

## A premontane hotspot for herpetological endemism on the windward side of Refugio de Vida Silvestre Texíguat, Honduras

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**Abstract.** Herpetofaunal inventory work totalling 2,320 person-hours of sampling on the windward side of Refugio de Vida Silvestre (RVS) Texíguat documented the presence of 47 herpetofaunal species, including 3 salamanders, 11 anurans, 12 lizards, and 21 snakes. Among these are 14 species endemic to Honduras, including three undescribed species (two bolitoglossine salamanders, one colubrid snake). Though herpetofaunal research and conservation assessment in this geographic area are ongoing, the windward slope of RVS Texíguat, along with two other areas in the Cordillera Nombre de Dios, the leeward slope of RVS Texíguat and Parque Nacional Pico Bonito, is among the most significant regions of herpetofaunal endemism in nuclear Central America. Thirty-three species found in at least one of these areas are endemic to Honduras, and these represent approximately one-third of the country's endemic herpetofauna. We recommend that local national management authorities make substantial protection of this region the centrepiece of Honduran biodiversity conservation efforts.

**Key words.** Cordillera Nombre de Dios, northern Honduras, Amphibia, Squamata, distribution, conservation, endemism, montane cloud forest.

**Resumen.** El trabajo de inventario de herpetofauna totaliza 2,320 personas-horas de muestreo en la vertiente Atlántica del Refugio de Vida Silvestre (RVS) Texíguat, documentando la presencia de 47 especies de reptiles y anfibios, incluyendo tres salamandras, 11 anuros, 12 lagartijas, y 21 serpientes. Dentro de esta lista se encuentran 14 especies endémicas de Honduras, incluyendo tres especies aún no descritas: dos salamandras del grupo bolitoglossine y una serpiente del grupo colúbridos. A pesar de que la investigación y la evaluación del estado de conservación de la herpetofauna en esta zona geográfica no ha finalizado, la porción de barlovento del RVS Texíguat, junto con otras dos áreas en la Cordillera Nombre de Dios, la vertiente de sotavento del RVS Texíguat y el Parque Nacional Pico Bonito, se encuentran entre las regiones de mayor importancia para el endemismo de la herpetofauna en Centro América Nuclear. Treinta y dos especies encontradas en por lo menos una de estas áreas, son endémicas para Honduras, y constituyen aproximadamente un tercio de la herpetofauna endémica del país. Recomendamos que las autoridades administrativas locales consideren la protección substancial de esta región como una pieza central en los esfuerzos de conservación de la biodiversidad de Honduras.

## Introduction

Honduras is home to a diverse amphibian and reptile fauna (McCRANIE & WILSON 2002, TOWNSEND & WILSON 2010), with the highest demonstrated rate of herpetofaunal endemism of any Central American country (WILSON & JOHNSON 2010). Most endemic diversity is geographically restricted to highland forests, which are increasingly under threat from unregulated logging and conversion to subsistence farming, largely driven by rural poverty and the failure of top-down development initiatives in the country (TOWNSEND & WILSON 2010). One of the most biologically diverse areas of highland forest in Honduras is the Cordillera Nombre de Dios, which tracks west-to-east across the north-central portion of the country (Fig. 1). The Cordillera Nombre de Dios contains two distinctive areas of herpetofaunal endemism: Parque Nacional Pico Bonito in the east-central portion of the mountain range, and Refugio de Vida Silvestre Texíguat at the western end of the range (Fig. 1; WILSON & McCRANIE 2004a, McCRANIE & CASTAÑEDA 2005).

The Refugio de Vida Silvestre (RVS) Texíguat was established in 1987 and consists of approximately 33,267 ha

of highland forest straddling the border of the Honduran departments of Atlántida and Yoro (CIPF 2009). RVS Texíguat is administered by the Instituto Nacional de Conservación y Desarrollo Forestal, Áreas Protegidas y Vida Silvestre (ICF) as part of the Sistema Nacional de Áreas Protegidas de Honduras (SINAPH), with the management of the reserve being directed by the non-governmental Fundación para la Protección de Lancetilla, Punta Sal y Texíguat (PROLANSATE). RVS Texíguat is already recognized as a regional hotspot for herpetofaunal endemism (McCRANIE & CASTAÑEDA 2007, TOWNSEND et al. 2010a); however, all herpetological sampling in RVS Texíguat since 1991 has been conducted on the leeward side of the park in Departamento de Yoro, at altitudes above 1,500 m in the vicinity of a coffee farm known locally as La Fortuna (HOLM & CRUZ 1994, McCRANIE et al. 1993a, b, McCRANIE & CASTAÑEDA 2004a, b, WILSON et al. 1994, 1998).

Since herpetofaunal research began in the 1990's, the leeward side of RVS Texíguat (herein referred to as Yoro Texíguat) has seen persistent illegal logging and forest clearing for subsistence agriculture (WILSON et al. 1998) that continues to the present day (TOWNSEND et al. 2010a). Despite the rapid advancement of deforestation in Yoro, little ex-

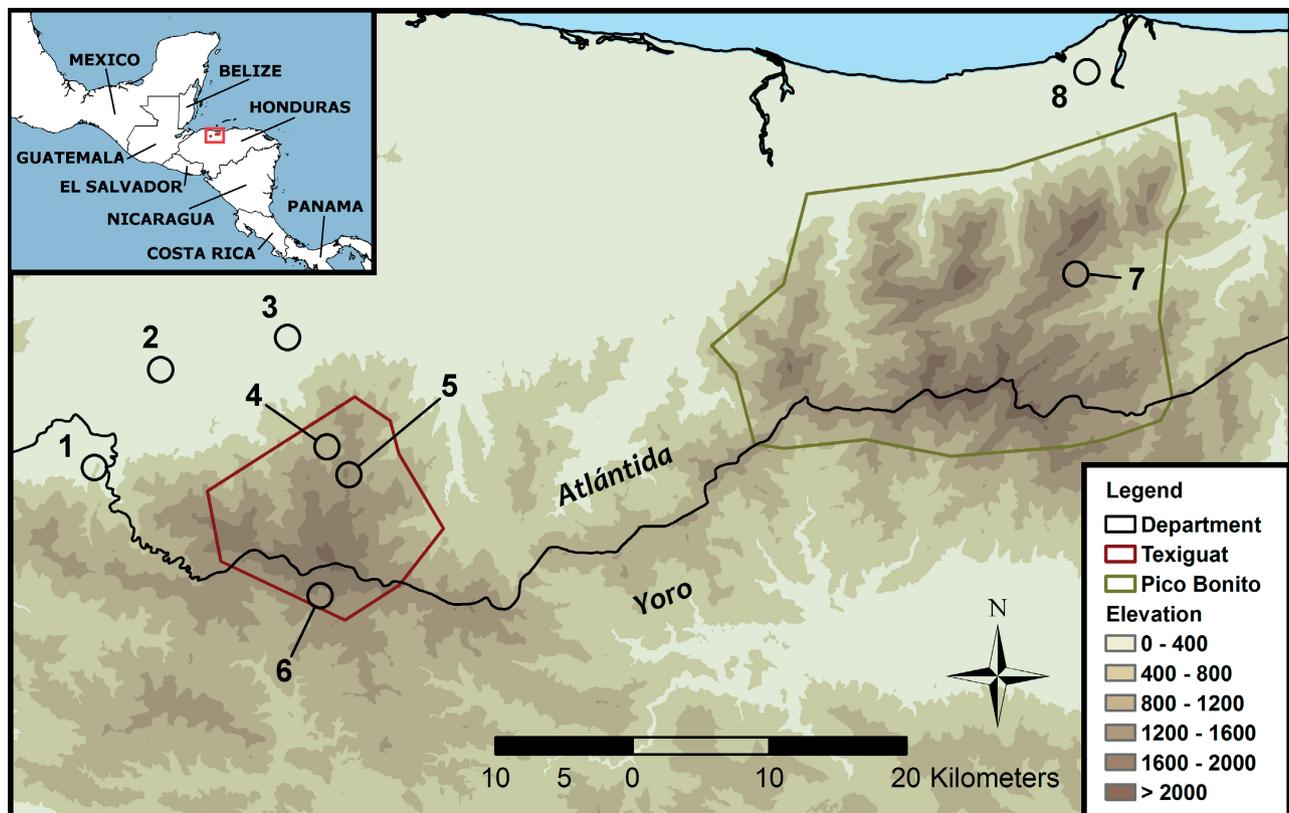


Figure 1. Topographical map showing the relative locations of the Refugio de Vida Silvestre Texíguat and Parque Nacional Pico Bonito in the Cordillera Nombre de Dios, northern Honduras; localities referenced in the text include: 1 = San Jose de Texíguat; 2 = Mezapita; 3 = Jilamito Nuevo; 4 = La Liberación (Atlántida Texíguat); 5 = Cerro El Chino (Atlántida Texíguat); 6 = La Fortuna (Yoro Texíguat); 7 = Quebrada de Oro; 8 = La Ceiba.

ploration of the virtually unknown Atlántida side of the refuge has been conducted to date. We herein present new information on herpetofaunal composition, distribution, endemism, and conservation status based on a rapid herpetofaunal inventory on the windward side of RVS Texíguat (Atlántida Texíguat). Using these data and published records, we perform a herpetofaunal community biogeographic resemblance analysis and use this biogeographic profile to suggest additional conservation priorities.

## Materials and methods

### Field-based sampling

Fieldwork was carried out by the authors: a team of North American and Honduran biologists, graduate and undergraduate students, and three local parataxonomists. We sampled the following locations: the vicinity of La Liberación (15.53° N, 87.29° W, camp established at 1,030 m above sea level) in the Refugio de Vida Silvestre (RVS) Texíguat during 10–21 June (1,320 person-hours; JHT [initials refer to authors], LDW, MMF, LAH, EAU, BKA, CAC, ACC, MMM, APA, and JOSÉ DUBÓN), 26 July–2 August 2010 (880 person hours; JHT, MMF, LAH, EAU, ACC, LNG, MMM, APA, ALS, PAUL HOUSE, CIRO NAVARRO-UMAÑA, HERMES VEGA-RODRÍGUEZ, and JOSÉ DUBÓN); the vicinity of San José de Texíguat (15.52° N, 87.45° W) during 10–12 November 2010 (120 person hours; JHT, MMF, LAH, EAU, and JDA). Specimens were opportunistically collected during the day and night, and fresh tissue samples were preserved in SED buffer (20% DMSO, 0.25 M EDTA, pH 7.5, NaCl saturated; SEUTIN et al. 1991, WILLIAMS 2007) and whole

specimens in 10% formalin, later transferred to 70% ethanol. Referred voucher specimens were deposited in the National Museum of Natural History, Smithsonian Institution (USNM); vouchers with JHT field numbers have not been deposited yet in a museum collection. Forest formation definitions follow the system of HOLDRIDGE (1967), as refined by McCRANIE & WILSON (2002) and SAVAGE (2002). Subgeneric classification for *Bolitoglossa* follows PARRA-OLEA et al. (2004), for *Oedipina* follows GARCÍA-PARÍS & WAKE (2000) and McCRANIE et al. (2008), and for Craugastoridae follows HEDGES et al. (2008); we follow MYERS (2011) in recognizing the species of the *Rhadinaea godmani* group as representing a separate genus, *Rhadinella*.

Access to the La Liberación area is gained by first utilizing a mule trail across the plain at the foot of the mountains to a point where the riding trail ends and a steep, trench-like footpath (Fig. 2A) continues upward for about 900 m to its vertex point at around 1,200 m a.s.l. Thereafter, the trail continues downward to La Liberación, which is comprised of a small house in the middle of a livestock pasture located at approximately 1,030 m a.s.l. This and a few other simple buildings lie on the lower edge of the valley of the Río Jilamito, which continues upward into the upper reaches of the Atlántida slope of RVS Texíguat (Fig. 2B). The river and a number of tributary streams are within easy walking distance from these buildings and there is a small pasture on the other side. The main pasture continues on above these buildings to about 1,200 m a.s.l. on the slope of Cerro El Chino, a ridge that peaks at 1,450 m a.s.l. Below the peak lies a small shallow pool at about 1,405 m a.s.l. The area around the pastures at La Liberación is covered by intact premontane rainforest (Premontane Wet Forest

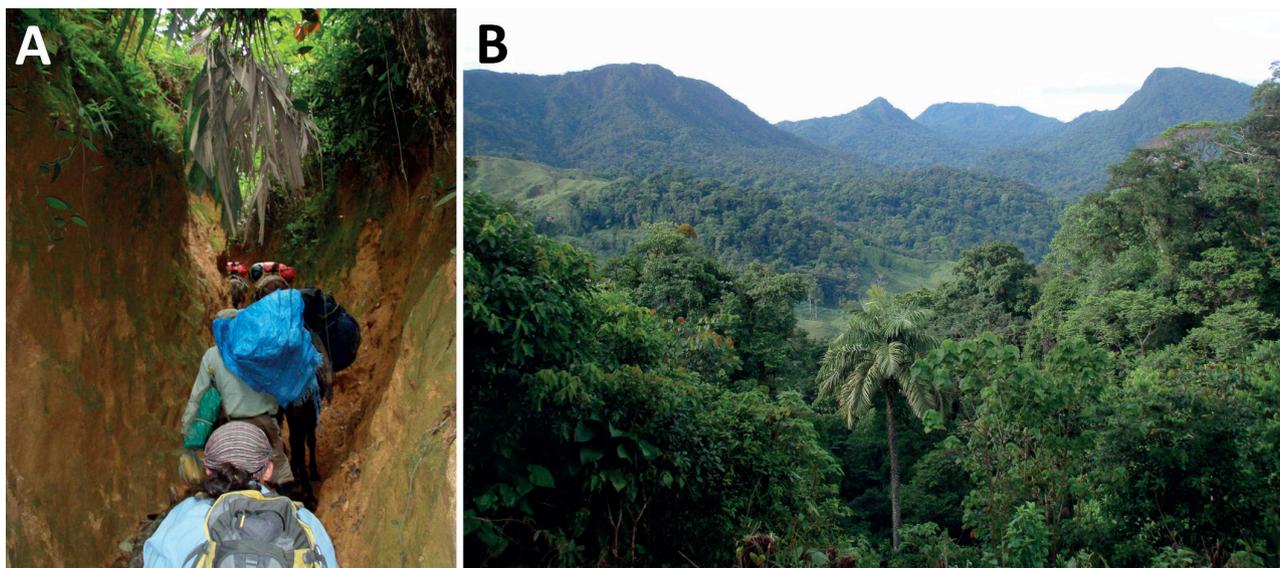


Figure 2. A) View of the deep trench-like cattle trail used to access La Liberación, at about 650 m a.s.l.; B) the Río Jilamito Valley seen from the north looking south from the highest point along the trail; La Liberación is the lowest clearing in the centre of the picture, at about 1,030 m a.s.l.

formation), which gives way to cloud forest (Lower Montane Wet Forest formation) at higher altitudes in the range.

Sampling around San José de Texíguat took place over the course of two nights in the protected ravine around a small spring-fed stream directly south of the community. The ravine was relatively narrow (4–8 m wide) and deep (4–12+ m), ascending from 105 m a.s.l., where it enters town, to around 310 m a.s.l., where the stream abruptly emerges from the base of a limestone wall. Most of the length of the ravine contains riparian rainforest vegetation, which is protected as part of the community's water source.

### Biogeographic analysis

In analysing herpetofaunal relationships among the three areas of the Cordillera Nombre de Dios, we employed DUELLMAN'S (1990) algorithm for the Coefficient of Biogeographic Resemblance ( $CBR = 2C/(N_1 + N_2)$ ), where  $C$  is the number of species common to both areas,  $N_1$  is the number of species in the first area, and  $N_2$  is the number of species in the second area. When the coefficient is 1, the herpetofauna under comparison are identical in the number of species and species composition (WILSON & JOHNSON 2010). Taxonomic diversity values for Yoro Texíguat are from TOWNSEND et al. (2010a) and for Parque Nacional Pico Bonito are from MCCRANIE & CASTAÑEDA (2005).

### Conservation status

We used three different measures to assess the conservation status of the herpetofauna: IUCN Red List categorization, Environmental Vulnerability Scores (WILSON & MCCRANIE 2003), and Conservation Status Scores (WILSON & TOWNSEND 2010). IUCN Red List categorizations were taken from one of two sources: the IUCN Red List of Threatened Species (v. 2011.1; [www.iucnredlist.org](http://www.iucnredlist.org)) for amphibians, marine turtles, crocodylians, and *Ctenosaura*, and TOWNSEND & WILSON (2010) for Honduran reptiles. Species not previously evaluated by the IUCN or other authors were assessed using the standard criteria of the IUCN (2001).

Environmental Vulnerability Scores (EVS) are the sum of three rankings: (1) the extent of total geographic range, (2a) the degree of specialization of reproductive mode for amphibians or (2b) the degree of persecution by humans for reptiles, and (3) the extent of ecological distribution in Honduras, with higher EVS values indicating relatively higher vulnerability to environmental degradation. The extent of total geographic range for species occurring in Honduras is determined on a scale of 1 to 5, with 1 being widespread in and outside of Honduras; and 5 being known only from the vicinity of the type locality in Honduras. The degree of specialisation of reproductive mode for amphibians is scored 1 through 5, with 1 having both eggs and tadpoles in large or small bodies of lentic or lo-

tic water, 2 having eggs in foam nests, tadpoles in small bodies of lentic or lotic water, 3 having tadpoles occur in small bodies of lentic or lotic water, eggs outside of water, 4 having eggs laid in moist situations on land or moist arboreal situations, direct development, and 5 having eggs and tadpoles in water-retaining arboreal bromeliads or water-filled tree cavities. The degree of persecution by humans for reptiles is scored 1 through 6, with: 1 being fossorial species that typically escape human notice; 2 being semi-fossorial, or nocturnal arboreal or aquatic, nonvenomous and usually non-mimicking species that sometimes escape human notice; 3 being terrestrial and/or arboreal or aquatic species that are generally ignored by humans; 4 being terrestrial and/or arboreal or aquatic species that are generally considered harmful (often mistakenly) and might be killed on sight; and 5 being venomous species or mimics thereof that are typically killed when encountered; and 6 being species that are exploited actively by humans for meat, eggs, or skin.

Conservation Status Scores (CSS) were developed by WILSON & TOWNSEND (2010) to provide a simple unit of measure for assessing the regional conservation status of amphibians and reptiles across Mesoamerica. The CSS represents a sum of individual scores for 1) numbers of countries, 2) physiographic regions, and 3) vegetation zones occupied by a given species of amphibian or reptile. The country score ranges from 1 to 8 (the number of countries of Central American plus México), the physiographic region score ranges from 1 to 21, and the vegetation zone score from 1 to 15 (WILSON & TOWNSEND 2010). Given this, the CSS can range from 3 (the most restricted endemic species, inhabiting a single vegetative zone in a single physiographic region in a single country) to the theoretical maximum of 44 (for a species found essentially everywhere in México and Central America).

## Results

We documented the presence of 47 herpetofaunal species in Atlántida Texíguat (Table 1), representing six families of amphibians and nine families of reptiles. The three salamander species represent two genera in one family (Plethodontidae). The 11 anuran species belong to five families: Bufonidae (1 genus, 2 species), Centrolenidae (2 genera, 2 species), Craugastoridae (1 genus, 2 species), Hylidae (4 genera, 4 species), and Leptodactylidae (1 genus, 1 species). Among reptiles, the 12 lizard species represent six families: Corytophanidae (2 genera, 2 species), Iguanidae (1 genus, 1 species), Phrynosomatidae (1 genus, 1 species), Polychrotidae (1 genus, 5 species), Scincidae (2 genera, 2 species), and Xantusiidae (1 genus, 1 species). Finally, 21 snake species are assigned to three families: Colubridae (14 genera, 16 species), Elapidae (1 genus, 1 species), and Viperidae (3 genera, 4 species). The following accounts are presented for each of the 47 species recorded during three visits to the Atlántida side of RVS Texíguat during 2010.

Table 1. Distribution of species documented from the Atlántida side of Reserva de Vida Silvestre Texíguat, and the distribution of those species in adjacent protected areas of the Cordillera Nombre de Dios. IUCN classifications follow IUCN (2011) and TOWNSEND & WILSON (2010) and are abbreviated: CR – Critically Endangered; CR\* – Recently described or undescribed species that qualify as Critically Endangered based on IUCN Red List criteria (IUCN, 2001); EN – Endangered; VU – Vulnerable; LC – Least Concern. Distributional categories are: (1) endemic to Texíguat; (2) endemic to Cordillera Nombre de Dios; (3) endemic to Honduras; (4) found both inside and outside Honduras.

TAXA	Recorded from YORO sector of RVS Texíguat	Recorded from Parque Nacional Pico Bonito	IUCN Red List Category	Distributional category
<b>AMPHIBIANS</b>				
Salamanders (3)				
<i>Bolitoglossa cf. porrasorum</i>	X		CR*	1
<i>Bolitoglossa cf. rufescens</i>		X	LC	4
<i>Nototriton</i> sp.	X		CR*	1
Anurans (11)				
<i>Craugastor aurilegulus</i>	X	X	EN	3
<i>Craugastor rostralis</i>			NT	4
<i>Duellmanohyla salvavida</i>	X	X	CR	2
<i>Hyalinobatrachium fleischmanni</i>		X	LC	4
<i>Incilius leucomyos</i>	X	X	EN	3
<i>Incilius valliceps</i>		X	LC	4
<i>Leptodactylus fragilis</i>			LC	4
<i>Plectrohyla chrysopleura</i>		X	CR	2
<i>Ptychohyla spinipollex</i>	X	X	CR	2
<i>Smilisca baudinii</i>		X	LC	4
<i>Teratohyla pulverata</i>			LC	4
<b>REPTILES</b>				
Lizards (12)				
<i>Anolis beckeri</i>			LC	4
<i>Anolis kreutzii</i>	X		CR	1
<i>Anolis loveridgei</i>		X	EN	2
<i>Anolis yoroensis</i>	X		EN	2
<i>Anolis zeus</i>		X	EN	2
<i>Corytophanes cristatus</i>		X	LC	4
<i>Iguana iguana</i>			LC	4
<i>Laemanctus longipes</i>			LC	4
<i>Lepidophyma flavimaculatum</i>		X	LC	4
<i>Plestiodon sumichrasti</i>		X	LC	4
<i>Sceloporus malachiticus</i>		X	LC	4
<i>Sphenomorphus cherriei</i>		X	LC	4
Snakes (21)				
<i>Adelphicos quadrivirgatum</i>		X	LC	4
<i>Atropoides mexicanus</i>			LC	4
<i>Bothriechis marchi</i>	X	X	EN	3
<i>Bothriechis schlegelii</i>		X	LC	4
<i>Bothrops asper</i>		X	LC	4
<i>Dendrophidion percarinatum</i>		X	LC	4
<i>Drymobius chloroticus</i>	X	X	VU	4
<i>Geophis damiani</i>	X		CR	1
<i>Hydromorphus concolor</i>		X	LC	4
<i>Imantodes cenchoa</i>		X	LC	4
<i>Leptodeira septentrionalis</i>		X	LC	4

Endemic herpetofauna of Texíguat, Honduras

TAXA	Recorded from YORO sector of RVS Texíguat	Recorded from Parque Nacional Pico Bonito	IUCN Red List Category	Distributional category
<i>Micrurus nigrocinctus</i>		X	LC	4
<i>Ninia pavimentata</i>	X		EN	4
<i>Ninia sebae</i>	X	X	LC	4
<i>Pliocercus elapoides</i>			LC	4
<i>Scaphiodontophis annulatus</i>			LC	4
<i>Sibon dimidiatus</i>			LC	4
<i>Sibon nebulatus</i>		X	LC	4
<i>Stenorrhina degenhardtii</i>			LC	4
<i>Tantilla</i> sp.			CR*	1
<i>Tropidodipsas sartorii</i>			LC	4
TOTALS (47)	13	28		

Amphibia  
Caudata

Plethodontidae

*Bolitoglossa* cf. *porrasorum* MCCRANIE & WILSON, 1995 (Fig. 3A–D)

Salamanders currently assigned to *B. porrasorum* (MCCRANIE & WILSON 1995, 2002) were abundant at night on Cerro El Chino (1,380–1,430 m a.s.l.), particularly on the hanging dead fronds of a large fan palm that was common along the ridge. Despite being confirmed as conspecific by data from two mitochondrial loci (TOWNSEND 2011), samples from the vicinity of La Liberación exhibit a remarkably high degree of variability in terms of coloration (Fig. 2A–D). Referred specimens: JHT 3104–06, 3143–53, 3171–72, 3229–31, 3250–57, 3264–66.

*Bolitoglossa* cf. *rufescens* (COPE, 1869) (Fig. 3E)

Two adult salamanders assignable to the *B. rufescens* complex (*sensu* MCCRANIE & WILSON 2002) were collected in San José de Texíguat at 180–200 m a.s.l. while active on vegetation at night in the bottom of a mesic ravine. Two individuals also assignable to *B. rufescens* were observed, but not collected, at night along a ridgeline trail descending from La Liberación on the western side of the Río Jilamito, at 795 m and 1,090 m a.s.l., respectively. As currently understood, this species is distributed on the Atlantic versant from San Luis Potosí, Mexico, to east-central Honduras, and the Pacific versant of Guatemala (MCCRANIE & CASTAÑEDA 2007). At least some samples from the Sierra de Omoa that were previously referred to as *B. rufescens* are shown to represent an undescribed cryptic species (TOWNSEND 2011), and some populations along the Honduras/Guatemala border can be referred to the recently described *B. nympha* (CAMPBELL et al. 2010). Referred specimens: JHT 3341–42.

*Nototriton* sp. (Fig. 3F)

A single specimen (USNM 578300) of *Nototriton* was collected on Cerro El Chino (1,420 m a.s.l.). It represents an

undescribed species endemic to RVS Texíguat (TOWNSEND et al. 2010a, 2011a). This adult male moss salamander was discovered as it crawled out of a bromeliad approximately 1.5 m above the ground on a rainy night.

Anura

Bufoidea

*Incilius leucomyos* (MCCRANIE & WILSON, 2000) (Fig. 4A)

This endemic toad was encountered at 300 m and at 600 m a.s.l. on the trail from Jilamito Nuevo to La Liberación, and a number of uncollected individuals were also seen along this trail up to around 800 m a.s.l. Referred specimens: USNM 578698, 578700.

*Incilius valliceps* (WIEGMANN, 1833)

One specimen (USNM 578699) of this widespread toad was found at 450 m a.s.l. on the trail from Jilamito Nuevo to La Liberación, and a number of uncollected individuals were encountered at lower altitudes along this trail.

Centrolenidae

*Hyalinobatrachium fleischmanni* (BOETTGER, 1893) (Fig. 4B)

This glassfrog was collected at around 200 m a.s.l. in a small forested ravine above San José de Texíguat, and specimens representing this species were also collected at Jilamito Nuevo and Mezapita. This species was not encountered at the premontane sites surveyed. Referred specimens: USNM 578701–02.

*Teratohyla pulverata* (PETERS, 1873) (Fig. 4C)

This glassfrog is otherwise known from Honduras from the northwestern portion of the department of Olancho through the Honduran Mosquitia in Colón and Gracias a Dios (WILSON et al. 2011). Two specimens we collected at 1,015 m a.s.l. represent a significant geographic range extension to the north and west, making it the most

northerly-occurring member of its family next to its relative *Hyalinobatrachium fleischmanni*, which occurs as far north as Veracruz and Guerrero, Mexico (McCRANIE & WILSON 2002). Several individuals of *T. pulverata* were heard calling from higher in the canopy alongside the Río Jilamito near where the referred specimens were collected (WILSON et al. 2011). Referred specimens: USNM 573991–92.

Craugastoridae  
*Craugastor aurilegulus* (SAVAGE, McCRANIE & WILSON, 1988) (Fig. 4D–E)

A juvenile of this streamside rainfrog was collected at the start of the footpath leading from the lowlands to La Liberación, at around 300 m a.s.l. This species was common in a small forested ravine above San José de Texíguat from



Figure 3. A) *Bolitoglossa* cf. *porrasorum* (JHT series), adult female; B) *B. cf. porrasorum* (JHT series), adult male in situ at night; C) *B. cf. porrasorum* (JHT series), adult male; D) *B. cf. porrasorum* (JHT series), subadult male; E) *B. cf. rufescens* (JHT 3341); F) *Nototriton* sp. (USNM 578300), adult male.

100–300 m a.s.l., but was absent from extensive, seemingly suitable habitat in the vicinity of La Liberación. Referred specimens: USNM 578594–603.

*Craugastor rostralis* (WERNER, 1896) (Fig. 4F)

This litter-dwelling rainfrog has a limited distribution on the Atlantic versant in extreme east-central Guatemala and

northwestern Honduras (MCCRANIE & CASTAÑEDA 2007). In the La Liberación area, we found it to be abundant on the forest floor from altitudes of around 1,000 to 1,430 m a.s.l.. Populations from the Cordillera Nombre de Dios likely represent one or more undescribed taxa (MCCRANIE & WILSON 2002: 435). Referred specimens: USNM 578628–42, 578619–24.

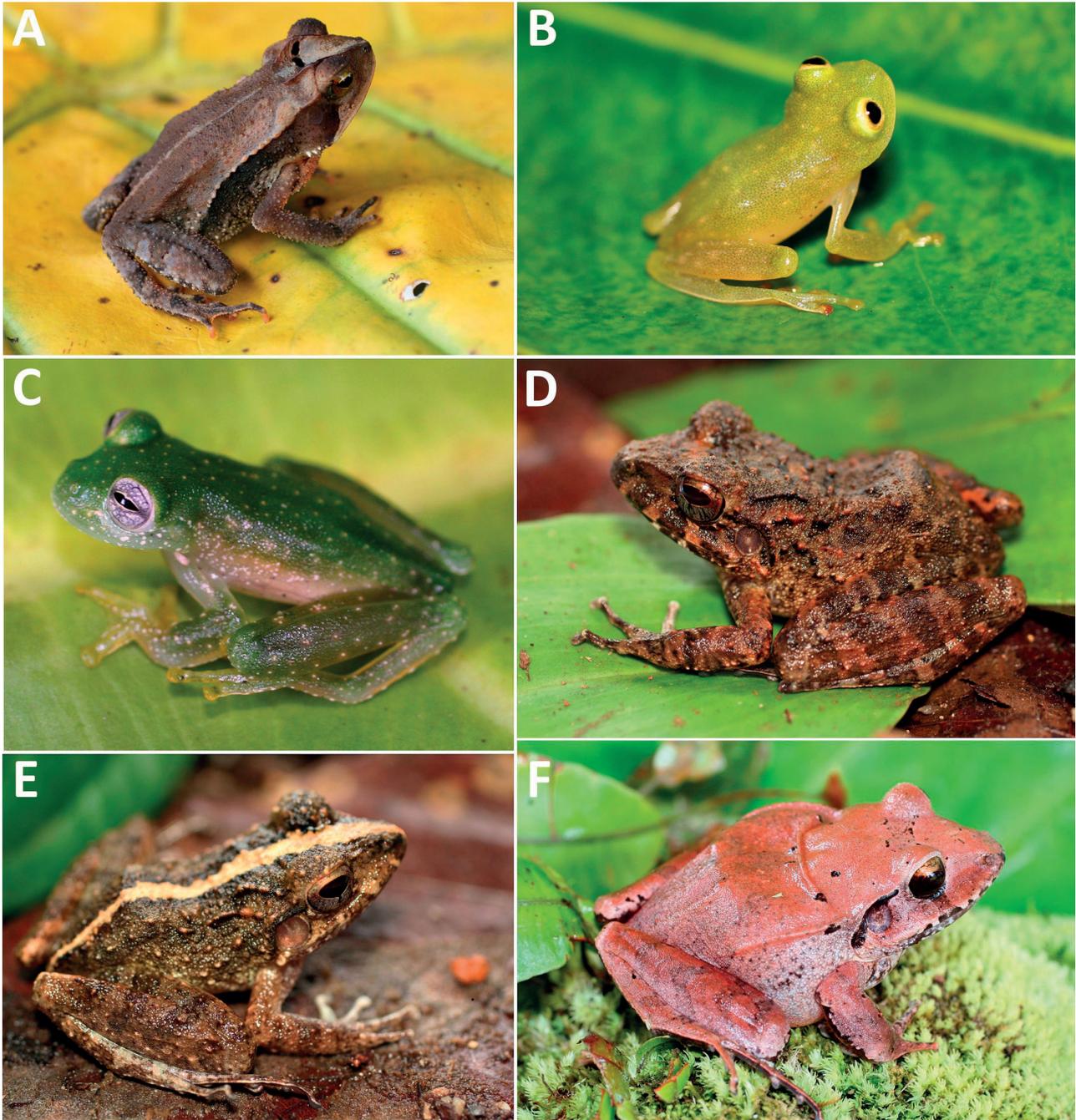


Figure 4. A) *Incilius leucomyos* (USNM 578698), subadult male; B) *Hyalinobatrachium fleischmanni* (USNM 578701), adult male; C) *Teratohyla pulverata* (USNM 573991), adult male; D) *Craugastor aurilegulus* (USNM series), adult female; E) *C. aurilegulus* (USNM series), adult male; F) *C. rostralis* (USNM series), adult female.

Hylidae

*Duellmanohyla salvavida* (MCCRANIE & WILSON, 1986)  
(Fig. 5A)

Despite the declines seen at other localities, *D. salvavida* was extremely abundant around La Liberación, with as many as 20 adults, juveniles, and emerging metamorphs observed each night in the vicinity of the Río Jilamito and its smaller tributaries. This species was also abundant in vegetation around a small stream in a forested ravine above San José de Texíguat from 150–300 m a.s.l. Referred specimens: USNM 578647–58.

*Plectrohyla chrysopleura* WILSON, MCCRANIE & CRUZ, 1994 (Fig. 5B)

We found *P. chrysopleura* in the La Liberación region, recording four adults and numerous metamorphs at altitudes ranging from 1,030 to 1,420 m a.s.l. (TOWNSEND et al. 2011b). Two adults and all metamorphs were found along tributary streams of the Río Jilamito, and two more adults were found on vegetation around a shallow pool near the summit of Cerro El Chino (TOWNSEND et al. 2011). Referred specimens: USNM 573993–96, 578660.

*Ptychohyla spinipollex* (SCHMIDT, 1936) (Fig. 5C–E)

This species was extremely abundant at La Liberación at altitudes from 1,030 to 1,430 m, and was the most commonly encountered amphibian in the area. A variety of colour patterns were present, representative of the wide range of variation in the species. Referred specimens: USNM 578665–88.

*Smilisca baudinii* (DUMÉRIL & BIBRON, 1841)

This treefrog is the most widely distributed amphibian in Honduras (MCCRANIE & WILSON 2002). In the La Liberación region, we found it calling from pasture rain pools and in disturbed riparian vegetation at about 1,030 m a.s.l., and on a tree trunk at the edge of a small forested ravine above San José de Texíguat at 150 m a.s.l. Referred specimens: USNM 578691–92.

Leptodactylidae

*Leptodactylus fragilis* (BROCCHI, 1877) (Fig. 5F)

This frog is extremely widespread in Honduras, but had not previously been recorded from the department of Atlántida (MCCRANIE 2006). We found it calling in the vicinity of rain pools in pastures at about 1,030 m a.s.l., and around the seepage at the top end of a small stream above San José de Texíguat at 300 m a.s.l. Referred specimens: USNM 578705–09.

Squamata

Corytophanidae

*Corytophanes cristatus* (MERREM, 1821)

A single specimen (USNM 578723) of this widespread rainforest species was collected at around 500 m a.s.l. above the Río Mezapa in the valley to the west of the Jilamito Valley.

*Laemanctus longipes* WIEGMANN, 1834

A single specimen (JHT 3350) of this widespread rainforest species was collected around 300 m a.s.l. above the community Jilamito Nuevo.

Iguanidae

*Iguana iguana* LINNAEUS, 1758

A single adult female green iguana was observed at night sleeping on a rock wall above a waterfall in a small forested ravine above San José de Texíguat at 180 m a.s.l.

Phrynosomatidae

*Sceloporus malachiticus* COPE, 1864

This spiny lizard is widely distributed in montane regions in Honduras and frequently seen in open areas in the forest, including edificarian settings. Most of our specimens came from dead standing trees in pastoral areas near our camp at about 1,030 m a.s.l. One specimen was collected around 5 metres up in a live tree exposed to the sun at the same altitude. Referred specimens: USNM 578725–30.

Polychrotidae

*Anolis beckeri* BOULENGER, 1881

A single specimen (USNM 578759) of this rarely collected anole was found just after dawn on a fence post near a hot spring outside of Jilamito Nuevo at about 150 m a.s.l. We herein follow KÖHLER (2010) in recognizing *A. beckeri* as a species distinct from *A. pentapryon*, distributed from southeastern México to northern Nicaragua.

*Anolis kreutzii* (MCCRANIE, KÖHLER & WILSON, 2000)

This Texíguat endemic is known from both Yoro and Atlántida Texíguat (see discussion below), and was collected while sleeping on vegetation at night in the vicinity of La Liberación between 1,030 and 1,200 m a.s.l. Referred specimens: USNM 578819, 578747–48.

*Anolis loveridgei* SCHMIDT, 1936 (Fig. 6A–B)

This endemic giant anole was encountered at night while sleeping on vegetation in the forest around La Liberación,

including palm fronds and woody lianas, 1.5 to 4 m above the ground. We observed numerous adult and juvenile males and females in these situations. Referred specimens: USNM 578755–58.

*Anolis yoroensis* (McCranie, Nicholson & Köhler, 2002) (Fig. 6C)

An anoline lizard that we tentatively assign to this taxon is the most abundant reptile species at La Liberación. Speci-

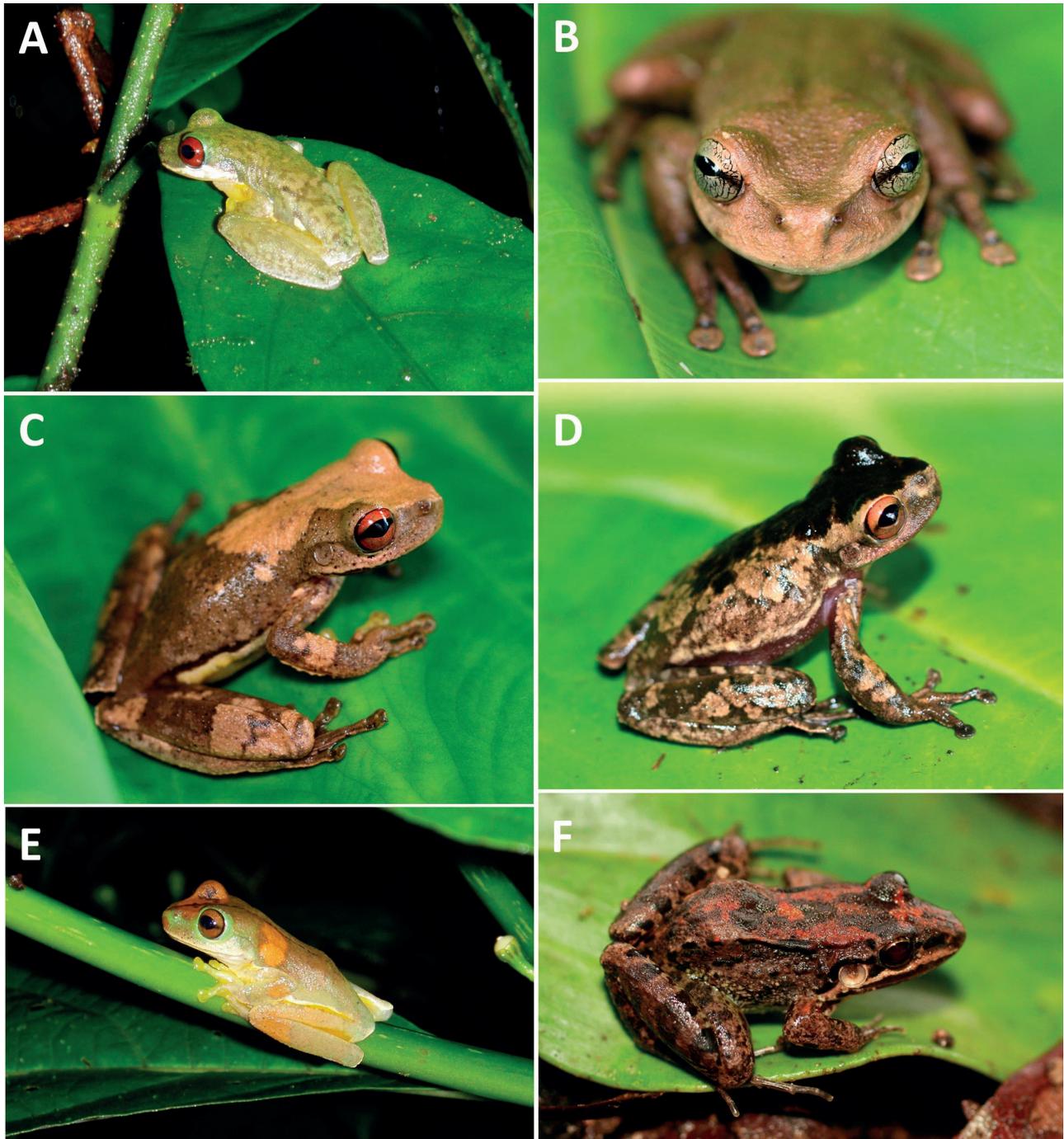


Figure 5. A) *Duellmanohyla salvavida* (USNM series), adult male in situ at night; B) *Plectrohyla chrysopleura* (USNM 573993), adult female; C) *Ptychohyla spinipollex* (USNM series), adult male; D) *Ptychohyla spinipollex* (USNM series), adult female; E) *Ptychohyla spinipollex* (USNM series), adult male in situ at night; F) *Leptodactylus fragilis* (USNM 578707), adult male.

mens were collected up to 1,400 m a.s.l. near the summit of Cerro El Chino. This anole is known from both Yoro and Atlántida Texíguat (see discussion below). Referred specimens: USNM 578779–809.

*Anolis zeus* (KÖHLER & McCRANIE, 2001) (Fig. 6D)

This endemic anole is known from lowland and premontane levels in PN Pico Bonito and Atlántida Texíguat (KÖHLER & McCRANIE 2001). We found this species (USNM 578818) along the primary trail to La Liberación at about 800 m a.s.l., and also at San José de Texíguat at 200 m a.s.l.

Scincidae

*Plestiodon sumichrasti* (COPE, 1867) (Fig. 6E)

This skink is distributed from central Veracruz, Mexico, to northwestern Honduras (KÖHLER 2008). It has previously been recorded from PN Pico Bonito, but not from RVS Texíguat (McCRANIE & CASTAÑEDA 2005). We collected and photographed a single individual of this species, which subsequently escaped.



Figure 6. A) *Anolis loveridgei* (USNM 578755), adult male; B) *A. loveridgei* (USNM 578756), adult female; C) *A. yoroensis* (USNM series), adult male; D) *A. zeus* (JHT 3344), adult male; E) *Plestiodon sumichrasti*, juvenile; F) *Lepidophyma flavimaculatum* (USNM 578860), adult female.

*Sphenomorphus cherriei* (COPE, 1893)

This skink (USNM 578848) was collected along a trail above La Liberación at about 1,200 m a.s.l., above a small coffee farm. *Sphenomorphus cherriei* is distributed at “low, moderate, and occasionally intermediate elevations on the Atlantic versant from central Veracruz, Mexico, to extreme western Panama and from northwestern Costa Rica to extreme western Panama on the Pacific versant” (MCCRANIE et al. 2006).

Xantusiidae

*Lepidophyma flavimaculatum* DUMÉRIL, 1851 (Fig. 6F)

This night lizard is distributed along the length of the Atlantic versant in Honduras, including the Honduran Mosquitia (MCCRANIE et al. 2006). We collected a single specimen from beneath sawn pieces of wood near one of the tributaries of the Río Jilamito at La Liberación. Referred specimens: USNM 578858–60.

Colubridae

*Adelphicos quadrivirgatum* JAN, 1862

An adult *A. quadrivirgatum* was collected from underneath a piece of cut wood next to a small house and coffee farm at 1,180 m a.s.l. A juvenile of this species was collected near a creek at about 750 m a.s.l., on the trail to La Liberación above the Río Jilamito. This small snake ranges from “low, moderate, and occasionally intermediate elevations on the Atlantic versant from southern Tamaulipas, Mexico, to northeastern Honduras and on the Pacific versant from central Oaxaca, Mexico, to central Guatemala” (MCCRANIE et al. 2006). Referred specimens: USNM 578868–69.

*Dendrophidion percarinatum* (COPE, 1893) (Fig. 7A)

This widespread forest racer is distributed in Honduras along most of the Caribbean coastal plain from the botanical garden at Lancetilla to the Honduran-Nicaraguan border (WILSON & MEYER 1985; MCCRANIE et al. 2006). We found a single juvenile (USNM 578864) along the trail from Jilamito Nueva to La Liberación at 600 m a.s.l.

*Drymobius chloroticus* (COPE, 1886) (Fig. 7B)

This green highland racer is widely distributed throughout the central mountains of Honduras in both premontane rainforest and cloud forest (KÖHLER 2008, TOWNSEND & WILSON 2008). We collected a single specimen (USNM 578865) along the trail from Jilamito Nuevo to La Liberación at 800 m a.s.l.

*Geophis damiani* WILSON, MCCRANIE & WILLIAMS, 1998 (Fig. 7C)

This fossorial snake is endemic to RVS Texíguat and known from three adult specimens, including the single adult male

(USNM 573999) we collected in the deep trench-like trail from Jilamito Nuevo to La Liberación at about 1,075 m a.s.l. (TOWNSEND et al. 2010b).

*Hydromorphus concolor* PETERS, 1859 (Fig. 7D)

This secretive and somewhat enigmatic water snake is distributed from eastern Guatemala to Panamá, and has been recorded from scattered localities in Honduras (WILSON & MEYER 1985; KÖHLER 2008). A single juvenile specimen of *H. concolor* (USNM 578872) was collected around a seepage that is the source of a small creek above San José de Texíguat. The snake was coiled up in a small rock crevice along the side of the seepage.

*Imantodes cenchoa* (LINNAEUS, 1758)

This blunt-headed tree snake is broadly distributed in Honduras at low to intermediate altitudes in the northern portion of the country (MCCRANIE et al. 2006; KÖHLER 2008). We found it to be relatively common between 1,015 and 1,120 m a.s.l. in the vicinity of La Liberación. Referred specimens: USNM 578875–77.

*Leptodeira septentrionalis* (KENNICOTT, 1859) (Fig. 7E)

This cat-eyed snake occurs widely in western and northern Honduras at low to intermediate altitudes (MCCRANIE et al. 2006; KÖHLER 2008). We collected a single specimen (USNM 578878) crawling in the sand at the riverside of Río Jilamito at 1,020 meters a.s.l.

*Ninia pavimentata* (BOCOURT, 1883) (Fig. 7F)

This species of coffee snake is limited in distribution to nuclear Central America. It was reported as new for Honduras in 2005 (TOWNSEND et al. 2005) and later found in the Yoro portion of RVS Texíguat as well (TOWNSEND et al. 2008). The specimen we encountered (USNM 578881) is the third known from the country at this time. The snake was found at night at around 1,080 m a.s.l. on a log.

*Ninia sebae* (DUMÉRIL, BIBRON & DUMÉRIL, 1854)

This species of coffee snake is distributed from central coastal México to Costa Rica, and is widespread in a variety of habitats and at a range of altitudes in Honduras (KÖHLER 2008). We encountered it (USNM 578885) in disturbed areas around the communities of Jilamito Nuevo.

*Pliocercus elapoides* COPE, 1860 (Fig. 7G, 9A)

Although this snake is distributed widely inside and outside of Honduras, it is particularly interesting because of its localised mimetic relationship to various species of venomous coral snakes (*Micrurus*) throughout its range (GREENE & MCDIARMID 1981). We found a specimen of this mimic in a rotten stump in a pasture at 1,050 m a.s.l., and another



Figure 7. A) *Dendrophidion percarinatum* (USNM 578869), juvenile; B) *Drymobius chloroticus* (USNM 578865), juvenile; C) *Geophis damiani* (USNM 573999), adult male; D) *Hydromorphus concolor* (USNM 578872), juvenile; E) *Leptodeira septentrionalis* (USNM 578878), adult female; F) *Ninia pavimentata* (USNM 578881), adult male; G) *Pliocercus elapoides* (USNM 578899), adult female; H) *Scaphiodontophis annulatus* (USNM 578898), adult female.

crawling along on top of a large log at night in riparian rainforest at the same altitude. Referred specimens: USNM 578899–900.

*Scaphiodontophis annulatus* (DUMÉRIL, BIBRON & DUMÉRIL, 1854) (Fig. 7H)

This shovel-toothed snake is known in Honduras from the Atlantic versant at low to moderate levels (MCCRANIE et al. 2006, KÖHLER 2008). We located a single specimen (USNM 578898) in an area of cut-over vegetation at about 1,030 m a.s.l.

*Sibon dimidiatus* (GÜNTHER, 1872) (Fig. 8A–B)

This snail-eater is distributed in Honduras at low to intermediate altitudes in the interior in premontane rainforest and cloud forest (WILSON & MEYER 1985, KÖHLER 2008). We found it to be relatively common at night, crawling in forest vegetation at between 1,015 and 1,120 m a.s.l. Referred specimens: USNM 578890–93.

*Sibon nebulatus* (LINNAEUS, 1758) (Fig. 8C)

This snail-eater occurs in Honduras at low to intermediate altitudes across the northern portion of the country (MCCRANIE et al. 2006; KÖHLER 2008). While not as locally abundant as *S. dimidiatus*, we encountered three individuals of this species active at night in primary forest from 1,030 to 1,120 m a.s.l. Referred specimens: USNM 578894–97.

*Stenorrhina degenhardtii* (BERTHOLD, 1845) (Fig. 8D)

This scorpion-eating snake is known in Honduras from the western portion at low to intermediate levels in lowland and premontane rainforest and cloud forest, as well as peripherally in lowland dry and premontane moist forests (TOWNSEND & WILSON 2008). We found a juvenile (USNM 578873) during the day next to a trail through a denuded area at La Liberación at 1,050 m a.s.l.

*Tantilla* sp.

A single specimen (USNM 573400) representing an undescribed species of *Tantilla* (TOWNSEND et al. in press) was collected by HERMES VEGA-R. and PAUL HOUSE, Honduran botanists that participated in our second expedition to La Liberación, while the snake was lying in leaf litter that had accumulated at the bottom of a trench-like portion of the principal trail.

*Tropidodipsas sartorii* COPE, 1863 (Fig. 8E–F)

This snail-eater is found in Honduras at low and lower moderate altitudes in northern portions of the Atlantic versant (KÖHLER 2008). We collected two specimens, both of which had plain bright yellow rings. One specimen was

found active on the ground at night at around 1,100 m a.s.l., and the second was found perched 4 m high in a large tree overhanging a tributary of the Río Jilamito. Referred specimens: USNM 578887–88.

Elapidae

*Micrurus nigrocinctus* (GIRARD, 1854) (Fig. 9B)

As currently recognized, *M. nigrocinctus* (Fig. 7) is a broadly distributed species of venomous coral snake (southern Mexico to northern Colombia). We found a single specimen (JHT 3177) on the trail from La Liberación to Jilamito Nuevo. Of considerable interest is the matching colour patterns of this snake and its mimic, *Pliocercus elapoides*, which is representative of our experience with these two snakes at other localities in Honduras.

Viperidae

*Atropoides mexicanus* (DUMÉRIL, BIBRON & DUMÉRIL, 1854) (Fig. 9C–D)

In Honduras, this jumping viper is found at low to moderate altitudes in the northwestern and north-central regions of the country (CAMPBELL & LAMAR 2004). We found the snake to be moderately common in the forest at night, with two adults and a juvenile collected at around 1,015 m a.s.l., and one adult male found coiled up in the middle of a trail through a denuded area at 780 m a.s.l. during the day. Referred specimens: USNM 578902–06.

*Bothriechis marchi* (BARBOUR & LOVERIDGE, 1929) (Fig. 9E–F)

We found a small adult female and three neonates near the top of Cerro El Chino at 1,410–1,430 m a.s.l. at night; two neonates were coiled up at the base of palm fronds, and the adult was wrapped around the stalks of a mature palm (at a height of about one metre above the ground) with the anterior portion poised, along the footpath in close proximity to a stagnant pool that was being utilized by a tapir (as evidenced by tracks). Another adult was encountered inactive during the day in a small shrub at the summit of Cerro Chino, and an additional juvenile was observed actively moving about in thin vines about 3 meters above the ground and subsequently collected. One adult was found near the bank of the Río Jilamito at night coiled up in the crown of a palm tree approximately 2 metres above the ground. Two more adults were collected along a ridge-top trail to the north of Cerro El Chino at 1,260 m; one was active at the edge of the trail in a small tree about 1 m above the ground, and a second adult was discovered coiled up on the ground along the same trail about 10 m away. Salamanders (*Bolitoglossa* cf. *porrasorum*), treefrogs (*Duellmanohyla salvavida* and *Ptychohyla spinipollex*), and rainfrogs (*Craugastor rostralis*) were abundant and active in close proximity to most individual snakes encountered. Referred specimens: JHT 3157–58, 3165, 3243, 3245–46, 3258–59, 3267.

*Bothriechis schlegelii* (BERTHOLD, 1845) (Fig. 9F)

This palm-pitviper is commonly encountered by local residents at lower altitude localities near Jilamito Nuevo, Me-

zapita, and San José de Texíguat. A small preserved collection of these snakes at the office of PROLANSATE demonstrates a high frequency of yellow-coloured individuals, similar to a subadult female (USNM 578907; Fig. 9F) taken near Jilamito Nuevo.



Figure 8. A) *Sibon dimidiatus* (USNM 578891), juvenile; B) *S. dimidiatus* (USNM 578890), adult female; C) *S. nebulatus*, adult female; D) *Stenorrhina degenhardtii* (USNM 578894), juvenile; E) *Tropidodipsas sartorii* (USNM 578887), subadult female; F) *T. sartorii* (USNM 578888), adult female.

*Bothrops asper* (GARMAN, 1884)

The skeleton (JHT 3045) of an adult *B. asper* (> 1.5 m total length) was collected on a small island in the Río Jilamito at La Liberación, 1,030 m a.s.l. This snake had been killed less than two weeks before our visit by the property caretaker, who led us to the skeleton. Nearly the entire skeleton, including the various parts of the skull, was intact, and was carefully collected and determined to be typical of *B. asper* (CAMPBELL & LAMAR 2004: 366).

**Discussion**

Situated at the western end of the Cordillera Nombre de Dios, the leeward side of RVS Texíguat and its counterpart at the eastern end of the Cordillera, Parque Nacional (PN) Pico Bonito, are the most significant areas of herpetofaunal diversity in a country whose national level of endemism has already been demonstrated to be the highest in Central America (WILSON & JOHNSON 2010). Our preliminary results from the windward side of RVS Texíguat indicate that



Figure 9. A) *Pliocercus elapoides* (USNM 578900), adult female; B) *Micrurus nigrocinctus* (JHT 3177) with a similar colour pattern as its sympatric mimic *P. elapoides* (Fig. 8G, 9A); C) *Atropoides mexicanus* (USNM 578904), adult male in situ at night; D) *A. mexicanus* (USNM 578903), juvenile; E) *Bothriechis marchi* (JHT series), adult male; F) *B. schlegelii* (USNM 578907), subadult female.

this area represents a veritable “lost world” of premontane rainforest and presents a unique opportunity for conserving the remarkable diversity that has already been documented on the leeward side of RVS Texíguat, and for expanding the knowledge of the reserve’s herpetofaunal diversity.

#### Endemism in the Greater Cordillera Nombre de Dios

Below, we discuss the 33 endemic species reported from at least one of three highland forest areas of documented herpetofaunal endemism in the greater Cordillera Nombre de Dios: Atlántida Texíguat, Yoro Texíguat, and Parque Nacional (PN) Pico Bonito. In summary, our results demonstrate that this relatively small region of north-central Honduras is among the richest hotspots for herpetofaunal endemism in Central America.

Salamanders (8 species): *Bolitoglossa (Magnadigita) cf. porrasorum* (Fig. 3A–D): Salamanders in the *Bolitoglossa dunni* species group (subgenus *Magnadigita*) from La Liberación are currently assigned to the taxon *B. porrasorum* (type locality: east slope of Pico Pijol, Montaña de Pijol; MCCRANIE & WILSON 1995, 2002). Based on the preliminary analysis of three mtDNA loci (TOWNSEND 2011), populations of salamanders from RVS Texíguat and PN Pico Bonito presently assigned to this taxon appear to represent two distinct species, each of which is endemic to its respective highland forest.

*Nototriton* sp. (Fig. 3F): Moss salamanders of the *Nototriton barbouri* species group from the Cordillera Nombre de Dios are currently assigned to the taxon *N. barbouri* (type locality: Montaña Macuzal, Depto. Yoro; MCCRANIE & WILSON 2002). Populations from RVS Texíguat and PN Pico Bonito are paraphyletic with respect to *N. barbouri* from the type locality, with each population representing an undescribed endemic species (TOWNSEND et al. 2010a, 2011a [as *Nototriton* sp. B]).

*Nototriton cf. barbouri*: Discussed above under *Nototriton* sp., this name is used in Table 2 to refer to the undescribed species from PN Pico Bonito.

*Nototriton tomamorum*: This recently described moss salamander (TOWNSEND et al. 2010a) is known from a single specimen from the Yoro side of RVS Texíguat. The specimen was collected in the immediate vicinity of the type locality of *Isthmohyla insolita* (see below), which is very close to an upstream area that has been clear-cut to the stream’s edge.

*Oedipina (Oedopinola) gephyra*: This worm salamander is only known from a series of specimens from the type locality in Yoro Texíguat (MCCRANIE et al. 1993a) and has not yet been found in Atlántida Texíguat. A specimen from PN Pico Bonito previously assigned to this taxon (MCCRANIE 1996, MCCRANIE & WILSON 2002) was described recently as a separate species (see *O. petiola* below; MCCRANIE & TOWNSEND 2011), leaving the known distribution of *O. gephyra* limited to the highest altitudes of RVS Texíguat.

*Oedipina (Oedopinola) petiola*: This recently-described worm salamander (MCCRANIE & TOWNSEND 2011) is known only from a single subadult male specimen from 1,580 m a.s.l., above Quebrada de Oro on the southern slope of Cerro Búfalo in PN Pico Bonito.

*Oedipina (Oeditriton) quadra*: This recently-described worm salamander (MCCRANIE et al. 2008) is known from lowland portions of PN Pico Bonito, as well as from lowland sites throughout eastern Honduras.

Anurans (12 species): *Craugastor (Craugastor) aurilegulus* (Fig. 4D–E): This streamside rainfrog is known from Atlántida Texíguat, Yoro Texíguat (MCCRANIE & CASTAÑEDA 2007), and PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005), as well as scattered premontane localities in the departments of Olancho and Yoro (MCCRANIE & WILSON 2002). We encountered this species in lowland streams near Jilamito Nuevo and San José de Texíguat during 2010. Despite being relatively common in lowland streams on the northern edge of RVS Texíguat, this species was conspicuously absent from seemingly suitable premontane habitat around La Liberación. Samples of these frogs from Atlántida Texíguat, as well as Jardín Botánica Lancetilla, form a well-supported sister clade to samples of *C. aurilegulus* from PN Pico Bonito, and we tentatively refer Atlántida Texíguat populations to this taxon pending further investigation (TOWNSEND 2011).

*Craugastor (Campbellius) chrysozetetes*: This streamside rainfrog is considered extinct (IUCN 2011, MCCRANIE & CASTAÑEDA 2005, 2007, WILSON & MCCRANIE 2004b), in as much as it has not been seen at the type and only known locality (Quebrada de Oro in PN Pico Bonito) since 1989 (MCCRANIE & WILSON 2002), despite repeated visits to the area from 1995 to the present (MCCRANIE & CASTAÑEDA 2007).

*Craugastor (Campbellius) cruzi*: This streamside rainfrog is known only from its type locality, a small stream above Quebrada de Oro at 1,520 m a.s.l. on the southern slope of Cerro Búfalo in PN Pico Bonito. The area was heavily damaged by a landslide in November 1988, and, despite searches of similar intact habitat near the type locality, this species has not been observed since and is feared extinct (MCCRANIE & WILSON 2002, MCCRANIE & CASTAÑEDA 2007).

*Craugastor (Campbellius) fecundus*: This streamside rainfrog is known from the PN Pico Bonito, in the vicinity of its type locality (Quebrada de Oro) and in the “mountains S of La Ceiba,” as well as from Cerro Calentura, above Trujillo (MCCRANIE & WILSON 2002). This is another species that has not been seen in the Quebrada de Oro region since 1995 and could be extinct.

*Craugastor (Campbellius) saltuarius*: This streamside rainfrog is known from its type locality on the southern slope of Cerro Búfalo in PN Pico Bonito and from Yoro Texíguat (MCCRANIE & WILSON 2002). Since this species’ discovery at these two localities, no additional specimens have been collected. This is yet another member of the subgenus *Campbellius*, also known as the *Craugastor milesi* group, presumed extinct.

*Craugastor (Campbellius) stadelmani*: Although this streamside rainfrog is known from a number of localities

Endemic herpetofauna of Texíguat, Honduras

Table 2. Distribution and conservation status of Honduran endemic species in three areas in the Cordillera Nombre de Dios and their conservation status in terms of IUCN categories, *Bolitoglossa* cf. *porrasorum* is listed twice to represent to the two undescribed taxa currently referred to this taxon. Environmental Vulnerability Score (EVS), and Conservation Status Score (CSS). See text for explanation of EVS and CSS. IUCN categories follow IUCN (2011) and TOWNSEND & WILSON (2010), and are abbreviated: EX – Extinct; CR – Critically Endangered; CR\* – Recently described or undescribed species that qualify as Critically Endangered based on IUCN Red List criteria (IUCN 2001); EN – Endangered; VU – Vulnerable.

Taxa	RVS Texíguat		PN Pico Bonito	IUCN Category	EVS	CSS
	Atlántida	Yoro				
<i>Bolitoglossa</i> cf. <i>porrasorum</i>	X	X		CR*	15	4
<i>Bolitoglossa</i> cf. <i>porrasorum</i>			X	CR*	15	4
<i>Nototriton</i> sp.	X	X		CR*	15	4
<i>Nototriton</i> cf. <i>barbouri</i>			X	CR*	15	4
<i>Nototriton tomamorom</i>		X		CR	17	3
<i>Oedipina gephyra</i>		X		CR*	16	3
<i>Oedipina petiola</i>			X	CR*	16	3
<i>Oedipina quadra</i>			X	EN	16	3
<i>Craugastor aurilegulus</i>	X	X	X	EN	14	6
<i>Craugastor chrysozetetes</i>			X	EX	17	3
<i>Craugastor cruzi</i>			X	CR	17	3
<i>Craugastor fecundus</i>			X	CR	15	5
<i>Craugastor saltuarius</i>		X	X	CR	16	3
<i>Craugastor stadelmani</i>		X		CR	15	4
<i>Duellmanohyla salvavida</i>	X	X	X	CR	12	5
<i>Incilius leucomyos</i>	X	X	X	EN	11	6
<i>Isthmohyla insolita</i>		X		CR	16	3
<i>Plectrohyla chrysopleura</i>	X		X	CR	13	4
<i>Ptychohyla spinipollex</i>	X	X	X	EN	11	6
<i>Rhinella chrysophora</i>		X	X	EN	12	4
<i>Anolis kreutzi</i>	X	X		CR	16	3
<i>Anolis loveridgei</i>	X		X	EN	14	6
<i>Anolis purpurgularis</i>		X	X	EN	15	3
<i>Anolis yoroensis</i>	X	X		EN	14	4
<i>Anolis zeus</i>	X		X	EN	14	5
<i>Celestus scansorius</i>		X		EN	14	3
<i>Sphaerodactylus dunni</i>			X	VU	14	4
<i>Bothriechis marchi</i>	X	X	X	EN	16	5
<i>Geophis damiani</i>	X	X		CR	15	3
<i>Omoadiphas texiguatensis</i>		X		CR	15	3
<i>Rhadinella tolpanorum</i>		X		EN	15	3
<i>Tantilla</i> sp.	X			CR*	15	3
<i>Typhlops stadelmani</i>			X	EN	12	6
TOTALS (33)	13	20	20	–	–	–

in the departments of Atlántida, Olancho, and Yoro (McCRANIE & WILSON 2002), it has recently been confirmed surviving at the Yoro Texíguat locality after apparently having suffered population crashes at all localities in the mid 1990's (McCRANIE et al. 2010).

*Duellmanohyla salvavida* (Fig. 5A): This red-eyed treefrog is known from all three areas discussed in this report, namely Atlántida Texíguat, Yoro Texíguat, and PN Pico Bonito (McCRANIE & CASTAÑEDA 2005). This endemic Honduran treefrog has undergone population de-

cline in the vicinity of its type locality in the Quebrada de Oro region of Parque Nacional Pico Bonito (McCRANIE & CASTAÑEDA 2005, 2007), and is otherwise known from higher altitudes in RVS Texíguat and from Montaña de Macuzal in Depto. Yoro (McCRANIE 2006). Our work in Atlántida Texíguat has documented that a robust population is present at La Liberación in the vicinity of the Río Jilamito and its tributaries, as well as in lowland streams at Jilamito Nuevo and San José de Texíguat. Two specimens were also collected along a small creek in the Quebrada de

Oro area in May 2010, confirming the persistence of this species in that badly denuded area.

*Incilius leucomyos*: This relatively widespread endemic toad is known from the Cordillera Nombre de Dios and the Sierra de La Muralla (MCCRANIE & WILSON 2002). It appears to tolerate disturbance poorly, and is readily displaced by the widespread generalist *I. valliceps*. These two closely related species are nearly syntopic in the foothills between Jilamito Nuevo and La Liberación, and their ecological (and potentially biological) interaction in areas of sympatry should be studied further.

*Isthmohyla insolita*: This endemic treefrog is known only from the vicinity of its type locality in Yoro Texíguat (MCCRANIE & WILSON 2002). It is one of the few Mesoamerican hylids known to deposit its eggs within masses of moss and other vegetation overhanging montane streams where they are brooded by the male (WILSON et al. 1994, CASTAÑEDA & MCCRANIE 2011). Hurricane Mitch heavily damaged the stream type locality in 1998, stripping the masses of moss from the trees along the stream, which have by now not yet regained their former luxuriance (MCCRANIE & CASTAÑEDA 2007, TOWNSEND et al. 2010a). Continued forest clearing along the periphery of this stream for slash-and-burn bean cultivation upstream of its type locality at 1,550 m a.s.l. has placed additional pressure on this frog. Our team was unable to locate the frog again at this locality in April 2008 (TOWNSEND et al. 2010a). Despite persistent searching through an abundance of mossy branches overhanging a myriad of streams in the vicinity of La Liberación, this species was not encountered.

*Plectrohyla chrysopleura* (Fig. 5B): Until recently, this endemic Honduran treefrog had been reported only from the vicinity of its type locality, the Quebrada de Oro region of PN Pico Bonito, where it had experienced an apparent catastrophic population decline and has not been seen since the collection of two malformed tadpoles in 1996 (MCCRANIE & CASTAÑEDA 2005, 2007). This decline is thought to be have been so serious that this species, then considered a single-site endemic, was believed to be on the verge of collapse, if not already extinct. The discovery of an extant population of this species at La Liberación is an encouraging development, not only for this species, but also as an indication that other Quebrada de Oro endemics might have broader distributions than previously supposed (TOWNSEND et al. 2011b).

*Ptychohyala spinipollex* (Fig. 5C–E): This treefrog is endemic to Honduras, and prior to our work, was known to occur in the Quebrada de Oro region of PN Pico Bonito, the Yoro side of RVS Texíguat, and localities at the eastern end of the Cordillera Nombre de Dios (MCCRANIE & WILSON 2002, MCCRANIE 2006). While absent from lowland sites, this species was the most abundant amphibian around the river and streams at La Liberación, with local abundance being approached only by that of *D. salvavida*. Preliminary phylogenetic analyses indicate that the large sample set from La Liberación forms a deeply divergent sister clade to *P. spinipollex* from the vicinity of the type locality (Quebrada de Oro, PN Pico Bonito), and we tenta-

tively refer the Texíguat populations to this taxon pending further taxonomic study (TOWNSEND 2011).

*Rhinella chrysophora*: This small toad is recorded both from the vicinity of the type locality in PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005) and Yoro Texíguat (MCCRANIE & CASTAÑEDA 2007). TOWNSEND et al. (2010a) inadvertently left this species out of calculations related to endemic species diversity for Yoro Texíguat. This anuran has not been seen since the mid-1990's, and is presumed extinct (MCCRANIE & WILSON 2002, MCCRANIE & CASTAÑEDA 2007).

Lizards (7 species): *Anolis kreutzii*: Until our discovery of this species on the Atlántida side of RVS Texíguat, it was only recorded from the vicinity of the type locality on the Yoro side of this refuge. As such, it has been judged Critically Endangered (TOWNSEND & WILSON 2010). Although we advocate maintaining this IUCN status, this anole is more broadly distributed in the refuge than previously understood, occurring in Premontane Wet Forest as low as 1030 m a.s.l.

*Anolis loveridgei* (Fig. 6A–B): This species is a giant anole endemic to Honduras (TOWNSEND & WILSON 2010). Its distribution appears limited to the Cordillera Nombre de Dios and the mountains of central Yoro in the vicinity of Portillo Grande and Yorito (MCCRANIE & CRUZ 1992). We consider this anole to be moderately abundant around La Liberación, having found both adults and juveniles.

*Anolis purpurularis*: This anole is known from both Yoro Texíguat (MCCRANIE et al. 1993b) and PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005), from 1,690 to 2,040 m a.s.l. (KÖHLER 2008).

*Anolis yoroensis* (Fig. 6C): As currently recognized, this Honduran endemic is somewhat more widespread in the country than the other endemic anoles discussed in this section (TOWNSEND & WILSON 2010). Its type locality is on the Yoro side of RVS Texíguat (MCCRANIE et al. 2002), and it is known from localities around the Yoro Valley.

*Anolis zeus* (Fig. 6D): This endemic anole inhabits low and premontane altitudes along the northern side of the Cordillera Nombre de Dios from 90 to 900 m a.s.l. (KÖHLER & MCCRANIE 2001). Morphological and molecular evidence indicates that populations of *A. zeus*-like anoles from Atlántida Texíguat, Lancetilla, and Parque Nacional Cerro Azul Meámbar in Depto. Cortés represent an undescribed species that is distinct from the typical form of *A. zeus* from the lowlands near PB Pico Bonito. We tentatively retain the use of the name *A. zeus* for western populations, pending completion of the associated taxonomic revision.

*Celestus scansorius*: This anguid lizard is known from its type locality in Yoro Texíguat and the Montaña de Macuzal, also in the department of Yoro (MCCRANIE & WILSON 1996).

*Sphaerodactylus dunni*: This small leaf litter-dwelling lizard is known from PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005), as well as other portions of northern Honduras (KÖHLER 2008), but has not been documented yet on the Atlántida side of Texíguat.

Snakes (6 species): *Bothriechis marchi* (Fig. 9E–F): This palm-pitviper is endemic to Honduras and known from scattered highland localities in the departments of Atlántida, Cortés, Santa Bárbara, and Yoro (CAMPBELL & LAMAR 2004). We are currently conducting a range-wide investigation of the phylogenetic systematics of this taxon.

*Geophis damiani* (Fig. 7C): Previously known from two specimens on the Yoro side of RVS Texíguat (WILSON et al. 1998, MCCRANIE & CASTAÑEDA 2004b), *G. damiani* is endemic to the reserve. A single specimen of this rarely observed semifossorial snake was collected from a deep portion of the trench-like trail above La Liberación at 1,080 m a.s.l. (TOWNSEND et al. 2010b).

*Omoadiphas texiguatensis*: This small semifossorial colubrid is one of the three species belonging to a Honduran endemic genus, and is known only from its type locality in Yoro Texíguat (MCCRANIE & CASTAÑEDA 2004a).

*Rhadinella topanorum*: This small colubrid is known only on the basis of two specimens from the vicinity of its type locality in Yoro Texíguat (HOLM & CRUZ D. 1994, MCCRANIE & CASTAÑEDA 2004b).

*Tantilla* sp.: A single specimen of a distinctive new species of *Tantilla* was found at 1,150 m a.s.l. in the steep trench-like portion of the trail from La Liberación to Jilamito Nuevo (TOWNSEND et al. in press).

*Typhlops stadelmani*: Among other localities in the country (MCCRANIE & WILSON 2001), this Honduran endemic is known from 320 m on the Caribbean slope of PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005).

### Biogeographic patterns

In terms of overlap in herpetofaunal composition among Atlántida Texíguat, Yoro Texíguat, and PN Pico Bonito (Table 1), Atlántida Texíguat shares 13 species (CBR = 0.30) with Yoro Texíguat and 28 species (CBR = 0.47) with PN Pico Bonito; Yoro Texíguat and PN Pico Bonito share seven species (CBR = 0.14). A degree of overlap also characterizes the endemic components of these three sites (Table 2). Of these 33 endemic species, 14 (44.4%) are known from Atlántida Texíguat, 20 (62.5%) from Yoro Texíguat, and 20 (60.6%) from PN Pico Bonito (Table 2). Atlántida Texíguat shares 10 (CBR = 0.59) species with Yoro Texíguat and eight (CBR = 0.47) with PN Pico Bonito. Yoro Texíguat and PN Pico Bonito share eight species (CBR = 0.40). Five species (*Craugastor aurilegulus*, *Duellmanohyla salvavida*, *Incilius leucomyos*, *Ptychohyla spinipollex*, and *Bothriechis marchi*) are shared among all three areas, according to how these taxa are currently understood (this does not include the nominal forms *Bolitoglossa porrasorum* and *Nototriton barbouri*, for reasons discussed below; see also the notes for other shared species below). Given the unexpected discovery of *Plectrohyla chrysopleura* in Atlántida Texíguat (TOWNSEND et al. 2011b), having previously been known only from Quebrada de Oro approximately 75 km east of La Liberación on the eastern side of PN Pico Bonito, we do not discount the potential for other species presumed

endemic to Quebrada de Oro to occur in RVS Texíguat as well.

### Conservation implications

In the limited time spent thus far in Atlántida Texíguat, we have documented 47 species of amphibians and reptiles (Table 1). These are seven more species than we are aware of from Yoro Texíguat. Sixteen of these 47 species are deemed to be of elevated conservation priority (eight CR, seven EN, and one VU; Table 1). This includes three undescribed species (two salamanders and one snake), two of which (the salamanders) are currently considered to be populations of a more widespread Endangered species, and one of which (the snake) has not been formally evaluated using IUCN criteria. Upon description, all three species would likely qualify as Critically Endangered due to their being restricted in distribution to RVS Texíguat. In addition to these three taxa, eleven others are endemic to the country (Table 1). This equates to a percentage of endemism of 29.8% (14/47 species), which is higher than that reported by TOWNSEND & WILSON (2010) for the entire Honduran herpetofauna.

Currently, we are aware of 40 species documented from Yoro Texíguat (TOWNSEND et al. 2010a, plus *Rhinella chrysochophora*). Of these 40 species, 28 are considered to be “conservation priority” species, defined as species judged to fall into one of three IUCN categories, Critically Endangered, Endangered, or Vulnerable (TOWNSEND et al. 2010a: 13). Of these 28, 9 are judged to be Critically Endangered, 13 Endangered, and six Vulnerable. Twenty of the 40 known species are endemic to Honduras, most of which are known only from the Texíguat refuge. These 20 species represent more than 20% of the entire endemic herpetofauna of Honduras (TOWNSEND & WILSON 2010) and establish the Yoro portion of RVS Texíguat as a critical conservation hotspot for the country.

At present, 74 species are recorded from PN Pico Bonito (MCCRANIE & CASTAÑEDA 2005, MCCRANIE & TOWNSEND 2011), of which 23 are judged of conservation priority (including one species of anuran, *Craugastor chrysozetetes*, presumed to be extinct by the IUCN [2010]). Of the 22 remaining species, six are considered to be Critically Endangered (several of which are presumed extinct), 13 Endangered, and three Vulnerable (TOWNSEND & WILSON 2010). PN Pico Bonito is also an important area of herpetofaunal endemism. Of 74 species recorded thus far, 20 are known only from Honduras (MCCRANIE & CASTAÑEDA 2005). As with RVS Texíguat, this represents roughly one-fifth of the 94 currently recognized endemics in the country.

All 33 endemic species found in the three areas are of elevated conservation priority, i.e., classifying for one of the three highest IUCN categories for extant taxa: Critically Endangered, Endangered, or Vulnerable. We also consider species judged Extinct to be of the highest conservation priority, which in this case includes *Craugastor chrysozetetes* from Quebrada de Oro. The concept of extinction,

however, has both a theoretical and a practical definition. RAVEN & BERG (2004: G6) defined the term to mean “the elimination of a species from Earth; occurs when the last individual member of a species dies.” This is the theoretical definition. Conservation biologists rely on a more practical definition: species are considered extinct when no individual of that species can be found any longer. This definition is not anymore useful, since it is subject to falsification. Thus, it is possible for species to be declared extinct and later found still in existence. A recent example involves the rediscovery of the Costa Rican endemic toad *Incilius holdridgei* (ABARCA et al. 2010). Given that such instances do occur, it is a good practice to continue to list such species as Critically Endangered, even if they have been declared “extinct” by one or more authorities. Therefore, we also include *Craugastor chrysozetetes* in Table 2. Of these 33 species, one is judged Extinct (3.0%), 18 Critically Endangered (54.5%), 13 Endangered (39.4%), and one Vulnerable (3.0%).

With respect to Environmental Vulnerability Scores, two species have a score of 11, three a score of 12, one a score of 13, six a score of 14, eleven a score of 15, seven a score of 16, and three a score of 17. Based on the categorization of EVS for the Honduran herpetofauna used by TOWNSEND & WILSON (2010), six species have a medium vulnerability (11–13) and 27 species a high vulnerability (14–17) to environmental degradation. Conservation Status Score values range from 3 to 6, all of which fall well within the category of very high conservation significance (CSS of 3–11) established by WILSON & TOWNSEND (2010). Of the 33 species, 15 have a CSS of 3 (the highest possible score). Essentially, all 33 species fall within the highest portion of the category of very high conservation significance, i.e., the half containing scores of 3–6, meaning that all 33 species are of the highest possible regional conservation priority.

### Conclusions

Our initial survey of the herpetofauna in the vicinity of La Liberación and adjacent lowland areas on the Atlántida side of Refugio de Vida Silvestre confirmed the presence of 47 species (14 amphibians, 33 reptiles; Table 1). Since our work was centred in the forests in the vicinity of our campsite at 1,030 m a.s.l. and above this campsite on Cerro El Chino (up to 1,430 m a.s.l.), and otherwise involved collecting a number of species on the trail into and out of the area and in nearby communities, this number promises to grow as our survey work extends to the higher altitudes of the refuge.

Our preliminary work demonstrates that the La Liberación region, i.e., the moderate altitudes of the windward slope of RVS Texíguat, is part of a triumvirate of herpetofaunal endemism in Honduras. Our work in this area and on the leeward slope of RVS Texíguat (summarized in TOWNSEND et al. 2010a) and in Parque Nacional Pico Bonito (summarized in MCCRANIE & CASTAÑEDA 2005) reveals that 33 of the 94 endemic species (close to

one-third) of amphibians and reptiles known from Honduras (TOWNSEND & WILSON 2010, TOWNSEND & MCCRANIE 2011, TOWNSEND et al. 2011a) occur in these three areas of the Cordillera Nombre de Dios. Honduras is thus a country that features Central America’s highest level of herpetofaunal endemism (WILSON & JOHNSON 2010). Our ongoing genetic work might add at least three more species to this list of endemics. We expect that continued fieldwork on the windward slope of RVS Texíguat will serve to enhance this area’s standing, as we are only beginning to explore Honduras’ herpetofaunal “lost world.”

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