage. However no enforcement of these restrictions has been employed despite open violations, and the recreational use of the lake itself is the principal attraction for tourists, despite such usage being prohibited by this categorization.

RNLB is currently privately owned by the Duarte family and the economic burdens of maintenance and vigilance of the reserve are the sole responsibility of the owners (working in cooperation with the non-governmental organization Para La Tierra). PLT have implemented environmental education campaigns for tourists, and workshops with local communities and schools to highlight the importance of respecting the local environment, and these have had some positive impacts in re-

gards to public perceptions and local support for the reserve. However the ability to properly enforce environmental law when necessary is key to the success of these campaigns and to the maintenance of this unique ecosystem. Formal legal protection of RNLB expired in January 2015, consolidating the long term conservation of the reserve should now be considered a national priority.

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*tereri* Steindachner, 1870 in Paraguay,” *Herpetozoa*, **26**(1/2), 91 – 94.

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## APPENDIX

### AMPHIBIANS

#### Siphonopidae

*Siphonops paulensis* Boettger, 1892 CZPLT 378

#### Hylidae

*Dendropsophus jimi* (Napoli et Caramaschi, 2003) CZPLT 175, 187, 250, 326,

*Dendropsophus minutus* (Peters, 1892) CZPLT 071, 271, 273, 275, 276, 277, 281, 510, 601, 797

*Dendropsophus nanus* (Boulenger, 1889) CZPLT 255, 274, 279, 280, 383, 385, 414, 542, 765

*Hypsiboas albopunctatus* (Spix, 1824) CZPLT 143, 264, 296, 297, 298

*Hypsiboas punctatus* (Lutz, 1951) CZPLT 004, 005, 014, 064, 065, 066, 104, 260, 262, 424, 589

*Hypsiboas raniceps* Cope, 1862 CZPLT 031, 034, 039, 068, 100, 246, 247

*Scinax fuscocomarginatus* (Lutz, 1925) CZPLT 020, 023, 025, 026, 056, 057, 067, 072, 174, 249, 259, 261, 511, 609, 758, 759, 766

*Scinax fuscovarius* (Lutz, 1925) CZPLT 018, 019, 213, 226, 227, 449, 512, 604, 788, 801

*Scinax nasicus* (Cope, 1862) CZPLT 168, 169, 282, 284, 361, 362, 488, 549, 798

*Scinax squalirostris* (Lutz, 1925) CZPLT 731

*Trachycephalus typhonius* (Linnaeus, 1758) CZPLT 059, 084, 214, 224, 228, 263

*Phyllomedusa azurea* Cope, 1862 CZPLT 217, 218, 219, 220, 221, 231, 232, 233, 234, 235, 267, 365, 536, 789, 794

#### Leptodactylidae

*Adenomera diptyx* Boettger, 1885 CZPLT 007, 009, 156, 158, 159, 229, 236, 238, 242, 300, 418, 480, 516, 560, 564, 690, 704, 750, 753, 764

*Leptodactylus chaquensis* Cei, 1958 CZPLT 016, 035, 109, 111, 198, 509

*Leptodactylus elenae* Heyer, 1978 CZPLT 311, 316, 528, 529, 561

*Leptodactylus fuscus* (Schneider, 1799) CZPLT 222, 225, 241, 243, 283, 593, 805

*Leptodactylus labyrinthicus* (Spix, 1824) CZPLT 781

*Leptodactylus latrans* (Linnaeus, 1758) CZPLT 473

*Leptodactylus mystacinus* (Burmeister, 1861) CZPLT 032, 054, 103, 189, 197, 230, 285, 286, 287, 527

*Leptodactylus podicipinus* (Cope, 1862) CZPLT 037, 051, 052, 082, 108, 133, 134, 138, 139, 140, 141, 145, 239, 240, 265, 463, 520, 562

#### Cycloramphidae

*Odontophrynus cf. americanus* CZPLT 001, 002, 003, 178, 339, 399, 450, 462, 464, 465, 530, 539, 543, 602, 719, 722, 723, 755, 756, 757, 761

#### Leiuperidae

*Eupemphix nattereri* Steindachner, 1863 CZPLT 036, 053, 055, 237, 245, 268, 269, 270, 341, 438, 439, 508, 522, 586, 591, 598, 689, 762, 800

*Physalaemus albonotatus* (Steindachner, 1864) CZPLT 315, 386, 494, 519, 547, 599, 796, 802, 806

*Physalaemus centralis* Bokermann, 1962 CZPLT 038, 044, 047, 049, 050, 085, 177, 179, 183, 184, 186, 190, 192, 212, 251, 252, 266, 317, 425, 426, 514, 735, 803

*Physalaemus cuvieri* Fitzinger, 1826 CZPLT 010, 180, 196, 204, 244, 313, 314, 366, 387, 408, 423, 448, 732, 752, 754, 763, 807

*Physalaemus marmoratus* Reinhardt et Lütken, 1862 CZPLT 040, 043, 045, 046, 048, 185, 248, 523

#### Bufo

*Rhinella schneideri* (Werner, 1894) CZPLT 132, 751

*Rhinella scitula* (Caramaschi et Niemeyer, 2003) CZPLT 024, 253, 254, 322, 323, 328, 329, 330, 331, 334, 374, 479, 495

#### Microhylidae

*Chiasmocleis albopunctata* (Boettger, 1885) CZPLT 272, 299, 340, 353, 355, 356, 363, 367, 382, 468, 506, 507, 515, 582, 603, 607, 608, 727

*Elachistocleis bicolor* (Guérin-Melville, 1838) CZPLT 006, 012, 013, 312, 384, 487, 521, 584, 592, 600

*Elachistocleis matogrosso* Caramaschi, 2010 CZPLT 505, 517, 535, 548, 550, 551, 552, 563, 583, 606

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#### Dactyloidae

*Norops meridionalis* Boettger, 1885 CZPLT 181, 194, 537, 559, 706, 790

#### Polychrotidae

*Polychrus acutirostris* Spix, 1825 CZPLT 022, 089, 091, 176, 321, 344, 531, 711

#### Tropiduridae

*Stenocercus caducus* (Cope, 1862) CZPLT 073, 074, 110, 164, 199, 200, 209, 404, 573, 799

*Tropidurus cf. xanthochilus* CZPLT 028, 041, 157, 342, 402, 405, 406, 409, 444, 461, 471

#### Gekkonidae

*Hemidactylus mabouia* (Moreau de Jonnés, 1818) CZPLT 170, 332, 337, 368, 545

**Mabuyidae**

- Aspronema dorsivittatum* (Cope, 1862) CZPLT 692  
*Manciola* cf. *guaporicola* CZPLT 567, 568, 605  
*Notomabuya frenata* (Cope, 1862) CZPLT 042, 077, 166, 307, 460, 478, 526, 804, 809

**Gymnophthalmidae**

- Cercosaura ocellata* Wagler, 1830 CZPLT 008, 428, 481, 489, 524, 532, 574  
*Cercosaura schreibersii* (Wiegmann, 1834) CZPLT 030, 061, 136, 147, 148, 149, 162, 167, 171, 202, 358, 441, 442, 491, 533, 590, 747  
*Colobosaura modesta* (Reinhardt et Lütken, 1862) CZPLT 161, 163, 172, 191, 193, 327, 421, 422, 432, 434, 459, 490, 534, 558, 715, 749, 760, 783  
*Micrablepharus maximiliani* (Reinhardt et Lütken, 1862) CZPLT 011, 070, 152, 188, 302, 433, 435, 437, 452, 518, 541, 557, 705, 714, 716, 745, 746  
*Vanzosaura rubricauda* (Boulenger, 1902) CZPLT 015, 021, 029, 153, 154, 203, 376, 379, 443, 451, 453, 472, 493, 748

**Teiidae**

- Ameiva ameiva* (Linnaeus, 1758) CZPLT 173, 303, 304, 308, 389, 394, 470  
*Ameivula abalosi* (Cabrera, 2012) CZPLT 027, 033, 058, 062, 063, 075, 076, 087, 088, 120, 121, 123, 124, 151, 201, 290, 291, 292, 293, 431, 445, 457, 538, 791, 792  
*Kentropyx viridistriga* (Boulenger, 1894) CZPLT 352, 369, 377, 476, 596  
*Teius teyou* (Daudin, 1802) CZPLT 105, 288, 289, 319, 429, 436, 469, 477, 787  
*Salvator merianae* Duméril et Bibron, 1839 CZPLT 129, 808

**Anguinidae**

- Ophiodon intermedius* Boulenger, 1894 CZPLT 117, 155, 370, 373, 380, 391, 440, 576, 577, 588, 696

**Amphisbaenidae**

- Amphisbaena alba* Linnaeus, 1758 CZPLT 695  
*Amphisbaena camura* Cope, 1862 CZPLT 336, 345, 346  
*Amphisbaena mertensii* Strauch, 1881 CZPLT 206, 372, 398, 475, 525  
*Amphisbaena roberti* (Gans, 1964) CZPLT 095, 482, 540, 572, 713

**Typhlopidae**

- Amerotyphlops brongersmianus* (Vanzolini, 1972) CZPLT 118, 195, 205, 207, 208, 216, 278, 301, 305, 306, 430, 595, 810

**Boidae**

- Boa constrictor* Linnaeus 1758 CZPLT 115  
*Epicrates crassus* Cope, 1862 CZPLT 135, 333, 697, 700  
*Eunectes murinus* (Linnaeus, 1758) Photographic evidence

**Colubridae**

- Chironius quadricarinatus* (Boie, 1827) CZPLT 165, 349, 350, 354, 483

- Drymoluber brazili* (Gomes, 1918) CZPLT 347, 566  
*Leptophis ahaetulla* (Linnaeus, 1758) CZPLT 309, 410, 415, 420  
*Mastigodryas bifossatus* (Raddi, 1820) CZPLT 116, 142, 546, 565, 698  
*Spilotes pullatus* (Linnaeus, 1758) CZPLT 113, 127, 446

**Dipsadidae**

- Apostolepis dimidiata* (Jan, 1862) CZPLT 357  
*Apostolepis intermedia* Koslowsky, 1898 CZPLT 257, 388, 390, 395, 466, 467, 784  
*Erythrolamprus aesculapii* (Linnaeus, 1766) CZPLT 096, 393, 427  
*Erythrolamprus frenatus* (Werner, 1909) CZPLT 318, 325, 338, 694  
*Erythrolamprus poecilogyrus* (Wied, 1825) CZPLT 126, 160, 210, 256, 343, 401, 411, 569, 578  
*Erythrolamprus reginae* (Linnaeus, 1758) CZPLT 454, 571, 795  
*Hydrodynastes gigas* (Duméril, Bibron et Duméril, 1854) CZPLT 324  
*Lygophis meridionalis* (Schenkel, 1901) CZPLT 701  
*Lygophis paucidens* Hoge, 1953 CZPLT 122, 144, 474, 570  
*Oxyrhopus guibei* Hoge et Romano, 1977 CZPLT 106, 348, 581  
*Phalotris* cf. *lativittatus* CZPLT 594  
*Philodryas livida* (Amaral, 1923) CZPLT 131, 458  
*Philodryas mattogrossensis* Koslowsky, 1898 CZPLT 101, 102  
*Philodryas nattereri* Steindachner, 1870 CZPLT 017, 295, 310, 702  
*Philodryas olfersii* (Lichtenstein, 1823) CZPLT 060, 407, 579, 786  
*Philodryas patagoniensis* (Girard, 1858) CZPLT 119, 146, 258, 360, 375, 381, 416, 580  
*Pseudoboa nigra* (Duméril, Bibron et Duméril, 1854) CZPLT 215, 455, 703, 785  
*Pseudoeryx plicatilis* (Linnaeus, 1758) CZPLT 097, 107, 125, 364, 413, 484, 597  
*Rhachidelus brazili* Boulenger, 1908 CZPLT 069  
*Taeniophallus occipitalis* (Jan, 1863) CZPLT 182, 335, 456, 492, 693  
*Xenodon merremi* (Wagler, 1824) CZPLT 078, 294

**Elapidae**

- Micrurus frontalis* (Duméril, Bibron et Duméril, 1854) CZPLT 114, 359, 587

**Viperidae**

- Bothrops alternatus* Duméril, Bibron et Duméril, 1854 CZPLT 211, 485  
*Bothrops diporus* Cope, 1862 CZPLT 090, 092, 137, 396, 447, 793  
*Crotalus durissus* Linnaeus, 1758 CZPLT 112, 128, 130, 150, 223, 371, 417